

6.3

Solving Equations Involving Integers

Focus Use algebra tiles and inspection to solve equations involving integers.

Recall that 1 red unit tile and 1 yellow unit tile combine to model 0.

These two unit tiles form a zero pair.



The yellow variable tile represents a variable, such as x .



Explore



You will need algebra tiles.

Tyler had some gumdrops and jellybeans.

He traded 5 gumdrops for 5 jellybeans.

Tyler then had 9 gumdrops and 9 jellybeans.

How many gumdrops did he have to begin with?



Let g represent the number of gumdrops Tyler began with.

Write an equation you can use to solve for g .

Use tiles to represent the equation.

Use the tiles to solve the equation. Sketch the tiles you used.

Reflect & Share

Compare your equation with that of another pair of classmates.

Share your strategies for solving the equation using tiles.

How did you use zero pairs in your solutions?

Work together to find how many jellybeans Tyler began with.

Discuss your strategies for finding out.

Connect

Michaela has a collection of old pennies.

She sells 3 pennies to another collector.

Michaela then has 10 pennies left.

How many pennies did she have before she made the sale?

Let p represent the number of pennies Michaela had before she made the sale.

The equation is: $p - 3 = 10$

One way to solve this equation is to use tiles.

Draw a vertical line in the centre of the page.

It represents the equal sign in the equation.

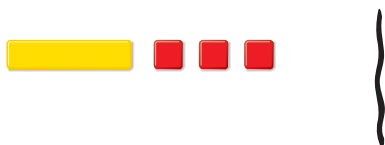
We arrange tiles on each side of the line to represent an equation.

Recall that subtracting 3 is equivalent to adding -3 .

So, we represent subtract 3 with 3 red unit tiles.



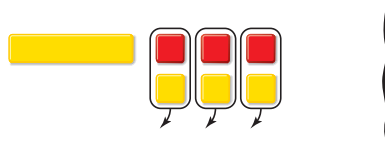
On the left side, put algebra tiles to represent $p - 3$.



On the right side, put algebra tiles to represent 10.



To isolate the variable tile, add 3 yellow unit tiles to make zero pairs. Remove zero pairs.



Add 3 yellow unit tiles to this side, too, to preserve the equality.



The tiles show the solution is $p = 13$.

Michaela had 13 old pennies before she made the sale.

Recall from Unit 1 that we can verify the solution by replacing p with 13 yellow unit tiles.

Then:



becomes



Since there are now 10 yellow unit tiles on each side, the solution is correct.

Example

At 10 a.m., it was cold outside.

By 2 p.m., the temperature had risen 3°C to -6°C .

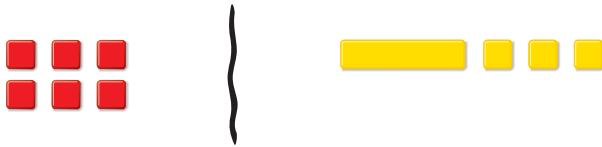
What was the temperature at 10 a.m.?

A Solution

Let t represent the temperature, in degrees Celsius, at 10 a.m.

After an increase of 3°C , the temperature was -6°C .

The equation is: $-6 = t + 3$



Add 3 red unit tiles to each side. Remove zero pairs.



9 red unit tiles equals one variable tile.



The solution is $t = -9$.

At 10 a.m., the temperature was -9°C .

The variable in an equation can be on the left side or the right side.

We can verify the solution by replacing one yellow variable tile with 9 red unit tiles in the original equation.

Another Solution

We can also solve equations involving integers by inspection.

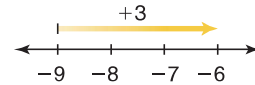
To solve $-6 = t + 3$ by inspection:

We find a number which, when 3 is added to it, gives -6 .

Think of moving 3 units to the right on a number line.

To arrive at -6 , we would have to start at -9 .

So $t = -9$.



Practice

1. Use tiles to solve each equation.

Sketch the tiles you used.

a) $x + 4 = 8$

b) $3 + x = 10$

c) $12 = x + 2$

d) $x - 4 = 8$

e) $10 = x - 3$

f) $12 = x - 2$

2. Solve by inspection. Show your work.

a) $9 = n - 4$

b) $x + 6 = 8$

c) $2 = p - 5$

d) $x - 4 = -9$

e) $-8 = s + 6$

f) $x - 5 = -2$

3. Four less than a number is 13.

Let x represent the number.

Then, an equation is: $x - 4 = 13$

Solve the equation. What is the number?

4. Jody had some friends over to watch movies.

Six of her friends left after the first movie.

Five friends stayed to watch a second movie.

Write an equation you can use to find how many of Jody's friends watched the first movie.

Solve the equation. Verify the solution.



5. Overnight, the temperature dropped 8°C to -3°C .

a) Write an equation you can solve to find the original temperature.

b) Use tiles to solve the equation.
Sketch the tiles you used.

- 6. Assessment Focus** Solve each equation using tiles, and by inspection.

Verify each solution. Show your work.

a) $x + 6 = 13$ b) $n - 6 = 13$

- 7.** At the Jungle Safari mini-golf course, par on each hole is 5.
A score of -1 means a player took 4 strokes to reach the hole.
A score of $+2$ means a player took 7 strokes to reach the hole.
Write an equation you can use to solve each problem below.
Solve the equation. Show your work.

Par is the number of strokes a good golfer should take to reach the hole.

- a) On the seventh hole, Andy scored $+2$.
His overall score was then $+4$.
What was Andy's overall score after six holes?
- b) On the thirteenth hole, Bethany scored -2 .
Her overall score was then $+1$.
What was Bethany's overall score after twelve holes?
- c) On the eighteenth hole,
Koorra reached the hole in one stroke.
His overall score was then -2 .
What was Koorra's overall score after seventeen holes?



- 8. Take It Further** Consider equations of the form $x + a = b$, where a and b are integers. Make up a problem that can be solved by an equation of this form in which:

- a) Both a and b are positive.
b) Both a and b are negative.
c) a is positive and b is negative.
d) a is negative and b is positive.

Solve each equation.

Explain the method you used each time.

Reflect

How did your knowledge of adding and subtracting integers help you in this lesson?