Section 9.3 - Operations with Radicals

- Add + subtract
- Distribute and FOIL
- multiply conjugates

To add and subtract anything they must be <u>like</u> things: Like terms $2x + 3x = 5x$

Like denominators $\frac{3}{4} - \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$

Like radicals $3\sqrt{2} - 1\sqrt{2} = 2\sqrt{2}$

Like items 3 dogs + 2 dogs = 5 dogs

ex:

2. $9\sqrt{5} + 6\sqrt{5}$ 9 cats + 6 cats

$= 15\sqrt{5}$ = 15 cats

4. $19\sqrt{7} - 2\sqrt{7}$ 19 mangos − 2 mangos

$= 17\sqrt{7}$ = 17 mangos

8. $9\sqrt{x} + 2\sqrt{x}$

$= 11\sqrt{x}$

10. $8\sqrt{y} - 28\sqrt{y}$

$= -20\sqrt{y}$

13. $7\sqrt{5y} - 1\sqrt{5y}$ put a 1 in front if there isn't a number

$= 6\sqrt{5y}$

16. $1\sqrt{3} + 1\sqrt{3}$ put in the 1's

$= 2\sqrt{3}$

18. $6\sqrt{3} + 2\sqrt{3} + 5\sqrt{3}$

$= 13\sqrt{3}$

22. $7\sqrt{17} - 10\sqrt{17} + 3\sqrt{17}$

$= 0\sqrt{17}$

$= 0$

Simplify Radicals if needed, before combining (use 9.2)

24. $\sqrt{3} + \sqrt{27}$ not like radicals but there is a perfect square in 27

$= \sqrt{3} + \sqrt{9}\sqrt{3}$

$= 1\sqrt{3} + 3\sqrt{3}$

$= 4\sqrt{3}$

30. $5\sqrt{12} + \sqrt{75}$

$= 5\sqrt{4}\sqrt{3} + \sqrt{25}\sqrt{3}$

$= 5 \cdot 2\sqrt{3} + 5\sqrt{3}$ multiply the outside numbers

$= 10\sqrt{3} + 5\sqrt{3}$ Now they have like radicals so we can add

$= 15\sqrt{3}$

42. $4\sqrt{8} - \sqrt{128} + 2\sqrt{48} + 3\sqrt{18}$

$= 4\sqrt{4}\sqrt{2} - \sqrt{64}\sqrt{2} + 2 \cdot \sqrt{16}\sqrt{3} + 3\sqrt{9}\sqrt{2}$ separate out the perfect squares

$= 4 \cdot 2\sqrt{2} - 8\sqrt{2} + 2 \cdot 4\sqrt{3} + 3 \cdot 3\sqrt{2}$

$= 8\sqrt{2} - 8\sqrt{2} + 8\sqrt{3} + 9\sqrt{2}$ combine like terms

$= 8\sqrt{3} + 9\sqrt{2}$

Multiplying Radicals

Distributing

44. $\sqrt{5}(\sqrt{3} + \sqrt{6})$

$= \sqrt{5} \cdot \sqrt{3} + \sqrt{5} \cdot \sqrt{6}$

$= \sqrt{15} + \sqrt{30}$ check to see if the square roots can be simplified

15
3 5

30
3 10
2 5

no perfect squares so it's done

50. $\sqrt{6}(\sqrt{6}-\sqrt{2})$

$= \sqrt{6}\sqrt{6} - \sqrt{6}\sqrt{2}$

$= \sqrt{36} - \sqrt{12}$ simplify roots by pulling out perfect squares

$= 6 - \sqrt{4}\sqrt{3}$

$= 6 - 2\sqrt{3}$

FOIL

52. $(7+\sqrt{2})(8+\sqrt{2})$

$= 7\cdot 8 + \underline{7\sqrt{2} + 8\sqrt{2}} + \sqrt{2}\sqrt{2}$ combine like terms

$= 56 + 15\sqrt{2} + \sqrt{4}$

$= \underline{56} + 15\sqrt{2} + \underline{2}$ combine like terms

$= 58 + 15\sqrt{2}$

54. $(6+\sqrt{5})(9-4\sqrt{5})$

$= 6\cdot 9 - \underline{24\sqrt{5}} + \underline{9\sqrt{5}} - 4\sqrt{5}\sqrt{5}$

$= 54 - 15\sqrt{5} - 4\sqrt{25}$

$= 54 - 15\sqrt{5} - 4\cdot 5$

$= \underline{54} - 15\sqrt{5} - \underline{20}$

$= 34 - 15\sqrt{5}$

70. $(\sqrt{10}-\sqrt{7})(\sqrt{10}+\sqrt{7})$

$= \sqrt{100} + \sqrt{70} - \sqrt{70} - \sqrt{49}$

$= 10 - 7$

$= 3$

Remember $(x+3)(x-3)$? what do you think will happen?

The middle terms cancelled out

$\sqrt{10}+\sqrt{7}$ is called the conjugate of $\sqrt{10}-\sqrt{7}$.

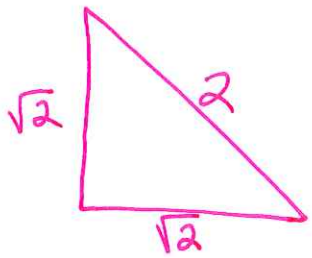
78. $(\sqrt{x}-\sqrt{11})^2$

$= (\sqrt{x}-\sqrt{11})(\sqrt{x}-\sqrt{11})$ Expand your exponents

$= \sqrt{x^2} - \sqrt{11x} - \sqrt{11x} + \sqrt{121}$

$= x - 2\sqrt{11x} + 11$

92. Find the area and perimeter of the figure. Assume that all measures are given in inches.



Perimeter $= 2 + \sqrt{2} + \sqrt{2}$ inches

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

Area $= \frac{1}{2} \cdot b \cdot h$

$= \frac{1}{2} \cdot \sqrt{2} \cdot \sqrt{2}$

$= \frac{1}{2}\sqrt{4} = \frac{1}{2} \cdot 2 = 1$ inch^2