p.242 - Topic: radicals (square roots)

$\sqrt{9} = 3 \quad (3^2 = 9)$

$\sqrt{4} = 2 \quad (2^2 = 4)$

Properties: ① $\sqrt{a \cdot b} = \sqrt{a} \cdot \sqrt{b}$

$\sqrt{25 \cdot 49} = \sqrt{25} \cdot \sqrt{49} =$

$5 \cdot 7 = 35$

② $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

$\sqrt{\frac{25}{49}} = \frac{\sqrt{25}}{\sqrt{49}} = \frac{5}{7}$

Note: even though

$(-2)^2 = 4$,

$\sqrt{4} \neq -2$ !

Why? define $\sqrt{x}$ as the positive square root of x.

Suppose: look at $\sqrt{x^2}$

what if $x = -2$ ?

$$\sqrt{x^2} = \sqrt{(-2)^2} = \sqrt{4} = 2$$

property ③ $\sqrt{x^2} = |x|$

in general

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

$$\sqrt{x^6} = |x^3|$$

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

$$\sqrt{x^{10}} = |x^5|$$

Remember:

odd power of negative = negative

even power of negative = positive

powers of $-2$

| n | $(-2)^n$ |
|---|---|
| 0 | 1 |
| 1 | -2 |
| 2 | 4 |
| 3 | -8 |
| 4 | 16 |

odd →

Q: $\sqrt{x^3} = \sqrt{x^2} \cdot \sqrt{x}$

$= |x| \sqrt{x}$

Q: $\sqrt{x^5} = \sqrt{x^4} \cdot \sqrt{x}$

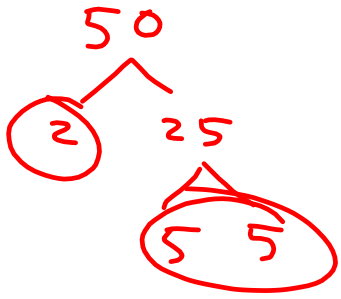
$= x^2 \sqrt{x}$

Ex. $\sqrt{50}$ Simplify

one approach: factor first

$\sqrt{5 \cdot 5} \cdot \sqrt{2}$

$5\sqrt{2}$




another

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

Ex. $\sqrt{\frac{5}{11}}$ Simplify.

Get rid of $\sqrt{\ }$ in denominator - called "rationalizing" the denominator.

Technique: $=1$

$$\sqrt{\frac{5}{11}} = \frac{\sqrt{5}}{\sqrt{11}} \cdot \frac{\sqrt{11}}{\sqrt{11}} = \frac{\sqrt{55}}{\sqrt{11^2}}$$

$$= \frac{\sqrt{55}}{11}$$

denominator does not have a radical.

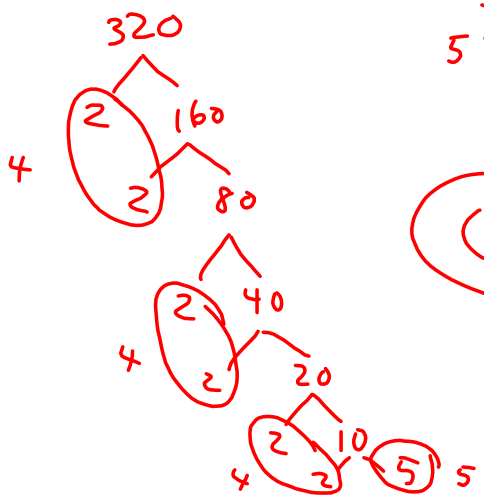
#1 $\sqrt{18}$ simplify

$$\sqrt{9 \cdot 2} = \sqrt{9} \cdot \sqrt{2} = 3\sqrt{2}$$

#4 $\sqrt{\frac{5}{7}}$ $\frac{\sqrt{5}}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{35}}{7}$

#8 $5 \cdot \sqrt{320}$

② factor tree




$5\sqrt{4} \cdot \sqrt{4} \cdot \sqrt{4} \cdot \sqrt{5}$

$5 \cdot 2 \cdot 2 \cdot 2 \cdot \sqrt{5}$

$40\sqrt{5}$

①

$320 = 16 \cdot 20$

$5\sqrt{320} = 5 \cdot \sqrt{16} \cdot \sqrt{20}$

$= 5 \cdot 4 \cdot \sqrt{20}$

$= 20\sqrt{20}$

$(20 = 4 \cdot 5)$

$20 \cdot \sqrt{4} \cdot \sqrt{5}$

$40 \cdot \sqrt{5}$

Hint #9: $(2\sqrt{27})^2 = 2 \cdot \sqrt{27} \cdot 2 \cdot \sqrt{27}$

$= 2^2(\sqrt{27})^2$

Hint #9: $2\sqrt{27} = 2 \cdot \sqrt{9} \cdot \sqrt{3}$

✳ #13 $-\sqrt{\frac{7x^3}{5x}} = -\sqrt{\frac{7x^2}{5}}$ ...

Remember: $\sqrt{x^2} = |x|$