Extension 6.1 Real Number Operations

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Lesson Tutorials
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Key Vocabulary
closed, *p. 266*

A set of numbers is **closed** under an operation when the operation performed on any two numbers in the set results in a number that is also in the set. For example, the set of integers is closed under addition, subtraction, and multiplication. This means that if a and b are two integers, then $a + b$, $a - b$, and ab are also integers.

ACTIVITY 1 Sums and Products of Rational Numbers

Remember

A *rational number* is a number that can be written as $\frac{a}{b}$, where a and b are integers and $b \neq 0$. An *irrational number* cannot be written as the ratio of two integers.

The table shows several sums and products of rational numbers. Complete the table.

Sum or Product	Answer	Rational or Irrational?
$12 + 5$		
$-4 + 9$		
$\frac{4}{5} + \frac{2}{3}$		
$0.74 + 2.1$		
3×8		
-4×6		
3.1×0.6		
$\frac{3}{4} \times \frac{5}{7}$		

ACTIVITY 2 Sums of Rational and Irrational Numbers

The table shows several sums of rational and irrational numbers. Complete the table.

Sum	Answer	Rational or Irrational?
$1 + \sqrt{5}$		
$\sqrt{2} + \frac{5}{6}$		
$4 + \pi$		
$-8 + \sqrt{10}$		

Practice

1. Using the results in Activity 1, do you think the set of rational numbers is closed under addition? under multiplication? Explain your reasoning.
2. Using the results in Activity 2, what do you notice about the sum of a rational number and an irrational number?

ACTIVITY 3 Products of Rational and Irrational Numbers

COMMON CORE

Real Number Operations

In this extension, you will

- determine whether sums or products are rational or irrational.

Learning Standard
N.RN.3

The table shows several products of rational and irrational numbers. Complete the table.

Product	Answer	Rational or Irrational?
$6 \cdot \sqrt{12}$		
$-2 \cdot \pi$		
$\frac{2}{5} \cdot \sqrt{3}$		
$0 \times \sqrt{6}$		

ACTIVITY 4 Sums and Products of Irrational Numbers

The table shows several sums and products of irrational numbers. Complete the table.

Sum or Product	Answer	Rational or Irrational?
$3\sqrt{2} + 5\sqrt{2}$		
$\sqrt{12} + \sqrt{27}$		
$\sqrt{7} + \pi$		
$-\pi + \pi$		
$\pi \cdot \sqrt{7}$		
$\sqrt{5} \times \sqrt{2}$		
$4\pi \cdot \sqrt{3}$		
$\sqrt{3} \times \sqrt{3}$		

Practice

3. Using the results in Activity 3, is the product of a rational number and an irrational number always irrational? Explain.

4. Using the results in Activity 4, do you think the set of irrational numbers is closed under addition? under multiplication? Explain your reasoning.

5. **CRITICAL THINKING** Is the set of irrational numbers closed under division? If not, find a counterexample. (A *counterexample* is an example that shows that a statement is false.)

6. **STRUCTURE** The set of integers is closed under addition and multiplication. Use this information to show that the sum and product of two rational numbers are always rational numbers.