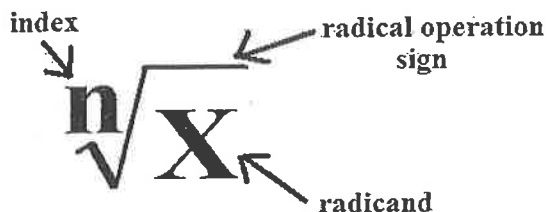


Objective # 43 **Square Roots and Operations with Radicals**

Material: Teacher Notes

Homework: worksheet

Parts of a Radical:



Square Root: is a radical operation (*index = 2*) performed on a number to get a value, such that the value when squared will give the original number back.

Cube Root: is a radical operation (*index = 3*) performed on a number to get a value, such that the value when cubed will give the original number back.

Example: Perform the following operations:

a) $\sqrt{36} = 6$ b) $\sqrt{64} = 8$ c) $\sqrt{169}$ d) $13 \sqrt[3]{8} = 2$ e) $\sqrt[3]{27} = 3$

Simplest Form of a Square Root: A square root is in its simplest form when the radicand does NOT contain a factor which is a perfect square.

Perfect Squares: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, etc.

Example: Simplify each of the following:

a) $\sqrt{50}$ is not in its simplest form because 50 has a factor of 25 which is a perfect square

$$\sqrt{50} = (\sqrt{25})(\sqrt{2}) = (5)(\sqrt{2}) = 5\sqrt{2}$$

b) $\sqrt{8} = (\sqrt{4})(\sqrt{2}) = (2)(\sqrt{2}) = 2\sqrt{2}$

c) $\sqrt{48} = (\sqrt{16})(\sqrt{3}) = (4)(\sqrt{3}) = 4\sqrt{3}$

d) $\sqrt{80} = (\sqrt{16})(\sqrt{5}) = (4)(\sqrt{5}) = 4\sqrt{5}$

e) $\sqrt{288} = (\sqrt{4})(\sqrt{72}) = (\sqrt{4})(\sqrt{9})(\sqrt{8}) = (\sqrt{4})(\sqrt{9})(\sqrt{4})(\sqrt{2})$
 $= (2)(3)(2)(\sqrt{2}) = 12\sqrt{2}$

f) $\sqrt{288} = (\sqrt{144})(\sqrt{2}) = (12)(\sqrt{2}) = 12\sqrt{2}$

g) $7\sqrt{175} = (7)(\sqrt{25})(\sqrt{7}) = (7)(5)(\sqrt{7}) = 35\sqrt{7}$

NOW DO EXERCISE 1 ON THE WORKSHEET!

Multiplying and Dividing Square Roots: If two square roots are being multiplied or divided, then write a single square root and move the multiplication or division inside that square root.

Example: Perform the following operations and simplify all radicals:

- a) $(\sqrt{2})(\sqrt{3}) = \sqrt{(2)(3)} = \sqrt{6}$ b) $\frac{\sqrt{24}}{\sqrt{8}} = \sqrt{\frac{24}{8}} = \sqrt{3}$
- c) $(3\sqrt{5})(4\sqrt{10}) = (3)(4)(\sqrt{(5)(10)}) = 12\sqrt{50} = (12)(\sqrt{25})(\sqrt{2}) = (12)(5)(\sqrt{2})$
 $= 60\sqrt{2}$
- d) $\frac{32\sqrt{54}}{2\sqrt{3}} = \left(\frac{32}{2}\right)\left(\sqrt{\frac{54}{3}}\right) = 16\sqrt{18} = (16)(\sqrt{9})(\sqrt{2}) = (16)(3)(\sqrt{2}) = 48\sqrt{2}$

NOW DO EXERCISE 2 ON THE WORKSHEET!

Like Square Roots: Like Square Roots are square roots that have the same number inside the radical sign.

Examples: Like Square Roots: $\sqrt{3}, 4\sqrt{3}, -2\sqrt{3}$
 NOT Like Square Roots: $\sqrt{3}, 4\sqrt{5}, -2\sqrt{7}$

Adding and Subtracting Square Roots: ONLY like square roots can be added or subtracted ... carry the common square root and add or subtract the coefficients (Numbers in front of the square root)

Example: Perform the following operations and simplify all radicals:

a) $3\sqrt{5} - 7\sqrt{5} + 8\sqrt{5} = 4\sqrt{5}$

b) $\sqrt{50} + \sqrt{18}$ NOTE: These are not like square roots and can't be added but they can be simplified

$(\sqrt{25})(\sqrt{2}) + (\sqrt{9})(\sqrt{2}) = 5\sqrt{2} + 3\sqrt{2}$
 $= 8\sqrt{2}$

Once they are simplified we notice that they are now like square roots and can now be added

c) $3\sqrt{28} - \sqrt{63} = (3)(\sqrt{4})(\sqrt{7}) - (\sqrt{9})(\sqrt{7})$ $(\sqrt{2} + \sqrt{3})(\sqrt{3} + \sqrt{2})$
 $= (3)(2)(\sqrt{7}) - (3)(\sqrt{7})$ d) $\sqrt{6} - \sqrt{4} + \sqrt{9} + \sqrt{6}$
 $= 6\sqrt{7} - 3\sqrt{7} = 3\sqrt{7}$ $2\sqrt{6} - 2 + 3 = 2\sqrt{6} + 1$

NOW DO EXERCISE 3 and 4 ON THE WORKSHEET!