8.5 Solving Equations by Systematic Trial

▶ **GOAL**

Write equations and solve them using systematic guessing and testing.

Learn about the Math

Tonya and Becky work at a provincial park. Tonya's job is to plant trees around groups of picnic tables to provide a windbreak. She uses a pattern like the one shown. Becky assembles picnic tables from kits and puts them in position. Tonya has 30 trees to plant. Becky wonders how many picnic-table kits she should get from storage.

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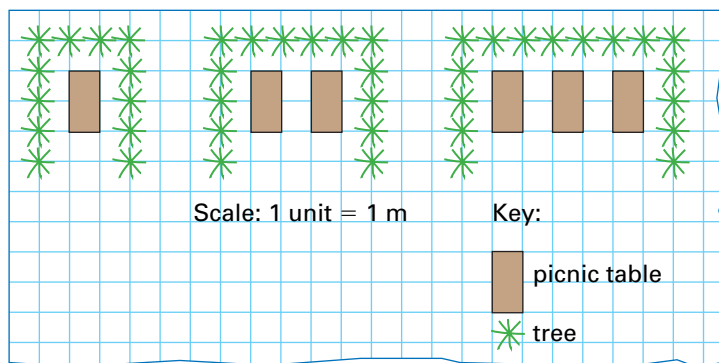
picnic table

✳ tree

? **How many picnic tables can be sheltered by 30 trees?**

Example 1: Using a table of values to solve a problem

Extend the pattern of trees around picnic tables using a table of values.

Rana's Solution

Number of tables	Number of trees
1	12
2	14
3	16
4	18
5	20
6	22
7	24
8	26
9	28
10	30

I set up a table of values to record the information in the drawing of the trees around the picnic tables.

From my table of values, I noticed that the number of trees goes up by 2 from one row to the next.

I used this pattern to fill in the rest of my table.

Ten picnic tables can be sheltered by 30 trees.

Example 2: Using systematic trial to create and solve an equation

Write an equation to figure out how many picnic tables can be sheltered by 30 trees. Solve the equation.

Tynessa's Solution

Predict p.	Evaluate $2p + 10$.	Is it equal to 30?
7	$2(7) + 10$ $= 14 + 10$ $= 24$	No, it's too low.
12	$2(12) + 10$ $= 24 + 10$ $= 34$	Now it's too high.
10	$2(10) + 10$ $= 20 + 10$ $= 30$	Yes!

I used p for picnic tables. Then I created the expression $2p + 10$ to represent the number of trees in terms of the number of picnic tables. There are 30 trees, so I substituted 30 for t in my equation $2p + 10 = t$ and wrote $2p + 10 = 30$.

I started with a guess of 7 and changed my prediction if the result was too high or too low.

The solution shows that you can shelter 10 picnic tables using 30 trees.

Reflecting

1. Who do you think used the more efficient strategy? Explain your answer.

2. After you solve an equation using inspection, you should check your answer. Why is this step not necessary when using systematic trial?

3. Describe how systematic trial requires both an organized approach to the problem and estimation skills.

Work with the Math

Example 3: Using systematic trial to solve an equation

Use systematic trial to solve $6c - 4 = 92$.

Kaitlyn's Solution

Predict c.	Evaluate $6c - 4$.	Is it equal to 92?
20	$6(20) - 4$ $= 120 - 4$ $= 116$	No, it's too high.
15	$6(15) - 4$ $= 90 - 4$ $= 86$	Now it's too low, but I'm getting closer.
16	$6(16) - 4$ $= 96 - 4$ $= 92$	I've solved it!

I guessed possible values for the variable and evaluated the expression. I kept track of my guessing and testing until I solved the equation.

A Checking

4. Which solution is correct? Explain your thinking.

a) $4r = 16$ $r = 4$ or $r = 64$

b) $p - 9 = 15$ $p = 6$ or $p = 24$

c) $n + 12 = 20$ $n = 8$ or $n = 32$

d) $5w - 2 = 73$ $w = 15$ or $w = 75$

5. Copy each table, and use it to solve the equation. In the second column, show your work. In the third column, write "too high," "too low," or "correct."

a) $n - 12 = 122$

Predict *n*.	Evaluate *n* − 12.	Is this the correct solution?
144		
124		
134		

b) $15b = 315$

Predict *b*.	Evaluate 15*b*.	Is this the correct solution?
15		
21		
25		

c) $4x + 9 = 73$

Predict *x*.	Evaluate 4*x* + 9.	Is this the correct solution?
10		
15		
16		

6. Use systematic trial to solve the equation $3p + 7 = 82$.

a) What value would you try first? Explain your choice.

b) Solve the equation.

B Practising

7. a) Write an equation that relates the number of black counters to the total number of counters used to make a figure in this pattern.
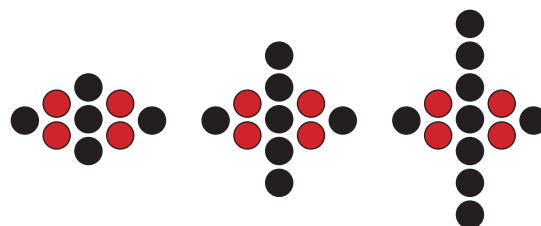

Figure 1   Figure 2   Figure 3

b) Write an equation that represents the following question: "How many black counters would you need to make a figure with 73 counters?"

c) Use systematic trial to solve your equation.

d) Would you prefer to use systematic trial or inspection to solve your equation? Justify your choice.

8. Use systematic trial to find the value of each variable.

a) $p - 8 = 33$

b) $97 + h = 201$

c) $9r = 792$

d) $5 + 4c = 105$

e) $78 = 3y + 3$

9. Write each sentence as an equation. Solve each equation.

a) The sum of a number and 19 is 55.

b) Eight times a number is 192.

c) Nine times a number subtract 26 is 136.

10. The sum of two consecutive whole numbers, n and $n + 1$, is given by the equation $n + (n + 1) = 171$. What are the two numbers?

11. a) Build this pattern
with coloured
counters.

b) Write and solve an equation to answer the following question: "If you use a total of 32 counters, how many of them will be blue?"

c) Is systematic trial an efficient method for solving your equation? Explain your thinking.

12. How do you decide when systematic trial will be more efficient than inspection for solving an equation?

13. The formula for the area of a parallelogram is $A = bh$.
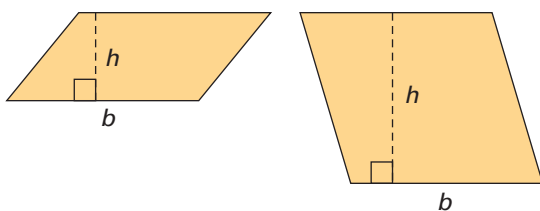
a) Determine the value of b, in centimetres, if A is 52 cm² and h is 4 cm. (*Hint*: Solve $52 = 4b$.)

b) Determine the value of h, in centimetres, if A is 171 cm² and b is 9 cm.

c) Determine the value of h, in metres, if b is 12 m and A is 156 m².

d) Determine the value of b, in metres, if h is 11 m and A is 121 m².

14. A scientist measured the temperature of a hot liquid using a thermometer that was marked in degrees Kelvin. The temperature was 403 K. Change the temperature to degrees Celsius by solving the equation $K = C + 273$. (*Hint*: Solve the equation $403 = C + 273$.)

C Extending

15. Rosa and her brother worked last summer weeding their neighbour's garden. Rosa earned $8 more than twice the amount earned by her brother. If their earnings totalled $71, how much did Rosa earn? Use an algebraic equation and systematic trial to solve this problem.

16. Which of the following relationships does the equation $2(10 + w) = 28$ describe? Explain your choice.

A. The area of a rectangle is 28 square units.

B. The length of a rectangle is 12 times its width.

C. Twice the length of a rectangle is 28 units.

D. The perimeter of a rectangle is 28 units.

17. Solve the equation in question 16 to find the width of the rectangle. Show your thinking.

18. Create a real-life problem based on the equation $28n + 75 = 215$. (*Hint:* You might consider 28 people in a group, or 28 days in February, or $28 as the cost of something.) Show how you would use systematic trial to solve the equation.

19. Look back at question 10. Is it possible for two consecutive whole numbers to have each sum below? Use equations to explain your answer.

a) an odd number **b)** an even number