

Solve the following using the square root property.

Key

$$1. y = x^2 - 18$$

$$0 = x^2 - 18$$

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

$$9 \cdot 2$$

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

$$2. f(x) = (x-5)^2 - 8$$

$$0 = (x-5)^2 - 8$$

$$\pm \sqrt{8} = \sqrt{(x-5)^2}$$

$$4 \cdot 2$$

$$\pm 2\sqrt{2} = x - 5$$

$$\boxed{5 \pm 2\sqrt{2} = x}$$

$$3. f(x) = -2(x+3)^2 + 56$$

$$0 = -2(x+3)^2 + 56$$

$$-56 = -2(x+3)^2$$

$$\frac{-56}{-2} = \frac{-2(x+3)^2}{-2}$$

$$\pm \sqrt{28} = \sqrt{(x+3)^2}$$

$$4 \cdot 7$$

$$\pm 2\sqrt{7} = x + 3$$

$$\boxed{-3 \pm 2\sqrt{7} = x}$$

$$4. g(x) = \frac{1}{4}(x-10)^2 - 12$$

$$0 = \frac{1}{4}(x-10)^2 - 12$$

$$(4) \cdot 2 = \frac{1}{4}(x-10)^2 - 12$$

$$\pm \sqrt{48} = \sqrt{(x-10)^2}$$

$$16 \cdot 3$$

$$\pm 4\sqrt{3} = x - 10$$

$$\boxed{10 \pm 4\sqrt{3} = x}$$

$$4. y = 4(x-2)^2 - 9$$

$$0 = 4(x-2)^2 - 9$$

$$9 = 4(x-2)^2$$

$$\frac{9}{4} = \frac{4(x-2)^2}{4}$$

$$\pm \sqrt{\frac{9}{4}} = \sqrt{(x-2)^2}$$

$$\frac{\sqrt{9}}{\sqrt{4}} \rightarrow \pm \frac{3}{2} = x - 2$$

$$\frac{4 \cdot 2}{2} \pm \frac{3}{2} = x$$

$$\boxed{x = \frac{7}{2} + \frac{1}{2}}$$

$$5. h(x) = -5(x-2)^2 + 1$$

$$0 = -5(x-2)^2 + 1$$

$$-1 = -5(x-2)^2$$

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

$$\frac{\sqrt{1}}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{5}}{5}$$

$$\pm \frac{\sqrt{5}}{5} = x - 2$$

$$\boxed{2 \pm \frac{\sqrt{5}}{5} = x}$$

$$6. g(x) = -4(x+1)^2 + 6$$

$$0 = -4(x+1)^2 + 6$$

$$-6 = -4(x+1)^2$$

$$\pm \sqrt{\frac{6}{4}} = \sqrt{(x+1)^2}$$

$$\frac{\sqrt{6}}{\sqrt{4}} \rightarrow \pm \frac{\sqrt{6}}{2} = x + 1$$

$$\boxed{-1 \pm \frac{\sqrt{6}}{2} = x}$$

$$7. y = 3(x+6)^2 - 8$$

$$0 = 3(x+6)^2 - 8$$

$$8 = 3(x+6)^2$$

$$\pm \sqrt{\frac{8}{3}} = \sqrt{(x+6)^2}$$

$$\frac{\sqrt{8}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{24}}{3} = \frac{2\sqrt{6}}{3}$$

$$\pm \frac{2\sqrt{6}}{3} = x + 6$$

$$\boxed{-6 \pm \frac{2\sqrt{6}}{3} = x}$$

Solve the following using the square root property.

$$8. -45 = -(x+4)^2 + 5$$

$$\frac{-45}{-5} = \frac{-(x+4)^2}{-5}$$

$$\pm \sqrt{50} = \sqrt{(x+4)^2}$$

$$25 \cdot 2$$

$$\pm 5\sqrt{2} = x + 4$$

$$\boxed{-4 \pm 5\sqrt{2}}$$

$$9. -3 = 2(x+7)^2 - 28$$

$$\frac{-3}{+28} = \frac{2(x+7)^2}{+28}$$

$$\frac{25}{2} = \frac{2(x+7)^2}{2}$$

$$\pm \sqrt{\frac{25}{2}} = \sqrt{(x+7)^2}$$

$$\frac{\sqrt{25}}{\sqrt{2}} = \frac{5 \cdot \sqrt{2}}{\sqrt{2} \cdot \sqrt{2}} = \frac{5\sqrt{2}}{2}$$

$$\pm \frac{5\sqrt{2}}{2} = x + 7$$

$$\boxed{-7 \pm \frac{5\sqrt{2}}{2} = x}$$

$$10. 1 = 9(x-2)^2 - 11$$

$$\frac{1}{+11} = \frac{9(x-2)^2}{+11}$$

$$\frac{4 \cdot 2}{3 \cdot 9} = \frac{9(x-2)^2}{9}$$

$$\pm \sqrt{\frac{4}{3}} = \sqrt{(x-2)^2}$$

$$\frac{\sqrt{4}}{\sqrt{3}} = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

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

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

$$11. -14 = -\frac{1}{2}(x-15)^2 + 6$$

$$\frac{-14}{-6} = \frac{-\frac{1}{2}(x-15)^2}{-6}$$

$$-20 = -\frac{1}{2}(x-15)^2$$

$$(-2) \cdot (-2) \cdot (-2) = \frac{-\frac{1}{2}(x-15)^2}{-2}$$

$$\pm \sqrt{40} = \sqrt{(x-15)^2}$$

$$\sqrt{4 \cdot 10}$$

$$\pm 2\sqrt{10} = x - 15$$

$$\boxed{15 \pm 2\sqrt{10} = x}$$

Applications

1) A rock is thrown from the top of a bridge. The height of the rock $h(x)$, in meters at x seconds is given by the equation $h(x) = -5(x - 1)^2 + 20$. How many seconds will it take for the rock to be 10m above the ground?

$$\begin{aligned}10 &= -5(x-1)^2 + 20 \\-10 &= -5(x-1)^2 \\ \pm\sqrt{2} &= \sqrt{(x-1)^2} \\ \pm\sqrt{2} &= x-1 \\ x &= 1+\sqrt{2} \text{ and } 1-\sqrt{2} \\ x &\approx 2.4 \quad x \approx -0.4\end{aligned}$$

2) The daily profit of a sofa company is estimated by the function rule $P(x) = -20(x - 5)^2 + 800$ where x is a \$1 price increase per sofa sold. What price increases will produce a \$600 profit?

$$\begin{aligned}600 &= -20(x-5)^2 + 800 \\-200 &= -20(x-5)^2 \\ \pm\sqrt{10} &= \sqrt{(x-5)^2} \\ \pm\sqrt{10} &= x-5 \\ x &= 5+\sqrt{10} \quad x = 5-\sqrt{10} \\ x &\approx 8.16 \quad x \approx 1.34\end{aligned}$$