8-2 Looking for Pythagoras

Unit Goals, Focus Questions, and Mathematical Reflections

Unit Goals

Pythagorean Theorem Understand and apply the Pythagorean Theorem

- Develop strategies for finding the distance between two points on a coordinate grid
- Explain a proof of the Pythagorean Theorem
- Use the Pythagorean Theorem and its converse to solve a variety of problems.
- Use the Pythagorean Theorem to find the equation of a circle with its center located at the origin

Real Numbers Understand the set of real numbers consists of rational and irrational numbers

- Interpret square roots and cube roots of numbers by making use of their related geometric representations
- Relate the area of a square to the side length of the square
- Estimate the values of square roots
- Estimate the values of cube roots
- Relate the volume of a cube to the edge length of the cube
- Compare numbers that can be represented as fractions (rational numbers) to numbers that cannot be represented as fractions (irrational numbers) and recognize that the set of real numbers consists of rational and irrational numbers.
- Represent rational numbers as fractions and as terminating decimals or repeating decimals
- Recognize that irrational numbers cannot be represented as fractions and are nonterminating, nonrepeating decimals
- Recognize that the square root of a whole number that is not a square is irrational
- Locate irrational numbers on a number line
- Use and understand properties of rational and irrational numbers.

8-2 Looking for Pythagoras: Focus Questions (FQ) and Mathematical Reflections

Investigation 1 Coordinate Grids	**Investigation 2** Squaring Off	**Investigation 3** They Pythagorean Theorem	**Investigation 4** Using the Pythagorean Theorem: Understanding Rational numbers	**Investigation 5** Using the Pythagorean Theorem: Analyzing Triangles and Circles
Problem 1.1 **Driving Around Euclid: Locating Points and Finding Distances** FQ: How do driving distance between two coordinates relate to each other? **Problem 1.2** **Planning Parks: Shapes on a Coordinate Grid** FQ: How do the coordinates of endpoints of a segment help draw other lines, which re parallel or perpendicular to the segment? **Problem 1.3** **Finding Areas** FQ: How does knowing how to calculate areas of rectangles and triangles help n the calculation of irregular areas?	**Problem 2.1** **Looking for Squares** FQ: How many different square areas are possible to draw using the dot grid as vertices? Why are some square areas not possible? **Problem 2.2** **Square Roots** FQ: What does $\sqrt{x}$ mean? How does it relate to x? **Problem 2.3** **Using Squares to Find Lengths** FQ: How can you find the distance between any two points on a grid? **Problem 2.4** **Cube Roots** FQ: What does it mean to take the cube root of a number?	**Problem 3.1** **Discovering the Pythagorean Theorem** FQ: You know the sum of the two shortest side lengths of a triangle must be greater than the third side length. Is there a similar relationship among the squares on the sides of a triangle? Is the relationship the same for all triangles? **Problem 3.2** **A Proof of the Pythagorean Theorem** FQ: How can you prove that the relationship observed in Problem 3.1 will work for all right triangles? **Problem 3.3** **Finding Distances** FQ: How can you find the distance between any two points on a plane? **Problem 3.4** **Measuring the Egyptian Way: Lengths That Form a Right Triangle** FQ: If a triangle with side lengths a, b, and c satisfies the relationship $a^2 + b^2 = c^2$, is the triangle a right triangle?	**Problem 4.1** **Analyzing the Wheel of Theodorus: Square Roots on a Number Line** FQ: Dan you find distances that are exact square roots of all whole numbers? Can you order square roots on a number line? **Problem 4.2** **Representing Fractions as Decimals** FQ: Why can you represent every fraction as a repeating or terminating decimal? How can you predict which representations will repeat and which will terminate? **Problem 4.3** **Representing Decimals as Fractions** FQ: Can you represent every repeating or terminating decimal as a fraction? **Problem 4.4** **Getting Real: Irrational Numbers** FQ: Can you identify every number as either rational or irrational?	**Problem 5.1** **Stopping Sneaky Sally: Finding Side Lengths** FQ: How can you use the Pythagorean Theorem to find distances in a geometric shape? **Problem 5.2** **Analyzing Triangles** FQ: How do the lengths of the sides of a 30-60-90 triangle relate to each other? **Problem 5.3** **Analyzing Circles** FQ: What is the relationship between the coordinates of a point (x, y) on a circle with a center at the origin?
Mathematical Reflections 1. In the city of Euclid, how does the driving distance form one place to another compare to the flying distance? 2. Suppose you know the coordinates of two landmarks in Euclid. How can you find the distance between the landmarks? 3. What are some strategies for finding areas of figures drawn on a grid?	**Mathematical Reflections** 1. Describe how you would find the length of a line segment connecting two dots on dot paper. Be sure to consider horizontal, vertical, and tilted segments. 2a. Explain what it means to find the square root of a number. 2b. Explain whether or not a number can have more than one square root. 3a. Explain what it means to find the cube root of a number. 3b. Explain whether or not a number can have more than one cube root.	**Mathematical Reflections** 1. Suppose you are given the lengths of two sides of a right triangle. Describe how you can find the length of the third side. 2. Suppose two points on a grid are not on the same horizontal or vertical line. Describe how you can use the Pythagorean Theorem to find the distance between the points without measuring. 3. How can you determine whether a triangle is a right triangle if you know only the lengths of its sides?	**Mathematical Reflections** 1. Give three examples of fractions with decimal representations that terminate. 2. Give three examples of fractions with decimal representations that repeat. 3. Give three examples of irrational numbers, including one irrational number greater than 5. 4. How can you determine whether you can write a given decimal as a fraction?	**Mathematical Reflections** 1. Give at least two examples of ways in which the Pythagorean Theorem can be useful. 2. Describe the special properties of a 30-60-90 triangle. 3. What information do you need to write the equation of a circle with the center at the origin?