Unit 4, Lesson 9

When Are They the Same?

Let's use equations to think about situations.

9.1 Which Would You Choose?

If you were babysitting, would you rather

- Charge $5 for the first hour and $8 for each additional hour?

Or

- Charge $15 for the first hour and $6 for each additional hour?

Explain your reasoning.

9.2 Water Tanks

The amount of water in two tanks is recorded every 5 minutes in the table.

1. Describe what is happening in each tank. You can draw a picture, say it verbally, or write a few sentences.

time (minutes)	tank 1 (liters)	tank 2 (liters)
0	25	1000
5	175	900
10	325	800
15	475	700
20	625	600
25	775	500
30	925	400
35	1075	300
40	1225	200
45	1375	100
50	1525	0

2. Use the table to estimate when the tanks will have the same amount of water.

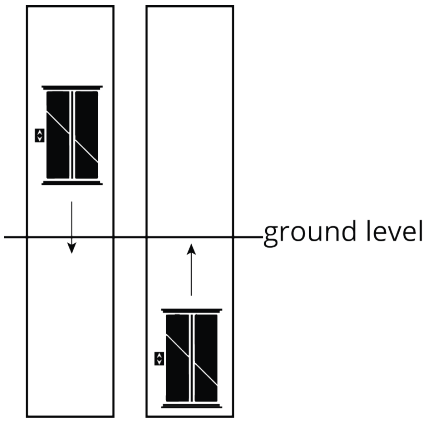
3. The amount of water (in liters) in Tank 1 after t minutes is $30t + 25$. The amount of water (in liters) in Tank 2 after t minutes is $-20t + 1000$. When is the amount of water in the 2 tanks equal?

9.3 Elevators

A building has two elevators that both go above and below ground.

At a certain time of day, the travel time, in seconds, that it takes Elevator A to reach height h in meters is given by the equation $t = 0.8h + 16$ seconds.

The travel time for Elevator B is given by the equation $t = -0.8h + 12$.



1. What is the height of each elevator at this time?

2. How long does it take each elevator to reach ground level at this time?

3. If the two elevators travel toward one another, at what height do they pass each other? How long does it take?

Are you ready for more?

1. In a two-digit number, the ones digit is twice the tens digit. If the digits are reversed, the new number is 36 more than the original number. Find the number.

2. The sum of the digits of a two-digit number is 11. If the digits are reversed, the new number is 45 less than the original number. Find the number.

3. The sum of the digits in a two-digit number is 8. The value of the number is 4 less than 5 times the ones digit. Find the number.

Lesson 9 Summary

Imagine a full 1,500 liter water tank that springs a leak, losing 2 liters per minute. We could represent the number of liters left in the tank with the expression $-2x + 1{,}500$, where x represents the number of minutes the tank has been leaking.

Now imagine at the same time, a second tank has 300 liters and is being filled at a rate of 6 liters per minute. We could represent the amount of water in liters in this second tank with the expression $6x + 300$, where x represents the number of minutes that have passed.

Since one tank is losing water and the other is gaining water, at some point they will have the same amount of water—but when? Asking when the two tanks have the same number of liters is the same as asking when $-2x + 1{,}500$ (the number of liters in the first tank after x minutes) is equal to $6x + 300$ (the number of liters in the second tank after x minutes),

$$-2x + 1{,}500 = 6x + 300$$

Solving for x gives us $x = 150$ minutes. So after 150 minutes, the number of liters of the first tank is equal to the number of liters of the second tank. We can check our answer and find the number of liters in each tank by substituting 150 for x in the original expressions.

Using the expression for the first tank, we get $-2(150) + 1{,}500$ which is equal to $-300 + 1{,}500$, or 1,200 liters.

If we use the expression for the second tank, we get $6(150) + 300$, or just $900 + 300$, which is also 1,200 liters. That means that after 150 minutes, each tank has 1,200 liters.