5.3 SQUARE ROOTS

Perfect squares are squares of positive integers.

n	1	2	3	4	5	6	7	8	9	10	11	12	13
n^2	1	4	9	16	25	36	49	64	81	100	121	144	169

A simplified square root has:

$\sqrt{\text{radicand}}$

- ☆ no perfect square factors > 1 in the radicand
- ☆ no fractions under the radical
- ☆ no radicals in the denominator of a fraction

examples

Simplify:

1. $\sqrt{160} = \sqrt{16}\cdot\sqrt{10}$
   $4\sqrt{10}$

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

3. $5\sqrt{18}\cdot 3\sqrt{5}$
   $5\sqrt{9}\sqrt{2}$
   3
   $15\sqrt{2}\cdot 3\sqrt{5}$
   $45\sqrt{10}$

4. $\frac{6}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}} = \frac{6\sqrt{3}}{3}$
   $= 2\sqrt{3}$

5. $\sqrt{\frac{7}{20}} = \frac{\sqrt{7}}{\sqrt{20}} = \frac{\sqrt{7}}{2\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{35}}{10}$

6. $\frac{4}{(\sqrt{5}-1)} \cdot \frac{(\sqrt{5}+1)}{(\sqrt{5}+1)} = \frac{\quad}{5-1} = \frac{4(\sqrt{5}+1)}{4} = \sqrt{5}+1$

conjugates

7. $\frac{8}{(5+\sqrt{3})} \cdot \frac{(5-\sqrt{3})}{(5-\sqrt{3})} = \frac{\quad}{25-3} = \frac{8(5-\sqrt{3})}{2 \cdot 11} = \frac{20-4\sqrt{3}}{11}$

$(a+b)\ (a-b)\ (a^2-b^2)$

Solve for x over the real numbers:

8. $4x^2 + 7 = 135$

$4x^2 = 128$

$\sqrt{x^2} = \sqrt{32}\ \sqrt{16}\sqrt{2}$

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

9. $\frac{(x-4)^2}{5} = 10$

$\sqrt{(x-4)^2} = \sqrt{50}$

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

$x = 4 \pm 5\sqrt{2}$