

# Solving Quadratics by Square Roots

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

### Q Quick Review

When a quadratic is in the form  $x^2 = k$  (or  $(x - h)^2 = k$ ), **the fastest solution method is taking square roots**. Steps: **(1)** isolate the squared expression; **(2)** take the square root of both sides, writing  $\pm$  on the right; **(3)** solve. If  $k > 0$ , two real solutions. If  $k = 0$ , one solution (the value that makes the squared expression zero). If  $k < 0$ , no real solutions (square roots of negatives aren't real). Works only when there's no middle term — otherwise factor or use the quadratic formula. Don't forget the  $\pm$  — it's the most common mistake in this method.

## PRACTICE

Solve by square roots.

- |                     |       |                         |       |
|---------------------|-------|-------------------------|-------|
| 1. $x^2 = 16$       | _____ | 11. $x^2 = -4$          | _____ |
| 2. $x^2 = 25$       | _____ | 12. $3x^2 = 27$         | _____ |
| 3. $x^2 = 49$       | _____ | 13. $x^2 - 7 = 0$       | _____ |
| 4. $x^2 = 81$       | _____ | 14. $(2x + 1)^2 = 25$   | _____ |
| 5. $(x - 2)^2 = 9$  | _____ | 15. $x^2 + 4 = 20$      | _____ |
| 6. $(x + 3)^2 = 16$ | _____ | 16. $(x - 4)^2 = 2$     | _____ |
| 7. $x^2 - 100 = 0$  | _____ | 17. $5x^2 - 20 = 0$     | _____ |
| 8. $x^2 = 12$       | _____ | 18. $(x + 2)^2 = 64$    | _____ |
| 9. $x^2 = 50$       | _____ | 19. $x^2 = \frac{9}{4}$ | _____ |
| 10. $(x - 1)^2 = 0$ | _____ | 20. $(3x)^2 = 36$       | _____ |

### ◆ Word Problems

21. A square garden has area 50 square meters. Use a square-root equation to find the side length.
- \_\_\_\_\_
22. An object falls according to  $h = 16t^2$ , where  $h$  is the distance fallen in feet after  $t$  seconds. How long does it take to fall 144 feet?
- \_\_\_\_\_
23. A square fountain model uses the side expression  $x + 1$ . If the area equation is  $(x + 1)^2 = 20$ , solve for the possible model values of  $x$ .
- \_\_\_\_\_
24. The kinetic energy formula  $K = \frac{1}{2}mv^2$  gives  $K = 400$  joules when  $m = 8$  kilograms. Use square roots to find the speed  $v$ .
- \_\_\_\_\_



## Answer Keys

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. <math>x = \pm 4</math></li> <li>2. <math>x = \pm 5</math></li> <li>3. <math>x = \pm 7</math></li> <li>4. <math>x = \pm 9</math></li> <li>5. <math>x = 5, -1</math></li> <li>6. <math>x = 1, -7</math></li> <li>7. <math>x = \pm 10</math></li> <li>8. <math>x = \pm 2\sqrt{3}</math></li> <li>9. <math>x = \pm 5\sqrt{2}</math></li> <li>10. <math>x = 1</math></li> <li>11. no real solution</li> <li>12. <math>x = \pm 3</math></li> </ol> | <ol style="list-style-type: none"> <li>13. <math>x = \pm\sqrt{7}</math></li> <li>14. <math>x = 2, -3</math></li> <li>15. <math>x = \pm 4</math></li> <li>16. <math>x = 4 \pm \sqrt{2}</math></li> <li>17. <math>x = \pm 2</math></li> <li>18. <math>x = 6, -10</math></li> <li>19. <math>x = \pm\frac{3}{2}</math></li> <li>20. <math>x = \pm 2</math></li> <li>21. <math>5\sqrt{2} \approx 7.07</math> m</li> <li>22. <math>t = 3</math> sec</li> <li>23. <math>x = -1 \pm 2\sqrt{5}</math></li> <li>24. <math>v = 10</math> m/s</li> </ol> |
|--|--|

### Step-by-Step Tutor Notes

1. Focus on the main idea of the problem, then simplify carefully.  $\sqrt{16} = 4$ ,  $\pm$  both ways. So the answer is  $x = \pm 4$ .
2. Take it one clear step at a time and keep the original question in mind.  $\pm 5$ . So the answer is  $x = \pm 5$ .
3. Start with the definition the problem is testing, then apply it directly.  $\pm 7$ . So the answer is  $x = \pm 7$ .
4. This is a good place to slow down, check the notation, and simplify cleanly.  $\pm 9$ . So the answer is  $x = \pm 9$ .
5. Use the clue in the question first, then let the arithmetic finish the job.  $x - 2 = \pm 3$ . So the answer is  $x = 5, -1$ .
6. Start with the definition the problem is testing, then apply it directly.  $x + 3 = \pm 4$ . So the answer is  $x = 1, -7$ .
7. Start with the definition the problem is testing, then apply it directly.  $x^2 = 100$ . So the answer is  $x = \pm 10$ .
8. Take it one clear step at a time and keep the original question in mind.  $\sqrt{12} = 2\sqrt{3}$ . So the answer is  $x = \pm 2\sqrt{3}$ .
9. Focus on the main idea of the problem, then simplify carefully.  $\sqrt{50} = 5\sqrt{2}$ . So the answer is  $x = \pm 5\sqrt{2}$ .
10. Take it one clear step at a time and keep the original question in mind. Only one solution (double root). So the answer is  $x = 1$ .
11. This is a good place to slow down, check the notation, and simplify cleanly. Can't take  $\sqrt{-4}$ . So the answer is no real solution.
12. Take it one clear step at a time and keep the original question in mind.  $x^2 = 9$ . So the answer is  $x = \pm 3$ .
13. This is a good place to slow down, check the notation, and simplify cleanly. Irrational. So the answer is  $x = \pm\sqrt{7}$ .
14. For a table question, slow down and locate the exact row, column, or cell before calculating.  $2x + 1 = \pm 5 \Rightarrow 2x = 4$  or  $-6$ . This gives  $x = 2, -3$ .
15. Use the clue in the question first, then let the arithmetic finish the job.  $x^2 = 16$ . So the answer is  $x = \pm 4$ .
16. Focus on the main idea of the problem, then simplify carefully.  $x - 4 = \pm\sqrt{2}$ . So the answer is  $x = 4 \pm \sqrt{2}$ .
17. Start with the definition the problem is testing, then apply it directly.  $x^2 = 4$ . So the answer is  $x = \pm 2$ .
18. Start with the definition the problem is testing, then apply it directly.  $x + 2 = \pm 8$ . So the answer is  $x = 6, -10$ .
19. This is a good place to slow down, check the notation, and simplify cleanly.  $\sqrt{\frac{9}{4}} = \frac{3}{2}$ . So the answer is  $x = \pm\frac{3}{2}$ .
20. Take it one clear step at a time and keep the original question in mind.  $3x = \pm 6$ . So the answer is  $x = \pm 2$ .
21. For a table question, slow down and locate the exact row, column, or cell before calculating.  $s^2 = 50 \Rightarrow s = \sqrt{50} = 5\sqrt{2}$ . Negative side doesn't make sense physically. This gives  $5\sqrt{2} \approx 7.07$  m.
22. For a table question, slow down and locate the exact row, column, or cell before calculating.  $16t^2 = 144 \Rightarrow t^2 = 9 \Rightarrow t = 3$  (positive only). This gives  $t = 3$  sec.
23. Name the quantities first so the model is easy to read.  $x + 1 = \pm 2\sqrt{5} = \pm 2\sqrt{5}$ . So  $x = -1 \pm 2\sqrt{5}$ .
24. For a table question, slow down and locate the exact row, column, or cell before calculating.  $400 = \frac{1}{2}(8)v^2 = 4v^2 \Rightarrow v^2 = 100 \Rightarrow v = 10$  (positive speed). This gives  $v = 10$  m/s.



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