

Practise

For help with #4 and #5, refer to Example 1 on page 396.

4. Use mental math to solve each equation. Explain your thought process.



a) $z + 7 = 4$ b) $g - 2 = 5$
 c) $n - 4 = 8$ d) $9 = k + 6$

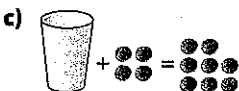
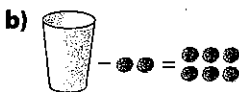
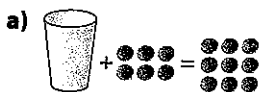
5. Solve by inspection.



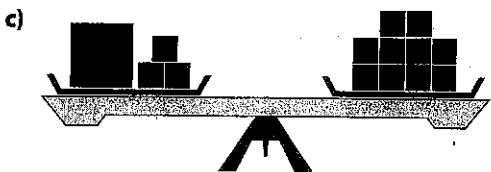
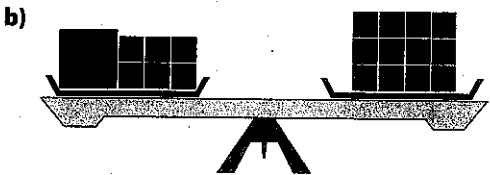
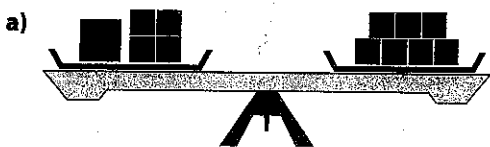
a) $b + 11 = 14$ b) $30 = r - 50$
 c) $w - 7 = 5$ d) $10 - h = 8$

For help with #6 to #8, refer to Example 2 on pages 396–397.

6. What is the number of counters needed in each cup to make each equation true?



7. What value must the variable have in each model to keep the scale balanced?



8. Ryan has a bag of oranges. His friends eat ten oranges. If there are two oranges left in the bag, how many oranges were there to start with?

- a) Model the situation using cups and counters or a sketch of a balance.
 b) Write an equation to represent your model.
 c) Solve by inspection.

For help with #9 to #11, refer to Example 3 on page 397.

9. Solve each equation using the opposite operation. Show your work. Check your answer.

a) $g + 7 = 13$
 b) $w + 5 = 5$
 c) $k - 8 = 8$
 d) $p - 9 = 16$

10. Solve each equation using the opposite operation. Show your work. Check your answer.

a) $6 = 4 + m$
 b) $k - 3 = -8$
 c) $14 = p - 10$
 d) $16 - x = 15$

11. If Charles had \$6 more in his pocket, he could buy a \$22 DVD. An equation to model this situation is $x + 6 = 22$.

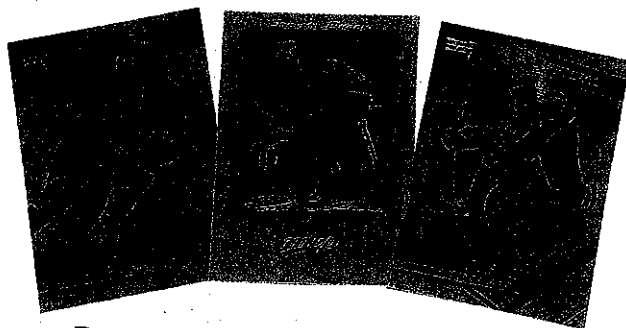
- a) What does the variable x represent? How do you know?
 b) How much money does Charles have?

12. Show whether or not $x = 5$ is the solution to each equation.

a) $x + 10 = 15$
 b) $10 - x = 15$
 c) $x - 7 = -2$
 d) $42 = 37 - x$

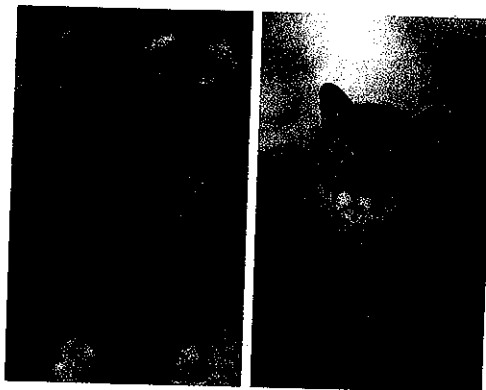
Apply

13. a) Draw a balance to show the equation $12 = 3 + m$, if m represents an unknown mass.
- b) What total mass should be on each side of the balance?
- c) Solve the equation to determine the unknown mass.
14. A 2003 Calgary Flames hockey team card set sells for \$12. This is \$8 more than the 2003 Vancouver Canucks set.



- a) Draw a model to represent the problem.
- b) Write an equation to model this situation.
- c) What is the cost of the Vancouver Canucks card set?
15. The blue whale is the largest animal on Earth. It is also a very fast swimmer, able to swim at a speed of up to 48 km/h when in danger. The orca (killer whale) is the fastest species of whale. It has been timed swimming at a speed 12 km/h more than the fastest speed of the blue whale.
- a) Write an equation that could be used to model the speed of a killer whale, k , given the speed of a blue whale.
- b) What is the speed of the killer whale in this question?

16. The average life span of a grizzly bear is 25 years. This is 15 years more than the average life span of a cougar.
- a) What equation will model this situation?
- b) What is the average life span of a cougar?



17. At the Commonwealth Games in Australia, Canada won 86 medals. This was 24 fewer medals than England won.
- a) Write an equation to model this situation.
- b) How many medals did England win?
18. Shawn received \$5 change from \$20 when he bought some binders. How many binders did he buy if each binder costs \$3.00? Write an equation, then show how you solve it.

Extend

19. The sum of 3 and a number is -11 .
- a) Model this situation.
- b) Write an equation.
- c) What is the unknown number? Check your answer.
- d) Why is a balance scale not a good method to use to solve this equation?

20. The formula $a + e = 85$ is often used to determine when an employee can retire. The variable a represents the age of the employee. The variable e represents the number of years of employment.
- Richard is 52 years old. He has been a plumber for 21 years. Can he retire this year? Explain.
 - Joan has been working for 31 years. How old is she if she is eligible to retire this year?
21. A blue whale is the loudest animal on Earth. The call of a blue whale can reach sound levels of 188 decibels. This is 48 decibels louder than a jet engine.
- What equation will model this situation?
 - What is the sound level in decibels for a jet engine?
 - A human whisper has a sound level about $\frac{1}{10}$ that of a jet engine. Write an equation to compare the sound of a jet engine to a whisper. Use your answer from part b) to determine the sound level in decibels for a whisper.
22. It costs \$3.00 to enter a city parking lot and then \$1.00 per hour after that.
- What equation will model this situation?
 - What is the cost of parking in the lot for 4 h?
 - How long can you park in the lot if you have only \$5?

In the code for a code and word to see if this friend can break it. The following is the coded message Jim wrote:

12 2 17 2 14 2 7 2 17 16 17 2 19 2 16

(Each space in the list and the symbol "/" separates words.)

Use the following information to help crack Jim's code.

The letter e is the most common letter in English, so code crackers often start by seeing what places in the code might be and solving for that number in the code.

The next most common letters in the English language are, in order, $A, O, I, N, S, H, G, D,$ and L .

Jim uses an equation of the form $4 + a = b$ to change the letters in the message to the numbers in the coded version.


Many codes start by using the following numbers to represent letters.

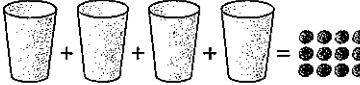
1 = a	2 = b	3 = c	4 = d	5 = e	6 = f	7 = g	8 = h	9 = i	10 = j	11 = k	12 = l	13 = m
14 = n	15 = o	16 = p	17 = q	18 = r	19 = s	20 = t	21 = u	22 = v	23 = w	24 = x	25 = y	26 = z

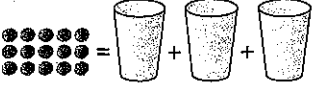
- What equation did Jim use as his code?
- Rewrite the code chart using Jim's equation to determine the number that represents each letter.
- What is the message?

Practise

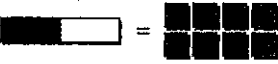
For help with #4 to #7, refer to Example 1 on page 403.

4. Solve using mental math.
How many counters will be in each cup?  M E

a) 

b) 

5. Use mental math to solve each equation modelled by the algebra tiles.

a) 

b) 

6. Solve by inspection.

a) $6r = 18$ b) $9g = 72$
c) $4d = 12$ d) $12 = 6f$

7. Solve by inspection.

a) $3 = \frac{p}{7}$ b) $\frac{v}{5} = 5$
c) $12 = \frac{c}{3}$ d) $\frac{x}{2} = 14$

For help with #8 to #10, refer to Example 2 on page 404.

8. By what number would you divide both sides of the equation to solve it?

a) $6x = 12$ b) $3n = 9$
c) $11t = 22$ d) $36 = 9k$

9. Solve each equation using the opposite operation. Check your answer.

a) $2r = 18$ b) $5j = 125$
c) $12g = 144$ d) $63 = 21t$

10. The distance a polar bear can swim is modelled by the formula $d = 6t$, where d represents distance, in kilometres, and t represents time, in hours. How long would it take a polar bear to swim 42 km? Check your answer.

For help with #11 to #13, refer to Example 3 on pages 404–405.

11. By what number would you multiply both sides of the equation to solve it?

a) $9 = \frac{m}{6}$ b) $\frac{h}{4} = 21$
c) $7 = \frac{q}{11}$ d) $\frac{x}{4} = 5$

12. Solve each equation using the opposite operation. Check your answer.

a) $\frac{u}{4} = 11$ b) $13 = \frac{c}{12}$
c) $\frac{w}{9} = 12$ d) $0 = \frac{x}{2}$

13. Paula and Kirsten work at the same restaurant, but Paula works one quarter the hours that Kirsten does. If Paula works 9 h each week, how many hours does Kirsten work? Check your answer.

Apply

14. Show whether or not $x = 3$ is the solution to each equation.

a) $8x = 24$ b) $10x = 30$
c) $7x = 35$ d) $48 = 12x$

15. Show whether or not $y = 8$ is the solution to each equation.

a) $1 = \frac{y}{8}$ b) $\frac{y}{4} = 16$
c) $4 = \frac{y}{2}$ d) $\frac{y}{2} = 16$

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16. Jag rides his bike to school, which is 6 km (6000 m) from his home. Jag's speed on his bike averages 300 m/min.

- a) What equation could be used to model this situation?
- b) How long will it take Jag to ride his bike to school?

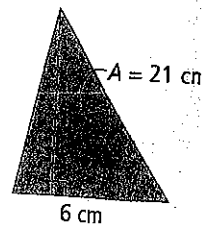
17. Marla's age is one half Brent's age. Marla is 21.

- a) Write an equation to model this situation.
- b) How old is Brent?

18. Derek is saving for a ski trip that costs \$495. He needs to triple his savings before he has enough money for the trip. How much money has Derek saved so far?

Extend

19. The formula for the area of a triangle is $A = (b \times h) \div 2$. Find h for a triangle with base 6 cm and area 21 cm².



20. The perimeter of a rectangular playing field is 240 m. The length is double the width.

- a) Model this situation with an equation. Use one variable only.
- b) How could you simplify this equation?
- c) What is the length and width of the playing field?

21. If a number of pencils are shared equally among ten girls, each will get eight. How many pencils will each girl get if the total number of pencils is the same, but there are 6 more girls?

PROBLEM SOLVING

Jim's new code is more complicated. Jim has written a new message to his friend using the new code.

00 24 27 57 7 9 49 12 45 7 27 37 7 63 42 6 54 15 2 35 3 6 36 15

(spaces separate letters and the symbol / separates words)

Use the following information to help you crack Jim's new code.

- Jim's new code uses an equation of the form $ax = b$ or $\frac{x}{a} = b$ to change the letters in the message to the numbers in the coded version.
- The most common letters in the English language are, in order, E, A, O, I, N, S, H, R, L, and D.

Jim's friend will find the following numbers to represent letters.

1 = a	2 = b	3 = c	4 = d	5 = e	6 = f	7 = g	8 = h	9 = i	10 = j	11 = k	12 = l	13 = m
14 = n	15 = o	16 = p	17 = q	18 = r	19 = s	20 = t	21 = u	22 = v	23 = w	24 = x	25 = y	26 = z

- a) What equation did Jim use as his code?
- b) Rewrite the code chart using Jim's equation to determine the number that represents each letter.
- c) Decode the message.

Key Ideas

- To solve an equation, isolate the variable on one side of the equal sign.
- When undoing the operations performed on the variable, follow the reverse order of operations:
 - subtract and/or add
 - multiply and/or divide

Communicate the Ideas

1. Show the steps you would use to solve the equation $34 = 11x + 12$. Explain each step.
2. Describe a situation that can be modelled with the equation $2c + 8 = 14$.
3. Henri and Anne are solving the equation $12r + 3 = 39$. Whose strategy is correct? Explain.

Henri:

First I divide both sides by 12.

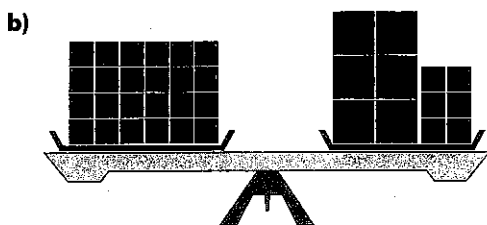
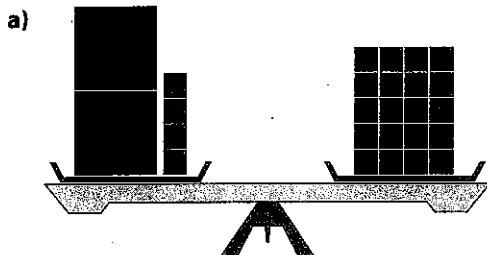
Anne:

I start by subtracting 3 from both sides.

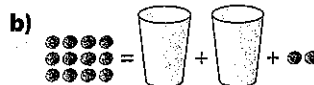
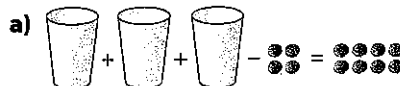
Practise

For help with #4 to #8, refer to Example 1 on page 409.

4. Solve the equation modelled by each diagram. Check your solution.



5. Solve the equation modelled by each diagram. Check your answer.



6. Solve each equation modelled by the algebra tiles. Check your answer.




7. Model and solve each equation. Check your answer.

- a) $3s + 1 = 7$ b) $4k - 4 = 8$
 c) $2 + 5n = 12$ d) $15 = 2w + 7$

8. Matt pays \$10 for two boxes of cereal and two 1-L cartons of milk. What is the price of one box of cereal?

Buy one box of cereal and get a 1-L carton of milk for \$1!



For help with #9 to #13, refer to Example 2 on page 410.

9. What is the first operation you should apply to solve each equation?

- a) $6t - 2 = 16$ b) $3 + 3n = 9$
 c) $22 = 10 + 2x$ d) $40 = 9k - 5$

10. What is the second operation you should apply to solve the equations in #9?

11. Solve using the reverse order of operations. Check your answer.

- a) $6r - 6 = 18$ b) $4m + 8 = 12$
 c) $4 + 9g = 22$ d) $37 = 6f - 5$

12. Solve using the reverse order of operations. Check your answer.

- a) $19 = 4k + 3$ b) $6x + 7 = 25$
 c) $29 = 12n + 5$ d) $14 = 4n - 2$

13. Brian has DVDs and CDs. The number of CDs he has can be modelled with the formula $C = 2D + 11$, where C represents the number of CDs and D represents the number DVDs. If he has 41 CDs, how many DVDs does he have?

14. Show whether or not $x = 6$ is the solution to each equation.

- a) $8x + 8 = 25$ b) $3 + 7x = 45$
 c) $58 = 10x - 1$ d) $48 = 3x + 12$

Apply

15. Solve each equation. Check your answer.

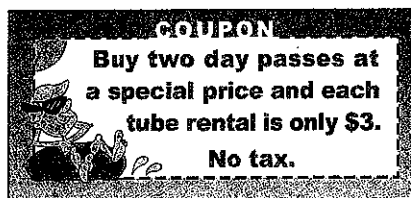
- a) $3r - 7 = 20$ b) $6y + 5 = 125$
 c) $12 + 9g = 93$ d) $130 = 25p - 20$

16. A camp charges \$75 per day to use the camp plus \$15 per day for food and supplies for each student. The cost for one day can be modelled using the equation $C = 15s + 75$.

- a) What do the variables C and s represent?
 b) A school raised \$375 for a one-day trip. How many students can go?

17. Tylena has a coupon for Water World Park.

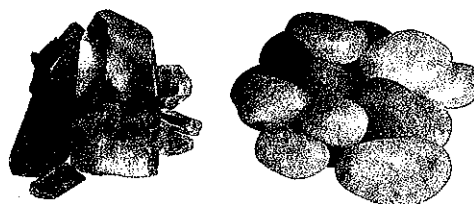
COUPON
 Buy two day passes at a special price and each tube rental is only \$3.
 No tax.



She pays \$54 for two day passes and two tube rentals.

- a) What equation models this situation?
 b) What is the cost of each day pass?

18. Sofia has 3 more rose quartz stones than twice the number of white quartz stones in her collection. If she has 15 rose quartz stones, how many white quartz stones does she have?



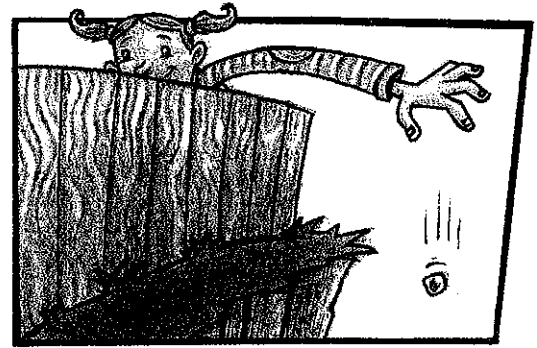
Extend

19. a) Create an equation in the form $ax + b = c$.
- b) Solve the equation using the correct order of operations.
- c) Solve the equation using an incorrect order of operations.
- d) Compare your answers. Are they the same? Why or why not?
- e) How could you prove which answer is correct and which one is not?

20. The food energy credits required by a steeplechase racer in a video game can be modelled with the formula $E = 3520 + 25T$, where E represents the amount of food energy, in calories, and T represents the simulated air temperature, in degrees Celsius. At what temperature does the racer require 4095 Cal of food energy?

21. Lacey drops a stone off a cliff. The speed of the stone changes as it falls. The speed is modelled using the formula $v = 10t + 15$, where v represents the speed of the stone, in metres per second, and t represents the time, in seconds.

- a) What is the speed of the stone one second after it is dropped?
- b) At what time is the speed of the stone 45 m/s?



MATH LINK

Once again you were able to crack Jim's code. He has now decided to make a new code that is as complicated as he can make it. Jim's final message to his friend is 43 19 24 41 // 21 41 // 29 53 // 7 13 41 43 // 9 33 11 13 // 53 13 43 (Spaces separate letters and // separates words).

Use the following information to help you crack Jim's new code:

- Jim's new code uses an equation of the form $ax + b = c$ to change the letters in the message to the numbers in the coded version.
- The most common letters in the English language are, in order, E, T, A, O, I, N, S, H, R, D, and L.
- Jim starts by using the following numbers to represent letters.

1 = a	2 = b	3 = c	4 = d	5 = e	6 = f	7 = g	8 = h	9 = i	10 = j	11 = k	12 = l	13 = m
14 = n	15 = o	16 = p	17 = q	18 = r	19 = s	20 = t	21 = u	22 = v	23 = w	24 = x	25 = y	26 = z

- a) What equation did Jim use as his code?
- b) Rewrite the code chart using Jim's equation to determine the number that represents each letter.
- c) Decode the message.