SQUARE ROOTS

$\sqrt{9} = 3$ OR -3

(3: principal root; -3: secondary root)

$\sqrt{28} = \sqrt{4 \cdot 7} = 2\sqrt{7}$

$\sqrt{45} = \sqrt{9 \cdot 5} = 3\sqrt{5}$

$\sqrt{72} = \sqrt{9 \cdot 8}$

$3\sqrt{8}$

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

$6\sqrt{2}$

$\sqrt{36 \cdot 2}$

$= 6\sqrt{2}$

$\sqrt{x^2} = \sqrt{9}$

$x = \pm 3$

$2\sqrt{3} + 8\sqrt{3} - 9\sqrt{2}$

$2x + 8x - 9y$

$= 10\sqrt{3} - 4\sqrt{2}$

$5\sqrt{2} - 3\sqrt{7} - 9\sqrt{2} + 6\sqrt{7}$

$= -4\sqrt{2} + 3\sqrt{7}$

$\sqrt{24} + \sqrt{54}$

$4 \cdot 6 \quad 9 \cdot 6$

$2\sqrt{6} + 3\sqrt{6} = \boxed{5\sqrt{6}}$

Multiplication

$\sqrt{2} \cdot \sqrt{6} = \sqrt{12} = 2\sqrt{3}$ ($12 = 4 \cdot 3$)

$3\sqrt{6} \cdot 5\sqrt{3} = 15\sqrt{18}$ ($18 = 3 \cdot 2$)

$= 45\sqrt{2}$

$\sqrt{24} \cdot \sqrt{72} =$ ($24 = 4 \cdot 6$, $72 = 36 \cdot 2$)

$= 2\sqrt{6} \cdot 6\sqrt{2}$

$= 12\sqrt{12}$ ($12 = 2 \cdot 3$)

$= 24\sqrt{3}$

$(3 + 4\sqrt{3})(5 - 2\sqrt{3})$

FOIL!

First Outer Inner Last

$15 - 6\sqrt{3} + 20\sqrt{3} - 8 \cdot 3$ ($8 \cdot 3 = 24$)

$= -9 + 14\sqrt{3}$

$\sqrt{3} \cdot \sqrt{3} = \sqrt{9} = 3$

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

$\sqrt{17} \cdot \sqrt{17} = 17$

$\sqrt{251} \cdot \sqrt{251} = 251$

DIVISION

$$\frac{\sqrt{21}}{\sqrt{7}} = \sqrt{3} \cdot \sqrt{\frac{21}{7}}$$

$$\sqrt{\frac{36}{25}} = \frac{\sqrt{36}}{\sqrt{25}} = \frac{6}{5}$$

$$\sqrt{\frac{20}{81}} = \frac{\sqrt{20}}{\sqrt{81}} = \frac{2\sqrt{5}}{9}$$

(4.5)

$$\frac{3\sqrt{5}}{9\sqrt{3}} = \frac{\sqrt{5}}{3}$$

More Rationalizing the Denom

$$\frac{3+4\sqrt{7}}{5-2\sqrt{7}} \quad \frac{(5+2\sqrt{7})}{(5+2\sqrt{7})} \leftarrow \text{FOIL!}$$

FL

multiply by the conjugate of the denom!

$$\frac{15+6\sqrt{7}+20\sqrt{7}+8\cdot 7}{25+10\sqrt{7}-10\sqrt{7}-4\cdot 7}$$

56

$$-28$$

$$\frac{-71+26\sqrt{7}}{+3} = \boxed{\frac{-71-26\sqrt{7}}{3}}$$

Rationalizing the Denominator

$$\frac{5}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{5\sqrt{7}}{7}$$

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

$$\sqrt{\frac{11}{12}} = \frac{\sqrt{11}}{\sqrt{12}} = \frac{\sqrt{11}}{2\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$$

(4·3)

$$= \boxed{\frac{\sqrt{33}}{6}}$$

$$\frac{-1}{2} \quad \frac{1}{-2} \quad -\frac{1}{2}$$

Conjugate?

$-9+2\sqrt{3}$ No $4-2\sqrt{3}$

$-9-\sqrt{7}$ yes $-9+\sqrt{7}$

Solve for x.

$3x^2 + 7 = 43$

$-7 \quad -7$

$\frac{3x^2}{3} = \frac{36}{3}$

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

$4 \cdot 3$

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

$\frac{2(x+6)^2}{2} = \frac{50}{2}$

$\sqrt{(x+6)^2} = \sqrt{25}$

$x + 6 = \pm 5$

$x + 6 = 5$

$x + 6 = -5$

$x = -6 \pm 5$

$x = -1$ OR -11

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Imaginary Numbers

Leonard Euler

$\sqrt{-1} = i$

$\sqrt{-16} = \sqrt{16 \cdot -1} = 4i$

$\sqrt{-81} = 9i$

$\sqrt{-90} = \sqrt{-1 \cdot 9 \cdot 10}$

$= 3i\sqrt{10}$