



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?

$$\begin{array}{r} 35 \\ \hline 27 \end{array}$$

$$\begin{array}{r} 35 \\ - 27 \\ \hline \end{array}$$

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.

3. Complete the sentences. Be prepared to explain your reasoning.

- A positive number divided by a positive number equals a _____.
- A positive number divided by a negative number equals a _____.
- A negative number divided by a positive number equals a _____.
- 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.

- Where is each person 10 seconds before they meet up?
- 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				

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

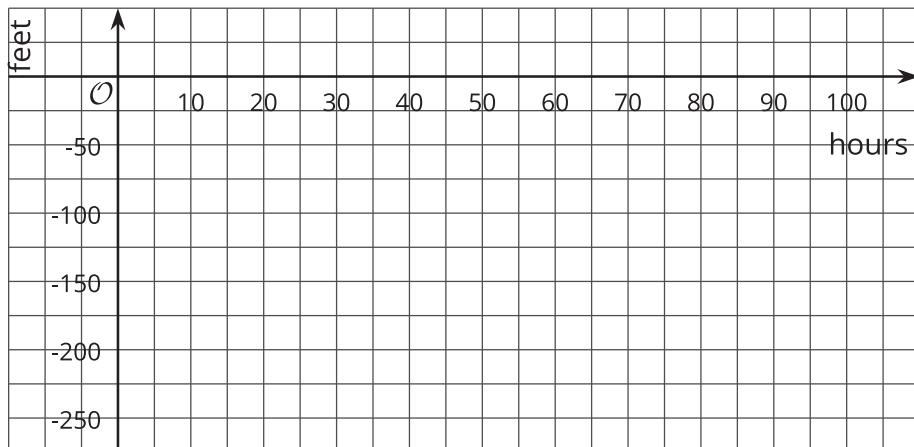
11.3 Drilling Down

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

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

- 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?

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



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



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 $-10 \div -2 = 5$.