

4.5 Equation Solving

Solutions

Solve.	
<p>1. $(\sqrt{3x})^2 = 6^2$ Check $x = 12$:</p> $3x = 36$ $\frac{3x}{3} = \frac{36}{3}$ $x = 12$ <p style="text-align: right;">$\sqrt{3 \cdot 12} = 6?$ $\sqrt{36} = 6?$ Yes.</p> <p style="text-align: right;">{12}</p>	<p>2. $\sqrt{4x} = 10$</p>
<p>3. $(\sqrt{x-5})^2 = 3^2$ Check $x = 14$:</p> $x - 5 = 9$ $\begin{array}{r} +5 \\ +5 \end{array}$ $x = 14$ <p style="text-align: right;">$\sqrt{14-5} = 3?$ $\sqrt{9} = 3?$ Yes.</p> <p style="text-align: right;">{14}</p>	<p>4. $\sqrt{x+11} = 4$</p>
<p>5. $(\sqrt[3]{2x})^3 = (-4)^3$ Check $x = -32$:</p> $2x = -64$ $\frac{2x}{2} = \frac{-64}{2}$ $x = -32$ <p style="text-align: right;">$\sqrt[3]{2(-32)} = -4?$ $\sqrt[3]{-64} = -4?$ Yes.</p> <p style="text-align: right;">{-32}</p>	<p>6.</p>
<p>7. $(\sqrt{3x-5})^2 = (\sqrt{x+3})^2$</p> $3x - 5 = x + 3$ $\begin{array}{r} -x \\ -x \end{array}$ $2x - 5 = 3$ $\begin{array}{r} +5 \\ +5 \end{array}$ $2x = 8$ $\frac{2x}{2} = \frac{8}{2}$ $x = 4$ <p style="text-align: right;">Check $x = 4$:</p> $\sqrt{3 \cdot 4 - 5} = \sqrt{4 + 3}?$ $\sqrt{12 - 5} = \sqrt{7}?$ <p style="text-align: right;">Yes.</p> <p style="text-align: right;">{4}</p>	<p>8. $\sqrt{4x+3} = \sqrt{3x+6}$</p>
Answers: 1. {12}; 3. {14}; 5. {-32}; 7. {4}	

Solve.

9. $(\sqrt{10x-24})^2 = x^2$

$$\begin{array}{r} 10x - 24 = x^2 \\ \underline{-10x} \qquad \underline{-10x} \\ -24 = x^2 - 10x \\ \underline{+24} \qquad \underline{+24} \\ 0 = x^2 - 10x + 24 \end{array}$$

$$0 = (x-4)(x-6)$$

$$x-4=0 \quad \text{or} \quad x-6=0$$

$$\underline{+4} \quad \underline{+4} \qquad \underline{+6} \quad \underline{+6}$$

$$x = 4 \quad \text{or} \quad x = 6$$

{4, 6}

10. $\sqrt{6x+10} = 2x$

Check $x = 4$:

$$\sqrt{10 \cdot 4 - 24} = 4?$$

$$\sqrt{40 - 24} = 4?$$

$$\sqrt{16} = 4?$$

Yes.

Check $x = 6$:

$$\sqrt{10 \cdot 6 - 24} = 6?$$

$$\sqrt{60 - 24} = 6?$$

$$\sqrt{36} = 6?$$

Yes.

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

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

$$x-1 = (x-1)(x-1)$$

$$x-1 = x^2 - x - x + 1$$

$$x-1 = x^2 - 2x + 1$$

$$\underline{-x} \qquad \underline{-x}$$

$$-1 = x^2 - 3x + 1$$

$$\underline{+1} \qquad \underline{+1}$$

$$0 = x^2 - 3x + 2$$

$$0 = (x-2)(x-1)$$

$$x-2=0 \quad \text{or} \quad x-1=0$$

$$\underline{+2} \quad \underline{+2} \qquad \underline{+1} \quad \underline{+1}$$

$$x = 2 \quad \text{or} \quad x = 1$$

{2, 1}

12. $\sqrt{2x-1} = 2x-1$

Check $x = 2$:

$$\sqrt{2-1} = 2-1?$$

$$\sqrt{1} = 1?$$

Yes.

Check $x = 1$:

$$\sqrt{1-1} = 1-1?$$

$$\sqrt{0} = 0?$$

Yes.

Answers: 9. {4, 6}; 11. {1, 2}

Solve.

13. $(\sqrt{2x^2 + 5x + 6})^2 = x^2$

$$\begin{array}{r} 2x^2 + 5x + 6 = x^2 \\ -x^2 \qquad \qquad -x^2 \end{array}$$

$$x^2 + 5x + 6 = 0$$

$$(x + 2)(x + 3) = 0$$

$$x + 2 = 0 \text{ or } x + 3 = 0$$

$$\underline{-2} \quad \underline{-2} \qquad \underline{-3} \quad \underline{-3}$$

$$x = -2 \text{ or } x = -3$$

Check:

$$x = -2 \Rightarrow \sqrt{2(-2)^2 + 5(-2) + 6} = -2$$

$$x = -3 \Rightarrow \sqrt{2(-3)^2 + 5(-3) + 6} = -3$$

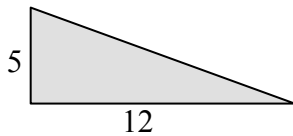
Square root value can never be negative.

Solution set: \emptyset

14. $\sqrt{2x^2 + 6x + 9} = x$

Find the length of the unknown side of each right triangle.

15.



$$5^2 + 12^2 = x^2$$

$$25 + 144 = x^2$$

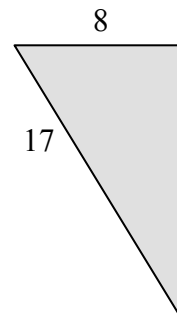
$$169 = x^2$$

$$\sqrt{169} = \sqrt{x^2}$$

$$13 = x$$

The unknown side has length 13.

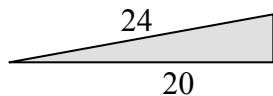
16.



Answers: 13. \emptyset ; 15. 13

Find the length of the unknown side of each right triangle. Write your answer in simplified radical form.

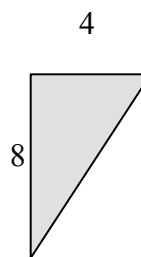
17.



$$\begin{aligned}
 20^2 + x^2 &= 24^2 \\
 400 + x^2 &= 576 \\
 \underline{-400} \quad \underline{-400} & \\
 x^2 &= 176 \\
 \sqrt{x^2} &= \sqrt{176} \\
 x &= \sqrt{2^4 \cdot 11} \\
 x &= 4\sqrt{11}
 \end{aligned}$$

The unknown side has length $4\sqrt{11}$.

18.



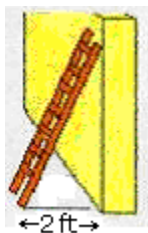
19. One end of a cable has to be attached to the top of a 30 ft. pole, while the other end is to be anchored 12 feet from the base of the pole. How much cable is needed?



$$\begin{aligned}
 30^2 + 12^2 &= x^2 \\
 900 + 144 &= x^2 \\
 1044 &= x^2 \\
 \sqrt{1044} &= \sqrt{x^2} \\
 32.3 &\approx x
 \end{aligned}$$

The cable should be about 32.3 feet long.

20. A 10-foot ladder leans against a wall. The base of the ladder is separated 2 feet from the wall. How far above the ground does the top of the ladder touch the wall?



Answer: 17. $4\sqrt{11}$; 19. ≈ 32.3 feet