Objective

- Understanding Signed Numbers
- Adding Signed Numbers
- Subtracting Signed Numbers
- Multiplying and Dividing Signed Numbers
- Exponents
- Square Roots
- Order of Operations, including exponents and square roots

Number Line

Example: Order the following numbers from smallest to largest:
8, -4.5, ¼, -1, -0.5, 1¼, 7.75, -⅜, -0.1

Absolute Value – the distance from zero (distance is always positive)
Examples: |23| =
|6| =

Opposite of a number – the number with the same absolute value but different sign
Examples: What is the opposite of 10?
What is the opposite of -2?

Using the number line
A positive number or addition means move to the right; a negative number means move to the left
Often, parentheses are around negative numbers to emphasize that they are negative
Examples: -2 + 4

(-8) + (5)
Adding Signed Numbers

Examples:
- \(-3 + -6 = \)
- \(17 + (-20) = \)
- \((-1) + 4 = \)
- \((-2) + -5 + 7 = \)
- \(3.4 + -5.7 = \)
- \(-\frac{1}{4} + \frac{3}{16} = \)

Other way of looking at addition of signed numbers:
- Same sign – add the absolute values of the numbers, keep the sign
- Different signs – find the different of the absolute values of the numbers, keep the sign of the bigger digit

Use what makes the most sense to you!

Try Yourself

1) \(7 + (-5) = \)

2) \((-3) + (-12) = \)

3) \(-4 + 1 = \)

4) \((-1.8) + 0.9 = \)

5) \(\frac{3}{2} + (-\frac{9}{16}) = \)

Subtracting Signed Numbers

Examples:
- \((-3) - 7 = \)
- \(2 - 15 = \)
- \(-4 - (-2) = \)
- \(-9 - 2 = \)
- \(\frac{1}{5} - \frac{2}{5} = \)

Change all subtraction signs to addition of the opposite

Examples: \(-2 - 8 = \)

\(-6 - (-3) = \)

\(4 - 9 = \)

Try Yourself

1) \(-4 - 1 \)

2) \(8 - 14 \)

3) \((-5) - (-7) \)

4) \(-\frac{1}{8} - (-\frac{7}{8}) \)
Multiplying/Dividing Signed Numbers

- Multiplying or dividing two numbers with the same sign results in a positive number
  - (+)(+) = (+)  (+)(+) = (+)
  - (-)(-) = (+)  (-)(-) = (+)

- Multiplying or dividing two numbers with different signs results in a negative number
  - (+)(-) = (-)  (+)/(-) = (-)
  - (-)(+) = (-)  (-)/(+) = (-)

- See www.mathisfun.com/multiplying-negatives.html

- Examples:
  - (+)(-) = (-)  (+)/(-) = (-)
  - (-)(+) = (-)  (-)/(+) = (-)

Try Yourself

- 1) (-3)(-1) =
- 2) -30 ÷ 5 =
- 3) -3 × 20 ÷ -6 =
- 4) \(-\frac{3}{4} \times -\frac{16}{5} =

Application Problems

- Example: If today it was -4°F in Alaska and 25°F in Green Bay, what is the temperature difference?

- Try Yourself: Your shop made a profit of $1,357 in January, had a loss of $1,531 in February, and a profit of $441 in March. What was the profit or loss for the first quarter? Represent with a signed number.

Exponents

- Exponents are used to represent the same number multiplied over and over
  \[ a^n = a \times a \times a \times \ldots \times a \]
  where a is multiplied n times
- a is called the base and n is called the exponent

- Examples:
  - 3^2 =
  - 2.5^3 =
  - 10^3 =
Exponents with Signed Numbers

Examples:
- \((-2)^2 = \)
- \((-2)^3 = \)
- \((-2)^4 = \)

What will be the sign of the answer if the exponent is 11? 14? 109?

Try Yourself

1) \(10^6 = \)
2) \(4.75^4 = \)
3) \((-4)^3 = \)
4) \((-4)^4 = \)

Square Roots

Taking the square root of a number "undoes" squaring a number.

Example: \(a^2 = 36 \)
\[ a = \sqrt{36} \]
\[ a = 6 \]

Examples:
- \(\sqrt{144} = \)
- \(\sqrt{80} = \)

Example: A one-story square house is approximately 1500 square feet. What are the dimensions of the home?

Try Yourself

1) \(\sqrt{16} \)
2) First, estimate then find the answer with your calculator, to the nearest hundredth: \(\sqrt{48} \)

Order of Operations

1. Parentheses
2. Exponents and Square Roots
3. Multiply/Divide from left to right
4. Add/Subtract

Example: \((-3 - 2) + (-1 \times 4)^3 \)

Example: The following formula will find the side of a triangle across from 90°. Calculate the missing side of the triangle: \(\sqrt{3.25^2 + 6.5^2} \)

Example: \((6-8) - 3(12 - 4 \times 2) \)
Try Yourself

1) \((-3)^2 - 2^4 + 3\cdot2\)

2) \(\frac{2-\sqrt{841}}{(-3)^3}\)