2. Evaluate each radical. Justify your answer.

a) $\sqrt{36} = 6$ b) $\sqrt[3]{8}$ 2 c) $\sqrt[4]{10\,000} = 10$ d) $\sqrt[5]{-32} = -2$

e) $\sqrt[3]{\frac{27}{125}}$ f) $\sqrt{2.25}$ g) $\sqrt[3]{0.125}$ h) $\sqrt[4]{625}$

$2 \times 2 = 4$

$-2 \times -2 = 4$

$\sqrt{-9}$

$-2 \times -2 \times -2 = -8$

$\sqrt[3]{-8}$

4.1 Math Lab: Estimating Roots

$-\sqrt{9}$

-3

4. a) What happens when you attempt to determine the square root of a number such as –4? Explain the result.
b) For which other radical indices do you get the same result with a negative radicand, as in part a?
c) When a radicand is negative:
i) Which types of radicals can be evaluated or estimated?
ii) Which types of radicals cannot be evaluated or estimated?

4.1 Math Lab: Estimating Roots

5. For each number below, write an equivalent form as:
i) a square root ii) a cube root iii) a fourth root
a) 2 b) 3 c) 4 d) 10 e) 0.9 f) 0.2

$\sqrt{4} = 2$

$\sqrt[3]{8} = 2$

$\sqrt[4]{16} = 2$

4.1 Math Lab: Estimating Roots

6. Choose values of n and x so that $\sqrt[n]{x}$ is:
   a) a whole number
   b) a negative integer
   c) a rational number
   d) an approximate decimal

Verify your answers.

a) $\sqrt{9} = 3$

b) $\sqrt[3]{-27} = -3$

c) $\sqrt{4} = 2$

$\sqrt{\frac{4}{9}} = \frac{2}{3}$

d) $\sqrt{10}$

4.1 Math Lab: Estimating Roots

Number systems

Natural Numbers	N
Whole Numbers	W
Integers	I
Rational	Q
Irrational	$\overline{Q}$
Real	R

Natural Numbers : Ex. 1, 2, 3, 4 ... Ex. 1, 2, 3 etc

Whole Numbers: Counting numbers including zero.
Ex. 0, 1, 2, 3, etc Ex. 0, 1, 2, 3...

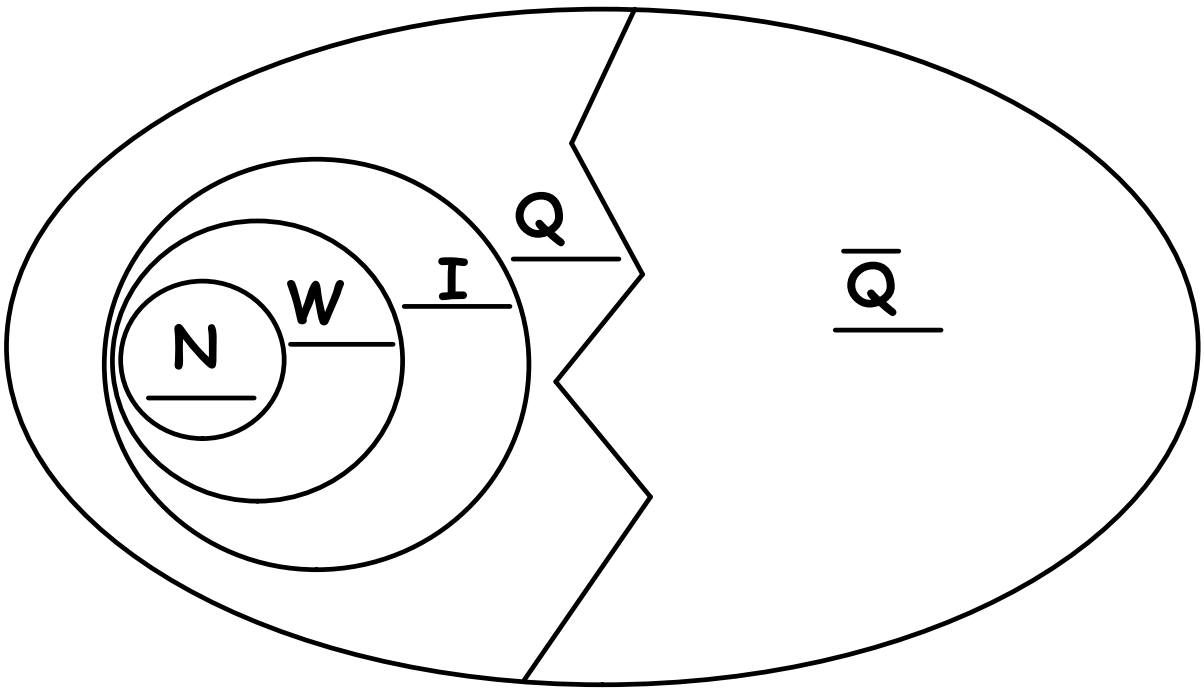
Integers: Are all positive and negative whole numbers.
(Remember zero is neither negative or positive)
Ex: ....3,2,1,0,-1-2,-3...
Ex. -3, -2, -1, 0, 1, 2, 3...

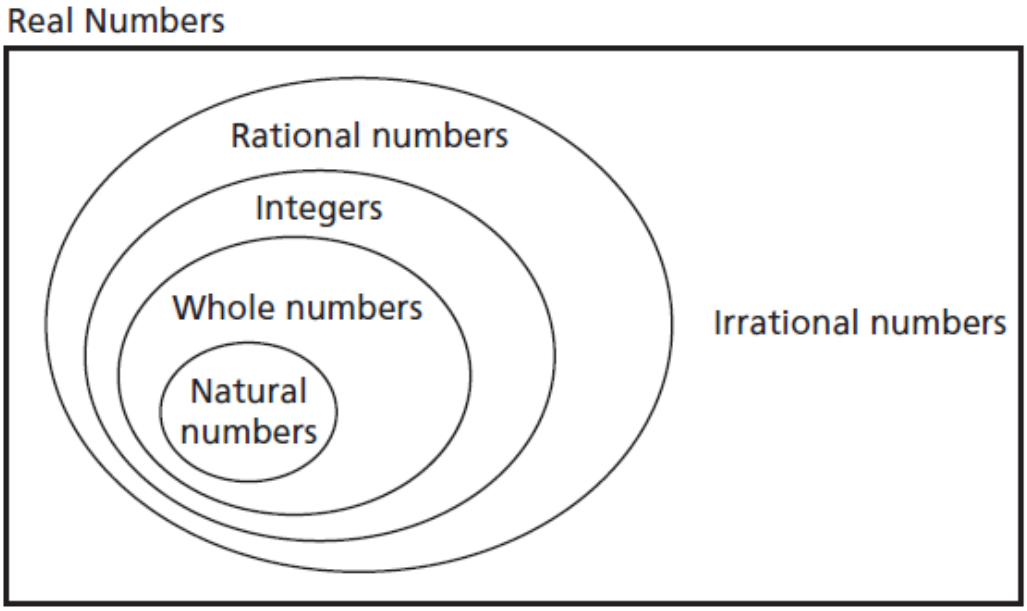
Rational Numbers: All whole numbers, fractions, mixed numbers, decimals and their negatives
The decimal must repeat or terminate also.
Ex: 1/3, 4, 3/4, -7/10 etc

Irrational Numbers: Decimals that never terminate or repeat.
Ex: $\sqrt{2}$ π

Real Numbers: All rational and irrational numbers are real numbers
Ex: All possible numbers

TITLE: Real #s





These are rational numbers.	These are not rational numbers.
$\sqrt{100}$ $\sqrt{0.25}$ $\sqrt[3]{8}$ 0.5	$\sqrt{0.24}$ $\sqrt[3]{9}$ $\sqrt{2}$
$\frac{5}{6}$ $\sqrt{\frac{9}{64}}$ 0.8^2 $\sqrt[5]{-32}$	$\sqrt{\frac{1}{3}}$ $\sqrt[4]{12}$

-2 $\frac{\sqrt{1}}{\sqrt{3}}$

WHICH OF THE FOLLOWING RADICALS ARE:

RATIONAL? **IRRATIONAL?**

$$\sqrt{1.44},\ \sqrt{\frac{64}{81}},\ \sqrt[3]{-27},\ \sqrt{\frac{4}{5}},\ \sqrt{5}$$

Q Q Q Q Q

$\frac{\sqrt{64}}{\sqrt{81}} = \frac{8}{9}$

Exercise

Complete the table.

	N	W	I	Q	$\overline{Q}$	R
5	✓	✓	✓	✓		✓
-2			✓	✓		✓
$\frac{3}{4}$				✓		✓
-1.3				✓		✓
$\sqrt{7}$					✓	✓
$\sqrt{9.5}$					✓	✓

EXAMPLE:

Order the following radicals from least to greatest.

$\sqrt[3]{13}, \sqrt{18}, \sqrt{9}, \sqrt[4]{27}, \sqrt[3]{-5}$

2.2 4.2 3 2.2

$\sqrt[3]{-5}, \sqrt[4]{27}, \sqrt[3]{13}, \sqrt{9}, \sqrt{18}$

YOU TRY!

Order the following radicals from least to greatest.

$\sqrt{2}, \sqrt[3]{-2}, \sqrt[3]{6}, \sqrt{11}, \sqrt[4]{30}$

② ① ③ ⑤ ④

1.2 (-1) 1.8 3.3 2.3

Check your understanding worksheet.

Do half from each question!

Warm-up 'Quiz' tomorrow!!! Practice radicals, estimation, ordering, number systems!

Check Your Understanding

1. Use mental math to calculate each root.

a) $\sqrt{36}$ **b)** $\sqrt{144}$ **c)** $\sqrt[3]{27}$ **d)** $\sqrt[3]{-64}$

2. Use mental math to calculate each root.

a) $\sqrt{3 \cdot 3 \cdot 3 \cdot 3}$ **b)** $\sqrt{2^{12}}$ **c)** $\sqrt[3]{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}$ d) $\sqrt[3]{9^6}$

3. a) A square has an area of 196 cm^2. Calculate its side length.

b) A cube has a volume of 216 cm^3. Calculate its edge length.

4. Use a calculator to calculate each square root.
Write the answer to 2 decimal places where necessary.

a) $\sqrt{289}$ **b)** $\sqrt{3.24}$ **c)** $\sqrt{1000}$ **d)** $\sqrt{\frac{3}{5}}$

Check Your Understanding

1. Write each expression as a power.

a) $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$
b) $(-7)(-7)(-7)(-7)(-7)(-7)(-7)(-7)$
c) $10 \cdot 10 \cdot 10 \cdot 10$
d) $(-5)(-5)(-5)$

2. Write each power as repeated multiplication.

a) 7^6 **b)** $(-17)^5$
c) 100^3 **d)** $(-99)^4$

3. Use mental math to calculate each power.

a) 3^3 **b)** 2^4
c) $(-5)^2$ **d)** $(-4)^3$

4. Use a calculator to calculate each power.

a) 13^5 **b)** 72^4
c) $(-24)^4$ **d)** $(-8)^9$

5. A shelf contains 8 boxes. Each box contains 8 cartons.
Each carton contains 8 pens. Write the number of pens as a power.
How many pens are on the shelf?