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# 2011–2012 **MATHCOUNTS<sup>®</sup>** School Handbook

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Contains more than 300 creative math problems  
that meet NCTM standards for grades 6-8.

For questions about your local MATHCOUNTS program,  
please contact your chapter (local) coordinator. Coordinator contact  
information is available through the Find a Coordinator option of the  
Competition Program link on [www.mathcounts.org](http://www.mathcounts.org).

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# Acknowledgments

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## Count Me In!

A contribution to the MATHCOUNTS Foundation will help us continue to make this worthwhile program available to middle school students nationwide.

The MATHCOUNTS Foundation will use your contribution for programwide support to give thousands of students the opportunity to participate.

### To become a supporter of MATHCOUNTS, send your contribution to:

MATHCOUNTS Foundation  
1420 King Street  
Alexandria, VA 22314-2794

### Or give online at:

[www.mathcounts.org/donate](http://www.mathcounts.org/donate)

### Other ways to give:

- Ask your employer about matching gifts. Your donation could double.
- Remember MATHCOUNTS in your United Way and Combined Federal Campaign at work.
- Leave a legacy. Include MATHCOUNTS in your will.

For more information regarding contributions, call the director of development at 703-299-9006, ext. 103 or e-mail [info@mathcounts.org](mailto:info@mathcounts.org).

*The MATHCOUNTS Foundation is a 501(c)3 organization. Your gift is fully tax deductible.*



The National Association of Secondary School Principals has placed this program on the NASSP Advisory List of National Contests and Activities for 2011–2012.

# Raytheon

2012 MATHCOUNTS  
National Competition Sponsor

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The MATHCOUNTS Foundation makes its products and services available on a nondiscriminatory basis. MATHCOUNTS does not discriminate on the basis of race, religion, color, creed, gender, physical disability or ethnic origin.

# CRITICAL 2011-2012 DATES

2011



Sept. 1 -  
Dec. 16

Send in your school's Registration Form to receive a hard copy of the *MATHCOUNTS School Handbook*, the Club in a Box Resource Kit and/or your copy of the 2011-2012 School Competition Kit. *Items will ship shortly after receipt of your form, with the mailing of the School Competition Kit following this schedule:*

Registration Forms *postmarked* by Oct. 1: Kits mailed in early November.

*Kits continue mailing every two weeks.*

Registration Forms *postmarked* by Dec. 16 deadline: Kits mailed in early January.

Mail or fax the MATHCOUNTS Registration Form (*with payment if participating in the competition*) to:

**MATHCOUNTS Registration, P.O. Box 441, Annapolis Junction, MD 20701**

**Fax: 240-396-5602** (*Please fax or mail, but do not do both.*)

Questions? Call 301-498-6141 or confirm your registration via the Registered Schools database and/or 2011-2012 Bronze Level Schools list at [www.mathcounts.org](http://www.mathcounts.org) in the Registered Schools or Club Program sections, respectively.



Sept. 1

Video submission period begins for Reel Math Challenge.



Oct. 12-13

American Math Challenge, brought to you by MATHCOUNTS and powered by Mathletics®



Nov. 15

General public voting period opens for Reel Math Challenge.



Dec. 16  
(postmark)

## Competition Registration Deadline

*In some circumstances, late registrations might be accepted, at the discretion of MATHCOUNTS and the local coordinator. **Late fees may also apply. Register on time to ensure participation by your students.***

2012



Early January

If you have not been contacted with details about your upcoming competition, call your local or state coordinator! *If you have not received your School Competition Kit by the end of January, contact MATHCOUNTS at 703-299-9006.*



Feb. 1-29

## Chapter Competitions



Feb. 1

Video submission period for Reel Math Challenge ends, and general public voting ends. Top 20 videos are announced in February.



March 1-31

## State Competitions



March 2

Deadline for MATHCOUNTS Club Programs to reach Silver Level. Applications for Silver Level Status must be received by MATHCOUNTS as of this date for entry to the Silver drawing.



March 15

Top four video submissions for Reel Math Challenge are announced.



March 30

Deadline for MATHCOUNTS Club Programs to reach Gold Level. Applications for Gold Level Status and Ultimate Math Challenges must be received by MATHCOUNTS as of this date for entry to the Gold drawing.



May 11

2012 Raytheon MATHCOUNTS National Competition in Orlando, Florida.

### Interested in more coaching materials or MATHCOUNTS items?

Purchase items from the MATHCOUNTS store at [www.mathcounts.org](http://www.mathcounts.org) or contact Sports Awards at 800-621-5803. Selected items also are available at [www.artofproblemsolving.com](http://www.artofproblemsolving.com).

# INTRODUCTION

The mission of MATHCOUNTS is to inspire excellence, confidence and curiosity in U.S. middle school students through fun and challenging math programs. Currently in its 29th year, MATHCOUNTS meets its mission by providing three separate but complementary programs for middle school students: the **MATHCOUNTS Competition Program**, the **MATHCOUNTS Club Program** and the newest program, **Reel Math Challenge**.



The **MATHCOUNTS Competition Program** is designed to excite and challenge middle school students. With four levels of competition - school, chapter (local), state and national - the Competition Program provides students with the incentive to prepare throughout the school year to represent their schools at these MATHCOUNTS-hosted\* events. MATHCOUNTS provides the preparation materials and the competition materials, and with the leadership of the National Society of Professional Engineers, more than 500 Chapter Competitions, 56 State Competitions and one National Competition are hosted each year. These competitions provide students with the opportunity to go head-to-head against their peers from other schools, cities and states; to earn great prizes individually and as members of their school team; and to progress to the 2012 Raytheon MATHCOUNTS National Competition in Orlando, Florida. There is a registration fee for students to participate in the Competition Program, and participation past the School Competition level is limited to the top 10 students per school. *A more detailed explanation of the Competition Program follows on pages 10 through 21.*



The **MATHCOUNTS Club Program (MCP)** is designed to increase enthusiasm for math by encouraging the formation within schools of math clubs that conduct meetings that are fun and include a variety of math activities. The resources provided through the MCP are also a great supplement for classroom teaching. The activities provided for the MCP foster a positive social atmosphere, with a focus on students working together as a club to earn recognition and rewards in the MATHCOUNTS Club Program. Some rewards are participation based, and others are achievement based, but all rewards require a minimum number of club members (based on school size). Therefore, there is an emphasis on building a strong club and encouraging more than just the top math students within a school to join. There is no cost to sign up for the MATHCOUNTS Club Program, but a Registration Form must be submitted to receive the free club materials. (A school that registers for the Competition Program is automatically signed up for the MATHCOUNTS Club Program.) *A more detailed explanation of the MATHCOUNTS Club Program follows on pages 23 through 26.*



Sponsored in part by the Department of Defense, the **Reel Math Challenge** is an innovative program involving teams of students using cutting-edge technology to create videos about math problems and their associated concepts. This new competition is meant to excite students about math while allowing them to hone their creativity and communication skills. Students will form teams consisting of four students and will create a video based on one of the 300 problems included in this handbook. In addition, students will be able to form teams with peers from around the country. As long as a student is a sixth-, seventh- or eighth- grader, he or she can participate. Each video must teach the solution to the selected math problem as well as demonstrate the real-world application of the math concept used in the problem. All videos will be posted to [www.reelmath.org](http://www.reelmath.org), where the general public will vote on the best videos. The 20 videos with the highest vote totals will advance to the semifinals of the competition, after which a panel of MATHCOUNTS judges will review them and select four finalists. Each of the four finalist teams will receive an all-expense-paid trip to the 2012 Raytheon MATHCOUNTS National Competition, where they will present their videos to the 224 students competing in that event. The competitors will then vote for one of the four videos to be the winner of the Reel Math Challenge. Each member of the winning team will receive a \$1000 college scholarship. *A more detailed explanation of Reel Math Challenge follows on page 27.*

\*While MATHCOUNTS provides the actual School Competition Booklet with the questions, answers and procedures necessary to run the School Competition, the administration of the School Competition is up to the MATHCOUNTS coach in the school. The School Competition is not required; selection of team and individual competitors for the Chapter Competition is entirely at the discretion of the school coach and need not be based solely on School Competition scores.

# NEW THIS YEAR

## REEL MATH CHALLENGE

The Reel Math Challenge is a brand new program involving teams of students using technology to create videos about math problems and their associated concepts. Reel Math Challenge is meant to excite students about math while allowing them to hone their creativity and communication skills. Students will form teams consisting of four students and will create a video based on one of the 300 problems included in the *MATHCOUNTS School Handbook*. Each video must teach the solution to the selected math problem as well as demonstrate the real-world application of the math concept used in the problem.

All videos will be posted to [www.reelmath.org](http://www.reelmath.org), where the general public will vote on the best videos. The 20 videos with the highest vote totals will advance to the semifinals of the competition, after which a panel of MATHCOUNTS judges will review them and select four finalists.

Each of the four finalist teams will receive an all-expense-paid trip to the 2012 MATHCOUNTS National Competition, where they will present their videos to the 224 students competing in that event. The competitors will then vote for one of the four videos to be the winner of the Reel Math Challenge. Each member of the winning team will receive a \$1000 college scholarship. Once the contest has concluded, the website containing the archive of videos will remain available for public use at no charge. Because these videos will be cross-referenced with specific MATHCOUNTS problems and each MATHCOUNTS problem is indexed to specific math concepts and standards, this library of videos will be a powerful teaching tool for teachers and students to utilize for years.

The submission period for videos opens September 1, 2011 and will remain open through February 1, 2012. Public voting begins November 15, 2011 and will remain open through February 1, 2012. For more information, visit [www.reelmath.org](http://www.reelmath.org).

## ELIGIBILITY UPDATE FOR HOMESCHOOLS AND VIRTUAL SCHOOLS

Homeschools and virtual schools are now eligible to participate as individuals and as members of a team. However, prior to participation in a MATHCOUNTS Chapter Competition, each registering homeschool, homeschool group or virtual school must complete and return the Homeschool Participation Attestation Form, which can be downloaded from the right navigation bar by visiting [www.mathcounts.org/competition](http://www.mathcounts.org/competition).

**Homeschools:** The definition of *homeschool* and the requirements for participation are outlined on page 14, and these have not changed since last year.

**Virtual Schools:** Any virtual school interested in registering students must contact the MATHCOUNTS national office at 703-299-9006 before December 16, 2011 for registration details.

## MAPPING TO COMMON CORE STATE STANDARDS

We are pleased to announce that this year, the *MATHCOUNTS School Handbook* problems will be categorized not only by topic and difficulty level but also by Common Core State Standard. The Common Core State Standards Initiative is a state-led effort coordinated by the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO). The Standards were developed in collaboration with teachers, school administrators and experts in the field of mathematics. Currently, 43 states and the District of Columbia have adopted the Standards. We hope this additional resource will allow you to further utilize handbook problems by supplementing your classroom teaching.

## LATE REGISTRATIONS

This program year, an additional fee of \$20 will be assessed to process late registrations. **Registrations postmarked after December 16, 2011 will be considered late.** (This fee is for each late registration form and not for each student being registered.) See the Registration Form on page 95 for additional details.



## COACHES' RESOURCE VIDEO SERIES

MATHCOUNTS has created a new video series to help you understand the free resources available to you in your Club in a Box Resource Kit. To date, there are three videos, but the library will continue to grow as we see a need.

**Introduction to the Club in a Box Resource Kit** - This short video will provide you with an understanding of the materials included in your Club in a Box Resource Kit and how to best utilize them.

**Achieving Silver Level and Gold Level Status in the MATHCOUNTS Club Program** - This video explains the steps necessary for your school to achieve Silver Level and Gold Level Status in the Club Program. Requirements, incentives and prizes are discussed.

**Introduction to the MATHCOUNTS School Handbook** - Have you received your handbook but are unsure about how to best utilize the problems? The *School Handbook* video discusses the variety of problems that can be found in the handbook as well as how to utilize the problems for MATHCOUNTS competition preparation or classroom use.

All of these videos can be accessed at [www.mathcounts.org/videos](http://www.mathcounts.org/videos) or on the MATHCOUNTS YouTube page, which can be found at [www.youtube.com/mathcountsfdn](http://www.youtube.com/mathcountsfdn).

## REFERRAL PROGRAM

On a recent survey, over 90% of MATHCOUNTS coaches said they would refer MATHCOUNTS to a colleague. Your referral can be rewarded by having a portion of your registration fees reimbursed! MATHCOUNTS is continuing its referral and registration incentives for the Competition Program.

**Simply refer a middle school that is not currently participating in MATHCOUNTS<sup>\*</sup>**. If the school you refer registers a team of four students for the MATHCOUNTS Competition Program this school year, your school and the referred school each will receive a refund of \$10. With enough successful referrals, your school could be reimbursed for its entire registration fee! The new Registration Form on page 95 has a section for you to indicate the school(s) you wish to refer.

### Incentive for MATHCOUNTS Club Program Schools

Schools that previously have participated only in the MATHCOUNTS Club Program (and not in the Competition Program) may also take advantage of the incentive program. If you choose to register a team of four for the MATHCOUNTS Competition Program this school year, you will receive a refund of \$10. Additional details may be found on the Registration Form on page 95.

## MATHCOUNTS AND SOCIAL MEDIA

Did you know that MATHCOUNTS is now on Facebook, Twitter and YouTube? Stay updated on important MATHCOUNTS news and math happenings through posts and tweets. Watch highlights from the National Competition, access the Coaches' Video Series, watch a promotional video about the Club Program and view all of the newest MATHCOUNTS Minis online!

Experience MATHCOUNTS on social media at the following websites:

[www.facebook.com/mathcounts](http://www.facebook.com/mathcounts)

[www.twitter.com/mathcounts](http://www.twitter.com/mathcounts)

[www.youtube.com/mathcountsfdn](http://www.youtube.com/mathcountsfdn)

<sup>\*</sup>To qualify as a referred school, a school may not have participated in the MATHCOUNTS Competition Program for the previous two school years.

# **THE MATHCOUNTS OPLET**

## **(One Problem Library and Extraction Tool)**

**... a database of thousands of MATHCOUNTS problems AND step-by-step solutions, giving you the ability to generate worksheets, flash cards and Problems of the Day**

Through [www.mathcounts.org](http://www.mathcounts.org), MATHCOUNTS is offering the MATHCOUNTS OPLET - a database of 10,000 problems and over 4,000 step-by-step solutions, with the ability to create personalized worksheets, flash cards and Problems of the Day. After purchasing a 12-month subscription to this online resource, the user will have access to *MATHCOUNTS School Handbook* problems and MATHCOUNTS competition problems from the past 11 years and the ability to extract the problems and solutions in personalized formats. (Each format is presented in a pdf file to be printed.)

Once the subscription is purchased, the user can access the MATHCOUNTS OPLET each time he or she goes to [www.mathcounts.org/oplet](http://www.mathcounts.org/oplet) and logs in. Once on the MATHCOUNTS OPLET page, the user can tailor the output to his or her needs by answering a few questions. These are some options that can be personalized:

**SAVE**  
**\$25 off**

**YOUR SUBSCRIPTION FEE IF YOU PURCHASE  
OPLET BEFORE  
OCTOBER 14, 2011.**

Use code **OPLET1112** to receive your discount  
when registering online as a NEW subscriber.

Use code **RENEW1112** to receive your discount  
when renewing your subscription online.

**MATHCOUNTS**  
**[www.mathcounts.org/OPLET](http://www.mathcounts.org/OPLET)**

- Format of the output: Worksheet, Flash Cards or Problems of the Day
- Number of questions to include
- Solutions (whether to include or not for selected problems)
- Math concept: Arithmetic, Algebra, Geometry, Counting and Probability, Number Theory, Other or a Random Sampling
- MATHCOUNTS usage: Problems without calculator usage (Sprint Round/Warm-Up), Problems with calculator usage (Target Round/Workout/Stretch), Team problems with calculator usage (Team Round), Quick problems without calculator usage (Countdown Round) or a Random Sampling
- Difficulty level: Easy, Easy/Medium, Medium, Medium/Difficult, Difficult or a Random Sampling
- Year range from which problems were originally used in MATHCOUNTS materials: Problems are grouped in five-year blocks in the system.

Once these criteria have been selected, the user either (1) can opt to have the computer select the problems at random from an appropriate pool of problems or (2) can manually select the problems from this appropriate pool of problems.

### **How does a person gain access to this incredible resource as soon as possible?**

A 12-month subscription to the MATHCOUNTS OPLET can be purchased at [www.mathcounts.org](http://www.mathcounts.org). The cost of a subscription is \$275; however, schools registering students in the MATHCOUNTS Competition Program will receive a \$5 discount per registered student. If you purchase OPLET before October 14, 2011, you can save a total of \$75\* off your subscription. Please refer to the coupon above for specific details.

If you would like to get a sneak peek at this invaluable resource before making your purchase, you can check out screen shots of the MATHCOUNTS OPLET at [www.mathcounts.org/oplet](http://www.mathcounts.org/oplet). You will see the ease with which you can create countless materials for your Mathletes, club members and classroom students.

\*The \$75 savings is calculated using the special \$25 offer plus an additional \$5 discount per student registered for the MATHCOUNTS Competition Program.



# BUILDING A COMPETITION AND/OR CLUB PROGRAM

## RECRUITING MATHLETES®

Ideally, the materials in this handbook will be incorporated into the regular classroom curriculum so that all students learn problem-solving techniques and develop critical thinking skills. When a school's MATHCOUNTS Competition Program or Club Program is limited to extracurricular sessions, all interested students should be invited to participate regardless of their academic standing. Because the greatest benefits of the MATHCOUNTS programs are realized at the school level, the more Mathletes involved, the better. Students should view their experience with MATHCOUNTS as fun, as well as challenging, so let them know from the very first meeting that the goal is to have a good time while learning.

Here are some suggestions from successful competition and club coaches on how to stimulate interest at the beginning of the school year:

- Build a display case showing MATHCOUNTS shirts and posters. Include trophies and photos from previous years' club sessions or competitions.
- Post intriguing math questions (involving specific school activities and situations) in hallways, the library and the cafeteria. Refer students to the first meeting for answers. **Use the MATHCOUNTS poster from your Club in a Box Resource Kit!**
- Make a presentation at the first pep rally or student assembly.
- Approach students through other extracurricular clubs (e.g., honor society, science club, chess club).
- Inform parents of the benefits of MATHCOUNTS participation via the school newsletter or PTA.
- Create a MATHCOUNTS display for Back-to-School Night.
- Have former Mathletes speak to students about the rewards of the program.
- Incorporate the Problem of the Week from the MATHCOUNTS website ([www.mathcounts.org/potw](http://www.mathcounts.org/potw)) into the weekly class schedule.

## MAINTAINING A STRONG PROGRAM

Keep the school program strong by soliciting local support and focusing attention on the rewards of MATHCOUNTS. Publicize success stories. Let the rest of the student body see how much fun Mathletes have. Remember, the more this year's students get from the experience, the easier recruiting will be next year. Here are some suggestions:

- Publicize MATHCOUNTS meetings and events in the school newspaper and local media.
- Inform parents of meetings and events through the PTA, open houses and the school newsletter.
- Schedule a special pep rally for the Mathletes.
- Recognize the achievements of club members at a school awards program.
- Have a students-versus-teachers Countdown Round, and invite the student body to watch.
- Solicit donations from local businesses to be used as prizes in practice competitions.
- Plan retreats or field trips for the Mathletes to area college campuses or hold an annual reunion.
- Take photos at club meetings, coaching sessions or competitions and keep a scrapbook.
- Distribute MATHCOUNTS shirts to participating students.
- Start a MATHCOUNTS summer-school program.
- Encourage teachers of students in lower grades to participate in mathematics enrichment programs.

# MATHCOUNTS COMPETITION PROGRAM . . .

## A MORE DETAILED LOOK



The MATHCOUNTS Foundation administers its math enrichment, coaching and competition program with a grassroots network of more than 17,000 volunteers who organize MATHCOUNTS competitions nationwide. Each year more than 500 local competitions and 56 “state” competitions are conducted, primarily by chapter and state societies of the National Society of Professional Engineers. All 50 states, the District of Columbia, Puerto Rico, Guam, Virgin Islands, U.S. Department of Defense schools and U.S. State Department schools worldwide participate in MATHCOUNTS. Here’s everything you need to know to get involved.

### PREPARATION MATERIALS

The annual *MATHCOUNTS School Handbook* provides the basis for coaches and volunteers to coach student Mathletes on problem-solving and mathematical skills. Coaches are encouraged to make maximum use of MATHCOUNTS materials by incorporating them into their classrooms or by using them with extracurricular math clubs. Coaches also are encouraged to share this material with other teachers at their schools, as well as with parents.

MATHCOUNTS has created a new video series to help you understand the free resources available to you. To date, there are three videos, but the library will continue to grow as we see a need. The **Introduction to the MATHCOUNTS School Handbook** video discusses the variety of problems that can be found in the handbook as well as how to utilize the problems for MATHCOUNTS competition preparation or classroom use. Please take advantage of these great new resources. All of these videos can be accessed at [www.mathcounts.org/videos](http://www.mathcounts.org/videos) or on the MATHCOUNTS YouTube page, which can be found at [www.youtube.com/mathcountsfdn](http://www.youtube.com/mathcountsfdn).

The *2011–2012 MATHCOUNTS School Handbook*, formerly in two volumes, has been consolidated into one volume with over 300 problems. As always, these FREE, challenging and creative problems have been written to meet the National Council of Teachers of Mathematics’ Standards for grades 6-8. The *School Handbook* is being sent electronically to every U.S. school with seventh- and/or eighth-grade students and to any other school that registered for the MATHCOUNTS Competition Program last year. This handbook also is available to schools with sixth-grade students. A hard copy of the *MATHCOUNTS School Handbook* is available upon request to all schools, free of charge. Coaches who register for the MATHCOUNTS Club Program or the MATHCOUNTS Competition Program will receive the handbook in their Club in a Box Resource Kit.

In addition to the great math problems, be sure to take advantage of the following resources that are included in the 2011-2012 MATHCOUNTS School Handbook:

**Vocabulary and Formulas** are listed on pages 20-21.

A **Problem Index** is provided on pages 92-93 to assist you in incorporating the *MATHCOUNTS School Handbook* problems into your curriculum. This index organizes the problems by topic, difficulty rating and mapping to the Common Core State Standard for each problem.

**Difficulty Ratings** on a scale of 1-7, with 7 being the most difficult, are explained on page 92.

**Common Core State Standards** are explained on page 91.

A variety of additional information and resources can be found on the MATHCOUNTS website, at [www.mathcounts.org](http://www.mathcounts.org), including problems and answers from the previous year’s Chapter and State Competitions, the MATHCOUNTS Coaching Kit, MATHCOUNTS Club Program resources, forums and links to state programs. When you sign up for the Club Program or Competition Program (and you have created a User Profile on the site), you will receive access to even more free resources, that are not visible or available to the general public. Be sure to create a User Profile as soon as possible, and then visit the Coaches section of the site.

The MATHCOUNTS OPLET, which contains *MATHCOUNTS School Handbook* problems and competition problems from the last 11 years, is a wonderful resource. Once a 12-month subscription is purchased, the user can create customized worksheets, flash cards and Problems of the Day by using this database of problems. For more information, see page 8 or go to [www.mathcounts.org/oplet](http://www.mathcounts.org/oplet) and check out some screen shots of the MATHCOUNTS OPLET. A 12-month subscription can be purchased online.

Additional coaching materials and novelty items may be ordered through Sports Awards. An order form, with information on the full range of products, is available in the MATHCOUNTS Store section at [www.mathcounts.org/store](http://www.mathcounts.org/store) or by calling Sports Awards toll-free at 800-621-5803. A limited selection of MATHCOUNTS materials also is available at [www.artofproblemsolving.com](http://www.artofproblemsolving.com).

## COACHING STUDENTS

The coaching season begins at the start of the school year. The sooner you begin your coaching sessions, the more likely students still will have room in their schedules for your meetings and the more preparation they can receive before the competitions.

Be sure to take advantage of the new Coaches' Resource Videos. The **Introduction to the *MATHCOUNTS School Handbook*** video discusses the variety of problems that can be found in the handbook as well as how to utilize the problems for MATHCOUNTS competition preparation or classroom use. The videos can be accessed at [www.mathcounts.org/videos](http://www.mathcounts.org/videos) or on the MATHCOUNTS YouTube page, which can be found at [www.youtube.com/mathcountsfdn](http://www.youtube.com/mathcountsfdn).

The original problems found in the *MATHCOUNTS School Handbook* are divided into three sections: Warm-Ups, Workouts and Stretches. Each Warm-Up and Workout contains problems that generally survey the grades 6-8 mathematics curricula. Workouts assume the use of a calculator; Warm-Ups do not. The Stretches are collections of problems centered around a specific topic.

The problems are designed to provide Mathletes with a large variety of challenges and prepare them for the MATHCOUNTS competitions. (These materials also may be used as the basis for an exciting extracurricular mathematics club or may simply supplement the normal middle school mathematics curriculum.)

Answers to all problems in the handbook include codes indicating level of difficulty and Common Core State Standard. The difficulty ratings are explained on page 92, and the Common Core State Standards are explained on page 91.

## WARM-UPS AND WORKOUTS

The Warm-Ups and Workouts are on pages 29-55 and are designed to increase in difficulty as students go through the handbook.

For use in the classroom, Warm-Ups and Workouts serve as excellent additional practice for the mathematics that students already are learning. In preparation for competition, the Warm-Ups can be used to prepare students for problems they will encounter in the Sprint Round. It is assumed that students will not be using calculators for Warm-Up problems. The Workouts can be used to prepare students for the Target and Team Rounds of competition. It is assumed that students will be using calculators for Workout problems.

All of the problems provide students with practice in a variety of problem-solving situations and may be used to diagnose skill levels, to practice and apply skills or to evaluate growth in skills.

## STRETCHES

Pages 56-59 present the Right Triangle, Sequences and Similarity Stretches. The problems cover a variety of difficulty levels. These Stretches may be incorporated in your students' practice at any time.

## ANSWERS

Answers to all problems can be found on pages 65-69.

## SOLUTIONS

Complete solutions for the problems start on page 70. These are only possible solutions. You or your students may come up with more elegant solutions.

## SCHEDULE

The Stretches and *What About Math?* problems can be used at any time. The following chart is the recommended schedule for using the Warm-Ups and Workouts if you are participating in the Competition Program.

September 2011	Warm-Ups 1-2	Workout 1
October	Warm-Ups 3-6	Workouts 2-3
November	Warm-Ups 7-10	Workouts 4-5
December	Warm-Ups 11-14	Workouts 6-7
January 2012	Warm-Ups 15-16	Workout 8
	MATHCOUNTS School Competition	
	Warm-Ups 17-18	Workout 9
February	Selection of competitors for Chapter Competition	
	MATHCOUNTS Chapter Competition	

To encourage participation by the greatest number of students, postpone selection of your school's official competitors until just before the local competition.

On average, MATHCOUNTS coaches meet with Mathletes for an hour one or two times a week at the beginning of the year and with increasing frequency as the competitions approach. Sessions may be held before school, during lunch, after school, on weekends or at other times, coordinating with your school's schedule and avoiding conflicts with other activities.

Here are some suggestions for getting the most out of the Warm-Ups and Workouts at coaching sessions:

- Encourage discussion of the problems so that students learn from one another.
- Encourage a variety of methods for solving problems.
- Have students write problems for each other.
- Use the MATHCOUNTS Problem of the Week. Currently, this set of problems is posted every Monday on the MATHCOUNTS website at [www.mathcounts.org/potw](http://www.mathcounts.org/potw).
- Practice working in groups to develop teamwork (and to prepare for the Team Round).
- Practice oral presentations to reinforce understanding.
- Take advantage of additional MATHCOUNTS coaching materials, such as previous years' competitions, to provide an extra challenge or to prepare for competition.
- Provide refreshments and vary the location of your meetings to create a relaxing, enjoyable atmosphere.
- Invite the school principal to a session to offer words of support.
- Recruit volunteers. Volunteer assistance can be used to enrich the program and expand it to more students. Fellow teachers can serve as assistant coaches. Individuals such as MATHCOUNTS alumni and high school students, parents, community professionals and retirees also can help.

# OFFICIAL RULES AND PROCEDURES

The following rules and procedures govern all MATHCOUNTS competitions. The MATHCOUNTS Foundation reserves the right to alter these rules and procedures at any time. **Coaches are responsible for being familiar with the rules and procedures outlined in this handbook.** Coaches should bring any difficulty in procedures or in student conduct to the immediate attention of the appropriate chapter, state or national official. Students violating any rules may be subject to immediate disqualification.

## REGISTRATION

To participate in the MATHCOUNTS Competition Program, a school representative is required to complete and return the Registration Form (available at the back of this handbook and on our website, at [www.mathcounts.org](http://www.mathcounts.org)) along with a check, money order, purchase order or credit card authorization. **Your registration must be postmarked no later than December 16, 2011** and mailed to MATHCOUNTS Registration, P.O. Box 441, Annapolis Junction, MD 20701. The team registration fee is \$90. The individual registration fee is \$25 per student. Reduced fees of \$40 per team and \$10 per individual are available to schools entitled to receive Title I funds. Registration fees are nonrefundable. An additional fee of \$20 will be assessed to process late registrations. (This fee is for each late registration form and not for each student being registered.) See the Registration Form on page 95 for additional details.

**Do not hold up the mailing of your Club in a Box Resource Kit because you are waiting for a purchase order to be processed or a check to be cut by your school for the competition registration fee. Fill out your Registration Form and send in a photocopy of it without payment. We immediately will mail your Club in a Box Resource Kit (which contains a hard copy of the *MATHCOUNTS School Handbook*) and credit your account once your payment is received with the original Registration Form.**

By completing the Registration Form, the coach attests to the school administration's permission to register students for MATHCOUNTS.

Academic centers or enrichment programs that do not function as students' official school of record are not eligible to register.

Registration in the Competition Program entitles a school to send students to the local competition and earns the school Bronze Level Status in the MATHCOUNTS Club Program. Additionally, registered schools will receive two mailings:

- The first, immediate mailing will be the Club in a Box Resource Kit, which contains a copy of the *2011-2012 MATHCOUNTS School Handbook*, the *Club Resource Guide* with 10 club meeting ideas and other materials for the MATHCOUNTS Club Program.
- The second mailing will include the School Competition Kit (with instructions, School Competition & Answer Key, recognition ribbons and student participation certificates) and a catalog of additional coaching materials. The first batch of School Competition Kits will be mailed in early November, and additional mailings will occur on a rolling basis to schools sending in the Registration Forms later in the fall.

**Your Registration Form must be postmarked by December 16, 2011.** *In some circumstances, late registrations might be accepted, at the discretion of MATHCOUNTS and the local coordinator.* However, late fees will apply.

The sooner you register, the sooner you will receive your School Competition Kit and can start preparing your team. Once processed, confirmation of your registration will be available through the registration database in the Registered Schools section of the MATHCOUNTS website ([www.mathcounts.org](http://www.mathcounts.org)). Other questions about the status of your registration should be directed to MATHCOUNTS Registration, P.O. Box 441, Annapolis Junction, MD 20701. Telephone: 301-498-6141. Your state or local coordinator will be notified of your registration, and you then will be informed of the date and location of your local competition. ***If you have not been contacted by mid-January with competition details, it is your responsibility to contact your local coordinator*** to confirm that your registration has been properly routed and that your school's participation is expected. Coordinator contact information is available in the Find a Coordinator section of [www.mathcounts.org](http://www.mathcounts.org). Questions about a local or state program should be addressed to your coordinator.



## ELIGIBLE PARTICIPANTS

**Students enrolled in the sixth, seventh or eighth grade are eligible to participate in MATHCOUNTS competitions.** Students taking middle school mathematics classes who are not full-time sixth-, seventh- or eighth-graders are not eligible. Participation in MATHCOUNTS competitions is limited to three years for each student, though there is no limit to the number of years a student may participate in the school-based coaching phase.

**School Registration: A school may register one team of four and up to six individuals for a total of 10 participants.** You must designate team members versus individuals prior to the start of the chapter (local) competition (i.e., a student registered as an “individual” may not help his or her school team advance to the next level of competition).

**Team Registration: Only one team (of up to four students) per school is eligible to compete.** Members of a school team will participate in the Sprint, Target and Team Rounds. Members of a school team also will be eligible to qualify for the Countdown Round (where conducted). Team members will be eligible for team awards, individual awards and progression to the state and national levels based on their individual and/or team performance. It is recommended that your strongest four Mathletes form your school team. Teams of fewer than four will be allowed to compete; however, the team score will be computed by dividing the sum of the team members’ scores by 4 (see “Scoring” on page 18 for details). Consequently, teams of fewer than four students will be at a disadvantage.

**Individual Registration: Up to six students may be registered in addition to or in lieu of a school team.** Students registered as individuals will participate in the Sprint and Target Rounds but not the Team Round. Individuals will be eligible to qualify for the Countdown Round (where conducted). Individuals also will be eligible for individual awards and progression to the state and national levels.

**School Definitions:** *Academic centers or enrichment programs that do not function as students’ official school of record are not eligible to register.* If it is unclear whether an educational institution is considered a school, please contact your local Department of Education for specific criteria governing your state.

**School Enrollment Status:** *A student may compete only for his or her official school of record.* A student’s school of record is the student’s base or main school. A student taking limited course work at a second school or educational center may not register or compete for that second school or center, even if the student is not competing for his or her school of record. MATHCOUNTS registration is not determined by where a student takes his or her math course. If there is any doubt about a student’s school of record, the local or state coordinator must be contacted for a decision before registering.

**Small Schools:** MATHCOUNTS no longer distinguishes between the sizes of schools for Competition Program registration and competition purposes. Every “brick-and-mortar” school will have the same registration allowance of up to one team of four students and/or up to six individuals. A school’s participants may not combine with any other school’s participants to form a team when registering or competing.

**Homeschools:** Homeschools in compliance with the homeschool laws of the state in which they are located are eligible to participate in MATHCOUNTS competitions in accordance with all other rules. Homeschool coaches must complete a Homeschool Participation Attestation Form, verifying that students from the homeschool or homeschool group are in the sixth, seventh or eighth grade and that each homeschool complies with applicable state laws. Completed attestations must be submitted to the national office before registrations will be processed. A Homeschool Participation Attestation Form can be downloaded from the right navigation bar by visiting [www.mathcounts.org/competition](http://www.mathcounts.org/competition). Please fax attestations to 703-299-5009.

**Virtual Schools:** Any virtual school interested in registering students must contact the MATHCOUNTS national office at 703-299-9006 before December 16, 2011 for registration details. Any student registering as a virtual school student must compete in the MATHCOUNTS Chapter Competition assigned according to the student’s home address. Additionally, virtual school coaches must complete a Homeschool Participation Attestation Form verifying that the students from the virtual school are in the sixth, seventh or eighth grade and that the virtual school complies with applicable state laws. Completed attestations must be submitted to the national office



before registrations will be processed. A Homeschool Participation Attestation Form can be downloaded from the right navigation bar by visiting [www.mathcounts.org/competition](http://www.mathcounts.org/competition). Please fax attestations to 703-299-5009.

**Substitutions by Coaches:** Coaches may not substitute team members for the State Competition unless a student voluntarily releases his or her position on the school team. Additional requirements and documentation for substitutions (such as requiring parental release or requiring the substitution request to be submitted in writing) are at the discretion of the state coordinator. Coaches may not make substitutions for students progressing to the State Competition as individuals. At all levels of competition, student substitutions are not permitted after on-site competition registration has been completed. A student being added to a team need not be a student who was registered for the Chapter Competition as an individual.

**Religious Observances:** A student who is unable to attend a competition due to religious observances may take the written portion of the competition up to one week in advance of the scheduled competition. In addition, all competitors from that student's school must take the exam at the same time. ***Advance testing will be done at the discretion of the local and state coordinators. If advance testing is deemed possible, it will be conducted under proctored conditions.*** If the student who is unable to attend the competition due to a religious observance is not part of the school team, then the team has the option of taking the Team Round during this advance testing or on the regularly scheduled day of the competition with the other teams. The coordinator must be made aware of the team's decision before the advance testing takes place. Students who qualify for an official Countdown Round but are unable to attend will automatically forfeit one place standing.

**Special Needs:** Reasonable accommodations may be made to allow students with special needs to participate. ***A request for accommodation of special needs must be directed to local or state coordinators in writing at least three weeks in advance of the local or state competition.*** This written request should thoroughly explain a student's special need as well as what the desired accommodation would entail. Many accommodations that are employed in a classroom or teaching environment cannot be implemented in the competition setting. Accommodations that are not permissible include, but are not limited to, granting a student extra time during any of the competition rounds or allowing a student to use a calculator for the Sprint or Countdown Rounds. In conjunction with the MATHCOUNTS Foundation, coordinators will review the needs of the student and determine if any accommodations will be made. In making final determinations, the feasibility of accommodating these needs at the National Competition will be taken into consideration.

## LEVELS OF COMPETITION

MATHCOUNTS competitions are organized at four levels: school, chapter (local), state and national. Competitions are written for the sixth- through eighth-grade audience. The competitions can be quite challenging, particularly for students who have not been coached using MATHCOUNTS materials. All competition materials are prepared by the national office.

The real success of MATHCOUNTS is influenced by the coaching sessions at the school level. This component of the program involves the most students (more than 500,000 annually), comprises the longest period of time and demands the greatest involvement.

**SCHOOL COMPETITION:** In January, after several months of coaching, schools registered for the Competition Program should administer the School Competition to all interested students. The School Competition is intended to be an aid to the coach in determining competitors for the Chapter (local) Competition. *Selection of team and individual competitors is entirely at the discretion of coaches and need not be based solely on School Competition scores.* The School Competition is sent to the coach of a school, and it may be used by the teachers and students only in association with that school's programs and activities. The current year's School Competition questions must remain confidential and may not be used in outside activities, such as tutoring sessions or enrichment programs with students from other schools. *For additional announcements or edits, please check the Coaches' Forum in the Coaches section on the MATHCOUNTS website before administering the School Competition.*

It is important that the coach look upon coaching sessions during the academic year as opportunities to develop better math skills in all students, not just in those students who will be competing. Therefore, it is suggested that the coach postpone selection of competitors until just prior to the local competitions.

**CHAPTER COMPETITIONS: Held from February 1 through February 29, 2012,** the Chapter Competition consists of the Sprint, Target and Team Rounds. The Countdown Round (official or just for fun) may or may not be included. The chapter and state coordinators determine the date and administration of the local competition in accordance with established national procedures and rules. Winning teams and students will receive recognition. The winning team will advance to the State Competition. Additionally, the two highest-ranking competitors not on the winning team (who may be registered as individuals or as members of a team) will advance to the State Competition. This is a minimum of six advancing Mathletes (assuming the winning team has four members). Additional teams and/or Mathletes also may progress at the discretion of the state coordinator. The policy for progression must be consistent for all chapters within a state.

**STATE COMPETITIONS: Held from March 1 through March 31, 2012,** the State Competition consists of the Sprint, Target and Team Rounds. The Countdown Round (official or just for fun) may or may not be included. The state coordinator determines the date and administration of the State Competition in accordance with established national procedures and rules. Winning teams and students will receive recognition. The four highest-ranked Mathletes and the coach of the winning team from each State Competition will receive an all-expense-paid trip to the National Competition.

**RAYTHEON MATHCOUNTS NATIONAL COMPETITION: Held Friday, May 11, 2012 in Orlando, Florida,** the National Competition consists of the Sprint, Target, Team and Countdown Rounds. Expenses of the state team and coach to travel to the National Competition will be paid by MATHCOUNTS. The national program does not make provisions for the attendance of additional students or coaches. All national competitors will receive a plaque and other items in recognition of their achievements. Winning teams and individuals also will receive medals, trophies and college scholarships.

## COMPETITION COMPONENTS

MATHCOUNTS competitions are designed to be completed in approximately three hours:

The **SPRINT ROUND** (40 minutes) consists of 30 problems. This round tests accuracy, with the time period allowing only the most capable students to complete all of the problems. **Calculators are not permitted.**

The **TARGET ROUND** (approximately 30 minutes) consists of 8 problems presented to competitors in four pairs (6 minutes per pair). This round features multistep problems that engage Mathletes in mathematical reasoning and problem-solving processes. **Problems assume the use of calculators.**

The **TEAM ROUND** (20 minutes) consists of 10 problems that team members work together to solve. Team member interaction is permitted and encouraged. **Problems assume the use of calculators.**

*Note:* Coordinators may opt to allow those competing as individuals to create a “squad” to take the Team Round for the experience, but the round *should not be scored and is not considered official*.

The **COUNTDOWN ROUND** is a fast-paced oral competition for top-scoring individuals (based on scores in the Sprint and Target Rounds). In this round, pairs of Mathletes compete against each other and the clock to solve problems. **Calculators are not permitted.**

At Chapter and State Competitions, a Countdown Round may be conducted officially or unofficially (for fun) or it may be omitted. However, the use of an official Countdown Round must be consistent for all chapters within a state. In other words, *all* chapters within a state must use the round officially in order for *any* chapter within a state to use it officially. All students, whether registered as part of a school team or as individual competitors, are eligible to qualify for the Countdown Round.

**An official Countdown Round** is defined as one that determines an individual’s final overall rank in the competition. If the Countdown Round is used officially, the official procedures as established by the MATHCOUNTS Foundation must be followed.

**If a Countdown Round is conducted unofficially,** the official procedures do not have to be followed. Chapters and states choosing not to conduct the round officially must determine individual winners on the sole basis of students’ scores in the Sprint and Target Rounds of the competition.

**In an official Countdown Round**, the top 25% of students, up to a maximum of 10, are selected to compete. These students are chosen based on their individual scores. The two lowest-ranked students are paired, a question is projected and students are given 45 seconds to solve the problem. A student may buzz in at any time, and if he or she answers correctly, a point is scored; if a student answers incorrectly, the other student has the remainder of the 45 seconds to answer. Three questions are read to the pair of students, one question at a time, and the student who scores the higher number of points (not necessarily 2 out of 3) captures the place, progresses to the next round and challenges the next-higher-ranked student. (If students are tied after three questions (at 1-1 or 0-0), questions continue to be read until one is successfully answered.) This procedure continues until the fourth-ranked Mathlete and his or her opponent compete. For the final four rounds, the first student to correctly answer three questions advances. The Countdown Round proceeds until a first-place individual is identified. (More detailed rules regarding the Countdown Round procedure are identified in the Instructions section of the School Competition Booklet.) ***Note:** Rules for the Countdown Round change for the National Competition.*

## **ADDITIONAL RULES**

**All answers must be legible.**

**Pencils and paper** will be provided for Mathletes by competition organizers. However, students may bring their own pencils, pens and erasers if they wish. They may not use their own scratch paper or graph paper.

**Use of notes or other reference materials** (including dictionaries and translation dictionaries) is not permitted.

**Specific instructions stated in a given problem** take precedence over any general rule or procedure.

**Communication with coaches is prohibited during rounds but is permitted during breaks.** All communication between guests and Mathletes is prohibited during competition rounds. Communication between teammates is permitted only during the Team Round.

**Calculators are not permitted in the Sprint and Countdown Rounds, but they are permitted in the Target, Team and Tiebreaker (if needed) Rounds.** When calculators are permitted, students may use any calculator (including programmable and graphing calculators) that does not contain a QWERTY (typewriter-like) keypad. Calculators that have the ability to enter letters of the alphabet but do not have a keypad in a standard typewriter arrangement are acceptable. Smart phones, laptops, iPads®, iPods®, personal digital assistants (PDAs), and any other “smart” devices are not considered to be calculators and may not be used during competitions. Students may not use calculators to exchange information with another person or device during the competition.

**Coaches are responsible for ensuring that their students use acceptable calculators, and students are responsible for providing their own calculators.** Coordinators are not responsible for providing Mathletes with calculators or batteries before or during MATHCOUNTS competitions. Coaches are strongly advised to bring backup calculators and spare batteries to the competition for their team members in case of a malfunctioning calculator or weak or dead batteries. Neither the MATHCOUNTS Foundation nor coordinators shall be responsible for the consequences of a calculator’s malfunctioning.

**Pagers, cell phones, iPods® and other MP3 players should not be brought into the competition room.** Failure to comply could result in dismissal from the competition.

***Should there be a rule violation or suspicion of irregularities, the MATHCOUNTS coordinator or competition official has the obligation and authority to exercise his or her judgment regarding the situation and take appropriate action, which might include disqualification of the suspected student(s) from the competition.***

## SCORING

Competition scores do not conform to traditional grading scales. **Coaches and students should view an individual written competition score of 23 (out of a possible 46) as highly commendable.**

**The individual score** is the sum of the number of Sprint Round questions answered correctly and twice the number of Target Round questions answered correctly. There are 30 questions in the Sprint Round and 8 questions in the Target Round, so the maximum possible individual score is  $30 + 2(8) = 46$ .

**The team score** is calculated by dividing the sum of the team members' individual scores by 4 (even if the team has fewer than four members) and adding twice the number of Team Round questions answered correctly. The highest possible individual score is 46. Four students may compete on a team, and there are 10 questions in the Team Round. Therefore, the maximum possible team score is  $((46 + 46 + 46 + 46) \div 4) + 2(10) = 66$ .

If used officially, the Countdown Round yields final individual standings.

**Ties will be broken** as necessary to determine team and individual prizes and to determine which individuals qualify for the Countdown Round. For ties between individuals, the student with the higher Sprint Round score will receive the higher rank. If a tie remains after this comparison, specific groups of questions from the Sprint and Target Rounds are compared. For ties between teams, the team with the higher Team Round score, and then the higher sum of the team members' Sprint Round scores, receives the higher rank. If a tie remains after these comparisons, specific questions from the Team Round will be compared. Note: These are very general guidelines. Competition officials receive more detailed procedures.

In general, questions in the Sprint, Target and Team Rounds increase in difficulty so that the most difficult questions occur near the end of each round. In a comparison of questions to break ties, generally those who correctly answer the more difficult questions receive the higher rank.

**Protests concerning the correctness of an answer** on the written portion of the competition must be registered with the room supervisor in writing by a coach within 30 minutes of the end of each round. Rulings on protests are final and may not be appealed. Protests will not be accepted during the Countdown Round.

## RESULTS DISTRIBUTION

Coaches should expect to receive the scores of their students and a list of the top 25% of students and top 40% of teams from their coordinators. In addition, single copies of the blank competition materials and answer keys may be distributed to coaches after all competitions at that level nationwide have been completed. ***Before distributing blank competition materials and answer keys, coordinators must wait for verification from the national office that all such competitions have been completed.*** Both the problems and answers from Chapter and State Competitions will be posted on the MATHCOUNTS website following the completion of all competitions at that level nationwide (Chapter - early March; State - early April). The previous year's problems and answers will be taken off the website at that time.

Student competition papers and answers will not be viewed by or distributed to coaches, parents, students or other individuals. Students' competition papers become the confidential property of the MATHCOUNTS Foundation.

## FORMS OF ANSWERS

The following rules explain acceptable forms for answers. Coaches should ensure that Mathletes are familiar with these rules prior to participating at any level of competition. Judges will score competition answers in compliance with these rules for forms of answers.

**All answers must be expressed in simplest form.** A “common fraction” is to be considered a fraction in the form  $\pm \frac{a}{b}$ , where  $a$  and  $b$  are natural numbers and  $\text{GCF}(a, b) = 1$ . In some cases the term “common fraction” is to be considered a fraction in the form  $\frac{A}{B}$ , where  $A$  and  $B$  are algebraic expressions and  $A$  and  $B$  do not have a common factor. A simplified “mixed number” (“mixed numeral,” “mixed fraction”) is to be considered a fraction in the form  $\pm N\frac{a}{b}$ , where  $N$ ,  $a$  and  $b$  are natural numbers,  $a < b$  and  $\text{GCF}(a, b) = 1$ . Examples:

*Problem:* Express 8 divided by 12 as a common fraction.      *Answer:*  $\frac{2}{3}$       *Unacceptable:*  $\frac{4}{6}$   
*Problem:* Express 12 divided by 8 as a common fraction.      *Answer:*  $\frac{3}{2}$       *Unacceptable:*  $\frac{12}{8}$ ,  $1\frac{1}{2}$   
*Problem:* Express the sum of the lengths of the radius and the circumference of a circle with a diameter of  $\frac{1}{4}$  as a common fraction in terms of  $\pi$ .      *Answer:*  $\frac{1+2\pi}{8}$   
*Problem:* Express 20 divided by 12 as a mixed number.      *Answer:*  $1\frac{2}{3}$       *Unacceptable:*  $1\frac{8}{12}$ ,  $\frac{5}{3}$

**Ratios should be expressed as simplified common fractions** unless otherwise specified. Examples:

*Simplified, Acceptable Forms:*  $\frac{7}{2}$ ,  $\frac{3}{\pi}$ ,  $\frac{4-\pi}{6}$       *Unacceptable:*  $3\frac{1}{2}$ ,  $\frac{1}{3}$ , 3.5, 2:1

**Radicals must be simplified.** A simplified radical must satisfy: 1) no radicands have a factor which possesses the root indicated by the index; 2) no radicands contain fractions; and 3) no radicals appear in the denominator of a fraction. Numbers with fractional exponents are *not* in radical form. Examples:

*Problem:* Evaluate  $\sqrt{15} \times \sqrt{5}$ .      *Answer:*  $5\sqrt{3}$       *Unacceptable:*  $\sqrt{75}$

**Answers to problems asking for a response in the form of a dollar amount or an unspecified monetary unit (e.g., “How many dollars...,” “How much will it cost...,” “What is the amount of interest...”) should be expressed in the form (\$)  $a.bc$ , where  $a$  is an integer and  $b$  and  $c$  are digits.** The *only* exceptions to this rule are when  $a$  is zero, in which case it may be omitted, or when  $b$  and  $c$  are both zero, in which case they may both be omitted. Examples:

*Acceptable:* 2.35, 0.38, .38, 5.00, 5      *Unacceptable:* 4.9, 8.0

**Units of measurement are not required in answers, but they must be correct if given.** When a problem asks for an answer expressed in a specific unit of measure or when a unit of measure is provided in the answer blank, equivalent answers expressed in other units are not acceptable. For example, if a problem asks for the number of ounces and 36 oz is the correct answer, 2 lb 4 oz will not be accepted. If a problem asks for the number of cents and 25 cents is the correct answer, \$0.25 will not be accepted.

**Do not make approximations for numbers** (e.g.,  $\pi$ ,  $\frac{2}{3}$ ,  $5\sqrt{3}$ ) in the data given or in solutions unless the problem says to do so.

**Do not do any intermediate rounding** (other than the “rounding” a calculator performs) when calculating solutions. All rounding should be done at the end of the calculation process.

**Scientific notation** should be expressed in the form  $a \times 10^n$  where  $a$  is a decimal,  $1 \leq |a| < 10$ , and  $n$  is an integer. Examples:

*Problem:* Write 6895 in scientific notation.      *Answer:*  $6.895 \times 10^3$   
*Problem:* Write 40,000 in scientific notation.      *Answer:*  $4 \times 10^4$  or  $4.0 \times 10^4$

**An answer expressed to a greater or lesser degree of accuracy than called for in the problem will not be accepted. Whole-number answers should be expressed in their whole-number form.**

Thus, 25.0 will not be accepted for 25, and 25 will not be accepted for 25.0.

**The plural form of the units will always be provided in the answer blank, even if the answer appears to require the singular form of the units.**



## VOCABULARY AND FORMULAS

The following list is representative of terminology used in the problems but should not be viewed as all-inclusive. It is recommended that coaches review this list with their Mathletes.

abscissa	decimal	integer
absolute value	degree measure	interior angle of a polygon
acute angle	denominator	intersection
additive inverse (opposite)	diagonal of a polygon	inverse variation
adjacent angles	diagonal of a polyhedron	irrational number
algorithm	diameter	isosceles
alternate exterior angles	difference	lateral edge
alternate interior angles	digit	lateral surface area
altitude (height)	digit-sum	lattice point(s)
area	direct variation	LCM
arithmetic mean	dividend	linear equation
arithmetic sequence	divisible	mean
base 10	divisor	median of a set of data
binary	edge	median of a triangle
bisect	endpoint	midpoint
box-and-whisker plot	equation	mixed number
center	equiangular	mode(s) of a set of data
chord	equidistant	multiple
circle	equilateral	multiplicative inverse (reciprocal)
circumference	evaluate	natural number
circumscribe	expected value	numerator
coefficient	exponent	obtuse angle
collinear	expression	octagon
combination	exterior angle of a polygon	octahedron
common denominator	factor	odds (probability)
common divisor	factorial	opposite of a number (additive inverse)
common factor	Fibonacci sequence	ordered pair
common fraction	finite	ordinate
common multiple	formula	origin
complementary angles	frequency distribution	palindrome
composite number	frustum	parallel
compound interest	function	parallelogram
concentric	GCF	Pascal's triangle
cone	geometric mean	pentagon
congruent	geometric sequence	percent increase/decrease
convex	height (altitude)	perimeter
coordinate plane/system	hemisphere	permutation
coordinates of a point	hexagon	perpendicular
coplanar	hypotenuse	planar
corresponding angles	image(s) of a point (points) (under a transformation)	polygon
counting numbers	improper fraction	polyhedron
counting principle	inequality	prime factorization
cube	infinite series	prime number
cylinder	inscribe	principal square root
data		



prism	remainder	system of equations/inequalities
probability	repeating decimal	tangent figures
product	revolution	tangent line
proper divisor	rhombus	term
proper factor	right angle	terminating decimal
proper fraction	right circular cone	tetrahedron
proportion	right circular cylinder	total surface area
pyramid	right polyhedron	transformation
Pythagorean Triple	right triangle	translation
quadrant	rotation	trapezoid
quadrilateral	scalene triangle	triangle
quotient	scientific notation	triangular numbers
radius	segment of a line	trisect
random	semicircle	union
range of a data set	sequence	unit fraction
rate	set	variable
ratio	similar figures	vertex
rational number	simple interest	vertical angles
ray	slope	volume
real number	slope-intercept form	whole number
reciprocal (multiplicative inverse)	solution set	x-axis
rectangle	sphere	x-coordinate
reflection	square	x-intercept
regular polygon	square root	y-axis
relatively prime	stem-and-leaf plot	y-coordinate
	sum	y-intercept
	supplementary angles	

The list of formulas below is representative of those needed to solve MATHCOUNTS problems but should not be viewed as the only formulas that may be used. Many other formulas that are useful in problem solving should be discovered and derived by Mathletes.

#### CIRCUMFERENCE

Circle	$C = 2 \times \pi \times r = \pi \times d$
--------	--

#### AREA

Square	$A = s^2$
Rectangle	$A = l \times w = b \times h$
Parallelogram	$A = b \times h$
Trapezoid	$A = \frac{1}{2}(b_1 + b_2) \times h$
Circle	$A = \pi \times r^2$
Triangle	$A = \frac{1}{2} \times b \times h$
Triangle	$A = \sqrt{s(s-a)(s-b)(s-c)}$
Equilateral triangle	$A = \frac{s^2 \sqrt{3}}{4}$
Rhombus	$A = \frac{1}{2} \times d_1 \times d_2$

#### SURFACE AREA AND VOLUME

Sphere	$SA = 4 \times \pi \times r^2$
Sphere	$V = \frac{4}{3} \times \pi \times r^3$
Rectangular prism	$V = l \times w \times h$
Circular cylinder	$V = \pi \times r^2 \times h$
Circular cone	$V = \frac{1}{3} \times \pi \times r^2 \times h$
Pyramid	$V = \frac{1}{3} \times B \times h$
Pythagorean Theorem	$c^2 = a^2 + b^2$
Counting/ Combinations	${}_nC_r = \frac{n!}{r!(n-r)!}$

# MATHCOUNTS CLUB PROGRAM . . .

## A MORE DETAILED LOOK



MATHCOUNTS recognizes that math clubs can play an important role in shaping students' attitudes and abilities. In an effort to support existing math clubs and their coaches, as well as encourage the formation of new math clubs, MATHCOUNTS offers the MATHCOUNTS Club Program (MCP).

Whether you are starting a new program or continuing a tradition of strong math clubs in your school, MATHCOUNTS understands the challenges involved in such a commitment. MATHCOUNTS also understands the meaningful rewards of coaching a math club and the strong impact you can have on students through organized math activities. The MATHCOUNTS Club Program is designed to provide schools with the structure and activities to hold regular meetings of a math club. Depending on the level of student and teacher involvement, a school may receive a recognition trophy or banner and be entered in a drawing for prizes.

The Club Program may be used by schools as a stand-alone program, a curriculum supplement for classroom work or part of the student preparation for the MATHCOUNTS Competition Program.

## CLUB MATERIALS

When a school registers a club in the MATHCOUNTS Club Program, the school will be sent a Club in a Box Resource Kit, containing (1) the *Club Resource Guide*, which outlines structured club activities, (2) the Silver Level Status Packet, complete with five Silver Level Challenges for your students, (3) a game set to supplement an activity in the *Club Resource Guide*, (4) 12 MATHCOUNTS pencils and (5) a resource CD with four years' worth of MATHCOUNTS Club Program activities, activity sheets and solutions. Additionally, solutions to all Silver Level Challenges and an Ultimate Math Challenge will be made available online for use by math club students.

Be sure to take advantage of the new Coaches' Resource Videos. The **Introduction to the Club in a Box Resource Kit** video will provide you with an overview of the materials in the Club in a Box Resource Kit. In addition, a second video, **Achieving Silver Level and Gold Level Status in the MATHCOUNTS Club Program**, explains the steps necessary for your school to achieve Silver Level and Gold Level Status in the Club Program. The videos can be accessed at [www.mathcounts.org/videos](http://www.mathcounts.org/videos) or on the MATHCOUNTS YouTube page, which can be found at [www.youtube.com/mathcountsfdn](http://www.youtube.com/mathcountsfdn).

The ***Club Resource Guide*** and the **Silver Level Challenges** are the backbone of the MCP. The *Club Resource Guide* contains 10 meeting activity ideas you can use as a basis for planning enjoyable, instructive get-togethers for your math club throughout the year. There is no particular order in which the meeting ideas must be used, and all activities are optional. In addition to the meeting ideas, five Silver Level Challenges are provided. Club sponsors should work these Challenges into their meeting plans, as completion of all five of these Challenges is required for Silver Level Status.

In addition to the materials sent in the Club in a Box Resource Kit, a special MCP Members Only page ([www.mathcounts.org/club](http://www.mathcounts.org/club)) will become visible and available to any coach signing up a club in the MCP or registering students in the Competition Program. (Coaches also must create a User Profile on [mathcounts.org](http://mathcounts.org) to gain access to this members-only page.) This web page provides solutions to all Silver Level Challenges (released one per month), over 40 meeting plans or ideas from previous years and all of the resources necessary to conduct any of the suggested meeting ideas.

## GETTING STARTED

1. The MATHCOUNTS Club Program is open only to sixth-, seventh- and eighth-grade students in U.S.-based schools.
2. The club coach must complete and submit the MATHCOUNTS Registration Form to register the school's math club. By selecting Option 1 or Option 2 on this form, your school has reached Bronze Level Status and will be recognized on the MATHCOUNTS website. (The MATHCOUNTS Registration Form is available at the back of this book and online at [www.mathcounts.org/club](http://www.mathcounts.org/club).)
3. Shortly after MATHCOUNTS receives your Registration Form, a hard copy of the *2011–2012 MATHCOUNTS School Handbook* and the Club in a Box Resource Kit will be sent to you.
4. Begin recruiting club members and spreading the word about your first club meeting. The *Club Resource Guide* included in the Club in a Box Resource Kit contains many helpful ideas for starting a club program.
5. Start using the handbook problems and materials in the Club in a Box Resource Kit with the students in your math club. Among other items, the Resource Kit includes structured club activities, the Silver Level Status Packet, pencils for your students and a game set that accompanies an activity in the *Club Resource Guide*.
6. Visit [www.mathcounts.org/videos](http://www.mathcounts.org/videos) to view the new Coaches' Resource Videos. The **Introduction to the Club in a Box Resource Kit** video will provide you with an overview of the materials in the Club in a Box Resource Kit and how to best utilize them. In addition, a second video, **Achieving Silver Level and Gold Level Status in the MATHCOUNTS Club Program**, explains the steps necessary for your school to achieve Silver Level and Gold Level Status in the Club Program. The videos can also be found on the MATHCOUNTS YouTube page at [www.youtube.com/mathcountsfdn](http://www.youtube.com/mathcountsfdn).

## ATTAINING SILVER LEVEL STATUS

1. Though it is hoped that more than 12\* students will participate in your math club and tackle the Silver Level Challenges, your school must have at least 12\* students who each complete all five of the Challenges. Silver Level Challenge solutions will be available each month from September through January.
2. Each of the Silver Level Challenges (and their answer keys) will be available on the MCP Members Only page in the Club Program section of [www.mathcounts.org](http://www.mathcounts.org).
3. Once your school club has 12\* students who have each fulfilled the Silver Level requirement of completing all five of the Silver Level Challenges, complete the Application for Silver Level Status with the names of those students and your contact information. This form is available in the Club in a Box Resource Kit, in the *Club Resource Guide* and on the MCP Members Only page of the MATHCOUNTS website.
4. Submit your Application for Silver Level Status via fax or mail to the address shown here. (Please submit your form only once.)
5. Deadline: Your Application for Silver Level Status must be received by March 2, 2012 for your school to be eligible for the prize drawing (\$250 gift cards).
6. The winners of the drawing will be notified by April 27, 2012. A list of the winners will be posted online. MATHCOUNTS will send the prizes to the winners by April 27, 2012.
7. In May, MATHCOUNTS will send a trophy to all Silver Level Schools in recognition of their achievement.

**MATHCOUNTS Foundation**  
**Silver Level - Club Program**  
**1420 King Street**  
**Alexandria, VA 22314**  
**Fax: 703-299-5009**

\*Minimum club participation based on number of students at your school. Please see *Frequently Asked Questions* on pages 25-26 for more information on Club Program eligibility.

## ATTAINING GOLD LEVEL STATUS

1. Your math club first must attain Silver Level Status in the Club Program.
2. Once a club has reached Silver Level Status, MATHCOUNTS will e-mail the coach the Ultimate Math Challenge. (The first e-mails will go out on February 10, 2012. Schools attaining Silver Level Status after this date will receive their Ultimate Math Challenge within one week of attaining Silver Level Status.)
3. Once your students have completed the Ultimate Math Challenge, mail students' completed Challenges (maximum of 20 per school) and the Application for Gold Level Status to the address shown here. More specific details and the Application for Gold Level Status will be provided when the Ultimate Math Challenge is e-mailed to the coach.
4. MATHCOUNTS will score the students' Ultimate Math Challenges and determine if your math club has attained Gold Level Status. Every math club member may take the Ultimate Math Challenge. However, no more than 20 completed Challenges per school may be submitted. At least 12\* of the submitted Ultimate Math Challenges each must have 80% or more of the problems answered correctly for a school to attain Gold Level Status.
5. Deadline: Your Application for Gold Level Status and your students' completed Challenges must be received by March 30, 2012 for your school to be eligible for the prize drawing (\$500 gift cards, trip to the National Competition).
6. The winners of the drawing will be notified by April 27, 2012. A list of the winners will be posted online. MATHCOUNTS will send the prizes to the winners by April 27, 2012.
7. In May, MATHCOUNTS will send a banner and a trophy to all Gold Level Schools in recognition of their achievement. (Gold Level Schools will not receive the Silver Level trophy, too.)

<b>MATHCOUNTS Foundation</b> <b>Gold Level - Club Program</b> <b>1420 King Street</b> <b>Alexandria, VA 22314</b>
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*\*Minimum club participation based on number of students at your school. Please see Frequently Asked Questions on pages 25-26 for more information on Club Program eligibility.*

## FREQUENTLY ASKED QUESTIONS

### Who is eligible to participate?

Anyone eligible for the MATHCOUNTS Competition Program is eligible to participate in the Club Program. The Club Program is open to all U.S. schools with sixth-, seventh- or eighth-grade students. Schools (brick-and-mortar, virtual and homeschools) with 12\* or fewer students in each of the sixth, seventh and eighth grades are permitted to combine for the purpose of reaching Silver or Gold Level Status.

### Can my enrichment and/or learning center participate?

No. The students can participate in Reel Math Challenge, but, only schools eligible for the MATHCOUNTS Competition Program can earn club prizes.

### How many students can participate?

There is no limit to the number of students who may participate in the MATHCOUNTS Club Program. Encourage every interested sixth-, seventh- and eighth-grade student to get involved.

### What if our school has more than one math club?

MATHCOUNTS encourages all math clubs in a school to make use of the MATHCOUNTS Club Program materials. However, each school may have only one officially registered club in the MATHCOUNTS Club Program. Therefore, it is recommended that schools combine their clubs when working toward meeting the requirements of Silver or Gold Level Status.

### What does it cost to participate?

**Nothing.** There is no fee to participate in the Club Program. The *MATHCOUNTS School Handbook*, participation in Reel Math Challenge and the Club in a Box Resource Kit are free to all eligible schools that request them. For more information on Reel Math Challenge, visit [www.reelmath.org](http://www.reelmath.org).

### Can a school participate in both the Club Program and the Competition Program?

**Yes.** A school may choose to participate in the Club Program, the Competition Program or both. Since these programs can complement each other, any school that registers for the MATHCOUNTS Competition Program (Option 2 on the MATHCOUNTS Registration Form) will automatically be signed up for the Club Program and will be sent the Club in a Box Resource Kit.

### How is the Club Program different from the Competition Program?

The Club Program does not include a school-versus-school competition with the opportunity for top performers to advance. There are no fees to participate in the Club Program, and recognition is focused entirely on the school and the math club.

### What if our school has a small student population?

The number of required participants in your club is based on the number of students at your school.

- For schools with **fewer than a total of 50 students** in the sixth, seventh and eighth grades, the minimum number of participants needed to satisfy the Silver and Gold Level requirements is **4**.
- For schools with **a total of 50-99 students** in the sixth, seventh and eighth grades, the minimum number of participants needed to satisfy the Silver and Gold Level requirements is **8**.
- For schools with **a total of 100 students or more** in the sixth, seventh and eighth grades, the minimum number of participants needed to satisfy the Silver and Gold Level requirements is **12**.

*\*Minimum club participation based on number of students at your school. Please see Frequently Asked Questions on pages 25-26 for more information on Club Program eligibility.*

## What are the different levels of the program?

Level	Requirements	School Receives
<b>BRONZE</b>	<ol style="list-style-type: none"> <li>1. Choose Option 1 (Club Program) or Option 2 (Club Program and Competition Program) and fill in the required information on the MATHCOUNTS Registration Form (p. 95), in the <i>2011–2012 MATHCOUNTS School Handbook</i> or online at <a href="http://www.mathcounts.org">www.mathcounts.org</a>.</li> <li>2. Submit the form to MATHCOUNTS.</li> </ol>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Recognition on <a href="http://www.mathcounts.org">www.mathcounts.org</a></li> <li><input type="checkbox"/> Club in a Box Resource Kit containing hard copy of the <i>2011-2012 MATHCOUNTS School Handbook</i></li> </ul>
<b>SILVER</b>	<ol style="list-style-type: none"> <li>1. Depending on the size of your school, at least 12* members of the math club each must take 5 Silver Level Challenges (available online and in the Silver Level Status Packet).</li> <li>2. The Application for Silver Level Status must be received by MATHCOUNTS by March 2, 2012 (available in the Club in a Box Resource Kit, in the <i>Club Resource Guide</i> and on the MCP Members Only page in the Club Program section of <a href="http://www.mathcounts.org">www.mathcounts.org</a>) for entry to drawings.</li> </ol>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Recognition on <a href="http://www.mathcounts.org">www.mathcounts.org</a></li> <li><input type="checkbox"/> Certificates for students</li> <li><input type="checkbox"/> Trophy identifying your school as a Silver Level MATHCOUNTS School</li> <li><input type="checkbox"/> Entry to a drawing** for one of ten \$250 gift cards for student recognition</li> </ul> <p><i>**Schools going on to reach Gold Level Status will be included in the Silver Level drawing but will receive only the Gold Level trophy.</i></p>
<b>GOLD</b>	<ol style="list-style-type: none"> <li>1. Achieve Silver Level Status.</li> <li>2. At least 12* members of the math club each must score 80% or higher on the Ultimate Math Challenge (available in February/e-mailed to coaches of Silver Level Schools).</li> <li>3. The completed Ultimate Math Challenges and Application for Gold Level Status must be received by MATHCOUNTS by March 30, 2012. (Any number of students may take the Challenge, but a maximum of 20 completed Ultimate Challenges may be submitted per school.)</li> </ol>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Recognition on <a href="http://www.mathcounts.org">www.mathcounts.org</a></li> <li><input type="checkbox"/> Certificates for students</li> <li><input type="checkbox"/> Banner and trophy identifying your school as a Gold Level MATHCOUNTS School</li> <li><input type="checkbox"/> Entry to a drawing for: <ol style="list-style-type: none"> <li>1) One of five \$500 gift cards for student recognition</li> <li>2) Grand Prize: \$500 gift card for student recognition and a trip for four students and the coach to witness the 2012 Raytheon MATHCOUNTS National Competition in Orlando, Florida (May 11, 2012)</li> </ol> </li> </ul>

**MATHCOUNTS reserves the right to modify the MATHCOUNTS Club Program guidelines as necessary.**

*\*Minimum club participation based on number of students at your school. Please see Frequently Asked Questions on pages 25-26 for more information on Club Program eligibility.*



# REEL MATH CHALLENGE . . .

## A MORE DETAILED LOOK



Reel Math Challenge is an innovative new program set to launch for the 2011-2012 program year. This program is underwritten in part by the Department of Defense, making the program free and accessible to all participants. Reel Math Challenge is unique among MATHCOUNTS programs in that technology is a main component. Students must utilize technology to create videos on math problems and their associated concepts. Technological proficiency is a critical skill for the 21st century, and MATHCOUNTS hopes Reel Math Challenge will help students embrace the opportunity to create digital media with cutting-edge technology.

Another new opportunity offered by this program is collaboration between students who are not in other MATHCOUNTS programs, as long as the students are in the sixth, seventh or eighth grade from eligible schools. Even if a school does not participate in other MATHCOUNTS programs, its students will be able to participate in Reel Math Challenge. Therefore, if a school does not participate in other MATHCOUNTS programs, students still will be able to participate in Reel Math Challenge.

MATHCOUNTS hopes the Reel Math Challenge will not only excite students about math but also allow them to be creative and build their communications skills in a math setting. In addition, MATHCOUNTS hopes the ability for students to form their own teams will help them create lifelong friendships with like-minded students.

### DETAILS

Reel Math Challenge is a team competition. Only a team of four students may submit a video. Each video must be based on one of the 300 problems included in the *2011-2012 MATHCOUNTS School Handbook* and must teach the solution to the selected math problem, as well as demonstrate the real-world application of the math concept used in the problem.

Once a video has been created, the team will need to visit [www.reelmath.org](http://www.reelmath.org) to create a user name and password. A team does not need an official coach or teacher in charge of its video project; however, a parent or guardian for each of the four students must give permission for his or her child to participate in the contest. As a precondition of participation in the Reel Math Challenge, a parent or guardian will be required to execute a Release Form on behalf of each team participant.

Once the team has successfully registered, it will be able to upload a video. The submission period for videos opens September 1, 2011 and will remain open through February 1, 2012.

All videos will be posted to [www.reelmath.org](http://www.reelmath.org), where the general public will vote on the best videos. Public voting begins November 15, 2011 and will remain open through February 1, 2012. The top 20 videos with the highest vote totals will be announced in February. The top 20 videos will advance to the semifinals of the competition, after which a panel of MATHCOUNTS judges will review them and select four finalists.

Each of the four finalist teams will receive an all-expense-paid trip to the 2012 MATHCOUNTS National Competition, where they will present their videos to the 224 students competing in that event. The National Competition Mathletes then will vote for one of the four videos to be the winner of the Reel Math Challenge. Each member of the winning team will receive a \$1000 college scholarship.

Once the winner has been decided and the contest has concluded, the website containing the archive of videos will remain available for public use at no charge.

Since these videos will be cross-referenced with specific MATHCOUNTS problems, and each MATHCOUNTS problem is indexed to specific math concepts and standards, this library of videos will be a powerful teaching tool for teachers and students to utilize for years.

**Please visit [www.reelmath.org](http://www.reelmath.org) for General Terms and Conditions.**





# Warm-Up 1

1. \_\_\_\_\_ months



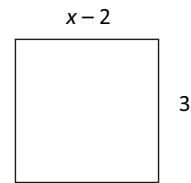
How many months are there in 35 years?

2. \_\_\_\_\_ A function exists of the form  $y = x + a$  that models the data shown. What is the value of  $a$ ?

$x$	$y$
2	5
3	6
4	7

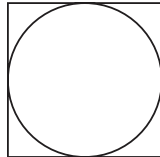
3. \_\_\_\_\_ numbers How many odd numbers are there between 20 and 158?

4. \_\_\_\_\_ The figure shown is a square. What is the value of  $x$ ?



5. \_\_\_\_\_ grapes A bowl contains 50 grapes of different colors. If 20% of the grapes in the bowl are red, how many grapes are *not* red?

6. \_\_\_\_\_  $\text{ft}^2$



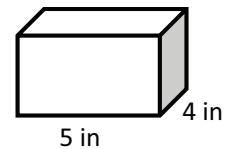
In the figure, a circle with radius 4 ft is inscribed in a square. What is the area of the square?

7. \_\_\_\_\_  $\text{mm}^2$  A triangle with an area of  $120 \text{ mm}^2$  has a height of 10 mm. What is the area of a similar triangle with a height of 20 mm?

8. \_\_\_\_\_ A bookshelf is to hold 6 literature books, 3 geometry books and 7 algebra books, arranged in random order. What is the probability that the books are arranged so that the first book on the shelf is a math book? Express your answer as a common fraction.



9. \_\_\_\_\_ in The volume of a rectangular prism is  $120 \text{ in}^3$ . Its length and width are 5 in and 4 in, respectively, as shown. What is the height of the prism?



10. \_\_\_\_\_ What is the greatest prime factor of 96?

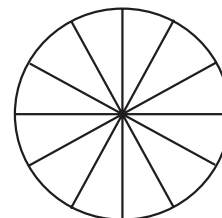


# Warm-Up 2

11. \_\_\_\_\_ What is the positive difference between the value of  $2 \times (3 + 4)$  and the value of  $2 \times 3 + 4$ ?

12. \_\_\_\_\_ uniforms Manny has 5 shirts, 3 pairs of pants, 2 ties and 4 pairs of shoes. If Manny's school uniform consists of a shirt, a pair of pants, a tie and a pair of shoes, how many different uniforms can he wear to school?

13. \_\_\_\_\_ degrees A circular pizza was cut into 12 congruent slices, as shown. If 2 slices were eaten, what is the sum of the central angles of the slices that were not eaten?



14. \_\_\_\_\_ ft A tennis court with a length of 78 ft is 6 ft longer than twice its width. What is the width of the tennis court?

15. \$ \_\_\_\_\_ Sam wishes to contribute a total of \$2500 to Charity A and Charity B, in the ratio of 2:3. How many dollars should Sam contribute to Charity B?

16. \_\_\_\_\_ % A number is selected at random from the first 20 positive integers. What is the probability the number selected is an odd prime number? Express your answer as a percent.

17. \_\_\_\_\_ What is the value of  $5 \times (11 + 4 \div 4)$ ?

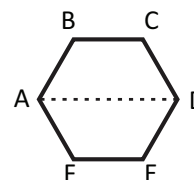
18. \_\_\_\_\_ cm The ratio of the lengths of corresponding sides of two similar decagons is 1:2. If the perimeter of the smaller decagon is 76 cm, what is the perimeter of the larger decagon?

19. \_\_\_\_\_ days



Each day a man floating on a raft paddles 3 mi north, but each night while he rests, the current of the river carries the raft 2 mi south. How many days will it take him to first reach a location 50 mi north of his starting location?

20. \_\_\_\_\_ cm Suppose ABCDEF, shown here, is a regular hexagon with sides of length 6 cm. What is the length of segment AD?





# Workout 1

21. \_\_\_\_\_ minutes If it was 10:30 am 55 minutes ago, in how many minutes will it be noon?

22. \$ \_\_\_\_\_ Phara purchased four different items from the list shown. The total price of the four items, not including tax, was \$17.36. What is the positive difference in the prices of the two items that she did not purchase?

Notebook	\$2.99
Wallet	\$3.49
Puzzle	\$6.29
Photo Album	\$4.99
Card Game	\$3.89
Book	\$5.49

23. \_\_\_\_\_ unit cubes Each face of a  $5 \times 5 \times 5$  cube is painted red. This cube is then cut into 125 unit cubes. How many of the unit cubes have no faces that are painted red?

24. \_\_\_\_\_ posts A rectangular yard is to be fenced with posts placed at each corner and along each side, evenly distributed so that the centers of the posts are 6 ft apart along each side. If the yard is 14 yd long and 6 yd wide, how many posts are needed to build such a fence?

25. \_\_\_\_\_ integers How many positive three-digit integers can be formed such that the hundreds digit is equal to the sum of the tens digit and ones digit?

26. \_\_\_\_\_ dentists



An advertisement states that 4 out of 7 dentists recommend Minty Fresh Mouthwash. If 1421 dentists were surveyed, how many dentists recommended Minty Fresh Mouthwash?

27. \_\_\_\_\_ ft A rectangular garden with an area of  $48 \text{ ft}^2$  has a width equal to  $\frac{1}{3}$  its length. What is the measure of the diagonal of the garden? Express your answer as a decimal to the nearest hundredth.

28. \_\_\_\_\_ cups A cookie recipe requires 4 cups of flour to make 5 dozen cookies. If Amy needs to make 15 dozen cookies, how many cups of flour will she need?



29. \_\_\_\_\_ in The length, width and height of a rectangular prism are in the ratio 3:2:1, respectively. What is the length of the prism if it has a volume of  $48 \text{ in}^3$ ?

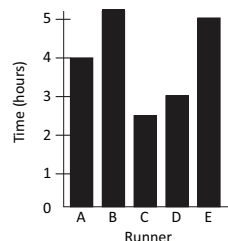
30. \$ \_\_\_\_\_ The manufacturer charges \$7.68 for a case that contains 24 cans of orange soda. If the Minute Magic Corner Store wishes to make a profit of at least \$4.40 per case of orange soda sold, what is the least amount the store should charge for a single can of orange soda?



# Warm-Up 3

31. \_\_\_\_\_ cm Each side of a regular hexagon measures 6 cm. What is the perimeter of the hexagon?

32. \_\_\_\_\_ hours The graph shows the length of time it took five runners to complete a marathon. What was the median time of the five runners?




33. \_\_\_\_\_ What is the product of the greatest and least two-digit prime numbers?

34. \_\_\_\_\_ minutes It takes a mechanic 4 hours to install carburetors in 3 cars. At this rate, how many minutes will it take the mechanic to install carburetors in 5 cars?

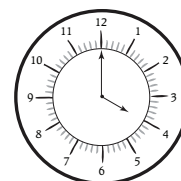
35. \_\_\_\_\_ In a certain parking lot, there are 2 black cars, 3 blue cars, 4 red cars and 3 green cars. If there are no other cars in the parking lot, what is the probability that a car randomly chosen from the parking lot is *not* green? Express your answer as a common fraction.



36. \_\_\_\_\_ in  Becca is making 20 craft projects. She has 15 yd of ribbon, and each craft project requires the same length of ribbon. What is the maximum length of ribbon each craft project can require, in inches?

37. \_\_\_\_\_ What is the value of  $2 \div 4 \times 8$ ?

38. \_\_\_\_\_ degrees What is the measure of the supplement of the smaller angle formed by the hands of a clock that displays a time of four o'clock?



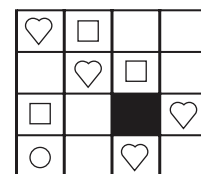
39. \$ \_\_\_\_\_ Marita purchased an item for 45% off the original price, plus an additional 20% off the sale price. She also had a \$5-off coupon, which the salesclerk applied after these two discounts. Marita's final purchase price for the item was \$50. Assuming she paid no sales tax, what was the original price of the item Marita purchased?

40. \_\_\_\_\_ Multiplying a number by  $x$  yields the same result as dividing the number by 0.125. What is the value of  $x$ ?





# Warm-Up 4

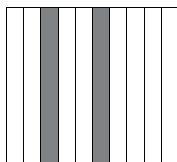


41. \_\_\_\_\_ If each row and each column shown here must contain exactly one heart, square, circle and triangle, which shape must be placed in the shaded space?

42. \_\_\_\_\_ degrees Two angles of a triangle measure 7 degrees and 97 degrees. What is the degree measure of the supplement of its third angle?

43. \_\_\_\_\_ What is the positive difference between 3.75 and  $\frac{7}{4}$ ?

44. \_\_\_\_\_ Assuming the sections are congruent, what portion of the figure is shaded? Express your answer as a common fraction.

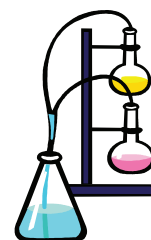


45. \_\_\_\_\_ If two different students are randomly selected from a class of 12 boys and 8 girls, what is the probability that both students are girls? Express your answer as a common fraction.

46. \_\_\_\_\_ degrees What is the degree measure of an interior angle of a regular pentagon?

47. \_\_\_\_\_ quarters Joe has 37 coins consisting of nickels, dimes and quarters. There are four more nickels than dimes and two more quarters than nickels. What is the total number of quarters that Joe has?

48. \_\_\_\_\_ fl oz A pharmacist must mix 12 fl oz of cough syrup that contains 25% active ingredient with flavored syrup that contains no active ingredient. How many fluid ounces of flavored syrup must the pharmacist add to create a mixture containing 10% active ingredient?



49. \_\_\_\_\_ When writing twenty-one-and-a-half trillion in scientific notation, what is the exponent needed on the base 10?

50. \$ \_\_\_\_\_ Safir can choose how he gets paid for a job. He can be paid \$1000 all at once, or he can earn \$1 for the first day, \$2 for the second, \$4 for the third, and so on, so that each day's pay is double that of the previous day. What is the positive difference of the total amounts Samir can be paid for completing a ten-day job, based on these two compensation plans?





# Workout 2

51. \_\_\_\_\_ % The city whose full name is El Pueblo de Nuestra Señora la Reina de Los Ángeles del Río de Porciúncula, which contains 61 letters, is typically abbreviated to Los Angeles. In terms of number of letters, what percent of the full name is the abbreviated name? Express your answer to the nearest hundredth.

52. \_\_\_\_\_ ft John is biking at a rate of 15 mi/h. There are 5280 ft in 1 mi. On average, how many feet does John travel in 1 minute?

53. \_\_\_\_\_ coins Malcolm gives a cashier two one-dollar bills to pay for a \$1.64 purchase. What is the least number of coins that Malcolm could receive as correct change?

54. \_\_\_\_\_ A fair eight-sided die with faces numbered 1 through 8 is rolled four times. What is the probability that exactly one 3 is rolled, and that the 3 is rolled on the third roll? Express your answer as a common fraction.



55. \_\_\_\_\_ ft The Livingstons' rectangular living room is 15 ft long and has an area of  $195 \text{ ft}^2$ . What is the width of the living room?

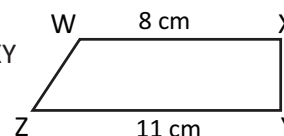
56. \_\_\_\_\_ students

I own a

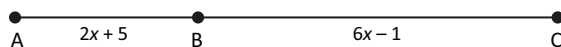
- ☐ cat  
☐ dog

According to a survey of Ms. Jones' pre-algebra class, 11 students own a cat, 12 students own a dog, 6 students own both a cat and a dog and 3 students own neither. What is the number of students in Ms. Jones' pre-algebra class?

57. \_\_\_\_\_  $\text{cm}^2$  In trapezoid WXYZ, shown here,  $WX = 8 \text{ cm}$  and  $ZY = 11 \text{ cm}$ . Segment XY is half as long as the shorter base, and  $\angle WXY$  and  $\angle XYZ$  are each right angles. What is the area of trapezoid WXYZ?



58. \_\_\_\_\_ cm In the figure,  $AC = 36 \text{ cm}$ . What is the length of segment AB?



59. \_\_\_\_\_ If two numbers are chosen randomly, with replacement, from the set of the first five counting numbers, what is the probability that the sum of the two numbers will be 3? Express your answer as a common fraction.

60. \$ \_\_\_\_\_ At a market, a customer who purchases 3 lb of potato salad and 4 lb of coleslaw pays a total of \$10.75. Another customer pays a total of \$4.75 to buy 1 lb of potato salad and 2 lb of coleslaw. What is the cost to purchase 2 lb of potato salad and 3 lb of coleslaw?



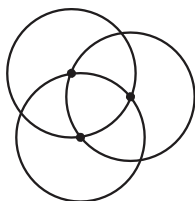
# Warm-Up 5

61. \_\_\_\_\_ cubes

It takes 6 cubes to build a staircase containing 3 rows. How many cubes are needed to build a staircase that contains 11 rows?



62. \_\_\_\_\_  $\text{cm}^2$



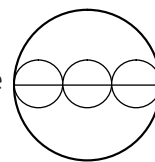
Three congruent, coplanar circles overlap so that each center lies on the other two circles. The diameter of each circle is 8 cm. What is the area of the triangle formed by connecting the centers of the circles? Express your answer in simplest radical form.

63. \_\_\_\_\_

What is the next number in the geometric sequence:  $-1, 4, -16, 64, \dots$ ?

64. \_\_\_\_\_ units

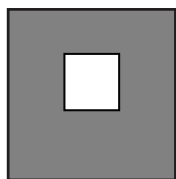
The centers of three congruent small circles are collinear, and their diameters form the diameter of the large circle, shown, whose area is  $81\pi$  units<sup>2</sup>. What is the circumference of one of the smaller circles? Express your answer in terms of  $\pi$ .



65. \_\_\_\_\_

If  $2x + 3 = 4$ , what is the value of  $12x + 18$ ?

66. \_\_\_\_\_ regions



In the figure shown, what is the greatest number of nonoverlapping regions into which the shaded region can be divided with exactly two lines?

67. \_\_\_\_\_ years

Sal collected data on all her family members who were born in the last half of the 20th century. Their birth years are shown in the stem-and-leaf plot. What is the positive difference between the median and the mode of these data?

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68. \_\_\_\_\_ minutes

In a game that lasts 48 minutes, exactly 6 players from each team are on the field at all times. Throughout the game, players are substituted so that 8 players on a team each play an equal amount of time. How many minutes is each of the 8 players on the field during the game?

69. \_\_\_\_\_ leaps

A dog is chasing a rabbit that has a head start of 150 ft. If their leaps are synchronized, and the dog leaps 9 ft every time the rabbit leaps 7 ft, in how many leaps will the dog catch up to the rabbit?



70. \_\_\_\_\_

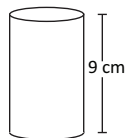
For a certain set of five numbers, the mean of all but the largest number is 80, and the mean of all but the smallest number is 90. What is the range of the set of five numbers?



# Warm-Up 6

71. \_\_\_\_\_ teams How many different three-member teams can be formed from a group of six students?

72. \_\_\_\_\_  $\text{cm}^2$



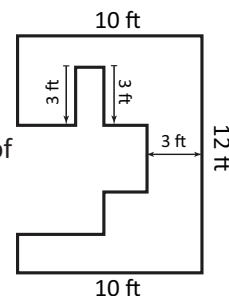
A right circular cylinder has a volume of  $144\pi \text{ cm}^3$  and a height of 9 cm. What is the area of its base? Express your answer in terms of  $\pi$ .

73. \_\_\_\_\_ The math team ordered 7 eight-slice pizzas. What fraction of the total amount of the pizza ordered is left after 41 slices are eaten? Express your answer as a common fraction.

74. \_\_\_\_\_ The square root of the quantity 3 less than twice a number is equal to 3. What is the number?

75. \_\_\_\_\_ marbles Bailey said to Kaylee, "If you gave me two of your marbles, I'd have twice as many as you'd have." And Kaylee responded, "If you gave me three of your marbles, I'd have three times as many as you'd have." What is the difference between the number of marbles that Bailey and Kaylee have?

76. \_\_\_\_\_ ft If all the angles in the figure shown are right angles, what is the perimeter of the figure?

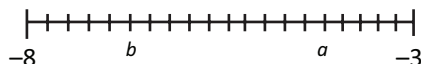


77. \_\_\_\_\_ strokes



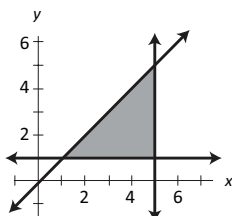
The average of Martha's first 5 rounds of golf is 98 strokes. How many strokes would Martha need to average on her next 3 rounds to bring her average down to 92 strokes?

78. \_\_\_\_\_ On the number line below, the tick marks are evenly spaced. What is the value of  $b - a$ ? Express your answer as a mixed number.



79. \_\_\_\_\_ dollars The price of a coat that originally sold for \$80 is reduced by 20%. A different coat that originally sold for \$100 is marked down 30%, and then a 10% discount is given on the reduced price. After all of the reductions, what is the positive difference in the prices of the two coats?

80. \_\_\_\_\_  $\text{units}^2$



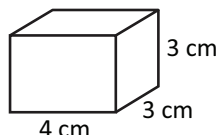
A region in the coordinate plane is bounded by  $y = x$ ,  $x = 5$  and  $y = 1$ . What is the area of this region?



# Workout 3

81. \_\_\_\_\_ students The president of the student body estimated that 2 out of every 3 students at Creighton Middle School would attend the Spring Festival. If there are 1140 students at this school, according to the estimate, how many students will *not* attend the Spring Festival?
82. \_\_\_\_\_ shots Vinnie made 60% of the shots he attempted in Friday's basketball game. If he made 18 shots in the game, how many shots did he attempt?

83. \_\_\_\_\_ cubes



How many  $0.5 \text{ cm} \times 0.5 \text{ cm} \times 0.5 \text{ cm}$  cubes are needed to completely fill this rectangular prism measuring  $4 \text{ cm} \times 3 \text{ cm} \times 3 \text{ cm}$ ?

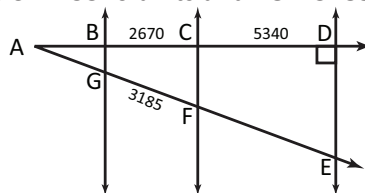
84. \$ \_\_\_\_\_ Allison spent a total of \$16.20 for lunch at Burrito De-lite, including tax and a tip. She paid 8% sales tax on her purchase and then left the waiter a tip equivalent to 20% of her total bill including tax. What was the cost of Allison's meal, before tax and the tip?

85. \_\_\_\_\_ g The table below shows the weight of various coins, according to U.S. Mint specifications. Jarnail has coins worth a total of 42¢ in his pocket. What is the least number of grams the coins in Jarnail's pocket could weigh? Express your answer as a decimal to the nearest thousandth.

Denomination	Penny	Nickel	Dime	Quarter
Weight	2.500 g	5.000 g	2.268 g	5.670 g

86. \_\_\_\_\_  $\text{cm}^2$  A rectangle has a perimeter of 62 cm. If the length and width are each increased by 2 cm, by how many square centimeters does the area increase?

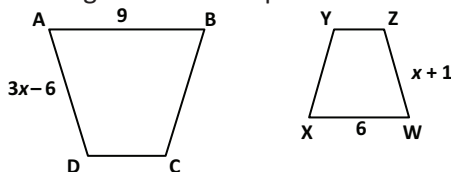
87. \_\_\_\_\_ units Lines BG, CF and DE are all parallel and coplanar. These three lines intersect rays AD and AE, as shown. Suppose  $BC = 2670$  units,  $CD = 5340$  units and  $FG = 3185$  units. What is the length of segment EF?



88. \_\_\_\_\_ messages A group of 9 friends received a combined total of 233 text messages in two hours. One person received 25 messages. How many text messages did each of the other 8 friends receive if they each received the same number of messages as each other?

89. \_\_\_\_\_  $\text{units}^2$  The coordinates of  $\triangle ABC$  are  $A(1, 2)$ ,  $B(1, 10)$  and  $C(16, 2)$ . What is the area of  $\triangle ABC$ ?

90. \_\_\_\_\_ units What is the length of segment AD if trapezoids ABCD and WXYZ are similar?





# Warm-Up 7

91. \$ \_\_\_\_\_ Vacations-R-Us charges \$130 a day plus a one-time, nonrefundable \$50 cleaning fee to rent a house at the beach. How much will it cost the Sanchez family to rent the house for 7 days?

92. \_\_\_\_\_ units A circle has a circumference with the same numerical value as its area. What is its radius?

93. \_\_\_\_\_ cm If the length of an insect is 4 cm, what is the length of the insect viewed under a magnifying glass that magnifies an object to three times its original size?



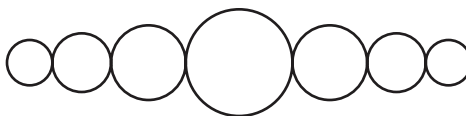
94. \_\_\_\_\_ A box contains only red, blue and green tokens. If the probability of randomly choosing a red token is  $\frac{1}{5}$  and the probability of randomly choosing a blue token is  $\frac{1}{3}$ , what is the probability of randomly choosing a green token? Express your answer as a common fraction.

95. \_\_\_\_\_ integers How many three-digit positive integers are square numbers?

96. \$ \_\_\_\_\_ The table shows the total dollar amounts of purchases by 21 randomly selected customers at a department store. What is the median of the dollar amounts?

\$10	\$18	\$10	\$22	\$14	\$41	\$31
\$43	\$8	\$6	\$27	\$18	\$27	\$32
\$5	\$53	\$30	\$25	\$30	\$22	\$42

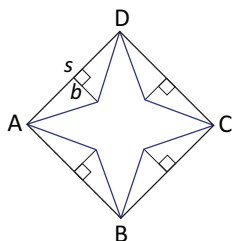
97. \_\_\_\_\_ cm A necklace is made of beads with centers that are collinear, as shown. The beads have diameters of integer lengths  $a$ ,  $b$ ,  $c$  and  $d$  cm such that  $a:b:c:d = 1:2:3:4$ . What is the smallest possible total length of the seven beads on the necklace?



98. \_\_\_\_\_ The number 6D45, where D represents a digit, is divisible by 3. What is the sum of all possible values of D?

99. \_\_\_\_\_ For what value of  $m$  does  $\frac{1}{m} + \frac{1}{2m} = 6$ ? Express your answer as a common fraction.

100. \_\_\_\_\_ units<sup>2</sup>



Square ABCD, shown here, has sides of length  $s$  units. A star is formed, creating four congruent isosceles triangles, each with a height of  $b$  units. What is the area of the star in terms of  $s$  and  $b$ ?

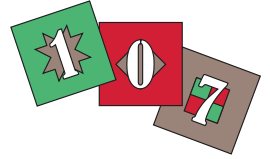




# Warm-Up 8

101. \_\_\_\_\_ ha A pasture with an area of 25 hectares is enclosed using 2 km of fencing. Another pasture is to be enclosed. For the second pasture, how many hectares of land can 8 km of fencing enclose if the two fenced areas are similar?

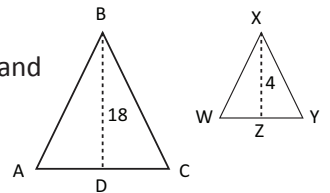
102. \_\_\_\_\_ stickers Angie is purchasing stickers to make house numbers for the houses in her neighborhood. If the houses are numbered consecutively from 101 to 250 and each sticker contains a single digit, how many stickers containing the digit 3 does Angie need to purchase?



103. \_\_\_\_\_ For what value of  $x$  does  $3x + 3 = 2x + 7$ ?

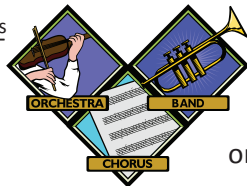
104. \_\_\_\_\_ mi Tim drove at an average rate of 30 mi/h, and Kim drove at an average rate of 40 mi/h for three times as long as Tim. Together they drove a total of 225 mi. How far did Tim drive?

105. \_\_\_\_\_ cm Triangle ABC with an area of  $243 \text{ cm}^2$  is similar to  $\triangle WXY$ . If  $BD = 18 \text{ cm}$  and  $XZ = 4 \text{ cm}$ , what is the length of segment WY?



106. ( \_\_\_\_\_ , \_\_\_\_\_ ) What are the coordinates of the midpoint of segment AB with endpoints  $A(-2, 4)$  and  $B(3, -3)$ ? Express the coordinates as decimals to the nearest tenth.

107. \_\_\_\_\_ students



At Euclid Middle School there are 33 students in the chorus, 45 students in the band and 21 students in the orchestra. Fifteen students are in both the band and chorus, 9 are in both orchestra and chorus, 4 are in the band and orchestra and 2 students are in all three. How many students are in the orchestra only?

108. \_\_\_\_\_ What is the positive difference between the range and the mean of the set  $\{4, 5, 7, 7, 8, 8, 8, 9, 16\}$ ?

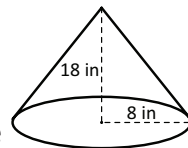
109. \_\_\_\_\_ m A rectangle measures 18 m by 24 m. What is the sum of the lengths of its diagonals?

110. \_\_\_\_\_ mi/h Blake traveled 117 mi in 2.25 hours to come home from college. What was the average speed at which Blake traveled?



# Workout 4

111. \_\_\_\_\_ in The height of a solid cone, shown here, is 18 in, and its radius is 8 in. A cut parallel to the circular base is made completely through the cone so that one of the two resulting solids is a smaller cone. The radius of the small cone is 2 in. What is the height of the smaller cone? Express your answer as a decimal to the nearest tenth.



112. \_\_\_\_\_ If  $a$  is the greatest common factor of 72 and 48, and if  $b$  is the greatest common factor of 108 and 144, what is the least common multiple of  $a$  and  $b$ ?

113. \_\_\_\_\_ arr



Some radio stations have call letters that contain 4 letters. Two examples are KTOO and WFXM. The first letter must be a K or W, and the last 3 letters can be any letter except K or W. How many different 4-letter arrangements of station call letters are possible?

114. \_\_\_\_\_ m A hare is running at a rate of 1 m every minute, while a tortoise is crawling at a rate of 1 cm every second. In meters, how much farther than the tortoise will the hare travel in an hour?



115. \_\_\_\_\_ ppl Each day on Earth more people are born than die. If there is a net gain of 150 living people on the planet each minute, how many more people are there on Earth every day? Express your answer in scientific notation with three significant digits.

116. \_\_\_\_\_ % If the length of each longer side of a rectangle is increased by 75% and each shorter side is increased in length by 25%, what is the overall percent increase in the area of the original rectangle? Express your answer as a decimal to the nearest hundredth.

117. \_\_\_\_\_ mL A scientist has 50 mL of a 50% acid solution and wishes to create a 20% acid solution by adding a quantity of a 10% acid solution. How many milliliters of the 20% acid solution will she have after she mixes the weaker and stronger solutions?

118. \_\_\_\_\_ mi On a county map, the distance between Tinsel Town and Emerald City measures 3.5 in. The actual distance between the two locations is 42 mi. If the distance between Emerald City and Diamond Bluff measures 2.75 in on that same map, how many miles apart are the two cities?



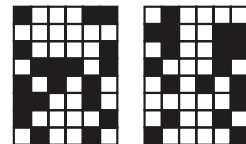
119. \_\_\_\_\_ ft After a ball is dropped, the rebound height of each bounce is 80% of the height of the previous bounce. The height of the first bounce is 5 ft. What is the height of the sixth bounce of this ball? Express your answer as a decimal to the nearest tenth.

120. \_\_\_\_\_ % If a circle with a diameter of  $8\frac{1}{2}$  in is cut from an  $8\frac{1}{2}$ -in by 11-in sheet of paper, what percent of the area of the sheet of paper is left over? Express your answer as a decimal to the nearest tenth.

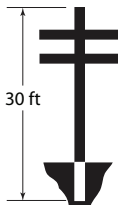


# Warm-Up 9

121. \_\_\_\_\_ In the two grids shown, some of the squares are black, and the remaining squares are transparent. If the grid on the left were translated so that it completely covers the grid on the right, what letter would be formed by the black squares?



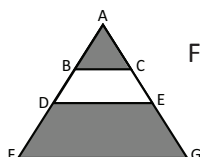
122. \_\_\_\_\_ ft A 30-ft-long telephone pole is perpendicular to the ground, as shown. The height of the pole above ground is four times the length of the portion of the pole located below ground. How many feet above ground is the top of the pole?



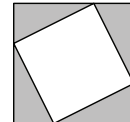
123. \_\_\_\_\_ The units digit of a positive three-digit integer is 0. The sum of the other two digits is 12. Interchanging the tens and hundreds digits increases the number by 540. What is the original number?

124. \_\_\_\_\_ out-comes A student rolls three standard, six-sided dice (one red, one blue and one green). How many possible outcomes are there for the three values showing on the top faces of the dice?

125. \_\_\_\_\_ ° From a piece of striped material, Tanya cut out the isosceles triangle shown here. If the measure of the vertex angle of this large isosceles triangle is  $50^\circ$  and  $\overline{BC} \parallel \overline{DE} \parallel \overline{FG}$ , what is the measure of  $\angle BCE$ ?

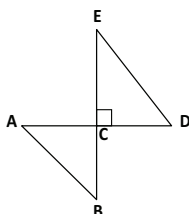


126. \_\_\_\_\_ % If the vertices of the smaller square divide each side of the larger square in the ratio of 2:1, in the figure shown, what percentage of the larger square is shaded? Express your answer to the nearest whole number.



127. \_\_\_\_\_ If the probability that Christoph will get an A on a test is 0.25, what is the probability that he will get an A on the next two tests? Express your answer as a common fraction.

128. \_\_\_\_\_ units In the figure shown, point C is the midpoint of segment AD, and  $BC = \frac{2}{3} EC$ . If  $AD = 10$  units, and the area of  $\triangle CDE$  is 30 units<sup>2</sup>, how long is segment AB? Express your answer in simplest radical form.



129. \_\_\_\_\_ milk balls Mandy had a box of chocolate malted milk balls. She ate 5 and gave her brother 3. Then she passed around the remaining milk balls to the 8 members of the math team. The first team member took 1, the second took 3, the third took 5, and so on, with each team member taking the next higher odd number of milk balls. There were just enough milk balls in the box for the last team member to take her correct amount. What was the original number of milk balls in Mandy's box?

130. ( , ) Point P(3, 2) lies on the graph of the equation  $y = 3x - 7$ . What are the coordinates of the image of point P after the line is reflected across the y-axis and translated up 4 units?



# Warm-Up 10

131. \_\_\_\_\_ Each pair of numbers below can be combined using one of the operations addition, subtraction, multiplication or division to obtain the same result. What is the common result for the three pairs?

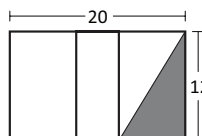
Pair A: 6, 4

Pair B: 16, 8

Pair C: 36, 12

132. \$ \_\_\_\_\_ Grandpa has 18 coins in his pocket. Three of the coins are quarters and the rest are dimes and nickels. There are twice as many dimes in his pocket as nickels. What is the total value of the nickels and dimes in his pocket?

133. \_\_\_\_\_ units<sup>2</sup>



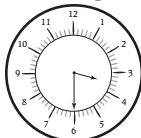
Two squares of side length 12 units overlap to form a  $20 \times 12$  rectangle, as shown. What is the area of the shaded triangle?

134. \_\_\_\_\_ The product of a set of distinct, positive integers greater than 1 is 84. What is the least possible sum of these integers?

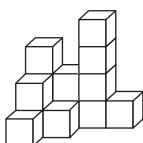
135. \_\_\_\_\_ pics An artist draws 20 pictures, one after the other, in 240 minutes. If she draws 3 times as fast, how many pictures will the artist draw in 6 hours?



136. \_\_\_\_\_ ° What is the degree measure of the smaller angle formed by the minute hand and the hour hand of a clock at 3:30?



137. \_\_\_\_\_ cm<sup>2</sup>

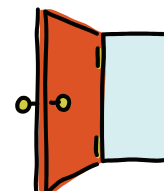


Gerard glues together 14 bricks to form the solid shown. Each brick is a cube with edge length 1 cm. Adjacent bricks are glued together so that faces entirely overlap. What is the surface area of Gerard's solid, including the bottom face?

138. \_\_\_\_\_ points A line contains the points  $P(1, 3)$  and  $Q(17, 43)$ . How many points on this line lie strictly between points P and Q and have two integer coordinates?

139. \_\_\_\_\_ ways In how many ways can the numeral 20 be written as the sum of three distinct positive integers? (Note:  $3 + 4 + 13$  and  $13 + 3 + 4$  are to be considered the same.)

140. \_\_\_\_\_ ways If a room has 7 doors, in how many ways can a person enter through one door and exit through a different door?



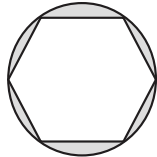


# Workout 5

141. \_\_\_\_\_ What number is 75% of the positive difference between 40% of 80 and 32% of 75?

142. \_\_\_\_\_  
phone numbers A telephone number consists of a three-digit area code followed by a seven-digit local code. Neither the area code nor the local code may have a first digit of 0 or 1. If the codes 800, 888, 877 and 866 are toll-free codes and are not used as area codes, how many ten-digit telephone numbers are possible? Express your answer in scientific notation with four significant digits.

143. \_\_\_\_\_ in<sup>2</sup> A regular hexagon is inscribed in a circle with a radius of 2 in, as shown. What is the area of the shaded region? Express your answer as a decimal to the nearest hundredth.

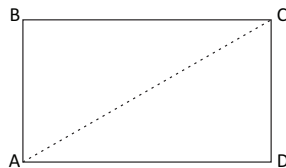


144. \_\_\_\_\_ Paulo bought and then sold two bikes. He made a 30% profit on the sale of the first bike and a 50% profit on the second one. If Paulo's total profit was 45%, what was the ratio of his cost for the first bike to his cost for the second bike? Express your answer as a common fraction.



145. \_\_\_\_\_ If each of the digits 2, 3, 4, 6, 7 and 8 is used exactly once to construct two three-digit numbers  $m$  and  $n$ , what is the smallest possible positive value of the difference  $m - n$ ?

146. \_\_\_\_\_ mm<sup>2</sup>



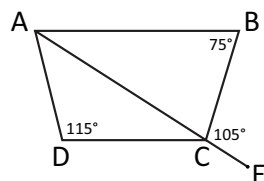
In rectangle ABCD, shown here,  $\angle ACB$  measures  $30^\circ$  and  $CD = 40$  mm. What is the area of rectangle ABCD? Express your answer as a decimal to the nearest tenth.

147. \_\_\_\_\_ points In the game of Smitch, a quitch and two gritches are worth 20 points, whereas a gritch and two quitches are worth 25 points. How many points is each gritch worth?

148. \_\_\_\_\_ mi Sam leaves home at the same time each morning and drives directly to work. If his travel speed averages 30 mi/h, he will be 18 minutes late for work. If his travel speed averages 45 mi/h, he will arrive 8 minutes early. What is the total number of miles between Sam's home and work?

149. \_\_\_\_\_  
sub-sets How many subsets containing an odd number of elements does a set with 10 elements have?

150. \_\_\_\_\_<sup>°</sup>



In trapezoid ABCD, shown here, diagonal  $\overline{AC}$  is extended to point E. What is the degree measure of  $\angle DAC$ ?



# Warm-Up 11

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

151. \_\_\_\_\_ On the number grid shown, Mara colored all of the positive multiples of  $n$ . Once completed, there was exactly one colored square in each column. What is the sum of all possible values of  $n$ ?

152. \_\_\_\_\_ Two standard, six-sided dice are rolled. What is the probability that the positive difference between the numbers rolled is 1? Express your answer as a common fraction.

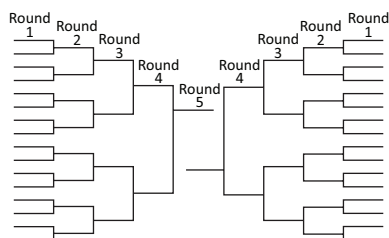


153. \_\_\_\_\_ What is the slope of a line perpendicular to the segment AB, which has endpoints A(−8.1, 4.9) and B(−7.6, 2.9)? Express your answer as a common fraction.

154. \_\_\_\_\_ Each of the digits 1 to 6 is placed in one of the boxes shown here to correctly complete the multiplication problem. What is the three-digit product?

$$\begin{array}{r} \square \square \\ \times \square \\ \hline \square \square \square \end{array}$$

155. \_\_\_\_\_ points

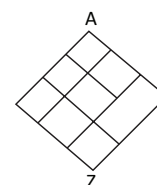


A jousting tournament has 32 competitors in a single elimination bracket, shown here. The table shows the number of points awarded for each correctly predicted match outcome in the tournament. What is the maximum number of points that can be earned?

Round 1	1 pt
Round 2	2 pts
Round 3	4 pts
Round 4	8 pts
Round 5	16 pts

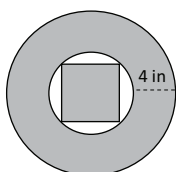
156. \_\_\_\_\_ The circumference of the base of a cone is triple the circumference of a cylinder with the same height. What is the ratio of the volume of the cylinder to the volume of the cone? Express your answer as a common fraction.

157. \_\_\_\_\_ paths How many paths from A to Z can be traced following line segments on this drawing if paths must be traced in a downward direction, with no retracing?



158. \_\_\_\_\_ If  $\frac{x-y}{z-y} = -2$ , what is the value of  $\frac{x-z}{y-z}$ ?

159. \_\_\_\_\_ in<sup>2</sup>



In the figure, the square is inscribed in the smaller circle, which has a radius of 4 in. The radius of the larger circle is 8 in. What is the total area of the shaded regions? Express your answer in terms of  $\pi$ .

160. \_\_\_\_\_ players In a tennis tournament, each of the 10 competitors plays each other player once. What is the maximum number of players who could end the tournament with a record of 7 or more wins?





# Warm-Up 12



161. \_\_\_\_\_ ft A rectangular swimming pool, shown here, is surrounded by a concrete deck that is 5 ft wide. The length of the pool is 1.5 times its width, and its area is  $216 \text{ ft}^2$ . What is the outside perimeter of the deck?

162. \_\_\_\_\_ : \_\_\_\_\_ pm A subway arrives at the station every 25 minutes. A train arrives at the station every 45 minutes. If the subway and the train each arrive at noon, at what time will they next arrive at the station together?

163. \_\_\_\_\_ hours Working together, Tom and Dick can dig 3 holes in 6 hours. Knowing Tom digs twice as fast as Dick, how many hours would it take Tom, working alone, to dig 12 holes?



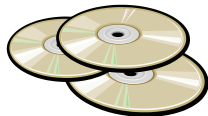
164. \_\_\_\_\_ times The pages in a book are numbered from 1 to 363. How many times does the digit 3 appear as part of a page number of this book?

165. \_\_\_\_\_ squares
- • • •  
• • • •  
• • • •  
• • • •
- How many squares can be formed on a 16-pin rectangular geoboard?

166. \_\_\_\_\_ In a sequence of five positive integers, each term after the first term is determined by multiplying the preceding term by 1.5. If the median of the five terms is 36, what is the mean of the five terms? Express your answer as a decimal to the nearest tenth.

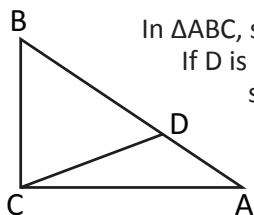
167. \_\_\_\_\_ years  
old The sum of Madison's age and 3 times Harper's age is 47 years. In 2 years Madison will be twice as old as Harper. How old is Harper?

168. \_\_\_\_\_ dollars
- Andie bought 3 oldies CDs and 2 current CDs for \$78. Deanne bought 2 oldies CDs and 3 current CDs for \$82. What is the positive difference in the price of an oldie CD and the price of a current CD?



169. \_\_\_\_\_ intgrs For how many positive integers containing no digit of zero is the sum of the digits equal to 5?

170. \_\_\_\_\_ units In  $\triangle ABC$ , shown here, the measure of  $\angle BCA$  is  $90^\circ$ ,  $AC = 12$  units and  $BC = 9$  units. If  $D$  is a point on hypotenuse  $\overline{AB}$ , such that  $AD = 5$  units, what is the length of segment  $CD$ ? Express your answer in simplest radical form.

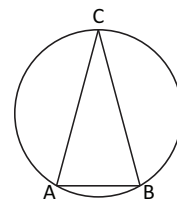




# Workout 6

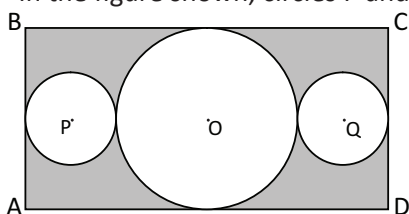
171. \_\_\_\_\_ pennies Mollie has fewer than 100 pennies. If she puts the pennies in stacks of five, there are three pennies left over. If Mollie puts them in stacks of seven, there is one penny left over. If she puts them in stacks of three, there are no pennies left over. What is the total number of pennies Mollie has?

172. \_\_\_\_\_ degrees Isosceles triangle ABC, shown here, is inscribed in a circle, and base AB of the triangle is equal in length to the radius of the circle. What is the degree measure of  $\angle C$ ?



173. \$ \_\_\_\_\_ The price of a shirt was reduced by 20%. Including the 5% sales tax, Cyndi paid \$15.54 for the shirt. What was the original price of the shirt before the discount was applied?

174. \_\_\_\_\_ in<sup>2</sup> In the figure shown, circles P and Q are congruent, and the radius of circle O is twice that of each of the smaller circles. Circle P is tangent to rectangle ABCD at the midpoint of  $\overline{AB}$ , and circle Q is tangent to rectangle ABCD at the midpoint of  $\overline{CD}$ . Circle O is tangent to each of the smaller circles and is tangent to two sides of rectangle ABCD. If the radius of circle O is 4 in, what is the total area of the shaded regions? Express your answer as a decimal to the nearest tenth.



175. \_\_\_\_\_ The four positive integers P, Q, P + Q and P – Q are all prime and their sum is S. What is the value of S?

176. \_\_\_\_\_ mi/h A square measures 80 yd on a side. Bob and Rob begin running from the same corner. Bob runs along a side to an adjacent corner, and Rob runs along a diagonal to an opposite corner. They arrive at their respective corners at the same time. If Bob's speed was 8 mi/h, what was Rob's speed? Express your answer as a decimal to the nearest tenth.

177. \_\_\_\_\_ intrs For how many positive integers  $n$  is the mean of the set  $\{9, 5, 10, 12, n\}$  equal to its median?

178. \_\_\_\_\_ Students were asked to vote for one of the five choices listed for the new school mascot. Based on this data, what is the probability that a student selected at random from those who voted will be a student who did not vote in favor of Grizzly Bear as the school mascot? Express your answer as a common fraction.

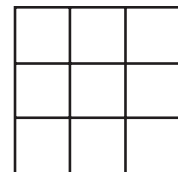
Mascot	Number of Votes
Grizzly Bear	68
Bull Dog	12
Bald Eagle	24
Wildcat	44
Panther	52

179. \_\_\_\_\_ factors How many positive integer factors does 96 have?

180. \_\_\_\_\_ units<sup>2</sup> What is the area of the quadrilateral whose vertices are (4, -4), (-4, 2), (6, 7) and (10, -1)?



# Warm-Up 13



181. \_\_\_\_\_ The figure shown consists of a large square divided into nine smaller, congruent squares. If a rectangle is chosen at random from this figure, what is the probability that it is a square? Express your answer as a common fraction.
182. \_\_\_\_\_  $\text{cm}^2$  An isosceles triangle has two congruent sides of length 13 cm and a height of 5 cm. What is the area of the triangle?
183. \_\_\_\_\_ If  $n$  is an even integer such that  $0 < n < 10$ , what is the sum of all possible unit fractions of the form  $\frac{1}{n}$ ? Express your answer as a common fraction.
184. \_\_\_\_\_ units The area of a particular rectangle is  $2a^2 - ab - b^2$  units<sup>2</sup>. If its width can be represented by the expression  $a - b$ , what is the length of the rectangle, in terms of  $a$  and  $b$ ?
185. \_\_\_\_\_  $\text{mi/h}$  If Mike travels for 3 hours at a rate of 20 mi/h and then travels for 2 hours at a rate of 30 mi/h, what is his average speed, in miles per hour?



186. \_\_\_\_\_ ints How many different, positive four-digit integers, with no repeated digits, can be formed using the digits 0 through 9?
187. \_\_\_\_\_  $\text{cm}^3$  A right circular cylinder has a surface area of  $160\pi \text{ cm}^2$ . If the height of the cylinder is twice the diameter of the base, what is the volume of the cylinder? Express your answer in terms of  $\pi$ .
188. \_\_\_\_\_ toy animals Ben and Jerry each have a collection of toy animals. Ben collects only two-legged toy animals and Jerry collects only toy animals with four legs. Jerry has 10 more toy animals than Ben. There are 220 legs in their combined collections. How many toy animals does Jerry have?



189. \_\_\_\_\_ Five blue marbles and five green marbles are randomly arranged in a row. What is the probability that the marbles alternate in color? Express your answer as a common fraction.



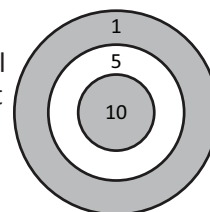
190. \_\_\_\_\_ % If the volume of an enlarged cube is 8 times the volume of the original cube, by what percent has the length of each edge increased?



# Warm-Up 14

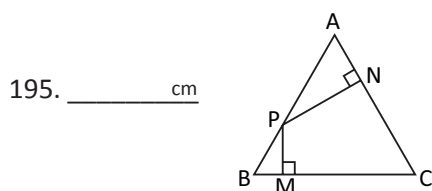
191. \_\_\_\_\_ factors How many factors of 2940 are perfect squares?

192. \_\_\_\_\_ scores Michael will throw three darts that will hit the dartboard shown. His total score will be the sum of the scores for the three hits. How many different total scores could Michael earn?



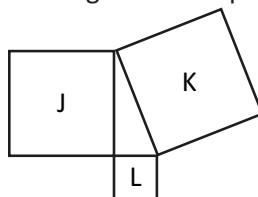
193. \_\_\_\_\_ For what value of  $x$  does  $2^{18} = \left(\frac{1}{4}\right)^x$ ?

194. \_\_\_\_\_  $\text{m}^3$  A spherical balloon contains 5 cubic meters of air. If it is inflated so that its diameter doubles, what will be the volume of air in the balloon?



195. \_\_\_\_\_ cm In the equilateral triangle ABC, shown here,  $\overline{PM} \perp \overline{BC}$  and  $\overline{PN} \perp \overline{AC}$ . If  $AB = 12$  cm, what is the value of  $CM + CN$ ?

196. \_\_\_\_\_  $\text{cm}^2$  A right triangle is formed by the sides of three squares, as shown. The side length of the square labeled K is 7 cm, and the side length of the square labeled L is 2 cm. What is the area of the square labeled J?



197. \_\_\_\_\_ Kathy ate one-eighth of the jelly beans in a jar, and Sue ate one-fifth of the rest. Pat ate twice as many jelly beans as Kathy and Sue combined, and then Drew ate the rest. What is the ratio of the number of jelly beans Drew ate to the number of jelly beans Pat ate? Express your answer as a common fraction.

198. \_\_\_\_\_ intgrs Randolph's favorite positive integers each have three digits and obey the following rules:

- All three digits are different.
- The sum of the digits is 9.

How many different favorite positive integers could Randolph have?

199. ( \_\_\_\_\_ , \_\_\_\_\_ ) What is the  $y$ -intercept of the line that contains the points  $(2, 0)$  and  $(4, -3)$ ? Express your answer as an ordered pair.

200. \_\_\_\_\_ The median of an ordered set of 11 integers is 35. In this set, the median of the first five integers is 29, and the median of the last five integers is 39. If the minimum and maximum values of the set are 12 and 52, respectively, what is the greatest possible value of the mean of this set?



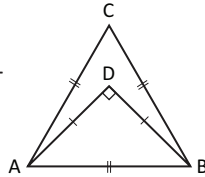
# Workout 7

201. \_\_\_\_\_ cm A rectangular prism has a volume of  $720 \text{ cm}^3$  and a surface area of  $666 \text{ cm}^2$ . If the lengths of all its edges are integers, what is the length of the longest edge?

202. \_\_\_\_\_ Marco's average score for all 14 quizzes this semester was 81. If Marco had an average score of 75 for his first 10 quizzes this semester, what was the average score for his last 4 quizzes?

203. \_\_\_\_\_

Point D is located in the interior of  $\triangle ABC$ , as shown. What is the ratio of the area of quadrilateral ACBD to the area of  $\triangle ABD$ ? Express your answer as a decimal to the nearest hundredth.



204. ( \_\_\_\_\_ , \_\_\_\_\_ ) The endpoints of a diameter of a circle are  $(-3, -2)$  and  $(11, -10)$ . What are the coordinates of the center of the circle?

205. \_\_\_\_\_ Letters have been substituted for digits in the equation  $ATE + AT = ROYS$ . Each distinct letter represents a unique digit. No two distinct letters represent the same digit. If T is odd, S is prime and  $E > T$ , what is the value of the sum  $A + T + E + O$ ?

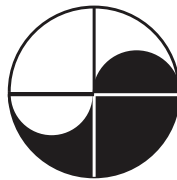
206. \_\_\_\_\_  
ninth-  
graders In a survey of ninth-graders, 8 students reported that they have attempted a marathon. Of those 8 students, 2 reported that they actually completed a marathon. If 2.5% of the ninth-graders surveyed completed a marathon, how many ninth-graders were surveyed?



207. \_\_\_\_\_ The line  $y = kx$  intersects the line that passes through points  $A(5, 0)$  and  $B(0, 2)$  at a point P such that  $AP:PB = 1:2$ . What is the value of  $k$ ? Express your answer as a common fraction.

208. \_\_\_\_\_ units

The shape shown is formed by a circle with radius of length  $r$  units and two smaller semicircular regions, each with diameter of length  $r$  units. What is the perimeter of the shaded portion of the large circle? Express your answer in terms of  $r$  and  $\pi$ .


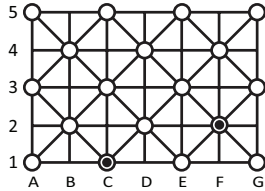

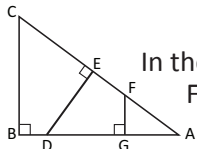


209. \$ \_\_\_\_\_ At the first store Arlene visited, she spent 40% of her money plus \$4. At the second store she spent 50% of her remaining money plus \$5. At the third store Arlene spent 60% of her remaining money plus \$6. When Arlene finished shopping at the three stores, she had \$2 left over. How many dollars did she have when she started shopping?

210. \_\_\_\_\_ days Judith received a gift on the first day of the year and every sixth day after that. Mort received a gift on the fourth day of the year and every fifth day after that. Kale received a gift on the ninth day of the year and every fourth day after that. On how many days during the year did all three receive a gift on the same day?



# Warm-Up 15

211. \_\_\_\_\_ studs A total of 1500 middle school students were surveyed. The results showed that  $\frac{1}{4}$  of the students have a pet living in their homes,  $\frac{1}{5}$  have a grandparent living in their homes and  $\frac{1}{3}$  have a baby living in their homes. What is the least possible number of students who have no pets, grandparents or babies living in their homes?
212. \_\_\_\_\_ The first term in a sequence is 5, and each subsequent term in the sequence is the units digit of 2 more than the square of the preceding term. What is the 100th term in the sequence?
213. \_\_\_\_\_ studs  Seventy-eight students participate in one or more of three sports: baseball, tennis and golf. Four students participate in all three sports. Five students play only baseball and golf. Two students play only tennis and golf. Three students play only baseball and tennis. If seven students play only tennis, and one student plays only golf, what is the total number of students who play only baseball?
214. \_\_\_\_\_ The lines in the grid shown indicate “sight lines.” A soldier standing at one location can see a soldier standing at another location only if the soldiers are on the same sight line. Two soldiers are located at C1 and F2, respectively. What are the locations of two other soldiers if none of the four soldiers are able to see any of the others?
- 
215. \_\_\_\_\_ A right triangle has legs of length  $\frac{3}{2}$  units and  $\frac{20}{3}$  units. If the triangle has a perimeter of  $x$  units and an area of  $y$  units<sup>2</sup>, what is the value of  $x^2 - y^2$ ?
216. \_\_\_\_\_ What is the coefficient of  $x^2y^2z^2$  in the expansion of  $(x + y + z)^6$ ?
217. \_\_\_\_\_ A two-digit positive integer is randomly selected. What is the probability that the units digit is a multiple of the tens digit? Express your answer as a common fraction.
218. \_\_\_\_\_ coins In Quaternion, the coin with the least value is the qua. Four quas equal one quab, four quabs equal one quac, four quacs equal one quad, four quads equal one quae and four quaes equal one quaf. What is the least number of coins that have a combined value of 2012 quas?
- 
219. \_\_\_\_\_ prs How many different pairs of numbers  $(m, n)$  can be formed using numbers from the list of integers  $\{1, 2, 3, \dots, 99, 100\}$  such that  $m < n$  and  $m + n$  is even?
220. \_\_\_\_\_ units  In the figure shown, right angles are as marked,  $AG = 4$  units and  $FG = FE$ . If  $FG:DE:CB = 1:2:3$ , what is the length of  $\overline{CE}$ ?

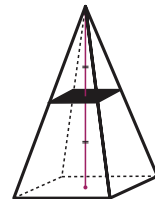




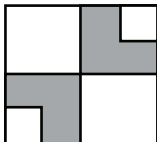
# Warm-Up 16

221. \_\_\_\_\_ ints How many positive two-digit integers each have the property that the integer's value increases by 75% when its digits are reversed?

222. \_\_\_\_\_  $\text{cm}^3$  The square pyramid shown has a volume of  $64 \text{ cm}^3$ . A plane parallel to the base of the pyramid bisects its altitude and divides the pyramid into two sections, as shown. What is the volume of the smaller pyramid?



223. \_\_\_\_\_ If  $x + \frac{4}{x} = y + \frac{4}{y}$  and  $x \neq y$ , then what is the value of the product  $xy$ ?

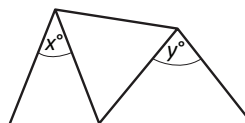
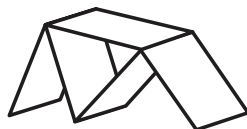
224. \_\_\_\_\_ %  A large square is divided into four congruent squares. Then those four squares are each divided into four smaller congruent squares, some of which are shaded, as shown. What is the probability that a dart thrown at random that lands in the largest square will also land in a shaded region? Express your answer as a percent to the nearest tenth.

225. \_\_\_\_\_  $\frac{\text{dance teams}}{\text{teams}}$  A 4-person dance team composed of 2 boys and 2 girls is to be selected from a group of 8 girls and 11 boys. How many different dance teams are possible?


226. \_\_\_\_\_ points Mrs. Garcia allowed each student in her class to drop the lowest of their five test scores. When Matt dropped the lowest of his test scores, a 60, his test average increased by 5 points. What is Matt's new test average?

227. \_\_\_\_\_ blocks What is the maximum number of  $3'' \times 1'' \times 1''$  blocks that will fit into a box with interior dimensions of  $5'' \times 5'' \times 10''$ ?

228. \_\_\_\_\_  $^\circ$  Using five identical index cards, the following structure can be created on a flat, level surface. What is the sum of the two marked angles on the side view of this construction?



229. \_\_\_\_\_  $\frac{\text{mi}}{\text{h}}$  A cruise ship must average 22  $\frac{\text{mi}}{\text{h}}$  for 10 hours to make its next port on schedule. During the first 4 hours, bad weather caused it to reduce its speed to 16  $\frac{\text{mi}}{\text{h}}$ . What should its speed be for the remainder of the trip to make it to the next port on schedule?

230. \_\_\_\_\_  Ms. Robinson gives the following homework assignment: You must write an essay by tomorrow. You may work alone or in boy-girl pairs. As it turned out,  $\frac{2}{3}$  of the boys and  $\frac{3}{5}$  of the girls worked in pairs. What portion of the class worked alone? Express your answer as a common fraction.



# Workout 8

231. \$ \_\_\_\_\_



Beginning January 1st, Marte will put \$100 in her savings account at the start of every month. The bank pays 4.8% annual interest compounded monthly (0.4% each month) at the end of each month. Assume the bank rounds the interest amount to the nearest cent. How much money will Marte have in her account at the end of the year? Express your answer to the nearest cent.

232. \_\_\_\_\_

The number of units in the length of the line segment with endpoints  $(-4, -5)$  and  $(4, 2)$  is a value between two consecutive positive integers. What is the sum of those two integers?

233. \_\_\_\_\_

What is the 2012th digit after the decimal point in the decimal expansion of  $\frac{8}{81}$ ?

234. \$ \_\_\_\_\_



Tito's bill was \$19.50 before the 6% sales tax was added. Tito wants to leave a tip of at least 20% of the bill amount before tax is added. What is the least amount he should pay for the bill, tax and tip?

235. \_\_\_\_\_

The deck used in the card game Krypto contains three each of cards numbered 1 to 10, two each of cards numbered 11 to 17, and one each of cards numbered 18 to 25. When five cards are dealt from the deck, what is the probability that all five cards will be 10 or less? Express your answer as a decimal to the nearest thousandth.



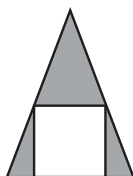
236. \_\_\_\_\_

If  $5\sqrt{x} - 30 = 2\sqrt{x} + 54$ , what is the value of  $x$ ?

237. \_\_\_\_\_ ft

A rectangular prism has dimensions in the ratio of 1:2:3. If the shortest edge is 2 ft, what is the longest distance between any two vertices? Express your answer as a decimal to the nearest hundredth.

238. \_\_\_\_\_  $\text{cm}^2$



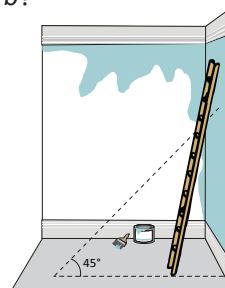
An isosceles triangle has sides of length 13 cm, 13 cm and 10 cm. If a square is inscribed in the triangle, as shown, what is the area of the shaded region? Express your answer as a decimal to the nearest hundredth.

239. \_\_\_\_\_

If  $\frac{x^2 + ax + 6}{x + 1} = x + b$  for all positive values of  $x$ , what is the value of  $6a - 7b$ ?

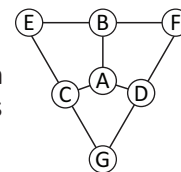
240. \_\_\_\_\_ ft

A 6-ft ladder is leaning against a wall so that the base of the ladder makes a  $45^\circ$  angle with the floor. The base of the ladder is then pushed in toward the wall so that its distance from the wall is one-third of what it was originally. In feet, how much farther up the wall does the top of the ladder reach? Express your answer as a decimal to the nearest hundredth.



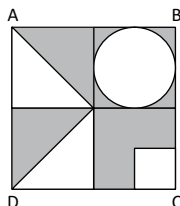


# Warm-Up 17



241. \_\_\_\_\_ Each of the letters A, B, C, D, E, F and G in the figure shown will be replaced with a different value from the set  $\{1, 2, 3, 4, 5, 6, 7\}$ . If the sums of the four numbers in each of the three quadrilaterals are each 15, what is the sum of all numbers that can replace A?

242. \_\_\_\_\_ units<sup>2</sup>



Square ABCD, shown here, has side length 8 units and is divided into four congruent squares. One of these squares contains an inscribed circle, two other squares contain diagonals and the fourth square has perpendicular line segments drawn from the midpoints of adjacent sides to form a square in the interior. In square units, what is the total area of the shaded regions? Express your answer in terms of  $\pi$ .

243. \_\_\_\_\_ Five integers form an arithmetic sequence with a mean of 18. If the mean of the squares of the five integers is 374, what is the largest of the five original integers?

244. \_\_\_\_\_ whole numbers

The prime factorization of 75 is written, without exponents, as  $3 \times 5 \times 5$ . The sum of the prime factors is  $3 + 5 + 5 = 13$ . For how many whole numbers is the sum of each number's prime factors, without exponents, equal to 13?

245. \_\_\_\_\_ marbles

Xavier gave Yvonne and Zeena the same number of marbles as each already had. Then Yvonne gave Xavier and Zeena the same number of marbles as each already had. Then Zeena gave Xavier and Yvonne the same number of marbles as each already had. At that point, each person had 48 marbles. How many fewer marbles did Xavier have at the end than he had at the start?

246. \$ \_\_\_\_\_



The ratio of Barbara's cell phone bill to Tina's cell phone bill was 7:5. Barbara's bill was \$14 more than Tina's bill. How much was Barbara's bill?

247. \_\_\_\_\_ ways

In how many ways can four different positive integers be placed, one per box, so the sum of the integers is 13?



248. \_\_\_\_\_

Three numbers have a sum of 5 and the sum of their squares is 29. If the product of the three numbers is  $-10$ , what is the least of the three numbers? Express your answer in simplest radical form.

249. \_\_\_\_\_

A box contains only quarters and dimes. If there were 10% more quarters, the total value of the money in the box would increase by 7.5%. What is the ratio of the number of quarters to the number of dimes in the box? Express your answer as a common fraction.



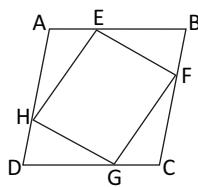
250. \_\_\_\_\_ units<sup>3</sup>

In trapezoid ABCD, angles A and D are right angles, and  $AB = 4$  units,  $DC = 16$  units and  $BC = 15$  units. The trapezoid is revolved  $360^\circ$  around side AD to form the frustum of a cone. What is the volume of this frustum? Express your answer in terms of  $\pi$ .

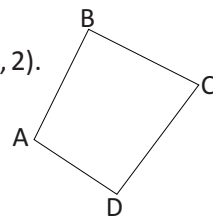


# Warm-Up 18

251. \_\_\_\_\_ There are 240 pairs of numbers such as  $\{7, 5318\}$  or  $\{17, 358\}$  that can be formed using each of the digits 1, 3, 5, 7 and 8 exactly once. What is the largest possible product of two such numbers?
252. \_\_\_\_\_ ft If a rectangle with an area of  $400 \text{ ft}^2$  is divided into two smaller rectangles with areas in the ratio of 3:1, what is the least possible value of the perimeter of the smaller rectangle?
253. \_\_\_\_\_ A set of seven different positive integers has a mean of 13. What is the positive difference between the largest and smallest possible values of its median?
254. \_\_\_\_\_ When written in a certain positive base  $b$ , 363 (base 10) is 123 (base  $b$ ). What is the value of  $b$ ?
255. \_\_\_\_\_  $\text{units}^2$  Rhombus EFGH is inscribed in rhombus ABCD with point E on  $\overline{AB}$ , point F on  $\overline{BC}$ , point G on  $\overline{CD}$  and point H on  $\overline{AD}$ . If  $AE:EB = BF:FC = CG:GD = DH:HA = 1:2$ , and if the area of rhombus ABCD is  $180 \text{ units}^2$ , what is the area of rhombus EFGH?

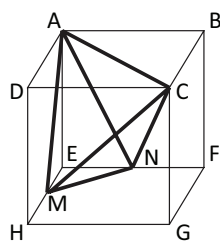


256. \_\_\_\_\_ The solutions  $x = u$  and  $x = v$  of the quadratic equation  $rx^2 + sx + t = 0$  are reciprocals of the solutions of the quadratic equation  $(2 + a)x^2 + 5x + (2 - a) = 0$  for some integer  $a$ . If the GCF of  $r$ ,  $s$  and  $t$  is 1, what is the value of  $r + s + t$ ?
257. \_\_\_\_\_ A club with 22 students is forming a committee of either 4 or 5 students. What is the ratio of the number of different 4-person committees possible to the number of different 5-person committees possible? Express your answer as a common fraction.
258. \_\_\_\_\_ Quadrilateral ABCD has vertices at points  $A(-9, 4)$ ,  $B(-7, 8)$ ,  $C(-3, 6)$  and  $D(-6, 2)$ . Quadrilateral WXYZ is congruent to quadrilateral ABCD and has vertices  $W(2, -3)$ ,  $X(4, 1)$  and  $Y(8, -1)$  and a fourth vertex, Z. What is the sum of the coordinates of vertex Z?



259. \_\_\_\_\_  $\text{units}^2$  A right triangle has integer side lengths  $a$ ,  $b$  and  $c$  with  $a < b < c$ . If  $a + c = 49$ , what is the area of the triangle?

260. \_\_\_\_\_  $\text{units}^3$



The cube with vertices A, B, C, D, E, F, G, H has edges of length 2 units. Point M is the midpoint of  $\overline{EH}$  and N is the midpoint of  $\overline{EF}$ . What is the volume of the tetrahedron with vertices A, C, M, N? Express your answer as a common fraction.



# Workout 9

261. \_\_\_\_\_ units<sup>3</sup> A 6-8-10 triangle is revolved about the side of length 10 units. What is the volume of the resulting solid? Express your answer as a decimal to the nearest tenth.

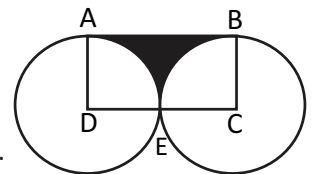
262. \_\_\_\_\_ students Some students in a gym class are wearing blue jerseys, and the rest are wearing red jerseys. There are exactly 25 ways to pick a team of 3 players that includes at least 1 player wearing each color. How many students are in the class?



263. \_\_\_\_\_ % Suppose that the price of game tickets has gone up 4% every year for the past 25 years. What percent of today's game ticket price is the price of a game ticket 13 years ago? Express your answer to the nearest whole number.

264. \_\_\_\_\_ The three sides of a right triangle form a geometric progression. What is the ratio of the length of the shortest side to the length of the hypotenuse? Express your answer as a decimal to the nearest hundredth.

265. \_\_\_\_\_ units<sup>2</sup> The radii of circles C and D are each 3 units long. The two circles are tangent at point E. Side AB of rectangle ABCD is tangent to circle D at point A and tangent to circle C at point B. What is the area of the shaded region? Express your answer as a decimal to the nearest tenth.



266. \_\_\_\_\_ What is the smallest positive integer that is greater than 100 and leaves a remainder of 1 when divided by 3, a remainder of 2 when divided by 5 and a remainder of 3 when divided by 7?

267. \_\_\_\_\_ units
- M P  
S Q R
- Trapezoid MPRS has  $\overline{MP}$  and  $\overline{RS}$  as bases and  $\overline{MS} \perp \overline{SR}$ . Additionally,  $MP = MS = 2$  units, and  $RS = 3$  units. If point Q lies on  $\overline{SR}$  such that  $PQ$  bisects the area of trapezoid MPRS, what is the length of  $PQ$ ? Express your answer as a decimal to the nearest tenth.

268. \_\_\_\_\_ values The mean of a set of five different positive integers is 21. How many values are possible for the median of this set of positive integers?

269. \_\_\_\_\_ hours One candle burns entirely in 6 hours, and another burns entirely in 9 hours. The candles were lit at the same time, and they were the same height when lit. After how many hours will one candle be half the height of the other? Express your answer as a decimal to the nearest tenth.



270. \_\_\_\_\_ For years, Mrs. Meany has had a tradition of giving her students a list of books from which they had to choose two to read during winter break. This year, Mrs. Meany added  $n$  book(s) to the list. If there are now 99 more ways that two books can be selected, what is the sum of all possible values of  $n$ ?



# Right Triangles Stretch

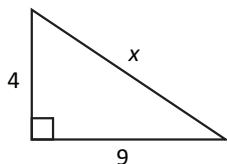
For problems 271-276, the Pythagorean Theorem or a knowledge of Pythagorean triples can be used to determine the value of  $x$  in each figure. For each figure, provide the exact value of  $x$  (as an integer or in simplest radical form). If  $x$  is not an integer value, also provide the value of  $x$  expressed as a decimal to the nearest tenth.

271. \_\_\_\_\_ units

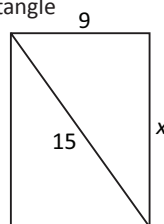
272. \_\_\_\_\_ units

273. \_\_\_\_\_ units

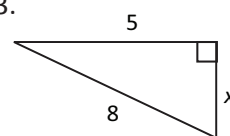
271.



272. rectangle

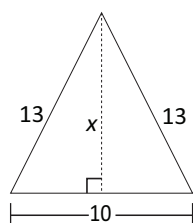


273.

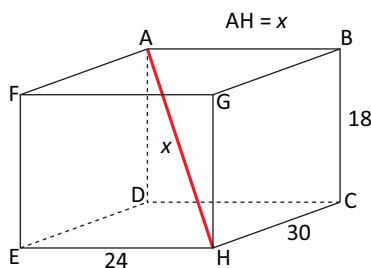


274. \_\_\_\_\_ units

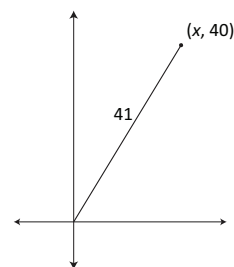
274. isosceles triangle



275. right rectangular prism



276.



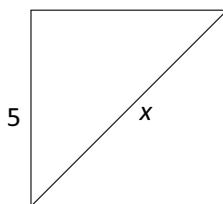
275. \_\_\_\_\_ units

276. \_\_\_\_\_ units

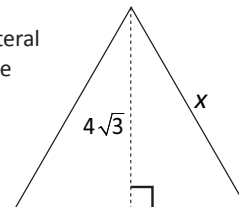
For problems 277-280, a knowledge of 30-60-90 or 45-45-90 triangles can be used to determine the value of  $x$  in each figure. For each figure, provide the exact value of  $x$  (as an integer or in simplest radical form). If  $x$  is not an integer value, also provide the value of  $x$  expressed as a decimal to the nearest tenth.

277. \_\_\_\_\_ units

277. square



278. equilateral triangle

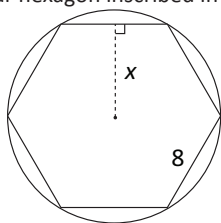


278. \_\_\_\_\_ units

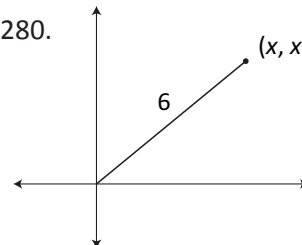
279. \_\_\_\_\_ units

280. \_\_\_\_\_ units

279. regular hexagon inscribed in a circle



280.



For problems 281-282, a knowledge of the properties of similar triangles and right triangles can be used to determine the value of  $x$  and  $y$  in each figure. If  $x$  and/or  $y$  is not an integer value, provide the value expressed as a decimal to the nearest tenth.

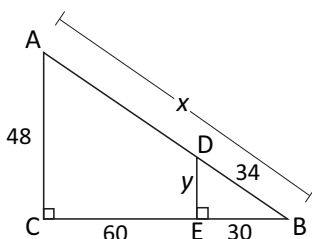
281.  $x =$  \_\_\_\_\_ units

$y =$  \_\_\_\_\_ units

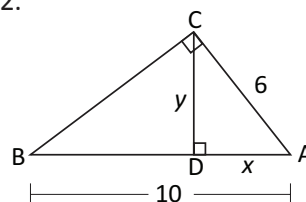
282.  $x =$  \_\_\_\_\_ units

$y =$  \_\_\_\_\_ units

281.



282.







# Sequences Stretch

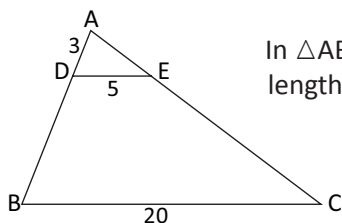
283. \_\_\_\_\_ What is the 100th term of the arithmetic sequence 3, 11, 19, 27, ...?
284. \_\_\_\_\_ What is the sum of the first 100 terms of the arithmetic sequence 3, 11, 19, 27, ...?
285. \_\_\_\_\_ What is the 10th term of the geometric sequence 729, 243, 81, 27, ...? Express your answer as a common fraction.
286. \_\_\_\_\_ The 1st and 18th terms of an arithmetic sequence are 4 and 8.25, respectively. What is the 35th term of the sequence? Express your answer as a decimal to the nearest tenth.
287. \_\_\_\_\_ The first three terms of an arithmetic sequence are  $p$ ,  $2p + 6$  and  $5p - 12$ . What is the 4th term of this sequence?
288. \_\_\_\_\_ All terms in a geometric sequence are positive integers, and the first three terms are  $n$ ,  $n + 3$  and  $2n + 6$ . What is the 4th term of this sequence?
289. \_\_\_\_\_ The 3rd term of an arithmetic sequence is 17, and the 9th term is 83. What is the 1st term?
290. \_\_\_\_\_ The 2nd term of a geometric sequence is 24, and the 5th term is 81. What is the 1st term?
291. \_\_\_\_\_ The 6th term of an arithmetic sequence is 24. What is the sum of the 5th and 7th terms?
292. \_\_\_\_\_ <sup>cells</sup> The number of bacterial cells within a Petri dish doubles every hour. If there are 8 cells in the dish at the end of the 2nd hour, how many cells will be in the dish at the end of the 8th hour?



# Similarity Stretch

Two geometric figures are similar if all of their corresponding angles are congruent and all of their corresponding sides are proportional. This means that the figures have the exact same shape but not necessarily the same size. For two triangles to be similar, it is sufficient to know that two pairs of corresponding angles are congruent.

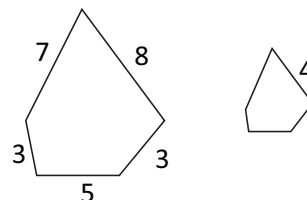
293. \_\_\_\_\_ units



In  $\triangle ABC$ ,  $\overline{DE}$  is parallel to  $\overline{BC}$ ,  $AD = 3$ ,  $DE = 5$  and  $BC = 20$ . What is the length of  $\overline{BD}$ ?

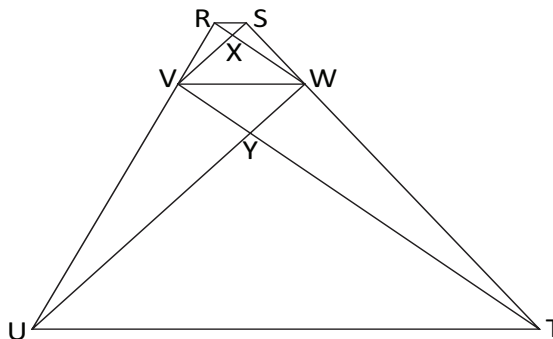
294. \_\_\_\_\_ units

The two pentagons shown here are similar, with the side of length 4 in the smaller pentagon corresponding to the side of length 8 in the larger pentagon, and with the indicated lengths given. What is the perimeter of the smaller pentagon?

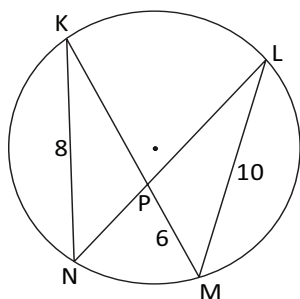


295. \_\_\_\_\_ units

In the figure below,  $\overline{RS}$ ,  $\overline{VW}$  and  $\overline{UT}$  are parallel. If  $RS = 3$ ,  $VW = 12$ ,  $UT = 48$  and  $XW = 10$ , what is the length of  $\overline{YT}$ ?



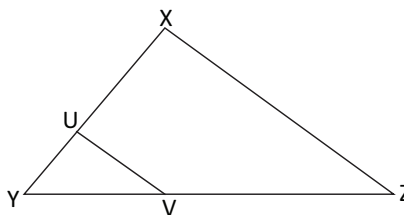
296. \_\_\_\_\_ units



Chords  $\overline{KM}$  and  $\overline{NL}$  of the circle shown intersect at point  $P$ . If  $KN = 8$ ,  $PM = 6$  and  $LM = 10$ , what is the length of  $\overline{PN}$ ? Express your answer as a decimal to the nearest tenth.

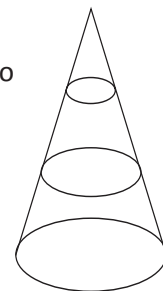
297. \_\_\_\_\_

Given that  $\overline{UV}$  and  $\overline{XZ}$  are parallel and that  $YV = 3$  and  $YZ = 5$ , what is the ratio of the area of  $\triangle UYV$  to the area of trapezoid  $UVZX$ ? Express your answer as a common fraction.

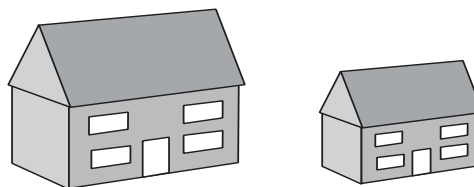


298. \_\_\_\_\_ units<sup>2</sup> Trapezoid ABCD has right angles at A and D, and diagonals AC and BD intersect at point E. The area of  $\triangle ABE$  is 25 units<sup>2</sup>, and the area of  $\triangle DEC$  is 49 units<sup>2</sup>. If AD = 6, what is the area of trapezoid ABCD?

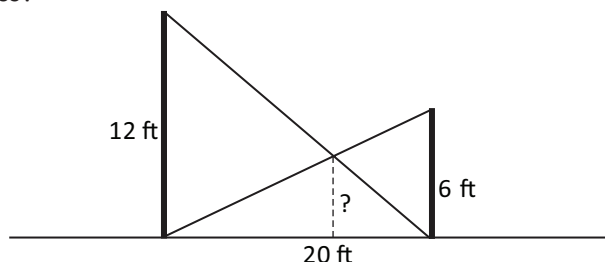
299. \_\_\_\_\_ In the figure shown, the largest cone has been divided into a smaller cone and two frustums by two planes that trisect the altitude of the original cone. What is the ratio of the volume of the smaller frustum to the volume of the larger frustum? Express your answer as a common fraction.



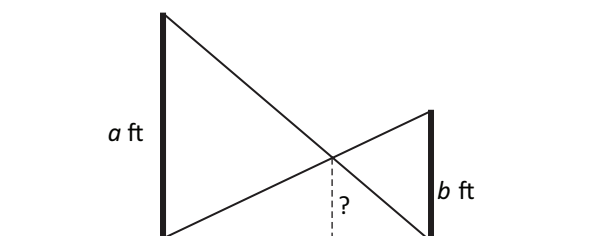
300. \_\_\_\_\_ cm<sup>2</sup> The two toy houses shown here are similar. If the volume of the larger one is 1000 cm<sup>3</sup> and the volume of the smaller one is 216 cm<sup>3</sup>, what is the surface area of the smaller house if the larger one has a surface area of 400 cm<sup>2</sup>?



301. \_\_\_\_\_ ft Two vertical poles with heights 6 ft and 12 ft, respectively, are placed 20 ft apart. A wire is strung from the top of each pole to the base of the other pole. How high above the ground do the two wires cross?



302. \_\_\_\_\_ ft Two vertical poles are  $a$  ft and  $b$  ft tall, respectively. A wire is strung from the top of each pole to the base of the other pole. How high above the ground do the two wires cross? Express your answer as a common fraction in terms of  $a$  and  $b$ .





# What About Math?

In an effort to bridge the gap between the knowledge students gain from MATHCOUNTS and the important applications of this knowledge, MATHCOUNTS is providing a *What About Math?* section in the *MATHCOUNTS School Handbook*. This year the problems are from the field of **meteorology**. Written by actual professionals in this field, these problems illustrate how students can put the skills they are learning today into practice in the near future.

This year's problems were written for MATHCOUNTS by members of the American Meteorological Society (AMS).

**AMS Writers/Editors:** *James Brey, Director, AMS Education Program; Elizabeth Mills, Associate Director, AMS Education Program; Joseph Moran, Associate Director, AMS Education Program*

## **AMERICAN METEOROLOGICAL SOCIETY (WWW.AMETSOC.ORG)**

The American Meteorological Society promotes the development and dissemination of information and education on the atmospheric and related oceanic and hydrologic sciences and promotes their professional applications. Founded in 1919, AMS has a membership of more than 15,000 professionals, students and weather enthusiasts.

The American Meteorological Society Education Program promotes the teaching of atmospheric, oceanographic, and hydrologic sciences through pre-college teacher training and instructional resource material development. It also promotes instructional innovation at the introductory college course level, hence the K-13 designation for the program. All programs promote activity directed toward greater human resource diversity in the sciences AMS represents.

To date, over 100,000 teachers have received AMS training and instructional resources, which have benefited millions of students.

# What About Math? - American Meteorological Society

Lightning is the electrical discharge in a thunderstorm. It results in both a visible flash and the heating of air, causing a sonic boom commonly referred to as thunder. The speed of light is so fast that one may consider seeing the flash as instantaneous with the lightning. The speed of sound is slower, about 340 meters per second, or 1100 feet per second, so counting the seconds from the lightning flash to the lightning bang (thunder) gives the distance to the thunderstorm, based on 3 seconds per kilometer, or 5 seconds per mile.



1. \_\_\_\_\_ km Using the *flash-to-bang* method based on 3 sec/km, what is the distance, in kilometers, to a thunderstorm if the time elapsed between the flash and the bang is 5 sec? Express your answer as a decimal to the nearest tenth.
2. \_\_\_\_\_ mi Using the *flash-to-bang* method based on 5 sec/mi, what is the distance, in miles, to a thunderstorm if the time elapsed between the flash and the bang is 12 sec? Express your answer as a decimal to the nearest tenth.

Rotating atmospheric storm systems, called cyclones in general, have centers of lower pressure about which the air swirls. In the tropics, these are tropical cyclones. At middle latitudes, they are extra-tropical cyclones and are associated with fronts – boundaries of changing temperatures. Cyclones, tropical cyclones and extra-tropical cyclones are all three-dimensional flows of air with stronger horizontal winds but also upward motions that result in their cloud patterns.

3. \_\_\_\_\_ km/h In a typical extra-tropical cyclone, the vertical motion of air is typically only 1% to 10% of the horizontal wind speed. If the horizontal wind in a cyclone is blowing at a rate of 20 km/h, what is the positive difference between the greatest and least typical values for the vertical air motion? Express your answer as a decimal to the nearest tenth.



Storms in the tropical regions do not have fronts and temperature changes. Instead they are organized thunderstorm masses about a center of lower air pressure. As these thunderstorm systems develop, they grow and are categorized by their associated wind speeds. When maximum sustained winds reach 37 km/h, the system is termed a tropical depression. Sustained winds of 63 km/h denote a tropical storm. A storm with maximum sustained winds reaching 119 km/h, by definition, is a hurricane (referred to as a typhoon in the western Pacific Ocean, or cyclone in the Indian Ocean and southern Pacific Ocean). Wind pressure is the force per unit area caused by air in motion. During a storm the factor by which the wind pressure increases is equal to the square of the factor by which the wind speed increases.

4. \_\_\_\_\_ Suppose that a tropical depression with a maximum sustained wind speed of 50 km/h intensifies to hurricane strength with a maximum sustained wind speed of 150 km/h. By what factor does the wind pressure increase?



Density is the mass of material in a unit volume. For example, 1 g of fresh water fills 1 cm<sup>3</sup>, so the density of fresh water is 1 g/cm<sup>3</sup>. For comparison, the density of cork is 0.25 g/cm<sup>3</sup> and iron has a density of 7.9 g/cm<sup>3</sup>. The general rule is that 10 cm of fresh snow melts to become 1 cm of liquid water. Hence, the average density of fresh snow is considered to be 0.1 g/cm<sup>3</sup>.

5. \_\_\_\_\_ g/cm<sup>3</sup> What is the density of snow if the ratio of snowfall depth to melted water depth is 3 to 1? Express your answer as a decimal to the nearest hundredth.
6. \_\_\_\_\_ cm If 10 in of freshly fallen snow melts down to 1 in of liquid water, what is the liquid water equivalent depth of 30 cm of fresh snow?

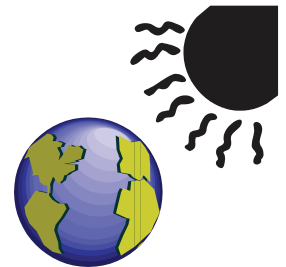
The atmosphere can be arbitrarily divided into layers based on the vertical temperature pattern. The lowest layer is called the troposphere, where the temperature generally decreases with altitude from Earth's surface up to about 11 km.

7. \_\_\_\_\_ °F If the air temperature within the troposphere drops 3.5 °F for every 1000-ft increase in altitude, what is the air temperature outside an airplane cruising at 18,000 ft if the temperature at ground level (sea level) is 70 °F?

Earth's atmosphere consists mainly of nitrogen and oxygen. These gases do not react with most radiation, thus transmitting almost 100%. Some gases transmit some types of radiation, such as visible light, but absorb other portions, particularly infrared radiation. Gases that absorb infrared (heat) radiation from Earth outward to space, of which the atmosphere in turn can emit part back down to the surface, help warm the planet. This is called the greenhouse effect. Such gases are called greenhouse gases or GHG. The major GHG (although minor components of the atmosphere) are water vapor and carbon dioxide (CO<sub>2</sub>), as well as methane, nitrous oxide, chlorofluorocarbons and others. Rising concentrations of CO<sub>2</sub> pose a problem in an enhanced greenhouse effect.

8. \_\_\_\_\_ years In 2004, the average annual concentration of atmospheric carbon dioxide (a GHG) was 377.6 parts per million by volume (ppmv), and the annual rate of increase was about 1.5 ppmv. At this rate of increase, how many years would it take the 2004 level of CO<sub>2</sub> to double? Express your answer as a decimal to the nearest tenth.
9. \_\_\_\_\_ years Suppose the rate of annual increase were to average 3.0 ppmv. How many years would it take the 2004 level of CO<sub>2</sub> to double? Express your answer as a decimal to the nearest tenth.

All objects including the Sun and Earth emit radiation. Depending on their temperature, the radiation has varying characteristics and differing names. Earth emits mainly infrared radiation (heat) outward to space. The Sun emits mostly visible light into space but also some ultraviolet and infrared, a small portion of which strikes Earth. Radiation that goes to Earth and encounters matter may be absorbed to become heat, may be reflected or scattered away, or may be transmitted to the Earth's surface without change.



10. \_\_\_\_\_ % Consider what happens to a solar beam traveling through the atmosphere on a particular day. If 15% of the radiation is absorbed and 20% is scattered, or reflected back to space mostly by clouds, what percent of the solar radiation is actually transmitted to Earth's surface?





# ANSWERS TO HANDBOOK AND WHAT ABOUT MATH? PROBLEMS

In addition to the answer, we have provided a difficulty rating for each problem. Our scale is 1-7, with 7 being the most difficult. These are only approximations, and how difficult a problem is for a particular student will vary. Below is a general guide to the ratings:

Difficulty 1/2/3 - One concept; one- to two-step solution; appropriate for students just starting the middle school curriculum.

4/5 - One or two concepts; multistep solution; knowledge of some middle school topics is necessary.

6/7 - Multiple and/or advanced concepts; multistep solution; knowledge of advanced middle school topics and/or problem-solving strategies is necessary.

## Warm-Up 1

Answer	Difficulty		
1. 420	(1)	6. 64	(3)
2. 3	(2)	7. 480	(4)
3. 69	(2)	8. $5/8$	(3)
4. 5	(2)	9. 6	(3)
5. 40	(3)	10. 3	(2)

## Warm-Up 2

Answer	Difficulty		
11. 4	(1)	16. 35	(3)
12. 120	(3)	17. 60	(3)
13. 300	(3)	18. 152	(3)
14. 36	(3)	19. 48	(3)
15. 1500 or 1500.00	(2)	20. 12	(4)

## Workout 1

Answer	Difficulty		
21. 35	(2)	26. 812	(2)
22. 2.80	(3)	27. 12.65	(4)
23. 27	(3)	28. 12	(2)
24. 20	(3)	29. 6	(4)
25. 54	(4)	30. 0.51	(3)

## Warm-Up 3

Answer	Difficulty		
31. 36	(1)	36. 27	(3)
32. 4	(3)	37. 4	(3)
33. 1067	(3)	38. 60	(4)
34. 400	(3)	39. 125 or 125.00	(4)
35. $3/4$	(3)	40. 8	(4)

## Warm-Up 4

Answer	Difficulty		
41. triangle or $\triangle$	(2)	46. 108	(4)
42. 104	(3)	47. 15	(3)
43. 2	(2)	48. 18	(5)
44. $1/5$	(2)	49. 13	(3)
45. $14/95$	(4)	50. 23 or 23.00	(4)

## Workout 2

Answer	Difficulty		
51. 16.39	(2)	56. 20	(3)
52. 1320	(3)	57. 38	(3)
53. 3	(2)	58. 13	(4)
54. $343/4096$	(4)	59. $2/25$	(4)
55. 13	(2)	60. 7.75	(4)

## Warm-Up 5

Answer	Difficulty		
61. 66	(2)	66. 5	(3)
62. $4\sqrt{3}$	(5)	67. 6	(4)
63. -256	(2)	68. 36	(4)
64. $6\pi$	(4)	69. 75	(3)
65. 24	(3)	70. 40	(4)

## Warm-Up 6

Answer	Difficulty		
71. 20	(4)	76. 64	(3)
72. $16\pi$	(3)	77. 82	(4)
73. 15/56	(2)	78. $-2\frac{1}{2}$	(3)
74. 6	(4)	79. $1^*$ or 1.00	(3)
75. 0	(5)	80. 8	(4)

## Workout 3

Answer	Difficulty		
81. 380	(2)	86. 66	(5)
82. 30	(2)	87. 6370	(4)
83. 288	(3)	88. 26	(3)
84. 12.50	(4)	89. 60	(3)
85. 14.072	(4)	90. 9	(5)

## Warm-Up 7

Answer	Difficulty		
91. 960 or 960.00	(1)	96. 25 or 25.00	(2)
92. 2	(3)	97. 16	(3)
93. 12	(1)	98. 18	(3)
94. 7/15	(3)	99. $1/4$	(5)
95. 22	(3)	100. $s^2 - 2sb$ or $s^2 - 2bs$	(5)

## Warm-Up 8

Answer	Difficulty		
101. 400	(4)	106. (0.5, 0.5)	(4)
102. 35	(3)	107. 10	(4)
103. 4	(2)	108. 4	(3)
104. 45	(4)	109. 60	(3)
105. 6	(4)	110. 52	(2)

## Workout 4

Answer	Difficulty		
111. 4.5	(5)	116. 118.75	(4)
112. 72	(3)	117. 200	(5)
113. 27,648	(3)	118. 33	(3)
114. 24	(4)	119. 1.6	(3)
115. $2.16 \times 10^5$	(3)	120. 39.3	(5)

\* The plural form of the units is always provided in the answer blank, even if the answer appears to require the singular form of the units.

## Warm-Up 9

Answer	Difficulty		
121. H	(1)	126. 44	(4)
122. 24	(3)	127. $1/16$	(3)
123. 390	(3)	128. $\sqrt{89}$	(4)
124. 216	(3)	129. 72	(2)
125. 115	(5)	130. $(-3, 6)$	(4)

## Warm-Up 11

Answer	Difficulty		
151. 13	(4)	156. $1/3$	(4)
152. $5/18$	(4)	157. 17	(4)
153. $1/4$	(5)	158. 3	(5)
154. 162	(3)	159. $48\pi + 32$	(4)
155. 80	(3)	160. 5	(5)

## Warm-Up 10

Answer	Difficulty		
131. 24	(2)	136. 75	(4)
132. 1.25	(2)	137. 50	(4)
133. 48	(3)	138. 7	(5)
134. 14	(3)	139. 24	(3)
135. 90	(3)	140. 42	(3)

## Warm-Up 12

Answer	Difficulty		
161. 100	(3)	166. 42.2	(4)
162. 3:45	(2)	167. 9	(4)
163. 36	(4)	168. 4 or 4.00	(4)
164. 141	(3)	169. 16	(3)
165. 20	(4)	170. $\sqrt{73}$	(6)

## Workout 5

Answer	Difficulty		
141. 6	(2)	146. 2771.3	(5)
142. $6.368 \times 10^9$	(4)	147. 5	(4)
143. 2.17	(5)	148. 39	(5)
144. $1/3$	(5)	149. 512	(5)
145. 39	(4)	150. 35	(5)

## Workout 6

Answer	Difficulty		
171. 78	(3)	176. 11.3	(4)
172. 30	(5)	177. 2	(4)
173. 18.50	(3)	178. $33/50$	(3)
174. 52.6	(4)	179. 12	(2)
175. 17	(4)	180. 80	(4)

## Warm-Up 13

Answer	Difficulty		
181. $7/18$	(4)	186. 4536	(4)
182. 60	(4)	187. $256\pi$	(6)
183. $25/24$	(2)	188. 40	(4)
184. $2a + b$	(5)	189. $1/126$	(5)
185. 24	(3)	190. 100	(4)

## Warm-Up 15

Answer	Difficulty		
211. 325	(3)	216. 90	(5)
212. 3	(4)	217. $16/45$	(4)
213. 56	(4)	218. 11	(4)
214. E5, B4 or B4, E5	(3)	219. 2450	(4)
215. 200	(5)	220. 7	(6)

## Warm-Up 14

Answer	Difficulty		
191. 4	(4)	196. 45	(4)
192. 10	(3)	197. $1/6$	(4)
193. -9	(4)	198. 34	(4)
194. 40	(5)	199. (0, 3)	(4)
195. 18	(6)	200. 36	(5)

## Warm-Up 16

Answer	Difficulty		
221. 4	(5)	226. 85	(6)
222. 8	(5)	227. 83	(4)
223. 4	(6)	228. 120	(5)
224. 37.5	(3)	229. 26	(4)
225. 1540	(5)	230. $7/19$	(5)

## Workout 7

Answer	Difficulty		
201. 16	(6)	206. 80	(3)
202. 96	(4)	207. $1/5$	(5)
203. 0.73	(6)	208. $2\pi r$	(5)
204. (4, -6)	(3)	209. 90 or 90.00	(5)
205. 16	(5)	210. 6	(5)

## Workout 8

Answer	Difficulty		
231. 1231.66	(4)	236. 784	(4)
232. 21	(5)	237. 7.48	(4)
233. 6	(4)	238. 30.25	(6)
234. 24.57	(3)	239. 0	(6)
235. 0.055	(5)	240. 1.59	(4)

## Warm-Up 17

Answer	Difficulty		
241. 4	(6)	246. 49 or 49.00	(4)
242. $44 - 4\pi$	(4)	247. 72	(5)
243. 28	(5)	248. $-\sqrt{2}$	(7)
244. 9	(4)	249. $6/5$	(6)
245. 30	(4)	250. $1008\pi$	(6)

## Warm-Up 18

Answer	Difficulty		
251. 62,333	(5)	256. 9	(7)
252. 40	(4)	257. $5/18$	(4)
253. 15	(5)	258. 0	(5)
254. 18	(5)	259. 210	(6)
255. 100	(5)	260. $4/3$	(7)

## Workout 9

Answer	Difficulty		
261. 241.3	(5)	266. 157	(4)
262. 7	(6)	267. 2.5	(6)
263. 60	(4)	268. 31	(4)
264. 0.62	(6)	269. 4.5	(5)
265. 3.9	(4)	270. 32	(6)

## Right Triangles Stretch

Answer	Difficulty		
271. $\sqrt{97} \approx 9.8$	(2)	277. $5\sqrt{2} \approx 7.1$	(3)
272. 12	(2)	278. 8	(4)
273. $\sqrt{39} \approx 6.2$	(2)	279. $4\sqrt{3} \approx 6.9$	(5)
274. 12	(4)	280. $3\sqrt{2} \approx 4.2$	(4)
275. $30\sqrt{2} \approx 42.4$	(4)	281. $x = 102$ $y = 16$	(4)
276. 9	(4)	282. $x = 3.6$ $y = 4.8$	(5)

## Sequences Stretch

Answer	Difficulty		
283. 795	(4)	288. 24	(6)
284. 39,900	(5)	289. $-5$	(4)
285. $1/27$	(4)	290. 16	(5)
286. 12.5	(4)	291. 48	(4)
287. 66	(5)	292. 512	(4)

## Similarity Stretch

Answer	Difficulty		
293. 9	(4)	298. 144	(6)
294. 13	(3)	299. $7/19$	(5)
295. 40	(4)	300. 144	(5)
296. 4.8	(5)	301. 4	(6)
297. $9/16$	(5)	302. $ab/(a + b)$	(7)

## What About Math?

Answer	Difficulty		
1. 1.7	(2)	6. 3	(3)
2. 2.4	(2)	7. 7	(3)
3. 1.8	(3)	8. 251.7	(3)
4. 9	(4)	9. 125.9	(3)
5. 0.33	(4)	10. 65	(2)

# MATHCOUNTS Problems Mapped to Common Core State Standards (CCSS)

Currently, 44 states have adopted the Common Core State Standards (CCSS). Because of this, MATHCOUNTS has concluded that it would be beneficial to teachers to see the connections between the CCSS and the *2011-2012 MATHCOUNTS School Handbook* problems. MATHCOUNTS not only has identified a general topic and assigned a difficulty level for each problem but also has provided a CCSS code in the Problem Index (pages 92-93). A complete list of the Common Core State Standards can be found at [www.corestandards.org](http://www.corestandards.org).

The CCSS for mathematics cover K-8 and high school courses. MATHCOUNTS problems are written to align with the NCTM Standards for Grades 6-8. As one would expect, there is great overlap between the two sets of standards. MATHCOUNTS also recognizes that in many school districts, algebra and geometry are taught in middle school, so some MATHCOUNTS problems also require skills taught in those courses.

In referring to the CCSS, the Problem Index code for each or the Standards for Mathematical Content for grades K-8 begins with the grade level. For the Standards for Mathematical Content for high school courses (such as algebra or geometry), each code begins with a letter to indicate the course name. The second part of each code indicates the domain within the grade level or course. Finally, the number of the individual standard within that domain follows. Here are two examples:

- *6.RP.3* → *Standard #3 in the Ratios and Proportional Relationships domain of grade 6*
- *G-SRT.6* → *Standard #6 in the Similarity, Right Triangles and Trigonometry domain of Geometry*

Some math concepts utilized in MATHCOUNTS problems are not specifically mentioned in the CCSS. Two examples are the Fundamental Counting Principle (FCP) and special right triangles. In cases like these, if a related standard could be identified, a code for that standard was used. For example, problems using the FCP were coded 7.SP.8, S-CP.8 or S-CP.9 depending on the context of the problem; SP → Statistics and Probability (the domain), S → Statistics and Probability (the course) and CP → Conditional Probability and the Rules of Probability. Problems based on special right triangles were given the code G-SRT.5 or G-SRT.6, explained above.

There are some MATHCOUNTS problems that either are based on math concepts outside the scope of the CCSS or based on concepts in the standards for grades K-5 but are obviously more difficult than a grade K-5 problem. When appropriate, these problems were given the code SMP for Standards for Mathematical Practice. The CCSS include the Standards for Mathematical Practice along with the Standards for Mathematical Content. The SMPs are (1) Make sense of problems and persevere in solving them; (2) Reason abstractly and quantitatively; (3) Construct viable arguments and critique the reasoning of others; (4) Model with mathematics; (5) Use appropriate tools strategically; (6) Attend to precision; (7) Look for and make use of structure and (8) Look for and express regularity in repeated reasoning.



# PROBLEM INDEX

It is difficult to categorize many of the problems in the *MATHCOUNTS School Handbook*. It is very common for a MATHCOUNTS problem to straddle multiple categories and cover several concepts. This index is intended to be a helpful resource, but since each problem has been placed in exactly one category and mapped to exactly one Common Core State Standard (CCSS), the index is not perfect. In this index, the code **8 (3) 7.SP.5** refers to problem 8 with difficulty rating 3 mapped to CCSS 7.SP.5. For an explanation of the difficulty ratings refer to page 65. For an explanation of the CCCS codes refer to page 91.

General Math	1	(1)	4.OA.2
	11	(1)	6.G.3
	17	(3)	5.OA.1
	21	(2)	SMP
	37	(3)	6.EE.2
	43	(2)	7.NS.2
	53	(2)	4.MD.2
	102	(3)	SMP
	164	(3)	SMP
	191	(4)	SMP
Number Theory	3	(2)	4.OA.3
	10	(2)	4.OA.5
	22	(3)	7.NS.3
	33	(3)	4.OA.5
	40	(4)	7.NS.2
	49	(3)	8.EE.2
	69	(3)	6.EE.6
	84	(4)	7.RP.3
	95	(3)	SMP
	98	(3)	4.OA.4
	112	(3)	6.NS.4
	123	(3)	3.NBT.2
	134	(3)	SMP
	145	(4)	SMP
	149	(5)	S-CP.9
	151	(4)	SMP
	154	(3)	7.NS.3
	167	(4)	7.EE.4
	169	(3)	SMP
	171	(3)	4.OA.3
	175	(4)	SMP
	179	(2)	SMP
	183	(2)	7.NS.1
	198	(4)	SMP
	205	(5)	SMP
	218	(4)	6.RP.3
	219	(4)	7.SP.8
	241	(6)	SMP
	244	(4)	7.NS.3
	248	(7)	7.NS.3
	251	(5)	SMP
	254	(5)	SMP
	266	(4)	6.NS.4
Probability, Counting & Combinatorics	8	(3)	7.SP.5
	12	(3)	7.SP.8
	16	(3)	7.SP.8
	35	(3)	7.SP.7
	45	(4)	7.SP.8
	59	(4)	7.SP.8
	67	(4)	6.SP.4
	71	(4)	S-CP.9
	94	(3)	7.SP.5
	113	(3)	7.SP.8
	124	(3)	7.SP.8
	127	(3)	6.EE.5
	140	(3)	7.SP.8
	142	(4)	7.SP.8
	152	(4)	7.SP.7
	157	(4)	S-CP.9
	178	(3)	7.SP.7
	186	(4)	7.SP.8
	189	(5)	S-CP.8
	192	(3)	7.SP.8
	217	(4)	7.SP.7
Sequences, Series & Patterns	25	(4)	3.MD.7
	50	(4)	F-LE.1
	61	(2)	4.OA.5
	63	(2)	F-LE.2
	119	(3)	6.EE.1
	129	(2)	SMP
	139	(3)	SMP
	166	(4)	6.SP.5
	210	(5)	6.NS.4
	212	(4)	F-BF.2
	233	(4)	8.NS.1
	243	(5)	F-BF.2
	264	(6)	F-LE.2
	*Sequences Stretch		
Percents & Fractions	5	(3)	6.RP.3
	15	(2)	6.RP.1
	39	(4)	7.RP.3
	44	(3)	6.NS.1
	51	(2)	8.NS.1
	73	(2)	6.NS.1
	79	(3)	7.RP.3
	82	(2)	6.RP.3
	126	(4)	6.G.1
	141	(2)	7.RP.3
	144	(5)	7.RP.3
	173	(3)	7.RP.3
	197	(4)	7.NS.3
	209	(5)	6.RP.3
	211	(3)	7.NS.3
Proportional Reasoning	230	(5)	7.NS.3
	231	(4)	A-CED.1
	234	(3)	7.RP.3
	249	(6)	A-CED.2
	263	(4)	6.EE.1
	7	(4)	7.EE.4
	18	(3)	6.RP.3
	26	(2)	6.RP.3
	28	(2)	6.RP.3
	34	(3)	6.RP.3
	36	(3)	6.EE.7
	52	(3)	6.RP.3
	81	(2)	7.SP.6
	87	(4)	G-CO.10
	93	(1)	4.OA.2
	101	(4)	6.RP.3
	105	(4)	7.RP.2
	110	(2)	6.EE.9
	114	(4)	6.EE.9
	118	(3)	7.RP.2
	122	(3)	6.EE.7
	135	(3)	6.RP.3
	163	(4)	6.RP.3
	190	(4)	5.MD.5
	194	(5)	8.G.9
	206	(3)	6.RP.3
	246	(4)	7.RP.2
	255	(5)	6.G.1

Measurement	27	(4)	6.G.1
	31	(1)	6.EE.3
	42	(3)	7.G.5
	46	(4)	G-CO.10
	55	(2)	6.EE.7
	64	(4)	7.G.4
	76	(4)	4.MD.3
	92	(3)	7.G.4
	97	(3)	6.RP.3
	116	(4)	4.MD.3
	120	(5)	7.G.4
	128	(4)	8.G.7
	133	(3)	7.G.6
	146	(5)	G-SRT.6
	161	(3)	7.G.6
	196	(4)	8.G.7
	208	(5)	7.G.4
	242	(4)	7.G.4
	252	(4)	7.G.6
	267	(6)	8.G.8
Coordinate Geometry	80	(4)	6.G.3
	89	(3)	6.G.3
	106	(4)	G-GPE.6
	130	(4)	8.G.1
	138	(5)	8.F.4
	180	(4)	6.G.1
	199	(4)	8.F.3
	204	(3)	G-GPE.6
	207	(5)	8.F.4
	232	(5)	8.G.8
	258	(5)	G-CO.5
Solid Geometry	9	(3)	6.EE.9
	23	(3)	7.G.6
	29	(4)	8.EE.7
	72	(3)	8.G.9
	83	(3)	6.G.2
	111	(5)	8.G.9
	137	(4)	7.G.6
	156	(4)	8.G.9
	187	(6)	8.G.9
	201	(6)	6.G.2
	222	(5)	G-GMD.3
	227	(4)	7.G.6
	237	(4)	8.G.7
	250	(6)	G-GMD.4
	260	(7)	7.G.6
	261	(5)	G-GMD.4
Plane Geometry	4	(2)	6.EE.7
	6	(3)	3.MD.7
	13	(3)	G-C.2
	20	(4)	6.G.1
	38	(4)	7.G.5
	57	(3)	6.G.1
	62	(5)	8.EE.2
	86	(5)	6.RP.3
	100	(5)	6.G.1
	109	(3)	8.G.7
	125	(5)	8.G.5
	136	(4)	4.MD.5
	143	(5)	7.G.4
	150	(5)	8.G.5
	159	(4)	7.G.4
	165	(4)	4.G.2
	170	(6)	G-SRT.5
	172	(5)	G-C.2
	174	(4)	7.G.4
	181	(4)	5.G.4
	182	(4)	8.G.7
	195	(6)	G-SRT.6
	203	(6)	6.G.1
	215	(5)	8.G.7
	220	(6)	G-SRT.5
	228	(5)	8.G.5
	238	(6)	7.G.6
	240	(4)	G-SRT.6
	265	(4)	7.G.4
	*Right Triangles Stretch		
	*Similarity Stretch		
Statistics	32	(3)	6.SP.4
	54	(4)	S-CP.8
	56	(3)	7.SP.1
	70	(4)	6.SP.5
	77	(4)	6.SP.5
	96	(2)	6.SP.5
	108	(3)	6.SP.5
	177	(4)	6.SP.5
	200	(5)	6.SP.5
	202	(4)	6.SP.2
Logic	226	(6)	6.SP.5
	253	(5)	6.SP.5
	268	(4)	6.SP.5
	19	(3)	6.NS.5
	41	(2)	SMP
Algebraic Expressions & Equations	66	(3)	SMP
	85	(4)	7.RP.1
	131	(2)	3.OA.8
	214	(3)	SMP
	2	(2)	6.EE.7
Problem Solving (Misc.)	14	(3)	6.RP.3
	47	(3)	7.EE.4
	58	(4)	8.EE.7
	60	(4)	8.EE.8
	65	(3)	7.EE.4
	74	(4)	A-REI.2
	75	(5)	8.EE.8
	90	(5)	6.EE.3
	91	(1)	6.EE.9
	99	(5)	8.EE.7
	103	(2)	6.EE.5
	104	(4)	6.EE.9
	117	(5)	7.EE.4
	147	(4)	8.EE.8
	148	(5)	8.EE.8
	153	(5)	G-GPE.5
	158	(5)	A-REI.2
	168	(4)	S-CP.9
	176	(4)	8.G.7
	184	(5)	A-REI.4
	188	(4)	A-SSE.3
	193	(4)	N-RN.1
	216	(5)	A-APR.5
	223	(6)	A-REI.2
	229	(4)	6.EE.9
	236	(4)	A-REI.2
	239	(6)	A-REI.2
	256	(7)	A-REI.4
	259	(6)	8.G.7
	269	(5)	A-CED.1
	24	(3)	SMP
	30	(3)	7.NS.3
	48	(5)	SMP
	68	(4)	SMP
	78	(4)	3.NF.2
	88	(3)	7.NS.3
	107	(4)	S-CP.1
	115	(3)	8.EE.4
	121	(1)	8.G.3
	132	(2)	8.EE.8
	155	(3)	7.NS.3
	160	(5)	7.NS.3
	162	(2)	6.NS.4
	185	(3)	6.EE.9
	213	(4)	SMP
	221	(5)	A-CED.2
	245	(4)	7.NS.3

# MATHCOUNTS®

## 2011-2012 Club and Competition Program Registration

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### Why do you need this form?

- Register a Math Club and Receive the Club in a Box Resource Kit [*FREE*]
  - Register Your School to Participate in the MATHCOUNTS Competition Program [*Competition Registration Deadline is Dec. 16, 2011*]
- 

### MATHCOUNTS CLUB PROGRAM

The **MATHCOUNTS Club Program (MCP)** may be used by schools as a stand-alone program, or it may be incorporated into preparation for the MATHCOUNTS Competition Program. The MCP provides schools with the structure and activities for regular meetings of a math club. Depending on the level of student and teacher involvement, a school may receive a recognition trophy or banner and may be entered in a drawing for prizes. Open to schools with sixth-, seventh- and eighth-grade students, the Club Program is free to all participants.

For the fifth year running, the grand prize in the Gold Level drawing is an all-expense-paid trip for the club coach and four students to watch the National Competition as our VIP guests. The 2012 Raytheon MATHCOUNTS National Competition will be held in Orlando, Florida. All schools that have successfully completed the Ultimate Math Challenge by the **March 30, 2012 deadline** will attain Gold Level Status and will be entered in the grand-prize drawing.

### MATHCOUNTS COMPETITION PROGRAM

MATHCOUNTS proudly presents the 29th consecutive year of the **MATHCOUNTS Competition Program**, consisting of a series of School, Local (Chapter), State and National Competitions. More than 6,000 schools from 56 U.S. states and territories will participate in this unique mathematical bee. The final 224 Mathletes® will travel to Orlando, Florida to compete for the prestigious title of National Champion at the 2012 Raytheon MATHCOUNTS National Competition, to be held May 11. Schools may register via [www.mathcounts.org](http://www.mathcounts.org) or on the following Registration Form.

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**Do not hold up the mailing of your Club in a Box Resource Kit because you are waiting for a purchase order to be processed or a check to be cut by your school for the registration fee. Process your Registration Form through your system, but send in a photocopy of it directly to MATHCOUNTS without payment. We immediately will mail your Club in a Box Resource Kit (which contains a hard copy of the *MATHCOUNTS School Handbook*) and credit your account once your payment is received with the original Registration Form.**

***Note: Registration fees are non-refundable.\****

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**Refer a colleague and save...**

**Turn to page 96 to learn how you can save on your registration fees!**

\*Exceptions to the refund policy will be considered in the event of an extenuating circumstance. All refunds are provided at the discretion of MATHCOUNTS.

# MATHCOUNTS® REGISTRATION FORM: 2011-2012 School Year (HB)

Mail or fax this completed form to:

**MATHCOUNTS Registration**

**P.O. Box 441, Annapolis Junction, MD 20701**

**Fax: 240-396-5602**

Registration questions should be directed to the  
MATHCOUNTS Registration Office at 301-498-6141.

**Competition Registration (Option 2) must include payment and be postmarked by Dec. 16, 2011 to avoid late fee.**

Teacher/Coach's Name \_\_\_\_\_ Principal's Name \_\_\_\_\_

School Name \_\_\_\_\_ ☐ Previous MATHCOUNTS School

School Mailing Address \_\_\_\_\_

City, State ZIP \_\_\_\_\_ County/District \_\_\_\_\_

If your school is overseas: My school is a ☐ DoDDS OR ☐ State Department sponsored school. Country \_\_\_\_\_

Teacher/Coach's Phone \_\_\_\_\_ MATHCOUNTS Chapter (if known) \_\_\_\_\_

Teacher/Coach's E-mail \_\_\_\_\_

Alternative E-mail Address \_\_\_\_\_

Please ship my materials to ☐ the School address above or ☐ the Alternative mailing address below.

Alternative Mailing Address \_\_\_\_\_

School Type ☐ Public ☐ Charter ☐ Religious ☐ Private ☐ Homeschool\* ☐ Virtual\*

Academic centers or enrichment programs that do not function as students' official school of record are not eligible to register.

\*Must complete the Homeschool Participation Attestation Form to compete as individuals or a team in the MATHCOUNTS Competition Program. Forms are available at [www.mathcounts.org/competition](http://www.mathcounts.org/competition).

## How did you hear about MATHCOUNTS?

☐ MATHCOUNTS Mailing ☐ Colleague ☐ Conference ☐ mathcounts.org ☐ Other \_\_\_\_\_

Total # of students in your math club: \_\_\_\_\_ Avg. # of problems used per month: \_\_\_\_\_

If you use MATHCOUNTS problems with your classes...

How many students work MATHCOUNTS problems during class? \_\_\_\_\_ Avg. # of problems per month: \_\_\_\_\_

Option 1



☐ **REGISTER MY MATH CLUB for the MATHCOUNTS Club Program**, and send me the Club in a Box Resource Kit with the **2011-2012 MATHCOUNTS School Handbook**, which contains over 300 math problems. (There is NO COST for the Club Program.)

By checking the box above, you agree to adhere to the rules of the MATHCOUNTS Club Program.

Option 2



☐ **REGISTER MY SCHOOL for the MATHCOUNTS Competition and Club Programs**, and send me the Club in a Box Resource Kit with the **2011-2012 MATHCOUNTS School Handbook**.

By checking the box above, you agree to adhere to the rules of the MATHCOUNTS Competition Program and you attest to the school administration's permission to register students for MATHCOUNTS under this school's name.

## Competition Registration Fees

☐ **Team Registration**

(max. of 1 team of up to 4 students)

\_\_\_\_\_ @ \$90 = \$ \_\_\_\_\_  
0 or 1

☐ **Individual Registration(s)**

(max. of 6 individuals in lieu of or in addition to a team)

\_\_\_\_\_ @ \$25 = \$ \_\_\_\_\_  
0 - 6

☐ **Late Fee** (if postmarked after Dec. 16, 2011)

\$0 or \$20 = \$ \_\_\_\_\_

**Total Due = \$ \_\_\_\_\_**

## Title I Rate\*

\_\_\_\_\_ @ \$40 = \$ \_\_\_\_\_  
0 or 1

\_\_\_\_\_ @ \$10 = \$ \_\_\_\_\_  
0 - 6

\$0 or \$20 = \$ \_\_\_\_\_

**Total Due = \$ \_\_\_\_\_**

\*Principal's signature is required for verifying that school qualifies for Title I fees: \_\_\_\_\_

**Payment:** ☐ Check ☐ Money order ☐ Purchase order # \_\_\_\_\_ (p.o. must be included) ☐ Credit card

Name on card: \_\_\_\_\_ ☐ Visa ☐ MasterCard

Signature: \_\_\_\_\_ Card #: \_\_\_\_\_ Exp. \_\_\_\_\_

Make checks payable to the MATHCOUNTS Foundation. Payment must accompany this registration form. All registrations will be confirmed with an invoice indicating payment received or payment due. Invoices will be sent to the school address provided. If a purchase order is used, the invoice will be sent to the address on the purchase order. Payment for purchase orders must include a copy of the invoice. Registration confirmation may be obtained at [www.mathcounts.org](http://www.mathcounts.org).

## MATHCOUNTS Referral Program

Help us spread the word about MATHCOUNTS Programs! Refer a middle school not currently participating in the MATHCOUNTS Competition Program.

Over 90% of MATHCOUNTS coaches say they would refer MATHCOUNTS to a colleague. Why not take advantage of a referral and get a portion of your registration fees reimbursed? MATHCOUNTS is once again utilizing the referral program to encourage schools to register for the Competition Program.

If you know of a school that is not participating in the MATHCOUNTS Competition Program and should be, please enter the school information in the last section below. You may also send the coach to our registration link ([www.mathcounts.org/competition](http://www.mathcounts.org/competition)). If the school you refer registers a team of four for the Competition Program, your school and the referred school each will receive a \$10 refund on your teams' registration fees!\* With enough successful referrals, your school could be reimbursed for its entire registration fee! *To qualify as a referred school, a school may not have participated in the MATHCOUNTS Competition Program for the previous two school years.*

### Incentive for MATHCOUNTS Club Program Schools

Schools that have participated only in the MATHCOUNTS Club Program (and not in the Competition Program) may also take advantage of the incentive program. If you choose to register a team of four for the MATHCOUNTS Competition Program this school year, you will receive a refund of \$10. Please check the appropriate box below indicating that (1) you were a MATHCOUNTS Club Program-only school in the past and (2) you are registering a team of four for the Competition Program this year.

Please check all that apply:

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☐ **Previous** MATHCOUNTS Club Program-only school and would like to receive a \$10 refund on my registration.

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☐ **NEW** school that was **REFERRED** to MATHCOUNTS and would like to receive a \$10 refund on my registration.

*If you were referred, please provide the referring school name and teacher's name below so we may give proper credit.*

School Name: \_\_\_\_\_

Teacher's Name: \_\_\_\_\_

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☐ Returning school **REFERRING** another school.

*Please list the school(s) you wish to refer. When a school registers, you will receive your \$10 refund.*

**1** Teacher's Name \_\_\_\_\_  
School Name \_\_\_\_\_  
School Mailing Address (if known) \_\_\_\_\_  
City/State \_\_\_\_\_  
E-mail \_\_\_\_\_

**2** Teacher's Name \_\_\_\_\_  
School Name \_\_\_\_\_  
School Mailing Address (if known) \_\_\_\_\_  
City/State \_\_\_\_\_  
E-mail \_\_\_\_\_

**3** Teacher's Name \_\_\_\_\_  
School Name \_\_\_\_\_  
School Mailing Address (if known) \_\_\_\_\_  
City/State \_\_\_\_\_  
E-mail \_\_\_\_\_

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\*Refund not to exceed total amount of registration fees. Refunds will be distributed before the end of the MATHCOUNTS program year.