



# Squares and Square Roots

Let's compare equations with squares and square roots.

## 6.1 Math Talk: Four Squares

Find the solutions of each equation mentally.

- $x^2 = 4$

- $x^2 = 2$

- $x^2 = 0$

- $x^2 = -1$



## 6.2 Finding Square Roots

Clare was adding  $\sqrt{4}$  and  $\sqrt{9}$ , and at first she wrote  $\sqrt{4} + \sqrt{9} = 2 + 3$ . But then she remembered that 2 and -2 both square to make 4, and that 3 and -3 both square to make 9.

She wrote down all the possible combinations:

$$2 + 3 = 5$$

$$2 + (-3) = -1$$

$$(-2) + 3 = 1$$

$$(-2) + (-3) = -5$$

Then she wondered, "Which of these are the same as  $\sqrt{4} + \sqrt{9}$ ? All of them? Or only some? Or just one?"

How would you answer Clare's question? Give reasons that support your answer.

### Are you ready for more?

- How many solutions are there to each equation?
  - $x^3 = 8$
  - $y^3 = -1$
  - $z^4 = 16$
  - $w^4 = -81$
- Write a rule to determine how many solutions there are to the equation  $x^n = m$  where  $n$  and  $m$  are non-zero integers.

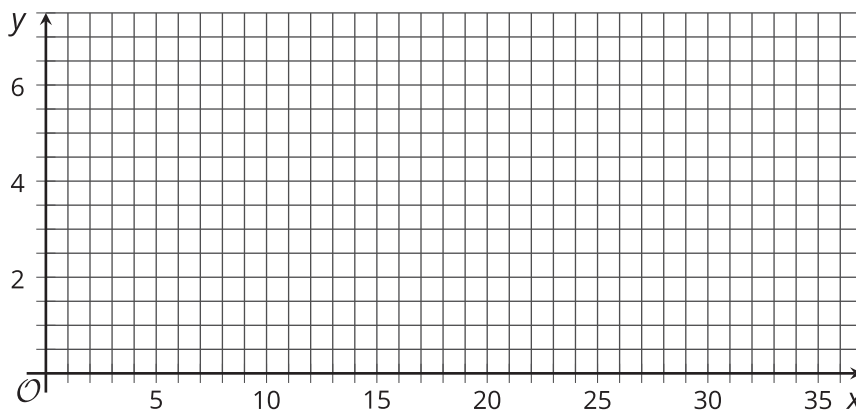
## 6.3

## One Solution or Two?

1. Complete the table.

|            |   |   |   |   |    |    |    |
|------------|---|---|---|---|----|----|----|
| $x$        | 0 | 1 | 4 | 9 | 16 | 25 | 36 |
| $\sqrt{x}$ |   |   |   |   |    |    |    |

2. Use the values from the table to plot seven points on the graph of  $y = \sqrt{x}$ . Then sketch the graph by smoothly connecting the points you drew.



3. Is the rule  $y = \sqrt{x}$  a function? Explain your reasoning.
4. Explain how you could use the graph to find any solutions to the equation  $\sqrt{x} = 5$ . How many solutions are there?
5. Use the graph to approximate the value of  $\sqrt{5}$ . Explain your reasoning.
6. Approximate any solutions to the equation  $x^2 = 20$ . Explain your reasoning.

## Lesson 6 Summary

To avoid confusion, we use the convention that  $\sqrt{a}$  represents a single positive number (when  $a$  is positive). This allows us to easily describe both solutions to the equation  $x^2 = a$ . The solutions are  $\sqrt{a}$  and  $-\sqrt{a}$ .

The equation  $x^2 = 11$  has two solutions, because  $\sqrt{11}^2 = 11$ , and also  $(-\sqrt{11})^2 = 11$ .

The equation  $\sqrt{x} = 11$  only has one solution, namely 121.

The equation  $\sqrt{x} = \sqrt{11}$  only has one solution, namely 11.

The equation  $\sqrt{x} = -11$  doesn't have any solutions, because the left side is positive and the right side is negative, which is impossible, because a positive number cannot equal a negative number.