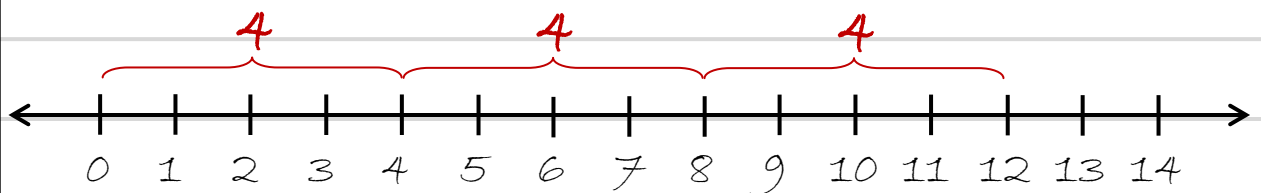# Division with Negative Numbers

Objective 1 Perform Division with Negative Numbers

Remember that multiplication represents repetitive addition of a number.

Recall $4 \cdot 3 = 4 + 4 + 4 = 12$

This means that "4 goes into 12" three times!

We can see that it takes three **4**'s to make 12.

Since $4 \cdot 3 = 12$, this means $12 \div 4 = 3$.

Note: $\dfrac{12}{4} = 3$ since $4 \cdot 3 = 12$

Do you see a pattern in the above note?

Recall: $-4 \cdot 3 = (-4) + (-4) + (-4) = -12$

We can see that it takes three **-4**'s to make **-12**.

Since $-4 \cdot 3 = -12$, this means $-12 \div (-4) = 3$.

Note: $\dfrac{-12}{-4} = 3$ since $-4 \cdot 3 = -12$

Do you see a pattern in the above note? Notice that negative divided by negative is positive!

Understanding our multiplication tables can help us with mentally determining basic division problems.

Notice that since $7 \cdot 3 = 3 \cdot 7 = 21$ we can conclude that

$$\frac{21}{7} = 3 \text{ and } \frac{21}{3} = 7.$$

Similarly, since $-7 \cdot 3 = 7 \cdot (-3) = -21$ we can conclude that

$$\frac{-21}{7} = -3 \text{ and } \frac{-21}{3} = -7.$$

We can now make a general conclusion regarding division with integers.

When dividing two numbers with the <u>same sign</u>, the quotient will be positive.
When dividing two numbers with <u>different signs</u>, the quotient will be negative.

Example 1: Find each quotient and then rewrite it as an equivalent multiplication problem by filling in the blank.

a) $\dfrac{15}{5} =$ since $5 \cdot \underline{\hspace{1cm}} = 15$

b) $\dfrac{-42}{7} =$ since $7 \cdot (\underline{\hspace{0.8cm}}) = -42$

c) $\dfrac{45}{-9} =$ since $-9 \cdot \underline{\hspace{0.8cm}} = 45$

d) $\dfrac{-54}{-6} =$ since $-6 \cdot \underline{\hspace{0.8cm}} = -54$

e) $\dfrac{0}{-12} =$ since $-12 \cdot \underline{\hspace{0.8cm}} = 0$

f) $\dfrac{-84}{4} =$ since $4 \cdot (\underline{\hspace{0.8cm}}) = -84$

g) $\dfrac{-128}{8} =$ since $8 \cdot (\underline{\hspace{0.8cm}}) = -128$

h) $\dfrac{162}{-9} =$ since $-9 \cdot \underline{\hspace{0.8cm}} = 162$

i) $\dfrac{216}{-12} =$ since $-12 \cdot \underline{\hspace{0.8cm}} = 216$

Answer the following homework questions.

In Exercises 1 – 6, find each quotient.

1) $28 \div (-7)$ 3) $-32 \div (-8)$ 5) $40 \div (-4) \div 5$

2) $132 \div (-11)$ 4) $-54 \div 9$ 6) $-56 \div (-7) \div 8$

In Exercises 7 – 10, write each word statement as a mathematical expression then find the value of the expression.

7) The quotient of -30 and 5.

8) Subtract -3 from the quotient of 27 and -9.

9) The quotient of -3 squared and -9.

10) The product of -1 and -4 squared, divided by -2.

In Exercises 11 – 19, evaluate each expression.

11) $\dfrac{20}{-4}$ 14) $\dfrac{4(-6)}{-3}$ 17) $(-2)^2 + 20 \div 4$

12) $\dfrac{0}{-8}$ 15) $\dfrac{7(-6)}{-3(-2)}$ 18) $-3^2 + 24 \div (-8)$

13) $\dfrac{-6}{0}$ 16) $(-3)^2 + 21 \div 7$ 19) $-2^2 - (-8)^2 \div (-4)$