# College Algebra

## Solving radical equations.

**Solve.**

1) $\sqrt{x-32}+\sqrt{x}=16$

2) $\sqrt{x+13}=1+\sqrt{x}$

3) $\sqrt{2x+1}-\sqrt{x+3}=\sqrt{x}$

4) $\sqrt{2x+3}-\sqrt{x+1}=\sqrt{3x-8}$

5) $\sqrt{x+3}+\sqrt{3x-3}=10$

6) $\sqrt{x+5}+\sqrt{x-8}=\sqrt{3}$

7) $\sqrt{x-3}-\sqrt{2x+8}=-3$

8) $\sqrt{x-3}+\sqrt{x+2}=-\sqrt{3x+4}$

9) $\sqrt{3x-3}=\sqrt{2x-1}-\sqrt{x-2}$

10) $\sqrt{x^2-14}=x-\sqrt{2}$

11) $\sqrt{x-9}=\sqrt{x}-1$

# Solutions:

1) $\sqrt{x-32}+\sqrt{x}=16.$

$$\sqrt{x-32}=16-\sqrt{x}$$
$$x-32=256-32\sqrt{x}+x$$
$$32\sqrt{x}=288$$
$$\sqrt{x}=9$$
$$x=81$$

2) $\sqrt{2x+1}-\sqrt{x+3}=\sqrt{x}.$

$$\sqrt{2x+1}=\sqrt{x}+\sqrt{x+3}$$
$$2x+1=x+2\sqrt{x^2+3x}+x+3$$
$$-\sqrt{x^2+3x}=1$$
$$x^2+3x=1$$
$$x=-\tfrac{3}{2}\pm\tfrac{1}{2}\sqrt{13}$$

3) $\sqrt{2x+3}-\sqrt{x+1}=\sqrt{3x-8}.$

$$2x+3-2\sqrt{2x^2+5x+3}+x+1=3x-8$$
$$-\sqrt{2x^2+5x+3}=-6$$
$$2x^2+5x=33$$
$$x^2+\tfrac{5}{2}x=\tfrac{33}{2}$$
$$x=-\tfrac{5}{4}\pm\sqrt{\tfrac{25}{16}+\tfrac{33}{2}}=-\tfrac{5}{4}\pm\tfrac{17}{4}=3,\text{ or }-5\tfrac{1}{2}$$

4) $\sqrt{x+3}+\sqrt{3x-3}=10.$

$$\sqrt{x+3}=10-\sqrt{3x-3}$$
$$x+3=100-20\sqrt{3x-3}+3x-3$$
$$10\sqrt{3x-3}=47+x$$
$$300x-300=2209+94x+x^2$$
$$x^2-206x=-2509$$
$$x=103\pm90=193,\text{ or }13$$

5) $\sqrt{x+5}+\sqrt{x-8}=\sqrt{3}.$

$$\sqrt{x+5}=\sqrt{3}-\sqrt{x-8}$$
$$x+5=3-2\sqrt{3x-24}+x-8$$
$$\sqrt{3x-24}=-5$$
$$3x-24=25$$
$$x=16\tfrac{1}{3}\qquad\text{(Verify.)}$$

6) Solve $\sqrt{x+13}=1+\sqrt{x}.$

$$x+13=1+2\sqrt{x}+x$$
$$\sqrt{x}=6$$
$$x=36$$

7)

$$\sqrt{x-3}-\sqrt{2x+8}=-3.$$
$$\sqrt{x-3}+3=\sqrt{2x+8}$$
$$x-3+6\sqrt{x-3}+9=2x+8$$
$$6\sqrt{x-3}=x+2$$
$$36x-108=x^2+4x+4$$
$$x^2-32x=-112$$
$$x=16\pm\sqrt{256-112}=16\pm 12=28,\text{ or }4$$

8)

$$\sqrt{x-3}+\sqrt{x+2}=-\sqrt{3x+4}$$
$$x-3+2\sqrt{x^2-x-6}+x+2=3x+4$$
$$2\sqrt{x^2-x-6}=x+5$$
$$4x^2-4x-24=x^2+10x+25$$
$$x^2-\tfrac{14}{3}x=\tfrac{49}{3}$$
$$x=\tfrac{7}{3}\pm\tfrac{14}{3}=7,\text{ or }-2\tfrac{1}{3}$$

9)

$$\sqrt{3x-3}=\sqrt{2x-1}-\sqrt{x-2}$$
$$3x-3=2x-1-2\sqrt{2x^2-5x+2}+x-2$$
$$2x^2-5x+2=0$$
$$x^2-\tfrac{5}{2}x=-1$$
$$x=\tfrac{5}{4}\pm\tfrac{3}{4}=2,\text{ or }\tfrac{1}{2}$$

10)

$$\sqrt{x^2-14}=x-\sqrt{2}.$$
$$x^2-14=x^2-2x\sqrt{2}+2$$
$$x\sqrt{2}=8$$
$$x=4\sqrt{2}$$

11)

$$\sqrt{x-9}=\sqrt{x}-1.$$
$$x-9=x-2\sqrt{x}+1$$
$$2\sqrt{x}=10 \qquad x=25$$