1.4 Working with Radicals – Lesson

MCR3U
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Investigation

a) Complete the following table:

A	B
$\sqrt{4}\times\sqrt{4}=$	$\sqrt{4\times4}=$
$\sqrt{81}\times\sqrt{81}=$	$\sqrt{81\times81}=$
$\sqrt{225}\times\sqrt{225}=$	$\sqrt{225\times225}=$
$\sqrt{5}\times\sqrt{5}=$	$\sqrt{5\times5}=$
$\sqrt{31}\times\sqrt{31}=$	$\sqrt{31\times31}=$
$\sqrt{12}\times\sqrt{9}=$	$\sqrt{12\times9}=$
$\sqrt{23}\times\sqrt{121}=$	$\sqrt{23\times121}=$

b) What do you notice about the results in each row?

c) Make a general conclusion about an equivalent expression for $\sqrt{a}\times\sqrt{b}$

Definitions

Radicand:

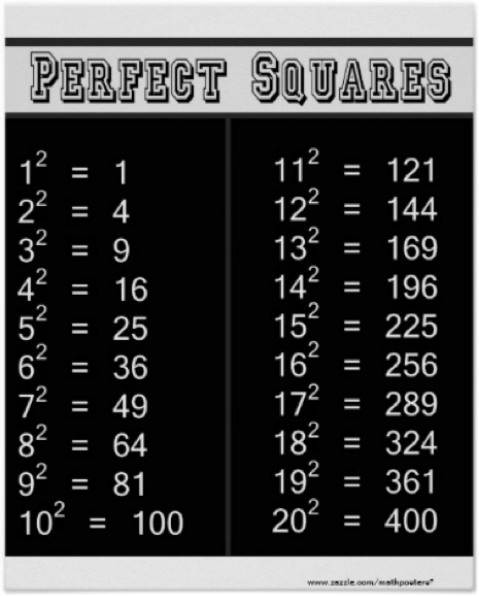
Entire Radical:

Mixed Radical:

More About Radicals

Some numbers cannot be expressed as fractions. These are called _____ numbers. One type of irrational number is of the form $\sqrt{n}$ where n is not a perfect square. These numbers are sometimes called _____.

An approximate value can be found for these irrational numbers using a calculator but it is better to work with an exact value. Answers should be left in radical form when an EXACT answer is needed. Sometimes entire radicals can be simplified by removing perfect square factors. The resulting expression is called a _____.



Example 1: Express each radical as a mixed radical in simplest form.

Hint: *remove perfect square factors and then simplify*

a) $\sqrt{50}$ **b)** $\sqrt{27}$ **c)** $\sqrt{180}$

Adding and Subtracting Radicals

Adding and subtracting radicals works in the same way as adding and subtracting polynomials. You can only add _____ terms or, in this case, _____ _____.

Example:

$2\sqrt{3} + 5\sqrt{7}$ cannot be added because they do not have the same radical.

However, $3\sqrt{5} + 6\sqrt{5}$ have a common radical, so they can be added. $3\sqrt{5} + 6\sqrt{5} = 9\sqrt{5}$

Note, the radical stays the same when adding and subtracting expressions with like radicals.

Example 2: Simplify the following

a) $9\sqrt{7} - 3\sqrt{7}$

b) $4\sqrt{3} - 2\sqrt{27}$

c) $5\sqrt{8} + 3\sqrt{18}$

d) $\frac{1}{4}\sqrt{28} - \frac{3}{4}\sqrt{63} + \frac{2}{3}\sqrt{50}$

Multiplying Radicals

Example 3: Simplify fully

a) $(2\sqrt{3})(3\sqrt{6})$

Multiply the coefficients together and then multiply the radicands together. Then simplify!

b) $2\sqrt{3}(4+5\sqrt{3})$

Don't forget the distributive property:

$a(x+y) = ax + ay$

c) $-7\sqrt{2}(6\sqrt{8}-11)$

d) $(\sqrt{3}+5)(2-\sqrt{3})$

Don't forget FOIL. Each term in the first binomial must be multiplied by each term in the second binomial.

e) $(2\sqrt{2}+3\sqrt{3})(2\sqrt{2}-3\sqrt{3})$

There is a shortcut! This is a difference of squares.

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