

Welcome Back MYP Math 9!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: 12/11 Topic: Unit 3 test Friday - no HW!	0 1 2	
Tuesday Date: _____ Topic: _____	0 1 2	
Wednesday Date: _____ Topic: _____	0 1 2	
Thursday Date: _____ Topic: _____	0 1 2	
Friday Date: _____ Topic: _____	0 1 2	

Class Plan:

1. Warm-up



2. Radicals and Surds

A

RADICALS AND SURDS

3. Investigate and Examples

INVESTIGATION 1

PROPERTIES OF RADICALS

4. Practice

Warm-up: Radicals

Find exact or approximated values of the radicals. (Try not use a calculator!)

$$\sqrt{4} = 2$$

$$\sqrt{8} \approx 2.7 \text{ close to } \sqrt{9} = 3$$

$$\sqrt{64} = 8$$

$$\sqrt{169} = 13$$

$$\sqrt{200} \approx 14.14 \text{ close to } \sqrt{196} = 14$$

$$\sqrt{225} = 15$$

✓

Square roots

Here are the square roots of all the perfect squares from 1 to 100.

$$\sqrt{1} = 1 \text{ since } 1^2 = 1$$

$$\sqrt{4} = 2 \text{ since } 2^2 = 4$$

$$\sqrt{9} = 3 \text{ since } 3^2 = 9$$

$$\sqrt{16} = 4 \text{ since } 4^2 = 16$$

$$\sqrt{25} = 5 \text{ since } 5^2 = 25$$

$$\sqrt{36} = 6 \text{ since } 6^2 = 36$$

$$\sqrt{49} = 7 \text{ since } 7^2 = 49$$

$$\sqrt{64} = 8 \text{ since } 8^2 = 64$$

$$\sqrt{81} = 9 \text{ since } 9^2 = 81$$

$$\sqrt{100} = 10 \text{ since } 10^2 = 100$$

Estimating is very important for all square roots that are not the square roots of perfect squares.

Estimate $\sqrt{10}$ by finding which two whole numbers it lies between

Unit 4: Radicals & Special Right Triangles

Chapter

5

Radicals - A number under $\sqrt{\quad}$

- Contents:**
- A** Radicals and surds
 - B** Simplifying radicals
 - C** Simplest radical form
 - D** Adding and subtracting radicals
 - E** Multiplications involving radicals
 - F** Division by radicals

A

RADICALS AND SURDS

A **radical** is a number that is written using the radical sign $\sqrt{\quad}$.

An irrational radical is called a **surd**.

Examples of rational radicals include:

terminates
repeats

$$\sqrt{9} = 3 = \frac{3}{1}$$

$$\sqrt{\frac{1}{25}} = \sqrt{\left(\frac{1}{5}\right)^2} = \frac{1}{5}$$

$$\sqrt{\frac{4}{9}} = \sqrt{\left(\frac{2}{3}\right)^2} = \frac{2}{3}$$

If the number under the radical sign can be written as the perfect square of a rational number, then the radical is rational.



Examples of surds include:

Irrational radical

$$\sqrt{2} \approx 1.414\ 213\ 56 \dots$$

$$\sqrt{19} \approx 4.358\ 898\ 94 \dots$$

$$\sqrt{\frac{1}{3}} \approx 0.577\ 350\ 269 \dots$$

$\sqrt{13}$ $\sqrt{23}$
 $\sqrt{11}$ $\sqrt{7}$

$\sqrt{(2)}$	1.414213562
$\sqrt{(19)}$	4.358898944
$\sqrt{(1/3)}$.5773502692

Purpose:

Why do we simplify radicals?

- explore geometric patterns (special rights)
- better exact values to work with

RESEARCH

- Where did the names *radical* and *surd* come from?
- Why do we use the word *irrational* to describe some numbers?

B**SIMPLIFYING RADICALS****1. Do:****INVESTIGATION 1****PROPERTIES OF RADICALS**

What patterns do you see?
 How can we use perfect squares to simplify radicals?

1) Explore radical patterns and simplify each radical:

$$a) \sqrt{4} \cdot \sqrt{4} = \underline{\quad} \cdot \underline{\quad} = \underline{\quad}$$

$$b) \sqrt{36} \cdot \sqrt{36} = \sqrt{36^2} = \underline{\quad}$$

$$c) \sqrt{9} \cdot \sqrt{25} = \underline{\quad} \cdot \underline{\quad} = \underline{\quad} = \sqrt{\underline{\quad}}$$

$$d) \sqrt{\frac{36}{4}} = \frac{\sqrt{\underline{\quad}}}{\sqrt{\underline{\quad}}} = \underline{\quad} = \underline{\quad}$$

2. Generalize Patterns:

$$\bullet \sqrt{a}\sqrt{a} = (\sqrt{a})^2 = \text{?} \quad \bullet \sqrt{a}\sqrt{b} = \text{?} \quad \bullet \frac{\sqrt{a}}{\sqrt{b}} = \text{?}$$

3. Practice simplifying radicals

1 Simplify:

$$a \quad (\sqrt{3})^2$$

$$b \quad (\sqrt{3})^3$$

$$c \quad (\sqrt{3})^5$$

$$d \quad \left(\frac{1}{\sqrt{3}}\right)^2$$

4. Challenge: Simplest Radical Form**C****SIMPLEST RADICAL FORM**

Done? Help others!

Perfect Squares (Square Numbers)

1) Complete the table to show the first few perfect squares of natural numbers.

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

square numbers

A square number can end only with digits 0, 1, 4, 6, 9, or 25.

4



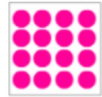
$2^2 \text{ or } 2 \times 2 = 4$

9



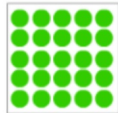
$3^2 \text{ or } 3 \times 3 = 9$

16



$4^2 \text{ or } 4 \times 4 = 16$

25



$5^2 \text{ or } 5 \times 5 = 25$

14|15
196 225

Know perfect squares to simplify radicals!

INVESTIGATION 1**PROPERTIES OF RADICALS**

1) Explore radical patterns and simplify each radical:

$$a) \sqrt{4} \cdot \sqrt{4} = \underline{2} \cdot \underline{2} = \underline{4}$$

$$b) \sqrt{36} \cdot \sqrt{36} = \sqrt{36^2} = \underline{36}$$

$$c) \sqrt{9} \cdot \sqrt{25} = \underline{3} \cdot \underline{5} = \underline{15} = \sqrt{225}$$

$$d) \sqrt{\frac{36}{4}} = \frac{\sqrt{36}}{\sqrt{4}} = \frac{6}{2} = \underline{3}$$

INVESTIGATION 1

PROPERTIES OF RADICALS

2) Generalize the radical patterns you observed:

$$\sqrt{n} \cdot \sqrt{n} = \sqrt{n^2} = \underline{n} \quad [\text{Reference a) and b)]}$$

$$\sqrt{a} \cdot \sqrt{b} = \sqrt{ab} \quad [\text{Reference c)]}$$

$$\sqrt{3} \cdot \sqrt{4} = \sqrt{12}$$

(a - d)

[Reference d)]

$$\sqrt{\frac{x}{y}} = \frac{\sqrt{x}}{\sqrt{y}}$$

$$a) \sqrt{4} \cdot \sqrt{4} = \underline{2} \cdot \underline{2} = \underline{4}$$

$$b) \sqrt{36} \cdot \sqrt{36} = \sqrt{36^2} = \underline{36}$$

$$c) \sqrt{9} \cdot \sqrt{25} = \underline{3} \cdot \underline{5} = \underline{15} = \sqrt{225}$$

$$d) \sqrt{\frac{36}{4}} = \frac{\sqrt{36}}{\sqrt{4}} = \frac{\underline{6}}{\underline{2}} = \underline{3}$$

INVESTIGATION 1**PROPERTIES OF RADICALS****1** Simplify:

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

b $(\sqrt{3})^3$

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

$$\textcircled{3}$$

$$\sqrt{3} \cdot \sqrt{3} \cdot \sqrt{3}$$

$$\sqrt{3 \cdot 3} \cdot \sqrt{3}$$

INVESTIGATION 1

PROPERTIES OF RADICALS

c $(\sqrt{3})^5$

d $\left(\frac{1}{\sqrt{3}}\right)^2$

$$\left(\frac{1}{\sqrt{3}}\right)\left(\frac{1}{\sqrt{3}}\right) = \frac{1}{3}$$

~~$$\sqrt{3} + \sqrt{3} = 2\sqrt{3}$$
$$x + x = 2x$$~~

INVESTIGATION 1**PROPERTIES OF RADICALS**

2 Simplify:

a $(2\sqrt{2})^2$

INVESTIGATION 1

PROPERTIES OF RADICALS

b $(4\sqrt{2})^2$

c $(2\sqrt{3})^2$

INVESTIGATION 1

PROPERTIES OF RADICALS

3) Practice:

1 Simplify:

a $(\sqrt{3})^2 = 3$

b $(\sqrt{3})^3$
 $\sqrt{3} \cdot \sqrt{3} \cdot \sqrt{3}$
 $3\sqrt{3}$

c $(\sqrt{3})^5$
 $\sqrt{3} \cdot \sqrt{3} \cdot \sqrt{3} \cdot \sqrt{3} \cdot \sqrt{3}$
 $3 \cdot 3 \cdot \sqrt{3}$
 $9\sqrt{3}$

d $\left(\frac{1}{\sqrt{3}}\right)^2$
 $\frac{1}{3}$

2 Simplify:

a $(2\sqrt{2})^2$

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

b $(4\sqrt{2})^2$

$(4\sqrt{2})(4\sqrt{2})$
 $= 16\sqrt{2} \cdot \sqrt{2}$
 $= 32$

c $(2\sqrt{3})^2$

$(2\sqrt{3})(2\sqrt{3})$
 $4\sqrt{3} \cdot \sqrt{3}$
 $4 \cdot 3 = 12$

Solutions

B**SIMPLIFYING RADICALS**PropertiesExamples

- $\sqrt{a}\sqrt{a} = (\sqrt{a})^2 = a$

$$\sqrt{278} \cdot \sqrt{278} = 278$$

- $\sqrt{a}\sqrt{b} = \sqrt{ab}$

$$\sqrt{8}\sqrt{32} = \sqrt{256} = 16$$

- $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$

$$\frac{\sqrt{100}}{\sqrt{4}} = \sqrt{\frac{100}{4}} = \sqrt{25} = 5$$

Exercises... Textbook (5B)

EXERCISE 5B

Choose 3 problems from 2, 3, 5, 6

Directions: Choose 3 problems from each of 2, 3, 5, 6

2 Simplify:

a $(2\sqrt{2})^2$

b $(4\sqrt{2})^2$

c $(2\sqrt{3})^2$

d $(3\sqrt{3})^2$

e $(2\sqrt{5})^2$

f $(3\sqrt{5})^2$

3 Simplify:

a $3\sqrt{2} \times 4\sqrt{2}$

b $5\sqrt{3} \times 2\sqrt{3}$

c $7\sqrt{2} \times 5\sqrt{2}$

d $(-4\sqrt{2})^2$

e $(-7\sqrt{3})^2$

f $\sqrt{2} \times (-3\sqrt{2})$

6 Simplify:

a $\sqrt{\frac{1}{16}}$

b $\sqrt{\frac{81}{144}}$

c $\sqrt{\frac{49}{64}}$

d $\sqrt{\frac{121}{9}}$

e $\sqrt{6\frac{1}{4}}$

f $\sqrt{1\frac{7}{9}}$

g $\sqrt{2\frac{14}{25}}$

h $\sqrt{7\frac{1}{9}}$

5 Simplify:

a $\frac{\sqrt{8}}{\sqrt{2}}$

b $\frac{\sqrt{3}}{\sqrt{27}}$

c $\frac{\sqrt{18}}{\sqrt{3}}$

d $\frac{\sqrt{2}}{\sqrt{50}}$

e $\frac{\sqrt{75}}{\sqrt{5}}$

f $\frac{\sqrt{5}}{\sqrt{75}}$

g $\frac{\sqrt{18}}{\sqrt{2}}$

h $\frac{\sqrt{3}}{\sqrt{48}}$

Challenge:

4 Simplify:

j $(-\sqrt{7}) \times (-2\sqrt{3})$

k $(2\sqrt{3})^2 \times 2\sqrt{5}$

l $(2\sqrt{2})^3 \times 5\sqrt{3}$

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Exercises... **Textbook (5B)**

EXERCISE 5B

Choose 3 problems from 2, 3, 5, 6

2 Simplify:

a $(2\sqrt{2})^2$

b $(4\sqrt{2})^2$

c $(2\sqrt{3})^2$

d $(3\sqrt{3})^2$

e $(2\sqrt{5})^2$

f $(3\sqrt{5})^2$

3 Simplify:

a $3\sqrt{2} \times 4\sqrt{2}$

b $5\sqrt{3} \times 2\sqrt{3}$

c $7\sqrt{2} \times 5\sqrt{2}$

d $(-4\sqrt{2})^2$

e $(-7\sqrt{3})^2$

f $\sqrt{2} \times (-3\sqrt{2})$

Exercises..Textbook (5B)

Choose 3 problems from 2, 3, 5, 6

5 Simplify:

a $\frac{\sqrt{8}}{\sqrt{2}}$

b $\frac{\sqrt{3}}{\sqrt{27}}$

c $\frac{\sqrt{18}}{\sqrt{3}}$

d $\frac{\sqrt{2}}{\sqrt{50}}$

e $\frac{\sqrt{75}}{\sqrt{5}}$

f $\frac{\sqrt{5}}{\sqrt{75}}$

g $\frac{\sqrt{18}}{\sqrt{2}}$

h $\frac{\sqrt{3}}{\sqrt{48}}$

6 Simplify:

a $\sqrt{\frac{1}{16}}$

b $\sqrt{\frac{81}{144}}$

c $\sqrt{\frac{49}{64}}$

d $\sqrt{\frac{121}{9}}$

e $\sqrt{6\frac{1}{4}}$

f $\sqrt{1\frac{7}{9}}$

g $\sqrt{2\frac{14}{25}}$

h $\sqrt{7\frac{1}{9}}$

Challenge:

4 Simplify:

i $(-\sqrt{7}) \times (-2\sqrt{3})$

k $(2\sqrt{3})^2 \times 2\sqrt{5}$

l $(2\sqrt{2})^3 \times 5\sqrt{3}$

Textbook ANSWERS (5B)

EXERCISE 5B

- 1** a 3 b $3\sqrt{3}$ c $9\sqrt{3}$ d $\frac{1}{3}$ e 7 f $7\sqrt{7}$
g $\frac{1}{7}$ h $\frac{9}{7}$ i 5 j 25 k 5 l 20
- 2** a 8 b 32 c 12 d 27 e 20 f 45
g 28 h 40 i 490
- 3** a 24 b 30 c 70 d 32 e 147 f -6
g 30 h -42 i -22
- 4** a $\sqrt{6}$ b $\sqrt{14}$ c $\sqrt{34}$ d $\sqrt{21}$
e $10\sqrt{6}$ f 48 g $5\sqrt{14}$ h $6\sqrt{30}$
i $-10\sqrt{14}$ j $2\sqrt{21}$ k $24\sqrt{5}$ l $80\sqrt{6}$
- 5** a 2 b $\frac{1}{3}$ c $\sqrt{6}$ d $\frac{1}{5}$ e $\sqrt{15}$ f $\sqrt{\frac{1}{15}}$
g 3 h $\frac{1}{4}$
- 6** a $\frac{1}{4}$ b $\frac{3}{4}$ c $\frac{7}{8}$ d $\frac{11}{3}$ e $\frac{5}{2}$ f $\frac{4}{3}$ g $\frac{8}{5}$ h $\frac{8}{3}$