Unit 5, Lesson 11

Dividing Rational Numbers

Let's divide signed numbers.

11.1 Tell Me Your Sign

Consider the equation: $-27x = -35$

Without computing:

1. Is the **solution** to this equation positive or negative?
2. Are either of these two numbers solutions to the equation?

$$\frac{35}{27} \qquad -\frac{35}{27}$$

11.2 Multiplication and Division

1. Find the unknown value in each equation.
   a. $-3 \cdot 4 = ?$
   b. $-3 \cdot ? = 12$
   c. $3 \cdot ? = 12$
   d. $? \cdot -4 = 12$
   e. $? \cdot 4 = -12$
2. Rewrite each unknown factor problem (the last four equations of the previous problem) as a division problem.

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3. Complete the sentences. Be prepared to explain your reasoning.
   a. A positive number divided by a positive number equals a _____.
   b. A positive number divided by a negative number equals a _____.
   c. A negative number divided by a positive number equals a _____.
   d. A negative number divided by a negative number equals a _____.
4. Han and Clare walk towards each other at a constant rate, meet up, and then continue past each other in opposite directions. We will call the position where they meet up 0 feet and the time when they meet up 0 seconds.
   - Han's velocity is 4 feet per second.
   - Clare's velocity is -5 feet per second.

   a. Where is each person 10 seconds before they meet up?

   b. When is each person at the position -10 feet from the meeting place?

Are you ready for more?

It is possible to make a new number system using *only* the numbers 0, 1, 2, and 3. We will write the symbols for multiplying in this system like this: $1 \otimes 2 = 2$. The table shows some of the products.

$\otimes$	0	1	2	3
0	0	0	0	0
1		1	2	3
2			0	2
3				

1. In this system, $1 \otimes 3 = 3$ and $2 \otimes 3 = 2$. How can you see that in the table?
2. What do you think $2 \otimes 1$ is?
3. What about $3 \otimes 3$?
4. What do you think the solution to $3 \otimes n = 2$ is?
5. What about $2 \otimes n = 3$?

11.3 Drilling Down

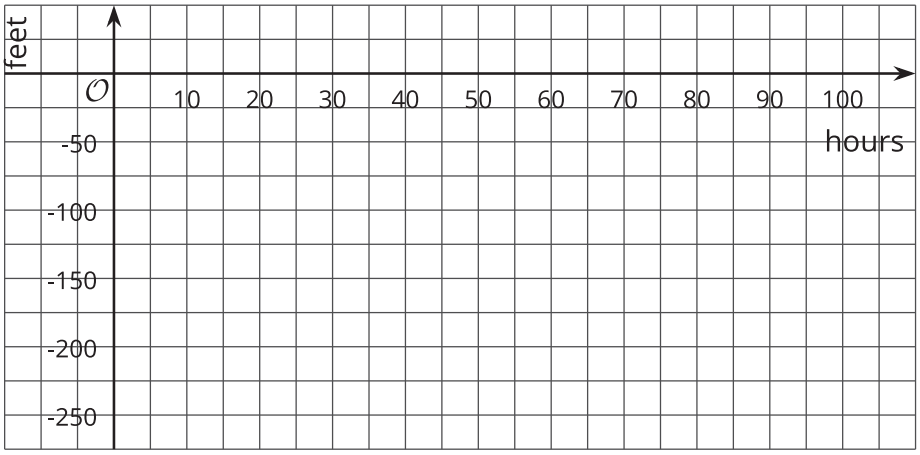
A water well drilling rig has dug to a height of -60 feet after 24 hours of continuous use.



1. Assuming the rig drilled at a constant rate, what was the height of the drill after 15 hours?

2. If the rig has been running constantly and is currently at a height of -147.5 feet, for how long has the rig been running?

3. Use the coordinate grid to show the drill's progress.



4. At this rate, how many hours will it take until the drill reaches -250 feet?

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Lesson 11 Summary

Any division problem is actually a multiplication problem:

- $6 \div 2 = 3$ because $2 \cdot 3 = 6$.
- $6 \div -2 = -3$ because $-2 \cdot -3 = 6$.
- $-6 \div 2 = -3$ because $2 \cdot -3 = -6$.
- $-6 \div -2 = 3$ because $-2 \cdot 3 = -6$.

Because we know how to multiply signed numbers, that means we know how to divide them.

- A positive number divided by a negative number always results in a negative number.
- A negative number divided by a positive number always results in a negative number.
- A negative number divided by a negative number always results in a positive number.

A number that can be used in place of the variable that makes the equation true is called a **solution** to the equation. For example, for the equation $x \div -2 = 5$, the solution is -10 because it is true that $-10 \div -2 = 5$.