Lesson 12: Solving Problems with Rational Numbers

Let's use all four operations with signed numbers to solve problems.

1|27

12.1: Which One Doesn't Belong: Equations

Which equation doesn't belong?

$\frac{1}{2}x = -50$

$x + 90 = -100$

$-60t = 30$

$-0.01 = -0.001x$

12.2: Draining and Filling a Tank

A tank of water is being drained. Due to a problem, the sensor does not start working until some time into the draining process. The sensor starts its recording at time zero when there are 770 liters in the tank.

→ losing 14 per min (-14)

1. Given that the drain empties the tank at a constant rate of 14 liters per minute, complete the table:

time after sensor starts (minutes)	change in water (liters)	expression	water in the tank (liters)
0	0	$770 + (0)(-14)$	770
1	-14	$770 + (1)(-14)$	756
5	-70	$770+(5)(-14)$	700
10	-140	$770+(10)(-14)$	630

770 - 700

770-140

2 14 + 5 -70

★ The more we go back in time, the more water is in the tank

2. Later, someone wants to use the data to find out how long the tank had been draining before the sensor started. Complete this table:

time after sensor starts (minutes)	change in water (liters)	expression	water in the tank (liters)
1	-14	$770 + (1)(-14)$	756
0	0	$770 + (0)(-14)$	770
-1	14	$770 + (-1)(-14)$	784
-2	28	$770 + (-2)(-14)$	798
-3	42	$770 + (-3)(-14)$	812
-4	56	$770 + (-4)(-14)$	826
-5	70	$770 + (-5)(-14)$	840

after −

before losing water (+)

770 + 28
770 + 42
770 + 56
770 + 70

3. If the sensor started working 15 minutes into the tank draining, how much was in the tank to begin with?

$-15 \times -14 = 210$

$770 + 210 = 980$

2 × 15 × 14 / 60 / 150 / 210

12.3: Buying and Selling Power

A utility company charges \$0.12 per kilowatt-hour for energy a customer uses. They give a credit of \$0.025 for every kilowatt-hour of electricity a customer with a solar panel generates that they don't use themselves.
A customer has a charge of \$82.04 and a credit of -\$4.10 on this month's bill.

1. What is the amount due this month?

2. How many kilowatt-hours did they use?

3. How many kilowatt-hours did they generate that they didn't use themselves?