5.1 Variables

$$\sqrt[3]{x^6} = (x^6)^{1/3} = x^2$$

Math 20-2
Radicals with Variables

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

A. Skills:
   Identify square and cube expressions using variables:
   $(5)(5) = 5^2$ so $\sqrt{5^2} = 5$
   $(x)(x) = x^2$ so $\sqrt{x^2} = x$
   $(x^2)(x^2) = x^4$ so $\sqrt{x^4} = x^2$

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

$(x^3)(x^3) = x^6$ so $\sqrt{x^6} = x^3$

$\sqrt{x^6} = (x^6)^{1/2} = x^3$

B. Determine the domain of square root expressions.
   o Restrictions: you cannot square root a negative number.
   o Find what makes the 'radicand' zero. Then determine the domain for the expression.

   Examples:
   1. $\sqrt{x-5}$

$$x - 5 = 0$$
$$x = 5$$

$$x \geq 5$$

makes zero or positive

2. $\sqrt{2x+1}$

less than $-\frac{1}{2}$
$-2, -5, -10, \ldots$
makes negative

$$2x + 1 = 0$$
$$2x = -1$$
$$x = -\frac{1}{2}$$

more than $-\frac{1}{2}$
$0, 5, 10, 1000$
makes positive

domain
$$x \geq -\frac{1}{2}$$

C. Express as mixed radicals in simplest form. Restrictions?
   Examples:
   1. $\sqrt{18x^3}$

$= 3x\sqrt{2x}$
$x \geq 0$

$\sqrt{18}$ $\sqrt{x^3}$
$\sqrt{9 \times 2}$ $\sqrt{x^2 \cdot x}$
$3\sqrt{2}$ $x\sqrt{x}$

2. $\sqrt{8x^5}$

$= 2x^2\sqrt{2x}$
$x \geq 0$

$\sqrt{8}$ $\sqrt{x^5}$
$\sqrt{4 \times 2}$ $\sqrt{x^4 \cdot x}$
$2\sqrt{2}$ $x^2\sqrt{x}$

$\boxed{x \cdot x} \boxed{x \cdot x} \boxed{x \cdot x} \cdot x$

3. $3x\sqrt{49x^7}$

$x \geq 0$

$3x\sqrt{49x^6 \cdot x}$
$3x(7x^3)\sqrt{x}$
$21x^4\sqrt{x}$

4. $\sqrt[3]{24x^7}$

$\sqrt[3]{8 \times 3}$ $\sqrt[3]{x^6 \cdot x}$

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

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

$\boxed{x \in R}$

$\boxed{x \cdot x \cdot x}\boxed{x \cdot x \cdot x} \cdot x$

$(x^6)^{1/3} = x^2$

$\sqrt[3]{neg}$ are real numbers...

5.1 Variables

D. Add and Subtract, Multiply, Divide. Restrictions.

Examples:

1. $5\sqrt{x} + 2\sqrt{x}$ same size

$$= 7\sqrt{x}$$

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

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

$$= 6\sqrt{x^2} - 10\sqrt{x} + 9\sqrt{x} - 15$$
$$= 6x - \sqrt{x} - 15$$

3. $\dfrac{15\sqrt{6x^3}}{3\sqrt{2x}}$ $\dfrac{15}{3}$ $\dfrac{\sqrt{6}}{\sqrt{2}}$ $\dfrac{\sqrt{x^3}}{\sqrt{x}}$

$$= 5\sqrt{3x^2}$$

$\sqrt{x^2}$

$$= 5x\sqrt{3}$$

4. $\dfrac{6\sqrt{5} - \sqrt{24x^3}}{2\sqrt{x}}$ $\dfrac{\sqrt{x}}{\sqrt{x}}$ $6, -1, 2$ $\sqrt{}$ $5, 24x^3, x$

radical x itself

$$\frac{6\sqrt{5x} - \sqrt{24x^4}}{2\sqrt{x^2}}$$

$$\frac{6\sqrt{5x} - \sqrt{4x^4}\sqrt{6}}{2(x)}$$

$$\frac{6\sqrt{5x} - 2x^2\sqrt{6}}{2x}$$

coefficient
$6, 2, 2$ ÷2

$$\frac{3\sqrt{5x} - x^2\sqrt{6}}{x}$$