Solving Quadratics by Square Roots

Name: ____________	Date: ____________	Score: ______ / 24

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

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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?

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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.

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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.

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Answer Keys

1. $x = \pm 4$
2. $x = \pm 5$
3. $x = \pm 7$
4. $x = \pm 9$
5. $x = 5, -1$
6. $x = 1, -7$
7. $x = \pm 10$
8. $x = \pm 2\sqrt{3}$
9. $x = \pm 5\sqrt{2}$
10. $x = 1$
11. no real solution
12. $x = \pm 3$
13. $x = \pm\sqrt{7}$
14. $x = 2, -3$
15. $x = \pm 4$
16. $x = 4 \pm \sqrt{2}$
17. $x = \pm 2$
18. $x = 6, -10$
19. $x = \pm\frac{3}{2}$
20. $x = \pm 2$
21. $5\sqrt{2} \approx 7.07$ m
22. $t = 3$ sec
23. $x = -1 \pm 2\sqrt{5}$
24. $v = 10$ m/s

Step-by-Step Tutor Notes

1. Focus on the main idea of the problem, then simplify carefully. $\sqrt{16} = 4$, ± 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. ± 5. So the answer is $x = \pm 5$.
3. Start with the definition the problem is testing, then apply it directly. ± 7. So the answer is $x = \pm 7$.
4. This is a good place to slow down, check the notation, and simplify cleanly. ± 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. $x + 1 = \pm\sqrt{20} = \pm 2\sqrt{5}$. 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.