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5.2F *Solve Quadratic Equations Using Square Roots to Find Real Solutions*

1. On a quiz, Omar solved a quadratic equation and got the answer wrong. His work is shown below. Identify his mistake and then solve the equation correctly to find the real solution.

12) $\frac{2(x-3)^2}{2} = \frac{18}{2}$

$\sqrt{(x-3)^2} = \sqrt{9}$

$|x-3| = 3$

$x-3=3$ or $x-3=-3$

$x=6$ or $x=0$

$(x-3)^2 = 9$

error here → $+3 \quad +3$

$\sqrt{x^2} = \sqrt{12}$

$x = 3.464, -3.464$

#2 – 5: Verify that each of the following values are solutions to the given equation. Show ALL of your work.

2. $2x^2+3=21;\ x=3, x=-3$

$2(3)^2+3=21$ $\quad 2(-3)^2+3=21$

$2(9)+3$ $\quad 2(9)+3$

$18+3=21$ ✓ $\quad 18+3=21$ ✓

3. $(x-5)^2+1=17;\ x=9, x=1$

$(9-5)^2+1=17$ $\quad (1-5)^2+1=17$

$(4)^2+1$ $\quad (-4)^2+1$

$16+1=17$ ✓ $\quad 16+1=17$ ✓

4. $x^2+7=35;\ x=2\sqrt{7}, x=-2\sqrt{7}$

$(2\sqrt{7})^2+7=35$ $\quad (-2\sqrt{7})^2+7=35$

$4\cdot 7$ $\quad 4\cdot 7$

$28+7=35$ ✓ $\quad 28+7=35$ ✓

5. $(x+3)^2-5=70;\ x=-3+\sqrt{5}, x=-3-\sqrt{5}$

$((-3+\sqrt{5})+3)^2-5=70$ $\quad ((-3-\sqrt{5})+3)^2-5=70$

$(\sqrt{5})^2$ $\quad (-\sqrt{5})^2$

$5-5 \neq 70$ $\quad 5-5 \neq 70$

$(-3+\sqrt{5})$ is NOT a soln. $\quad (-3-\sqrt{5})$ is NOT a soln.

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5.2F *Solve Quadratic Equations Using Square Roots to Find Real Solutions*

6. Samantha solved the following problem on a test and got the right answer. Unfortunately, she doesn't know which answer is the actual solution. Explain to her which solution is correct and why.

> 5) The height "h" of a water balloon (in feet) at time "x" (in seconds) is given by the equation. $h(x) = -16(x-0.65)^2 + 10$. If a student throws the balloon and it hits a student who is 6 feet tall in the head, how long was the balloon in the air?

$6 = -16(x-0.65)^2 + 10$

$-10 \qquad -10$

$-4 = -16(x-0.65)^2$

$-16 \quad -16$

$\sqrt{0.25} = \sqrt{(x-0.65)^2}$

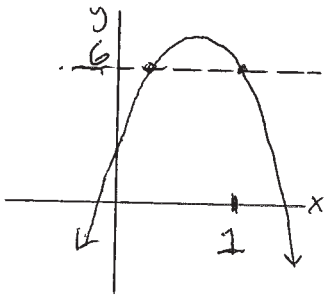
$0.5 = x - 0.65 \qquad -0.5 = x - 0.65$

Not sure which is right??? HELP!

$+0.65 \quad +0.65 \qquad +0.65 \quad +0.65$

$x = 1.15$ seconds or $x = 0.15$ seconds

Both answers are correct. The balloon could have hit a 6 ft tall student on the way up after 0.15 seconds, OR it could have hit the student on its descending path after 1.15 seconds. See graph at right.



#7 – 10: Solve each equation for real solutions and simplify your answers. Verify your solutions!

7. $x^2 + 3 = 21$

$\sqrt{x^2} = \sqrt{18}$

$|x| = \sqrt{9 \cdot 2}$

$x = \pm 3\sqrt{2}$

✓Verify your solution(s):

$(3\sqrt{2})^2 + 3$

$9 \cdot 2 + 3 = 21$ ✓

$(-3\sqrt{2})^2 + 3$

$9 \cdot 2 + 3 = 21$ ✓

8. $\sqrt{(x-1)^2} = \sqrt{32}$

$|x-1| = \sqrt{16 \cdot 2}$

$x - 1 = \pm 4\sqrt{2}$

$x = 1 \pm 4\sqrt{2}$

✓ Verify your solution(s):

$((1+4\sqrt{2})-1)^2 = 32$

$(4\sqrt{2})^2 = 32$

$16 \cdot 2 = 32$ ✓

$((1-4\sqrt{2})-1)^2 = 32$

$(-4\sqrt{2})^2 = 32$

$16 \cdot 2 = 32$ ✓

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5.2F *Solve Quadratic Equations Using Square Roots to Find Real Solutions*

#7 – 10 (continued): Solve each equation for real solutions and simplify your answers. Verify your solutions!

9. $2x^2 - 8 = 0$

$\frac{2x^2}{2} = \frac{8}{2}$

$\sqrt{x^2} = \sqrt{4}$

$|x| = 2$

$x = \pm 2$

✓Verify your solution(s):

$2(2)^2 - 8 = 0$

$2 \cdot 4 - 8 = 0$ ✓

$2(-2)^2 - 8$

$2(4) - 8 = 0$ ✓

10. $5(x-1)^2 - 3 = 42$

$\frac{5(x-1)^2}{5} = \frac{45}{5}$

$\sqrt{(x-1)^2} = \sqrt{9}$

$|x-1| = 3$

$x - 1 = 3$ or $x - 1 = -3$

$+1 \quad +1 \qquad +1 \quad +1$

$x = 4$ or $x = -2$

✓ Verify your solution(s):

$5(4-1)^2 - 3$

$5(3)^2 - 3$

$5 \cdot 9 - 3 = 42$ ✓

$5(-2-1)^2 - 3 = 42$

$5(-3)^2 - 3$

$5 \cdot 9 - 3 = 42$ ✓

#11 – 14: Find the roots of each function and simplify your answers. Verify your solutions!

11. $f(x) = x^2 - 75$

$x^2 - 75 = 0$

$\sqrt{x^2} = \sqrt{75}$

$|x| = \sqrt{25 \cdot 3}$

$x = \pm 5\sqrt{3}$

✓Verify your solution(s):

$(5\sqrt{3})^2 - 75 = 0$

$25 \cdot 3 - 75 = 0$ ✓

$(-5\sqrt{3})^2$

$25 \cdot 3 - 75 = 0$ ✓

12. $f(x) = (x+2)^2$

$\sqrt{(x+2)^2} = \sqrt{0}$

$|x+2| = 0$

$x + 2 = 0$

$-2 \quad -2$

$x = -2$

✓ Verify your solution(s):

$(-2+2)^2 = 0$

$0^2 = 0$ ✓

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5.2F Solve Quadratic Equations Using Square Roots to Find Real Solutions

#11 – 14 (continued): Find the roots of each function and simplify your answers. Verify your solutions!

13. $f(x)=2(x-1)^2-18$

$2(x-1)^2-18=0$
$2(x-1)^2=18$
$(x-1)^2=9$
$\sqrt{(x-1)^2}=\sqrt{9}$
$|x-1|=3$
$x-1=3$ or $x-1=-3$
$x=4$ or $x=-2$

✓Verify your solution(s):

$2(4-1)^2-18$ $2(3)^2$ $2\cdot 9-18=0$ ✓

$2(-2-1)^2-18$ $2(-3)^2$ $2\cdot 9-18=0$ ✓

14. $f(x)=3x^2-24$

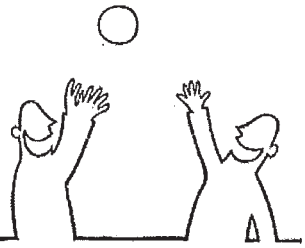
$3x^2-24=0$
$3x^2=24$
$\sqrt{x^2}=\sqrt{8}$
$|x|=2\sqrt{2}$
$x=\pm 2\sqrt{2}$

✓ Verify your solution(s):

$3(2\sqrt{2})^2-24$ $3(4\cdot 2)-24$ $24-24=0$ ✓

$3(-2\sqrt{2})^2-24$ $3(4\cdot 2)-24$ $3\cdot 8-24=0$ ✓

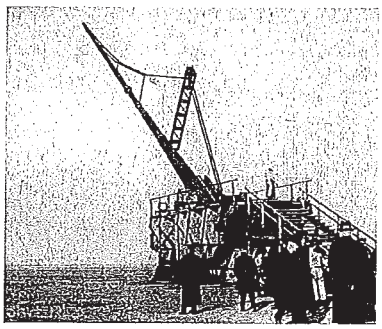
15. The height of a ball in the air, h, at time t can be modeled by the equation $h(t)=-16(t-1)^2+32$. How long does it take for the ball to reach the ground? (round answers to the nearest hundredth)



$-16(t-1)^2+32=0$
$-16(t-1)^2=-32$
$\sqrt{(t-1)^2}=\sqrt{2}$
$|t-1|=\sqrt{2}$

$t-1=\sqrt{2}$ or $t-1=-\sqrt{2}$
$t=1+\sqrt{2}$ $t=1-\sqrt{2}$
$t\approx 2.41$ sec $t\approx -.41$ extraneous

16. Big Bertha, a cannon used in WW1, could fire shells incredibly long distances. The page of a shell could be modeled by $y=-0.0196(x-25)^2+12$ where x was the horizontal distance traveled (in miles), and y was the height (in miles). How far could Big Bertha fire a shell? (round answers to the nearest mile)



Big Bertha (Paris Gun), courtesy http://www.militaryimages.net

$-0.0196(x-25)^2+12=0$
$-0.0196(x-25)^2=-12$
$\sqrt{(x-25)^2}=\sqrt{612.245}$
$|x-25|=24.74$
$x-25=24.74$ or $x-25=-24.74$
$+25\quad 25$ $+25\quad 25$
$x=49.74$ $x=0.26\approx 0$ miles extraneous
$x\approx 49.74$

Section 5.2F