5.1b Radicals

* To compare radicals, write them in their entire form and compare the radicands. They must have the same index.

ex. put the following in increasing order:

$5 \qquad 3\sqrt{3} \qquad 2\sqrt{6} \qquad \sqrt{23}$

$=\sqrt{5^2} \qquad =\sqrt{3^2\cdot 3} \qquad =\sqrt{2^2\cdot 6}$

$=\sqrt{25} \qquad =\sqrt{27} \qquad =\sqrt{24}$

$\therefore \sqrt{23} < 2\sqrt{6} < 5 < 3\sqrt{3}$

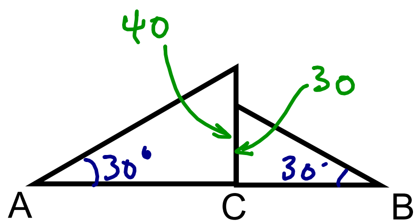
* to add radicals, you must group like terms

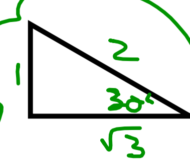
ex. a) $2\sqrt{7} + 8\sqrt{7} = 10\sqrt{7}$

b) $\sqrt{24} - \sqrt{6} = \sqrt{4\cdot 6} - \sqrt{6}$
$= 2\sqrt{6} - \sqrt{6}$
$= \sqrt{6}$

c) $\sqrt{20x} - 3\sqrt{45x}$ $\times 3$
$= \sqrt{4\cdot 5x} - 3\sqrt{9\cdot 5x}$
$= 2\sqrt{5x} - 9\sqrt{5x} = -7\sqrt{5x}$

ex. Calculate length AB exactly





$\tan 30° = \frac{1}{\sqrt{3}}$

$\tan 30° = \frac{40}{AC}$

$\overline{AC} = \frac{40}{\tan 30°}$

$\overline{AC} = \frac{40}{1/\sqrt{3}} = 40 \div \frac{1}{\sqrt{3}}$

$= 40 \times \frac{\sqrt{3}}{1} = 40\sqrt{3}$

$\overline{AB} = \overline{AC} + \overline{CB}$

or use similar Δs since I have a special Δ

$\therefore \frac{CB}{\sqrt{3}} = \frac{30}{1}$

$CB = 30\sqrt{3}$

$\therefore AB = 40\sqrt{3} + 30\sqrt{3}$
$= \boxed{70\sqrt{3}}$

your turn: pg. 277

<u>Definition</u>: a radical in simplified form has the following properties

* the radicand contains no fractions
* there are no perfect roots left as factors of the radicand
* there is no radical in the denominator

ex. a) $\sqrt{\frac{3}{5}} = \frac{\sqrt{3}}{\sqrt{5}} \cdot \underbrace{\frac{\sqrt{5}}{\sqrt{5}}}_{=1} = \frac{\sqrt{15}}{5}$ b) $\sqrt{20} = \sqrt{4 \cdot 5}$

$= 2\sqrt{5}$

$\sqrt{☺} \cdot \sqrt{☺} = ☺$

<u>Property</u>: A radical with an even index can only represent a real number if the radicand is positive or zero. There are no restrictions on radicals with odd indexes.

ex. a) $\sqrt{-3}$ has no real roots b) $\sqrt[3]{-27} = -3$

since $(-3)^3 = -27$

* for $\sqrt{16 - x}$ to be a real number, $16 - x \geq 0$

$\boxed{16 \geq x}$

* $\sqrt[3]{16 - x}$ will always be a real number → no restrictions on the domain

* Recall: when multiplying or dividing an inequality by a negative number, you MUST change the sign of the inequality.

ex. $5 - 3x \geq 0$

$\frac{-3x}{-3} \geq \frac{-5}{-3}$

$\boxed{x \leq \frac{5}{3}}$

or

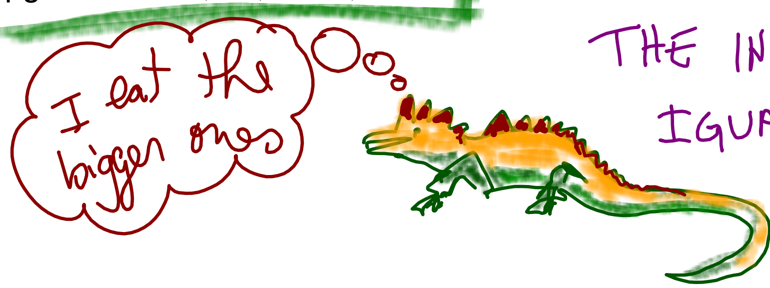
$5 - 3x \geq 0$

$\frac{5}{3} \geq \frac{3x}{3}$

$\boxed{\frac{5}{3} \geq x}$

$x \leq \frac{5}{3} \xrightarrow{\text{same}} \frac{5}{3} \geq x$

homefun: pg. 278 #8-11, 15,17-20, 23-25



THE INEQUALITY IGUANA