Recall

$$3x + 4y + 2x.$$
$$= 3x + 2x + 4y$$
$$= (3+2)x + 4y$$
$$= 5x + 4y$$

Adding Like terms

$$3\sqrt{x} + 7\sqrt{x} = 10\sqrt{x}$$
$$(3+7)\sqrt{x} = 10\sqrt{x} \checkmark$$

$$6\sqrt{11} - 2\sqrt{11} = 4\sqrt{11}$$

$$\sqrt{3} + \sqrt{3} = \sqrt{3}(1+1) = 2\sqrt{3}$$

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

Let $\sqrt{3} = x$

$$-2\sqrt[3]{ab} \quad + 7\sqrt[3]{ab} \quad -1\sqrt[3]{ab}$$

$$(-2 + 7 - 1) \quad \sqrt[3]{ab}$$

$$4 \cdot \sqrt[3]{ab}$$

$$\frac{1}{4} x\sqrt{3y} \quad - \quad \frac{3}{2} x\sqrt{3y}$$

$$= \left(\frac{1}{4} - \frac{3}{2}\right) x\sqrt{3y}$$

$$= \left(\frac{1}{4} - \frac{3}{\cancel{2}}\left(\frac{\cancel{4}^{2}}{4}\right)\right) x\sqrt{3y}$$

$$= \left(\frac{1}{4} - \frac{6}{4}\right) \quad x\sqrt{3y}$$

$$= \boxed{-\frac{5}{4} \cdot x\sqrt{3y}} = \boxed{-\frac{5x\sqrt{3y}}{4}}$$

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

$3\sqrt{4}\,\sqrt{2} + \sqrt{2}$

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

$6\sqrt{2} + \sqrt{2} = 7\sqrt{2}$

$* \; 8 = 2^3 = 4 \cdot 2$

We observed that

$\sqrt{8} \neq \sqrt{2}$

but $\sqrt{8}$ is $\sqrt{4}\,\sqrt{2}$

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

$3\sqrt{2^2}\,\sqrt{2} + \sqrt{2}$

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

$6\sqrt{2} + \sqrt{2} = 7\sqrt{2}$

$4\sqrt{75} + 2\sqrt{108} - 2\sqrt{27} + \sqrt{63}$

$4\sqrt{25}\,\sqrt{3} + 2\sqrt{12}\,\sqrt{9} - 2\sqrt{9}\,\sqrt{3} + \sqrt{9}\,\sqrt{7}$

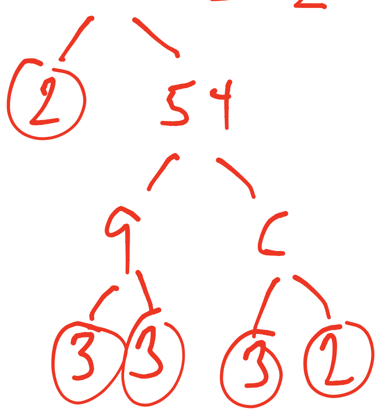
$4 \cdot 5\sqrt{3} + 2 \cdot 3\,\sqrt{4}\,\sqrt{3} - 2 \cdot 3\sqrt{3} + 3\sqrt{7}$

$20\sqrt{3} + 2 \cdot 3 \cdot 2\sqrt{3} - 6\sqrt{3} + 3\sqrt{7}$

$20\sqrt{3} + 12\sqrt{3} - 6\sqrt{3} + 3\sqrt{7}$

$\boxed{26\sqrt{3} + 3\sqrt{7}}$

$108 = 2^2 \cdot 3^3$



$\sqrt{108} = \sqrt[2]{2^2 3^2} \cdot \sqrt[2]{3^1}$

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

$= 6\sqrt{3}$

$\sqrt[3]{2} - \sqrt{2}$ * can't do it different indexes

* We need like radicals

- same radicand
- same index

$\sqrt[3]{2} - \sqrt{8}$

$\sqrt[3]{2} - \sqrt{4}\sqrt{2}$

$\sqrt[3]{2} - 2\sqrt{2}$

$\sqrt[3]{8} - \sqrt{2}$

$\underset{(\sqrt{2})^2}{2} - \sqrt{2}$

$\sqrt{2}\sqrt{2} - \sqrt{2}$

$\sqrt{2}(\sqrt{2} - 1)$

$$8\sqrt[2]{x^3y^2} - 3y\sqrt[2]{x^3}$$

$$8\sqrt[2]{x^2y^2}\sqrt{x^1} - 3y\sqrt{x^2}\sqrt{x}$$

$$8xy\sqrt{x} - 3yx\sqrt{x}$$

multiplication

$xy = yx$

commutative

$$8xy\sqrt{x} - 3xy\sqrt{x}$$

$$5xy\sqrt{x}$$

$$\sqrt{50x^2y^5} - 13y\sqrt{2x^2y^3} + xy\sqrt{98y^3}$$

$$\sqrt{25\cdot 2x^2y^4y} - 13y\sqrt{2x^2y^2y} + xy\sqrt{49\cdot 2y^2y}$$

$$5xy^2\sqrt{2y} - 13yxy\sqrt{2y} \qquad xy\cdot 7y\sqrt{2y}$$

$$5xy^2\sqrt{2y} - 13xy^2\sqrt{2y} + 7xy^2\sqrt{2y}$$

$$(5-13+7)xy^2\sqrt{2y}$$

$$-1\,xy^2\sqrt{2y}$$

$$\boxed{-xy^2\sqrt{2y}}$$

Multiplying radicals

$a^n \cdot b^n = (ab)^n$

$(\sqrt[m]{a} \cdot \sqrt[m]{b}) = \sqrt[m]{ab}$

multiply same powers

multiply same roots

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

$= 15\sqrt{12}$

$= 15\sqrt{4}\sqrt{3}$

$= 15 \cdot 2\sqrt{3}$

$= \boxed{30\sqrt{3}}$

$(3^1 \cdot 2^{\frac{1}{2}})(5^1 \cdot 6^{\frac{1}{2}})$

Cannot multiply 3 and 6 diff. exponents

2 and 5 roots

$$(2x\sqrt{y})(-7\sqrt{xy}) = (2x\cdot -7)(\sqrt{y}\sqrt{xy})$$
$$= -14x\sqrt{xy^2}$$
$$= -14x\sqrt{y^2}\sqrt{x}$$
$$= -14xy\sqrt{x}$$

$$\left(15c\sqrt[3]{cd}\right)\left(\frac{1}{3}\sqrt[3]{cd^2}\right) = \left(15c\cdot\frac{1}{3}\right)\left(\sqrt[3]{c^1d^1}\sqrt[3]{c^1d^2}\right)$$
$$= 5c\sqrt[3]{c^2d^3}$$
$$= 5c\sqrt[3]{d^3}\sqrt[3]{c^2}$$
$$= \boxed{5cd\sqrt[3]{c^2}}$$

$$\sqrt{5}\left(3+\sqrt{10}\right) = 3\sqrt{5}+\sqrt{50}$$
$$= 3\sqrt{5}+\sqrt{25}\sqrt{2}$$
$$= 3\sqrt{5}+5\sqrt{2}$$

distributive property

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

$$= 2\sqrt{5}\sqrt{5} - \sqrt{5}\sqrt{2} + 3\sqrt{2}\cdot 2\sqrt{5} - 3\sqrt{2}\sqrt{2}$$

$$= 2\sqrt{25} - \sqrt{10} + 6\sqrt{10} - 3\sqrt{4}$$

$$= 2\cdot 5 + 5\sqrt{10} - 3\cdot 2$$

$$= 10 + 5\sqrt{10} - 6$$

$$= 4 + 5\sqrt{10}$$