*Unit 8: Pythagorean Theorem & Irrational Numbers

Content Area: **Mathematics**
Course(s): **Math - Grade 8**
Time Period: **4th Marking Period**
Length: **6 Weeks**
Status: **Published**

Unit Overview

Understand how to apply and solve the Pythagorean Theorem.

Determine if a value is rational or irrational

Work with rational and irrational numbers.

Transfer

Students will be able to independently use their learning to appropriately apply skills in real-life situations ...

Know there are irrational numbers

Be able to find decimal expansions of all rational numbers

Approximate irrational numbers on a number line

Apply the Pythagorean Theorem to real-world context

Solve Pythagorean Theorem problem from missing side of a right triangle

Explain and prove the pythagorean Theorem iits converse

Meaning

Understandings

Students will understand that:

- Right triangles have special relationship among the side length which can be represented by a model and a formula
- The Pythagorean Theorem can be used to find the missing side length in a coordinate plane and real world situation

- They Pythagoren Theorem and its converse can be proven.
- Numbers are reational and irrational and can be written in different ways.

Essential Questions

At the end of this unit, students shoudl be able to answer

- Why are formulas important in math and science
- Why does the Pythagorean Theorem apply only to right triangles?
- How does the knowledge of how to use right triangles and the Pythagorean Theorem enable the design and construction of such structures as a properly pitched roof, handicap ramps to meet code, structurally stable bridges, and roads?
- How can the Pythagorean Theorem be used for indirect measurement?
- How do indirect measurement strategies allow for the measurement of items in the real world such as playground structures, flagpoles, and buildings?
- How to order and place irrational numbers on a number line?
- How do you approximating irrational numbers?

Application of Knowledge and Skill

Students will know...

Students will know....

- Decimals that "terminate" actually repeat the digit zero.
- Number that repeat in their decimal form are called rational. (8.NS.1)
- Numbers that do not repeat in their decimal form are called irrational (8.NS.1)
- If the number is irrational (8.NS.2)
- The Pythagorean Theorem
- When to apply the Pythagoren Theorem
- How to determine the key in formation to plug into the Pythagorean Theorem.

Students will be skilled at...

- Explain a proof of the Pythagorean Theorem and its converse
- Use the Pythagorean Theorem to solve for a missing side of a right triangle both 2-D and 3-D problems.
- Apply the Pythagoren Theorem to solve problems in real-world contexts

- Apply the Pythagoren Thorem to find the distand between two points on a coordinate plane
- Distinguish between rational and irrational numbers
- Convert a decimal expansion which repeats eventually into a rational number.
- Find rational approximations of irrational numbers
- Use ration approximations of irrational number to compare the size of irrational numbers, locate them approximately on a number line and estimate the value of expressions

Academic Vocabulary

square root, square, irrational number, square root symbol, rational number, diagonal, decimal approximation, pythagoren theorem, hypotenuse, leg, right triangle, coverse of the pythagorean theorem, edge length, cube root, infinite decimal expansion, irrational number, repeated decimal.

Learning Goal 1

Determine side lengths of a squares using their area.

Use the Pythagorean Theorem to find side lengths of right triangles and distances on the coordinate plane.

Understand and apply the Pythagorean Theorem

CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.8.1.8.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.

Target 1.1- (Level of Difficulty: Retrieval (executing), DOK: 2 - Skill/Concepts)

Find square root and determind size lenght of a square using the area.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.8.NS.A.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

Target 1.2-- (Level of Difficulty: Retrieval (executing), DOK: 2 - Skill/Concepts)

Estimate square root of non-perfect squares

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.8.NS.A.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.

Target 1.3-- (Level of Difficulty: Comprehension, DOK: 2 - Skill/Concepts)

Estimate square root

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.8.NS.A.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

Target 1.4 -- (Level of Difficulty: Comprehension, DOK: 2- Skill/Concept)

SWBAT: Use the Pythagorean Theorem. **(Chapter 9, Lesson 9)**

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.
MA.8.G.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

Target 1.5 -- (Level of Difficulty: Analysis, DOK: 3- Strategic Thinking) INQUIRY LAB

SWBAT: Prove the Pythagorean Theorem and its converse. **(Chapter 9, Lesson 7 & 8)**

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.7	Look for and make use of structure.

MA.8.G.B.6	Explain a proof of the Pythagorean Theorem and its converse.

Target 1.6 -- (Level of Difficulty: Retrieval (executing), DOK: 2- Skill/Concept)

SWBAT: Solve problems using the Pythagorean Theorem **(Chapter 10, Lesson 9)**

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.
MA.K-12.7	Look for and make use of structure.
MA.8.G.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

Target 1.7 -- (Level of Difficulty: Retrieval (executing), DOK: 2- Skill/Concept)

SWBAT: Find the distance between two points on the coordinate plane. **(Chapter 10, Lesson 10)**

MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.
MA.8.G.B.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Target 1.8-- (Level of Difficulty: Retrieval (executing), DOK: 2 - Skill/Concepts)

Find cube roots

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.8.NS.A.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.

Target 1.9-- (Level of Difficulty: Comprehension, DOK: 2 - Skill/Concepts)

Estimate cube roots and non-perfect cube roots

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.8.NS.A.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.

Learning Goal 2

Know that there are numbers that are not rational, and approximate them by rational numbers. Use rational approximations to estimate roots and to compare real numbers

Target 2.1--(Level of Difficulty: Retrieval (recalling), DOK: 1- Recall)

SWBAT:

Write fractions as decimals and decimals as fractions. **(Chapter 10, Lesson 11 & 12)**

Examples:)

1) 50% of tasks require students to write a fraction a/b as a repeating decimal by showing, filling in, or otherwise producing the steps of a long division $a \div b$.

2) 50% of tasks require students to write a given repeating decimal as a fraction.

3) Tasks should involve no more than two repeating decimals i.e. 2.16666..., 0.23232323.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.8.NS.A.1	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

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.CRP12	Work productively in teams while using cultural global competence.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
CAEP.9.2.8.B.6	Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Technology

TECH.8.1.8	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.8.B.CS2	Create original works as a means of personal or group expression.

Formative Assessment and Performance Opportunities

- Mid Chapter check assessment
- inquiry labs
- test
- quizzes
- informal assessment
- graded classwork
- surveys
- whiteboard activities
- group activities
- projects
- teacher observations
- student interviews
- aleks assessment linkit

Summative Assessment

- Chapter Test/Unit Test-Found on Linkit
- Aleks-overall percentage check
- Unit Project
- Performance based assessment

Accommodations & Modifications

See Unit resources below for specific targeted resources

- Calculator for support
- Extra time to complete tasks
- Interactive notebook sheets-including visual for vocabulary
- Listed number system w/examples
- Modifications as per 504/IEP
- Number line to follow decimal
- Review and Practice
- Small Group instruction
- Translate Text
- Worked examples with procedural steps
- word bank w/vocabulary

Unit Resources

Addition found in unit folder

• http://www.youtube.com/watch?v=0fKBhvDjuy0
• Aleks online supplement
• Inquiry Labs
• Unit 1 Project
• http://achievethecore.org/coherence-map/#8/35/396/196/1
• http://illuminations.nctm.org/LessonsList.aspx?grade=3&standard=all
• http://insidemathematics.org/index.php/8th-grade
• http://learnzillion.com/
• http://www.illustrativemathematics.org/
• https://www.khanacademy.org/
• www.desmos.com
• www.geogebra.org
• www.quizlet.com

Interdisciplinary Connections

Design different ramps that will work with various buildings. (MA.8.EE.A.2)

SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.