Unit 3: Reasoning, Sets and Logic

Content Area: **Mathematics**
Course(s): **College Math I**
Time Period: **January**
Length: **8 weeks**
Status: **Published**

Unit Overview

This unit investigates mathematical reasoning, sets, logic and problem solving skills.

Transfer

Students will be able to independently use their learning to...

Think and reason critically, estimate and interpret basic graphs, and apply the four-step problem solving model.

Define, write and classify sets and subsets

Illustrate and interpret Venn Diagrams

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand that...

- It is important to be able to analyze a situation and make a decision based on logical thinking.
- Often an exact answer isn't necessary and an estimate is good enough to make an informed decision.
- The study of mathematics is all about learning and applying problem-solving skills and strategies.
- Our world is divided into groups of things (or sets). So studying sets from a mathematical standpoint is a good opportunity to study how math is used in our world.

- Sets often have relationships with one another
- One good way to get a handle on a complicated situation is to diagram it.
- Use of symbolic notation allows us to analytically evaluate the logic of an argument without letting bias of emotion affect our judgement.
- The more effectively a brain can analyze and evaluate information, the more successful one is likely to be.

Essential Questions

- What is the difference between inductive and deductive reasoning?
- What is a counter-example? What are they used for?
- How can estimation be used as a quick check to see if the answer to a math problem is reasonable?
- What are the four steps to successful problem solving?
- What are the three ways to write sets?
- What is the difference between the union and intersection of two sets?
- What are the steps to find the cardinal number of the union of two sets?
- What is the difference between a simple and a compound statement?
- What is the purpose of a truth table?
- What is the difference between a tautology and a self-contradiction?

Application of Knowledge and Skill

Students will know...

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- There are two types of reasoning, inductive and deductive.
- Exact answers are not always necessary.
- The four-step probelm solving model can be used as a framework for problem solving in any area of life, from mathematics to home improvements
- Studying sets from a mathematical standpoint is a good opportunity to study how math is used in our world.
- The relationship between sets.
- One good way to get a handle on a complicated situation is to diagram it.
- It is more important that ever to be able to make sensible, objective evaluations of the information available.

Students will be skilled at...

Students will be skilled at...

- Reasoning, inductive and deductive.
- Estimating.
- Applying The four-step probelm solving model
- Classifying sets
- Using subsets
- Using Venn Diagrams to study set operations
- Defining and identifying statements
- Constructing truth tables

Academic Vocabulary

Inductive reasoning	deductive reasoning	conjecture
counterexample	estimation	bar graph
circle graph	line graph	set
element	roster method	set-builder notation
variable	finite	infinite
null set	cardinal number	descriptive method
equivalent	one-to-one coorespondence	universal set
complement	subset	proper subset
intersection	union	statement
difference	cartesian product	connectives

===> LEARNING GOAL 3.1 - Problem Solving

Construct mathematically viable arguments and critique the mathematical reasoning of others using inductive and deductive reasoning to find patterns, make and prove conjectures, and provide counter examples to disprove conjectures.

Objective 3.1.1 (Reasoning) (level of difficulty: Retrieval to Analysis - specifying)

SWBAT:

(1.1)

- Identify the two types of reasoning.
- Use inductive/deductive reasoning to form/prove conjectures
- Use counter-examples to disprove conjectures

MA.K-12.3	Construct viable arguments and critique the reasoning of others.

Objective 3.1.2 (Estimation) (level of difficulty: Retrieval)

SWBAT:

(1.2)

- Identify uses for estimation
- Estimate the answers to real world problems
- Use estimation to obtain information from graphs

MA.K-12.5	Use appropriate tools strategically.

Objective 3.1.3 (Problem Solving) (level of difficulty: Knowledge Utilization - problem solving)

SWBAT:

(1.3)

- Define and explain the four-step problem solving model
- Solve problems by usign a diagram

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

===> LEARNING GOAL 3.2 - Sets

Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).

Objective 3.2.1 (Sets and Subsets) (level of difficulty: Retrieval)

SWBAT

(2.1-2)

- Define and classify sets
- Find the cardinality of a set
- Define and classify subsets
- Find intersections, unions and differences of sets
- Use subset notation

MA.S-CP.A.1	Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).

Objective 3.2.2 (Set Operations) (level of difficulty: Retrieval)

SWBAT

(2.3)

- Illustrate set statements with Venn Diagrams
- Use the formula for cardinality of a union
- Solve problems using Venn Diagrams

MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.S-CP.A.1	Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).

===> LEARNING GOAL 3.3 - Logic

Make conjectures and build a logical progression of statements to explore the truth of the conjectures.

Objective 3.3.1 (Statements) (level of difficulty: Retrieval)

SWBAT

(3.1)

- Define,identify and classify statements
- Write statements symbolically

MA.K-12.3	Construct viable arguments and critique the reasoning of others.

Objective 3.3.2 (Truth Tables) (level of difficulty: Retrieval)

SWBAT

(3.2)

- Construct truth tables
- Identify the heirarchy of logical connectives

MA.K-12.1	Make sense of problems and persevere in solving them.

Objective 3.3.3 (Logic) (level of difficulty: Comprehension)

SWBAT

(3.3)

- Classify a statement as a tautology (true), self-contradiction (false) or neither
- Write the converse, inverse and contrapositive of a statement

MA.K-12.3	Construct viable arguments and critique the reasoning of others.

Summative Assessment

Tests, quizzes, End of Unit Benchmark, Projects

21st Century Life and Careers

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.

Formative Assessment and Performance Opportunities

Classroom discussion

class/homework

class closure

class openers

group work

presentations

projects

student teacher discussions

Accommodations and Modifications

504 Accomodations

IEPs

challenge problems

heterogeneous grouping

Problems of the week

projects

small group instruction

technology

Unit Resources

- Textbook: Math in Our World, 2nd Edition (McGraw Hill, 2011)
- Kuta Software
- Examview Software

Additional Websites:

- Dan Meyer's 3-Act Math Tasks: https://docs.google.com/spreadsheet/pub?key=0AjIqyKM9d7ZYdEhtR3BJMmdBWnM2YWxWYVM1UWowTEE&output=html
- NCTM Illuminations Website: Resources for Teaching Math:

http://illuminations.nctm.org/Default.aspx

- PARCC Educator Resources: http://www.parcconline.org/for-educators
- The Geometer's Sketchpad Resource Center: http://www.dynamicgeometry.com/
- Khan Academy: https://www.khanacademy.org/