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Properties of Irrational Numbers

Unit 1 Lesson 5

Students will be able to:

Understand the properties of irrational numbers

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Properties of Irrational Numbers

Key Vocabulary:

Irrational Numbers

Commutative Property

Associative Property

Distributive Property

Additive Identity

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Properties of Irrational Numbers

1. The decimal expansion of an irrational number is non-terminating non-recurring.

Example: $\sqrt{5} = 2.23606797 \ldots\ldots\ldots\ldots..$

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Properties of Irrational Numbers

2. The sum or difference of a rational number and an irrational number is irrational.

Example: $5 + \sqrt{3} = 5 + 1.73215 \ldots \ldots = 6.73215 \ldots \ldots ..$

$5 - \sqrt{3} = 5 - 1.73215 \ldots \ldots = 3.2679 \ldots \ldots ..$

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Properties of Irrational Numbers

3. The product or quotient of a non-zero rational number with an irrational number is irrational.

Example: $2 * \sqrt{2} = 2\sqrt{2}$

$$\sqrt{2} \div (-3) = -\frac{\sqrt{2}}{3}$$

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Properties of Irrational Numbers

4. If you add, subtract, multiply or divide two irrationals, the result may be rational or irrational.

Example:

$$\sqrt{2} + \sqrt{3} = 1.41421\ldots. + 1.73215\ldots.. = 3.14626\ldots\ldots.$$

$$\sqrt{3} - \sqrt{3} = 1.73215\ldots.. - 1.73215\ldots. = 0$$

$$\sqrt{2} - \sqrt{3} = 1.41421\ldots. - 1.73215\ldots.. = -0.3178\ldots\ldots.$$

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Properties of Irrational Numbers

4. If you add, subtract, multiply or divide two irrationals, the result may be rational or irrational.

Example:

$$\sqrt{2} * \sqrt{3} = 1.41421\ldots * 1.73215\ldots = 2.49962\ldots\ldots$$

$$\sqrt{2} * \sqrt{2} = 2$$

$$\sqrt{2} \div \sqrt{3} = 1.41421\ldots \div 1.73215\ldots = 0.816447\ldots\ldots$$

$$\sqrt{2} \div \sqrt{2} = 1$$

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Sample Problem 1: Identify if the answer will be rational or irrational.

a. $3\pi + 2\pi$

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Sample Problem 1: Identify if the answer will be rational or irrational.

a. $3\pi + 2\pi$

$3\pi + 2\pi = 5\pi$

$5\pi = 5 * 3.14159 \ldots\ldots = 15.70796 \ldots$

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Sample Problem 1: Identify if the answer will be rational or irrational.

b. $\sqrt{6} - \sqrt{6}$

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Sample Problem 1: Identify if the answer will be rational or irrational.

b. $\sqrt{6} - \sqrt{6}$

$\sqrt{6} - \sqrt{6} = 0$

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Sample Problem 1: Identify if the answer will be rational or irrational.

c. $\sqrt{5} * \frac{1}{\sqrt{5}}$

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Sample Problem 1: Identify if the answer will be rational or irrational.

c. $\sqrt{5} * \frac{1}{\sqrt{5}}$

$$\sqrt{5} * \frac{1}{\sqrt{5}} = 1$$

Rational

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Sample Problem 1: Identify if the answer will be rational or irrational.

d. $\sqrt{3} \div \sqrt{11}$

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Sample Problem 1: Identify if the answer will be rational or irrational.

d. $\sqrt{3} \div \sqrt{11}$

$$1.73215\ldots\ldots \div 3.3166\ldots\ldots = 0.52223\ldots\ldots$$

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Sample Problem 2: Identify if the answer will be rational or irrational.

a. $3 + 5\pi$

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Sample Problem 2: Identify if the answer will be rational or irrational.

a. $3 + 5\pi =$

$= 3 + 5 * 3.14159 \ldots \ldots$

$= 3 + 15.707963 \ldots .$

$= 18.707963$

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Sample Problem 2: Identify if the answer will be rational or irrational.

b. $\sqrt{7} - (-8)$

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Sample Problem 2: Identify if the answer will be rational or irrational.

b. $\sqrt{7} - (-8) =$

$= 2.6475 \ldots . + 8$

$= 10.6475 \ldots$

Irrational

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Sample Problem 2: Identify if the answer will be rational or irrational.

c. $\sqrt{5} * (-12)$

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Sample Problem 2: **Identify if the answer will be rational or irrational.**

c. $\sqrt{5} * (-12) =$

$= 2.2360 \ldots . * (-12)$

$= -26.8328 \ldots$

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Sample Problem 2: Identify if the answer will be rational or irrational.

d. $\sqrt{33} \div 33$

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Sample Problem 2: Identify if the answer will be rational or irrational.

d. $\sqrt{33} \div 33$

$= 1.73215 \ldots\ldots \div 3.3166 \ldots\ldots$

$= 0.52223 \ldots$

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Properties of Irrational Numbers

Commutative Property	for Addition for Multiplication	$a + b = b + a$ $a * b = b * a$
Associative Property	for Addition: for Multiplication	$(a + b) + c = b + (a + c)$ $(a * b) * c = b * (a * c)$
Distributive Property		$a(b + c) = ab + ac$
Additive Identity		$a + 0 = 0 + a = a$

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Sample Problem 3: **Insert a rational and an irrational number between each numbers.**

a. **2** and **3**

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Sample Problem 3: **Insert a rational and an irrational number between each numbers.**

a. 2 and 3

$$\frac{2+3}{2} = \frac{5}{2} = 2.5 \quad \textbf{Rational}$$

$$\sqrt{2 * 3} = \sqrt{6} \qquad \textbf{Irrational}$$

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Sample Problem 3: **Insert a rational and an irrational number between each numbers.**

b. **5** and **6**

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Sample Problem 3: **Insert a rational and an irrational number between each numbers.**

b. 5 and 6

$$\frac{5+6}{2} = \frac{11}{2} = 5.5 \quad \textbf{Rational}$$

$$\sqrt{5 * 6} = \sqrt{30} \qquad \textbf{Irrational}$$

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