6.5 Operations with Radicals - Day 1 Notes

objective: adding, subtracting and multiplying radicals

When adding and subtracting radicals, simplify each radical to find like terms. Only like terms can be combined.

Ex. $\sqrt{98} - 2\sqrt{32} =$

$\sqrt{98} = \sqrt{\cancel{49} \cdot 2} = 7\sqrt{2}$

$2\sqrt{32} = 2\sqrt{\cancel{16} \cdot 2} = 2 \cdot 4\sqrt{2} = 8\sqrt{2}$

$7\sqrt{2} - 8\sqrt{2} = \boxed{-\sqrt{2}}$

1. $4\sqrt{8} + 3\sqrt{50}$

$4\sqrt{8} = 4\sqrt{\cancel{4} \cdot 2} = 4 \cdot 2\sqrt{2} = 8\sqrt{2}$

$3\sqrt{50} = 3\sqrt{\cancel{25} \cdot 2} = 3 \cdot 5\sqrt{2} = 15\sqrt{2}$

$8\sqrt{2} + 15\sqrt{2} = \boxed{23\sqrt{2}}$

2. $2\sqrt{48} - \sqrt{75} - \sqrt{12}$

$2\sqrt{48} = 2\sqrt{\cancel{16} \cdot 3} = 2 \cdot 4\sqrt{3} = 8\sqrt{3}$

$\sqrt{75} = \sqrt{\cancel{25} \cdot 3} = 5\sqrt{3}$

$\sqrt{12} = \sqrt{\cancel{4} \cdot 3} = 2\sqrt{3}$

$8\sqrt{3} - 5\sqrt{3} - 2\sqrt{3} = \boxed{\sqrt{3}}$

3. $\sqrt{12} - 2\sqrt{3} + \sqrt{27}$

$\sqrt{12} = \sqrt{\cancel{4} \cdot 3} = 2\sqrt{3}$

$\sqrt{27} = \sqrt{\cancel{9} \cdot 3} = 3\sqrt{3}$

$\cancel{2\sqrt{3} - 2\sqrt{3}} + 3\sqrt{3}$

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

4. $5\sqrt{12} + 2\sqrt{27} - \sqrt{8}$

$5\sqrt{12} = 5\sqrt{\cancel{4} \cdot 3} = 5 \cdot 2\sqrt{3} = 10\sqrt{3}$

$2\sqrt{27} = 2\sqrt{\cancel{9} \cdot 3} = 2 \cdot 3\sqrt{3} = 6\sqrt{3}$

$\sqrt{8} = \sqrt{\cancel{4} \cdot 2} = 2\sqrt{2}$

$\underbrace{10\sqrt{3} - 6\sqrt{3}} + 2\sqrt{2}$

$\boxed{= 4\sqrt{3} + 2\sqrt{2}}$

5. $5\sqrt{32} + \sqrt{27} + 2\sqrt{75}$

$5\sqrt{32} = 5\sqrt{\cancel{16} \cdot 2} = 5 \cdot 4\sqrt{2} = 20\sqrt{2}$

$\sqrt{27} = \sqrt{\cancel{9} \cdot 3} = 3\sqrt{3}$

$2\sqrt{75} = 2\sqrt{\cancel{25} \cdot 3} = 2 \cdot 5\sqrt{3} = 10\sqrt{3}$

$20\sqrt{2} + \underbrace{3\sqrt{3} + 10\sqrt{3}}$

$\boxed{= 20\sqrt{2} + 13\sqrt{3}}$

Multiplying radicals:

We use the product property to break radicals apart or put them together in order to simplify.

Product Property of Radicals: $\sqrt[n]{ab} = \sqrt[n]{a} * \sqrt[n]{b}$

ex. $\sqrt{32x^8} = \sqrt{32} \cdot \sqrt{x^8}$

$\sqrt{32} = \sqrt{\cancel{16} \cdot 2} = 4\sqrt{2}$

$\sqrt{x^8} = x^4$

$\boxed{= 4\sqrt{2}x^4}$

1. $\sqrt{50x^4} = \sqrt{50} \cdot \sqrt{x^4}$

$\sqrt{50} = \sqrt{\cancel{25} \cdot 2} = 5\sqrt{2}$

$\sqrt{x^4} = x^2$

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

Ex. $\sqrt[3]{125t^6w^7} = \sqrt[3]{125} \cdot \sqrt[3]{t^6} \cdot \sqrt[3]{w^7}$

$\sqrt[3]{125} = 5$

$\sqrt[3]{t^6} = t^2$

$\sqrt[3]{w^7} = \sqrt[3]{w^6 \cdot w} = w^2 \sqrt[3]{w}$

$\boxed{= 5t^2w^2\sqrt[3]{w}}$

3. $\sqrt[3]{8g^3k^8} = \sqrt[3]{8} \cdot \sqrt[3]{g^3} \cdot \sqrt[3]{k^8}$

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

$\sqrt[3]{g^3} = g$

$\sqrt[3]{k^8} = \sqrt[3]{\cancel{k^6} \cdot k^2} = k\sqrt[3]{k^2}$

$= \boxed{2gk\sqrt[3]{k^2}}$

ex. $\sqrt[3]{-54x^6y^5} = \sqrt[3]{-54} \cdot \sqrt[3]{x^6} \cdot \sqrt[3]{y^5}$

$\sqrt[3]{-54} = \sqrt[3]{\cancel{-27} \cdot 2} = -3\sqrt[3]{2}$

$\sqrt[3]{x^6} = x^2$

$\sqrt[3]{y^5} = \sqrt[3]{\cancel{y^3} \cdot y^2} = y\sqrt[3]{y^2}$

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

4. $\sqrt[3]{-16y^4z^{12}}$

$\sqrt[3]{-16} = \sqrt[3]{\cancel{-8} \cdot 2} = -2\sqrt[3]{2y}$

$\sqrt[3]{y^4} = \sqrt[3]{\cancel{y^3} \cdot y} = y\sqrt[3]{y}$

$\sqrt[3]{z^{12}} = z^4$

$\boxed{= -2yz^4\sqrt[3]{2y}}$