

10.2 Modelling & Solving 2-Step
Equations: $ax + b = c$

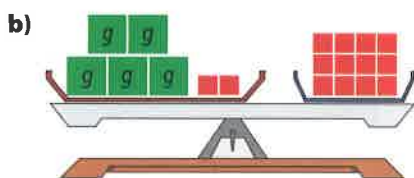
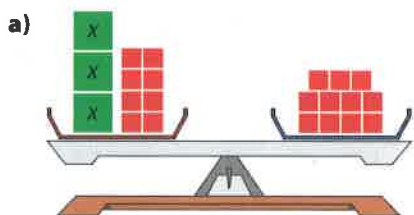
Pg 384 Q# 3-6a (Using Models), 9-10 ab (Using Opposites),
15-17

Check Your Understanding

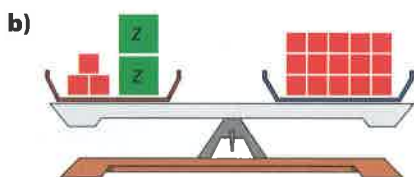
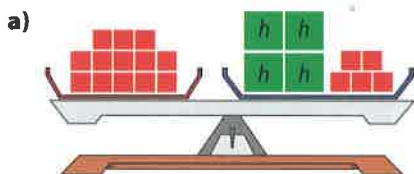
Practise

For help with #3 and #4, refer to Example 1 on page 380–381.

3. Solve the equation modelled by each balance scale. Check your solution.

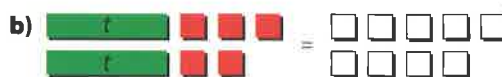
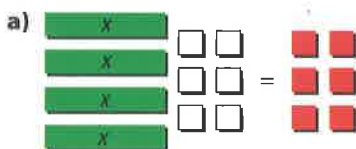


4. Solve the equation represented by each balance scale. Verify your solution.

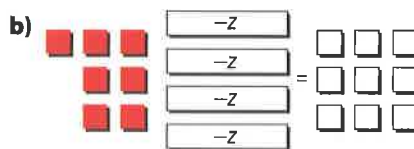
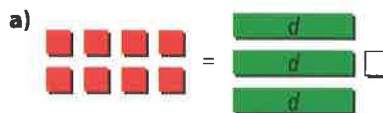


For help with #5 and #6, refer to Example 2 on page 382.

5. Solve each equation modelled by the algebra tiles. Check your solution.



6. Solve each equation represented by the algebra tiles. Verify your solution.

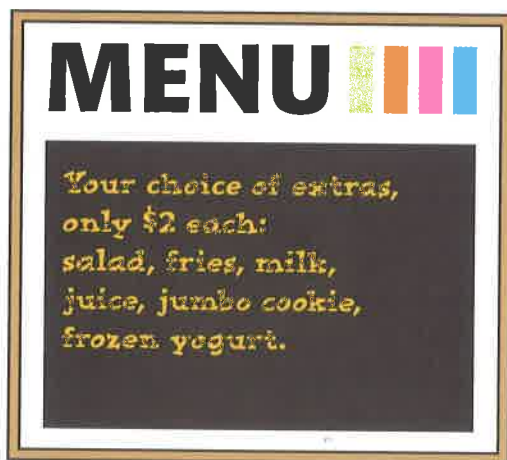


For help with #7 to #10, refer to Example 3 on page 383.

7. What is the first operation you should perform to solve each equation?
- $4r - 2 = 14$
 - $3 - 3x = -9$
 - $-22 = -10 + 2m$
 - $53 = -9k - 1$
8. What is the second operation you should perform to solve each equation in #7?
9. Solve each equation. Check your answer.
- $6r + 6 = 18$
 - $4m + 8 = 12$
 - $39 + 9g = 75$
 - $-37 = 8f - 139$
10. Solve. Verify your answer.
- $-17 = 3k + 4$
 - $29 = -14n + 1$
 - $8x - 7 = -31$
 - $-10 = 4n - 12$

Apply

11. Show whether $x = -3$ is the solution to each equation.
 - a) $-8x - 1 = 25$
 - b) $3 - 7x = -24$
 - c) $29 = -10x - 1$
 - d) $30 = 6x + 12$
12. Matt is saving \$750 to buy a clothes dryer. If he triples the amount he has saved so far, he will have \$30 more than he needs. The situation can be modelled as $3s - 30 = 750$, where s represents the amount he has saved so far.
 - a) Explain how $3s - 30 = 750$ models the situation.
 - b) How much money has Matt saved so far?
 - c) What other strategy could you use to determine Matt's savings?
13. You are buying lunch at Sandwich Express. The cost is \$4 for a sandwich and \$2 each for your choice of extras. You have \$10. The equation to determine how many extras you can get is $10 = 2e + 4$, where e is the number of extras. How many extras can you buy if you spend all of your money?
14. The percent of elementary school students who choose hockey as their favourite physical activity is 14%. This percent of students is 2% more than four times the percent who choose skiing.
 - a) Let s represent the percent of students who choose skiing. What equation models this situation?
 - b) Solve the equation to find the percent of students who choose skiing.
15. If Jennifer doubled the money that she has in her account now and then took out \$50, she would have enough left in her account to buy a new bike that costs \$299. Write and solve an equation to determine how much money Jennifer has now.
16. A classroom's length is 3 m less than two times its width. The classroom has a length of 9 m. Write and solve an equation to determine the width of the classroom.
17. An eagle is hunting a bird in flight. The eagle begins its descent from a height of 74 m. The eagle reaches its prey at a height of 3 m. This situation can be modelled using the formula $74 = 3 + 6t$, where t represents the time in seconds.



- a) What do you think the value of 6 represents in the equation?
- b) After how many seconds does the eagle reach its prey? Give your answer to the nearest tenth of a second.

Example 2: Model With Algebra Tiles

A cow sleeps 7 h a day. This amount of sleep is 1 h less than twice the amount an elephant sleeps a day. How long does an elephant sleep?



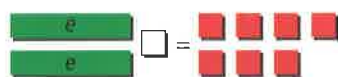
Solution

Let e represent the hours an elephant sleeps.

A cow sleeps 1 h less than twice what an elephant sleeps, or $2e - 1$.

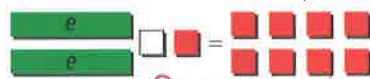
A cow sleeps 7 h.

$$2e - 1 = 7$$



One less means you need to subtract 1, and twice means you need to multiply by 2.

To isolate the variable, first add one positive 1-tile to both sides.

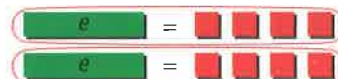


$$\begin{array}{c} \square \\ -1 \end{array} \begin{array}{c} \square \\ +1 \end{array}$$

This is called a zero pair because $-1 + (+1) = 0$.

The negative 1-tile and positive 1-tile on the left side equal zero.

The two variable tiles must have the same value as the eight positive 1-tiles on the right side of the model. Each variable tile must then have a value of four positive 1-tiles.



An elephant sleeps 4 h a day.

Check:

$$\begin{aligned} \text{Left Side} &= 2e - 1 & \text{Right Side} &= 7 \\ &= 2(4) - 1 \\ &= 8 - 1 \\ &= 7 \end{aligned}$$

Left Side = Right Side

The solution is correct.

Show You Know

Model each equation with algebra tiles. Then, solve.

a) $2g + 4 = -6$ b) $-2r - 7 = -11$

How do you represent $-2r$ using algebra tiles?

Literacy Link

To solve a problem, you sometimes need to translate words into an equation. For example, *two more* means you need to add 2, and *three times* means you need to multiply by 3. What other words translate into math operations?

Literacy Link

Order of Operations

When substituting a value into the equation, make sure to use the correct order of operations:

- first, multiply and divide in order from left to right
- finally, add and subtract in order from left to right

Example 3: Apply the Opposite Operations

Cali borrowed \$19 from her brother. The next day, she paid back \$3. To pay off the rest of the debt, she will give him \$4/week. How many weeks will it take her to pay off the debt?

Solution

Let w represent the number of weeks.

Cali is paying off \$4/week and has already paid \$3. The total she will pay is $4w + 3$. She owes a total of \$19.

$$4w + 3 = 19$$

Isolate the variable w to solve the equation.

$$4w + 3 = 19$$

$$4w + 3 - 3 = 19 - 3 \quad \text{Subtract 3 from both sides of the equation.}$$

$$4w = 16$$

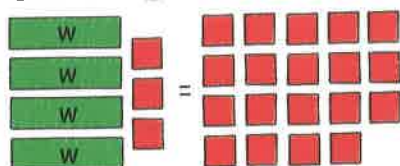
$$\frac{4w}{4} = \frac{16}{4}$$

Divide both sides of the equation by 4.

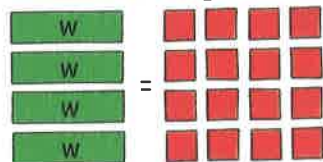
$$w = 4$$

It will take Cali four weeks to pay off her debt.

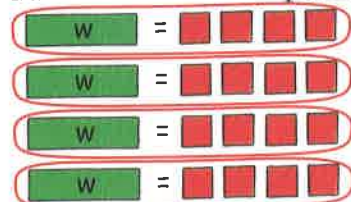
Check:



Subtract three positive 1-tiles from both sides.



The four variable tiles must have the same value as the 16 positive 1-tiles on the right side of the model. Each variable tile must then have a value of four positive 1-tiles.



$$w = 4$$

The solution is correct.

Show You Know

Solve by applying the opposite operations.

a) $4 + 26g = -48$ b) $-3x + 7 = 19$

The amount Cali still needs to pay back is \$4 times the number of weeks, or " $4w$ ". The amount of \$3 that she has already paid back is represented by " $+ 3$ ".

If you think of money owed as being negative, you can use the equation $-4w - 3 = -19$. When you solve it, the value of w is still the same.

Literacy Link

Reverse Order of Operations

When isolating a variable, follow the reverse order of operations:

- add and/or subtract
- multiply and/or divide

Strategies

Draw a Diagram