NB *Foundations and Pre-Calculus Math 10* *Name:*____________________

Chapter 4 Part 1 Notes

STUDENT COPY **Final Mark: /8**

Marks ➔ Requirement 🡇	**2**	**1**	**0**
Notes Present	All notes present	Most notes present	Less than half of notes present
Organization / Neatness	Notes in chronological order, name and date on everything	Almost all notes in chronological order, name and date on most pages	Mostly out of order, name and date often missing
Questions	Question column completed on all notes, higher level questions attempted	Most question columns complete, some higher level questions	Less than half of the question columns complete
Main Ideas and Reflections	All 'main ideas' and 'reflections' complete <u>with care</u> in notes	Most 'main ideas' and 'reflections' complete in notes	Less than half of the 'main ideas' and 'reflections' complete

*If your mark does not total up to at least 4 out of 8, your notes are INCOMPLETE and must be fixed up as soon as possible and re-evaluated.

TEACHER COPY **Final Mark: /8**

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4.1 – Estimating Roots

Name:
Date:

Goal: to explore decimal representations of different roots of numbers

Toolkit:	**Main Ideas:**
• Finding a square root • Finding a cube root • Multiplication • Estimating	

Definitions:

Radical: an expression consisting of a radical sign, a radicand, and an index. $\sqrt[n]{x}$

Perfect squares and cubes to memorize: $\sqrt{4} =$, $\sqrt{9} =$, $\sqrt{16} =$, $\sqrt{25} =$, $\sqrt{36} =$ $\sqrt{49} =$, $\sqrt{64} =$, $\sqrt{81} =$, $\sqrt[3]{8} =$, $\sqrt[3]{27} =$, $\sqrt[3]{64} =$, $\sqrt[3]{125} =$

Ex 1) Evaluate the following radicals, identify the radicand and index for each:

a) $\sqrt{16}$

Radicand: ____
Index: ____

b) $\sqrt[3]{64}$

Radicand: ____
Index: ____

Estimating square roots

Ex 2) Estimate the value of $\sqrt{20}$ to one decimal place.

Step 1: Find the two perfect squares that are closest to the radicand you are looking for (one that is lower and one that is higher).

Step 2: Find which of the two perfect squares is closest to your radicand; this will determine the decimal point of your root.

Evaluate $\sqrt{20}$, how close was your estimate?

Estimating cube roots	Ex 3) Estimate the value of $\sqrt[3]{16}$ **Step 1:** Find the two perfect cubes that are closest to the radicand you are looking for. **Step 2:** Find which of the two perfect cubes is closest to your radicand. Evaluate $\sqrt[3]{16}$, how close was your estimate?
Why can you take the cube root of a negative number but not the square root of a negative number?	Ex 4) Estimate the value of $\sqrt[3]{-32}$ Ex 5) Evaluate $\sqrt{0.64}$ Ex 6) Evaluate $\sqrt{0.0196}$ Ex 7) Write an equivalent form of 0.3 as a cube root.

Reflection: How would you write 5 as a square root? A cube root? A fourth root?

4.2 – Irrational Numbers

Name:
Date:

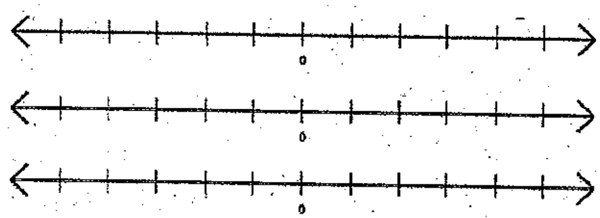
Goal: to classify real numbers, and to identify & order irrational numbers

Toolkit:	**Main Ideas:**
• Estimating roots • Placing numbers on number lines • Anything you remember about classifying Real Numbers	

Natural Numbers ( )

Whole Numbers ( )

Integers ( )



Rational Numbers ( )

Irrational Numbers ( )

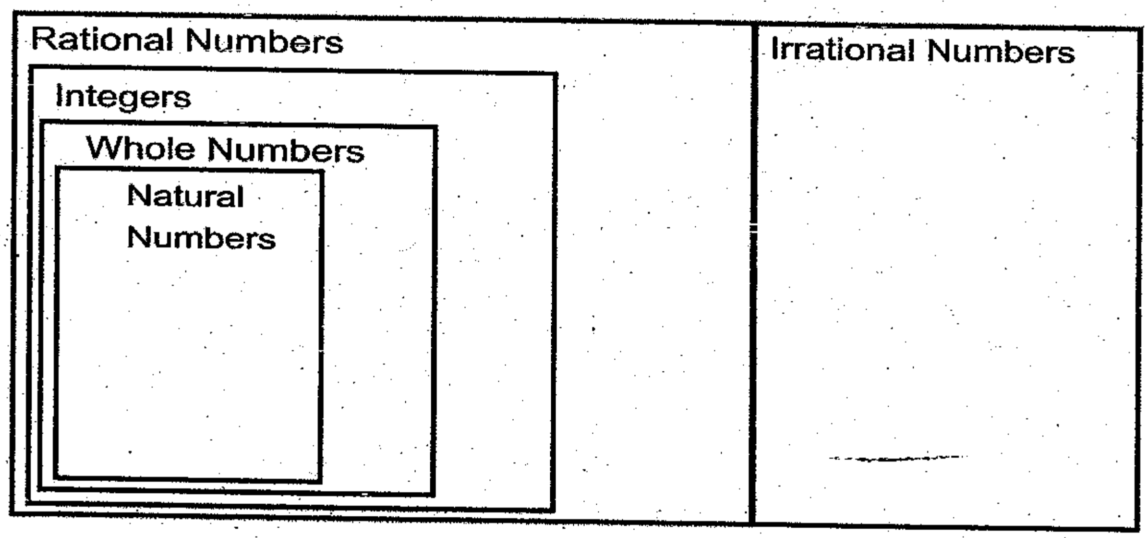
Classifying Real Numbers

Ex1) Where do these numbers belong in the diagram of Real numbers?

$2 \quad 0.\overline{6} \quad 4\sqrt{2} \quad \frac{4}{3} \quad \frac{-8}{2} \quad -12 \quad \pi \quad 0 \quad \sqrt{16}$

$1.35 \quad \sqrt[3]{-125} \quad \sqrt{3} \quad \sqrt[3]{15} \quad 19 \quad \sqrt{\frac{4}{9}}$

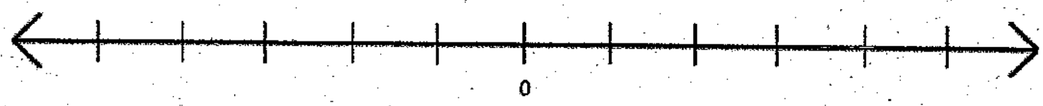
Real Numbers:



Ordering numbers on a number line

Ex2) Use a number line to order these numbers from least to greatest.

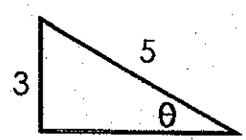
A	B	C	D	E
$\sqrt[3]{6}$	$\sqrt[3]{-2}$	$\sqrt{11}$	$\sqrt[4]{30}$	$\sqrt{2}$



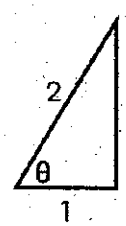
Connect:

Ex3) Is the tangent ratio for θ in each right triangle rational or irrational?

a)



b)



Reflection: How could you order a set of irrational numbers if you do not have a calculator?

4.3A – From Entire to Mixed Radicals

Name:
Date:

Goal: to express an entire radical as a mixed radical

Toolkit:	**Main Ideas:**
• Understanding Radicals • Identifying Factors of a Number	

Perfect Squares - 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, ...

Perfect Cubes - 1, 8, 27, 64, 125, 216, ...

What is an entire radical?

What is a mixed radical?

Equivalent Forms:
Ex. 1)
a) $\sqrt{16 \cdot 9}$ is equivalent to $\sqrt{16} \cdot \sqrt{9}$ because: b) $\sqrt[3]{8 \cdot 27}$ is equivalent to $\sqrt[3]{8} \cdot \sqrt[3]{27}$ because:

What is the Multiplication Property of Radicals?

$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$, where n is a natural number, and a and b are real numbers

***We can use this property to simplify square roots and cube roots that are *not* perfect squares or perfect cubes, but have *factors* that are perfect squares or perfect cubes.**

Simplifying Square Roots

We can simplify $\sqrt{24}$ because 24 has a perfect square factor of _____.
(hint:look at list of perfect squares!)

- Re-write $\sqrt{24}$ as a product of two factors, with the first one being the perfect square:

Simplifying Cube Roots

We can also simplify $\sqrt[3]{24}$ because 24 has a perfect cube factor of _____.
(hint:look at list of perfect cubes!)

- Re-write $\sqrt[3]{24}$ as a product of two factors, with the first one being the perfect cube:

Tip: If there is MORE than one perfect square or perfect cube factor, choose the LARGEST one!

Ex. 2) Simplify each radical: (remember your list of perfect squares and perfect cubes!)

a) $\sqrt{80}$ b) $\sqrt{32}$ c) $\sqrt{98}$ d) $\sqrt[3]{162}$ e) $\sqrt[3]{108}$

How do you simplify something with an index of 4? (a fourth root?)

Ex. 3) Simplify $\sqrt[4]{162}$

-Rewrite radical with the prime factorization of 162
-Since $\sqrt[4]{162}$ is a fourth root, look for a factor that appears 4 times!

Ex. 4) Simplify $\sqrt[4]{48}$

Word Problem

Ex. 5) A cube has a volume of $128cm^3$. Write the edge length of the cube in simplest radical form.

Reflection: How do you use the index of a radical when you simplify a radical? Use an example.

4.3B – From Mixed to Entire Radicals

Name:
Date:

Goal: to express a mixed radical as an entire radical

Toolkit:
- List of Perfect Squares: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100…
- List of Perfect Cubes: 1, 8, 27, 64, 125, 216, ….
- Multiplication Property of Radicals $(\sqrt{ab} = \sqrt{a} \cdot \sqrt{b})$
- Mixed Radical….ex.
- Entire Radical……ex.

Main Ideas:

How do you write a mixed radical as an entire radical?

Write the mixed radical $4\sqrt{3}$ as an entire radical:

$4\sqrt{3}$
$= 4 \cdot \sqrt{3}$
$= \sqrt{16} \cdot \sqrt{3}$
$= \sqrt{16 \cdot 3}$
$= \sqrt{48}$

- Use the Multiplication Property of Radicals (re-write 4 as a radical…..think …..$4 = \sqrt{?}$…..$\sqrt{16}$!)
- Combine these under the same radical sign and multiply

(***NOTICE…these are the *opposite* steps to writing an entire radical as a mixed radical)

Ex. 1) Write each as an entire radical:

a) $5\sqrt{2}$ b) $3\sqrt{3}$ c) $3\sqrt[3]{2}$ d) $2\sqrt[3]{6}$

What do you do if the index is 4 or 5 (or higher?)

Write $3\sqrt[5]{2}$ as an entire radical:

First, re-write 3 as $\sqrt[5]{?}$ …. $3 = \sqrt[5]{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3} = \sqrt[5]{243}$

So now, $3\sqrt[5]{2}$
$= 3 \cdot \sqrt[5]{2}$
$= \sqrt[5]{243} \cdot \sqrt[5]{2}$ now, using the Multiplication Property of Radicals…
$= \sqrt[5]{243 \cdot 2}$
$= \sqrt[5]{486}$

Ex. 2) Write each as an entire radical:

a) $2\sqrt[4]{5}$ b) $4\sqrt[5]{2}$

How can entire radicals be used to help you order a set of mixed radicals with the same index?	Ex. 3) Arrange the following in order from greatest to least: $3\sqrt{5}, 2\sqrt{13}, 4\sqrt{3}, 2, 9\sqrt{2}$

Reflection: How do you use the index of a radical when you write a mixed radical as an entire radical? Use an example to help your explanation