MATH 1010 ~ Intermediate Algebra

Chapter 7: RADICALS AND COMPLEX NUMBERS

Section 7.3: Adding and Subtracting Radical Expressions

Objectives:

- Use the distributive property to add and subtract like radicals.
- Use radical expressions in application problems.

$$5\sqrt{x^3} - x\sqrt{4x} + 3x\sqrt{x} =$$

Like radicals can be added or subtracted using their coefficients.

eg $\sqrt{2} + \sqrt{2} = 2\sqrt{2}$

$x + x = 2x$

① EXAMPLE

Combine these where possible.

a) $5\sqrt{3} - 2\sqrt{3} = 3\sqrt{3}$

b) $12\sqrt{8} - 3\sqrt[3]{8} = 12\sqrt{4}\sqrt{2} - 3(2)$

$= 24\sqrt{2} - 6$

$\sqrt{8} \neq \sqrt[3]{8}$

c) $14\sqrt[5]{2} - 6\sqrt[5]{2} = 8\sqrt[5]{2}$

d) $5\sqrt{12} + 16\sqrt{27}$

$= 5\sqrt{4}\sqrt{3} + 16\sqrt{9}\sqrt{3}$

$= 5(2)\sqrt{3} + 16(3)\sqrt{3}$

$= 10\sqrt{3} + 48\sqrt{3} = 58\sqrt{3}$

② EXAMPLE

Combine these where possible.

a) $\sqrt[3]{54x} - \sqrt[3]{2x^4}$ $= \sqrt[3]{27}\sqrt[3]{2x} - \sqrt[3]{x^3}\sqrt[3]{2x}$

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

$= \sqrt[3]{2x}(3-x)$

b) $\sqrt{9x-9} - \sqrt{x^3-x^2}$

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

$= 3\sqrt{x-1} - |x|\sqrt{x-1} = \sqrt{x-1}(3-|x|)$

c) $6\sqrt{x} - \sqrt[3]{4} - 5\sqrt{x} + 2\sqrt[3]{4}$

$= (6\sqrt{x} - 5\sqrt{x}) + (2\sqrt[3]{4} - \sqrt[3]{4})$

$= \sqrt{x} + \sqrt[3]{4}$

d) $5\sqrt{x^3} - x\sqrt{4x}$

$= 5\sqrt{x^2}\sqrt{x} - x\sqrt{4}\sqrt{x}$

$= 5|x|\sqrt{x} - x(2)\sqrt{x}$

$= 5|x|\sqrt{x} - 2x\sqrt{x}$

(assume $x \geq 0$) $\Rightarrow |x| = x$.

$= 5x\sqrt{x} - 2x\sqrt{x}$

$= 3x\sqrt{x}$

assume $x > 0$

f) $\dfrac{8}{\sqrt{5x}} + \sqrt{5x} = \dfrac{8}{\sqrt{5x}}\left(\dfrac{\sqrt{5x}}{\sqrt{5x}}\right) + \sqrt{5x}$

$= \dfrac{8\sqrt{5x}}{\sqrt{5^2x^2}} + \sqrt{5x} = \dfrac{8\sqrt{5x}}{5x} + \sqrt{5x}$

$= \sqrt{5x}\left(\dfrac{8}{5x} + 1\right)$

g) $\sqrt{\dfrac{4}{3x^3}} + \sqrt{3x^3}$

assume ~~$x \neq 0$~~ $x > 0$

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

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

$= \dfrac{\sqrt{4}}{\sqrt{3x^3}} + \sqrt{3x^3} = \dfrac{2}{x\sqrt{3x}} + x\sqrt{3x}$

$= \dfrac{2}{x\sqrt{3x}}\left(\dfrac{\sqrt{3x}}{\sqrt{3x}}\right) + x\sqrt{3x}$

$= \dfrac{2\sqrt{3x}}{x(3x)} + x\sqrt{3x}$

$= \sqrt{3x}\left(\dfrac{2}{3x^2} + x\right)$

Application:

Four corners are cut from a 4x8 foot sheet of wood. Find the perimeter of the remaining piece of wood.

Pythagorean Thm

$2^2+2^2=x^2$

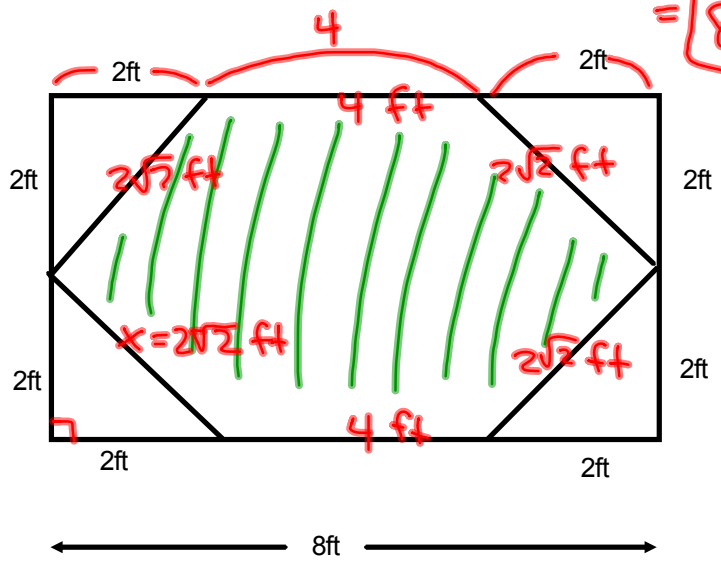
$4+4=x^2$

$8=x^2$

$\sqrt{8}=x$

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

$=2\sqrt{2}$



$P=4+4+4(2\sqrt{2})$

$=8+8\sqrt{2}$ ft