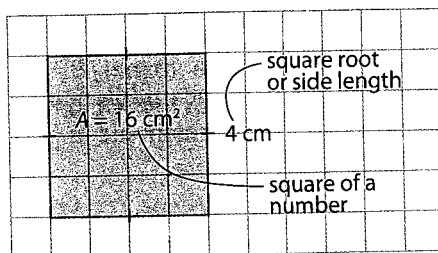




Connect and Reflect

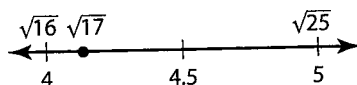
Key Ideas

- The square of a number is the number multiplied by itself. The square of a whole number is a perfect square. $4 \times 4 = 16$ or $4^2 = 16$, so 16 is a perfect square.
- You can think of the square of a number as the area of a square whose side length is that number.



- You can think of the square root of a number as the side length of a square. So, $\sqrt{16} = 4$.
- To estimate the square root of a whole number that is not a perfect square, use the roots of the perfect squares on either side of the number.

For example, estimate the square root of 17: $\sqrt{17} \approx 4.1$

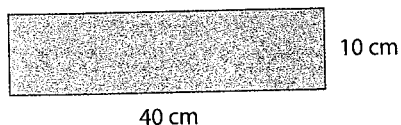


- In the prime factorization of a perfect square, there is an even number of each prime factor.

Practise

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

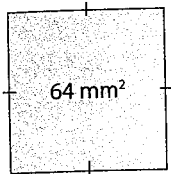
- a) What is the area of the rectangle below?
 - b) Determine the prime factorization of the area you calculated in part a).
 - c) Is the area a perfect square number? Explain your thinking.
 - d) What are the dimensions of a square with the same area as this rectangle?



2. The prime factorization of 72 is $2 \times 2 \times 2 \times 3 \times 3$. How could you use the factors to determine whether 72 is a perfect square?
3. Write the prime factorization of each number. Identify the numbers that are perfect squares.
a) 42 b) 169 c) 256
4. Determine the prime factorization of each number. Which numbers are perfect squares? Show how you know.
a) 144 b) 60 c) 40

For help with #5 to #8, refer to Example 2 on page 8.

5. What is the side length of the square?



6. Determine the side length of a square with an area of 900 cm².

7. Evaluate.

- a) $\sqrt{49}$ b) $\sqrt{121}$ c) $\sqrt{324}$

8. Determine the square root.

- a) $\sqrt{9}$ b) $\sqrt{25}$ c) $\sqrt{1600}$

For help with #9 and #10, refer to Example 3 on page 9.

9. Place each number on a number line between the two nearest perfect squares. Then estimate the square root of each number to one decimal place. Check your estimates with a calculator.

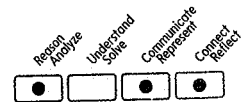
- a) 72 b) 103 c) 55

10. Estimate each value to one decimal place. Check your answer with a calculator.

- a) $\sqrt{14}$ b) $\sqrt{86}$ c) $\sqrt{136}$

Apply

11. **✓ Competency Check** The inverse of multiplying is dividing. Explain how squaring a number is the inverse of finding the square root of a number. Include an example with your explanation.

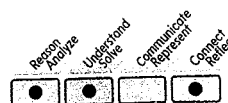
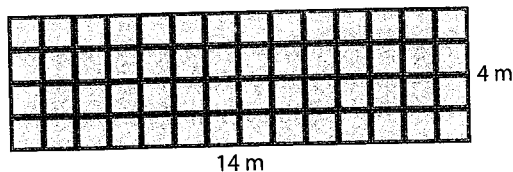


12. Roberto claims that all perfect squares are even. Is Roberto correct? Justify your thinking.
13. A helicopter landing pad has a square shape. The area is 400 m². Use two different methods to find the side length of the pad.



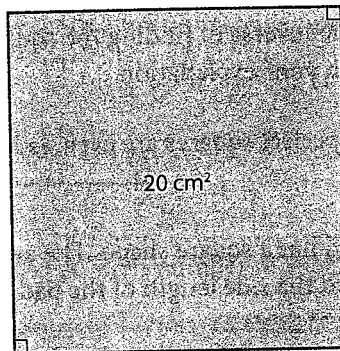
14. How would you use prime factorization to determine the square root of 225? Compare your answer with a classmate's.
15. Yolanda is shopping online for a rug for her bedroom. One rug that she likes is a square with an area of 18 m². She measures her room and finds that the dimensions are 4 m by 5 m. Will the rug fit in her room? Explain your thinking.

16. Kate is making a patio in her backyard. The patio stones each have an area of 1 m^2 . She creates the rectangular design shown.



- What is the area of the patio?
 - What are the dimensions of another rectangular patio she could build with the same area?
 - Kate decides to make a patio with the same area but she wants it to be a square with side lengths that are whole numbers. Is this possible? Explain your reasoning.
17. Students ran twice around the perimeter of the school field. The area of the square field is $28\,900 \text{ m}^2$. What distance did the students run?

18. The square has an area of 20 cm^2 .
- Use perfect squares to estimate the side length to one decimal place.
 - Check your answer using a ruler to measure the side of the square. Measure to the nearest tenth of a centimetre.

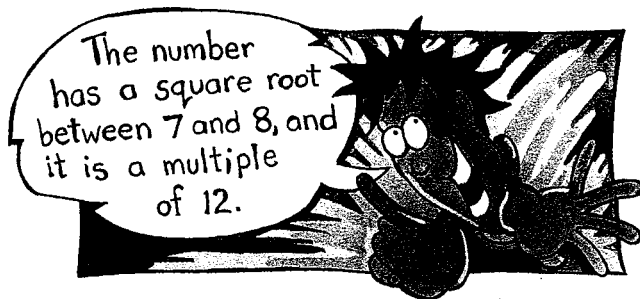


19. Kai uses an entire can of paint on a square backdrop for the school play. The label on the can states that one can covers 27 m^2 of wall surface. Assuming no waste, estimate the backdrop's side length, to one decimal place.



20. What are all the possible whole numbers that have a square root between 4 and 5?
21. Evaluate.
- $\sqrt{\frac{1}{16}}$
 - $\sqrt{\frac{25}{36}}$
 - $\left(\frac{1}{2}\right)^2$
 - $\left(\frac{3}{7}\right)^2$

22. Alex is thinking of a number.



- a) What number could he be thinking of?
b) Is there more than one answer? Explain.
23. The Canadian government determines the average individual income for each member of a family by dividing the household income by the square root of the number of people in the home.
- a) What is the government's measured individual income for each member of a family of 4 if the household income is \$80 000?
b) The government determines that each member in a household with a combined income of \$100 000 has an average individual income of \$44 721. How many people live in this home?
24. Order the numbers from least to greatest without using technology: $\sqrt{46}$, 5.8, $\sqrt{26}$, 7. Check your answer with a calculator.

Extend

25. The British mathematician Augustus de Morgan told his friends that he was x years old in the year x^2 . He died in 1871. What year was he born?
26. a) Determine which numbers are perfect squares: 10, 100, 1000, 10 000, 100 000.
b) State the square root of each perfect square.
c) Choose one of the numbers that is not a perfect square. Explain how you know it is not a perfect square.
d) Describe a quick mental math method to determine whether these types of numbers are perfect squares.
e) Use your method in part d) to decide if 1 000 000 000 is a perfect square.
27. Determine two numbers that have a square root between 326 and 327, are divisible by 100, and are a multiple of 6.
28. What is the smallest natural number value for n if the solution for $\sqrt{56n}$ is also a natural number?

