Rational & Irrational

Rational Numbers: any number that is an integer, fraction, decimal (terminating or repeating), & radical (perfect square).

Rational #'s:

3.14 0.5 $\frac{1}{2}$ $0.\overline{3}$ $\frac{5}{3}$ $\sqrt{64}$

Integers: Whole's & Opposites

$-2, -1, 0, 1, 2$

Whole #s: & Counting

$0, 1, 2, 3, 4 \ldots$

Irrational Numbers: any number that is a decimal (nonterminating & non repeating) & radical (nonperfect square).

Irrational #s:

π $3.121221222\ldots$

$\sqrt{3}$ $-\sqrt{17}$

$\sqrt{2}$ $13.71289\ldots$

Rational & Irrational Rules

Finding the sum/diff & products of rational & irrational numbers.

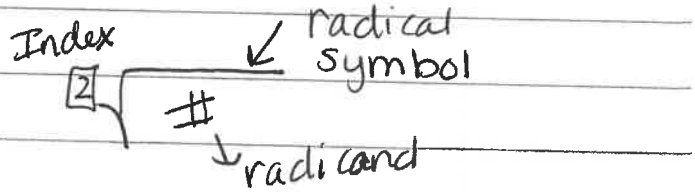
ALWAYS

- $R \pm R = R$
  - $5 + 2 = 7$ ✓
  - $5 + \sqrt{25} = 10$ ✓
- $R \pm I = I$
  - $5 + \pi = 8.14...$ ✓
  - $5 + \sqrt{3} = 5 + \sqrt{3}$
- $R \times R = R$
  - $5 \cdot 2 = 10$
  - $5 \cdot \sqrt{25} = 25$
- $R \times I = I$
  - $5 \times \pi = 5\pi$
  - $5 \times \sqrt{3} = 5\sqrt{3}$

SomeTimes

- $I \pm I = ?$
  - $\sqrt{5} + \sqrt{5} = 2\sqrt{5}$ I
  - $\sqrt{5} - \sqrt{5} = 0$ R
- $I \times I = ?$
  - $\sqrt{5} \times \sqrt{3} = \sqrt{15}$ I
  - $\sqrt{5} \times \sqrt{5} = \sqrt{25} = 5$ R

Simplifying Radicals



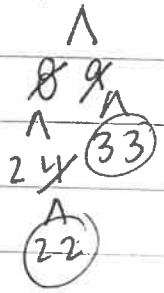
To simplify means to completely reduce to find another expression w/ the same value.

It does not mean to find a decimal approximation.

Steps:

1. Make a factor tree
2. Since "2" is the index, find the square root by grouping like factors in pairs.
3. Pairs go outside of radical, singles stay in.
   * multiple values in/out are to be multiplied.

a) $\sqrt{72}$



pairs singles

$3 \cdot 2\sqrt{2}$

$= 6\sqrt{2}$

b) $\sqrt{225}$

pairs sing

$5 \cdot 3$

$= 15$

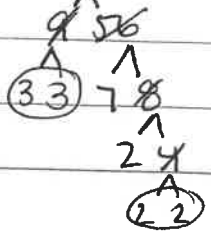
c) $\sqrt{56}$

pairs sing.

$2\sqrt{2 \cdot 7}$

$= 2\sqrt{14}$

d) $\sqrt{504}$



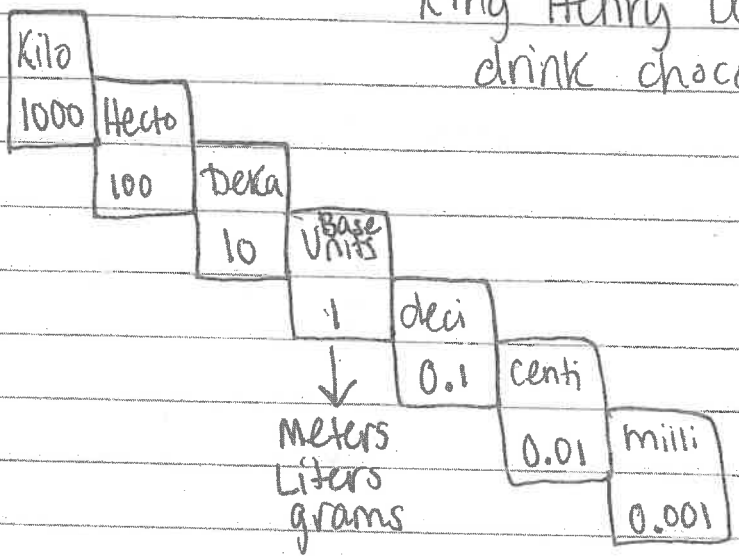
$2 \cdot 3\sqrt{7 \cdot 2}$

$= 6\sqrt{14}$

(4)

Metric System

"King Henry Doesn't usually drink chocolate milk"



How to use the ladder method?

1. determine the starting point
2. count the "jumps" to your ending point
3. move the decimal the same number of jumps in the same direction

Ex: K H D **u** d c m
3→

4 km = 4000 m
4,000

K H D **u** d c m
<3

250 m = .250 km
.250

1000 mg = 1 g
K H D **u** d c m
lee

14 km = 14,000 m
K H D **u** d c m
3→
14.000

Unit Conversions - English

Numbers w/ units are important.
Units are a comparison to a standard measurement.

Examples of units

Length or distance
time
volume
weight
mass
speed

When calculating the number & units, you must carry along the unit & do the same calculation on the unit as the number. Sometimes units are cancelled during calculations. (cancel top & bottom)

Ex: 3 miles = 15,840 ft $\frac{3 \text{ mile}}{1} \times \frac{5280 \text{ ft}}{1 \text{ mile}}$

19 in = 1.58 ft $\frac{19 \text{ in}}{1} \times \frac{1 \text{ ft}}{12 \text{ in}}$

5400 in = 0.085 miles $\frac{5400 \text{ in}}{1} \times \frac{1 \text{ ft}}{12 \text{ in}} \times \frac{1 \text{ mile}}{5280 \text{ ft}}$

4 gallons to pints

$$\frac{4 \text{ gallons}}{1} \times \frac{4 \text{ qts}}{1 \text{ gal}} \times \frac{2 \text{ pts}}{1 \text{ qt}} = 32 \text{ pts}$$

Convert 32 ft/sec to in/min.

$$\frac{32 \text{ ft}}{1 \text{ sec}} \times \frac{12 \text{ in}}{1 \text{ ft}} \times \frac{60 \text{ sec}}{1 \text{ min}} = 23{,}040 \text{ in/min}$$

Algebraic Expressions

Parts to an algebraic expression.

$3x + 4$ ← constant

- 3 ↗ Coefficient: # in front of the variable
- x ↑ variable: letter that represents a number
- $+$ ↖ Operation
- constant ↓ a number that never changes

Words in Math

addition

add
sum
Increased by
together
More
and
Plus
combined

Subtraction

subtract
difference
decreased by
minus
take away

Division

Quotient
Shared
Per
Ratio
Divided By

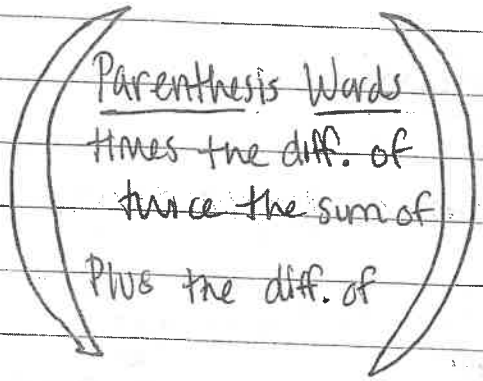
Multiplication

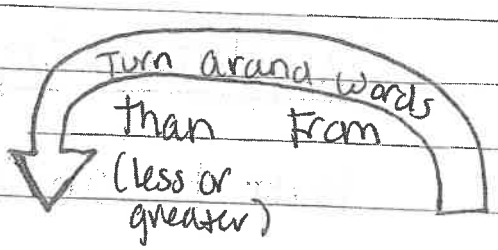
Product
times
Of
Multiply
twice

Equals

IS

are
were
give
will be
total


Parenthesis Words
times the diff. of
twice the sum of
Plus the diff. of


Turn around words
than from
(less or greater)

Adding & Subtracting Polynomials

Monomial: 1 term given by a number, variable or product of both. 4, x, $4x$, $4xy$

Binomial: 2 terms given by two different monomials together by operations. $5x-3$, $3x^4-x^2$

Polynomial: 3 or more terms give by monomials together by operations. $3a^2-5a+4$

Add: Ex $(x^3+3x+1)+(4x^3+5)$ ← Just Combine

$= 5x^3+3x+6$

Ex $(2a^3+3a^2+5a)+(a^3+4a+3) = 3a^3+3a^2+9a+3$

Subtract: Keep Change Change

Ex $(3x^3+2x+7)+(-x^2+x-4) = 2x^2+x+3$ (K, C, KCC)

Ex $(9y^2-3y+1)+(-2y^2+y+9) = 7y^2-4y+10$ (K, C)

Multiplying Polynomials

*When multiplying variables we add the values of the exponents.

EX) $4(2x-5) = 8x-20$
Distribute

EX) $3a^1(8a^1+12)$
$= 24a^2+36a$

EX) $6r^1s^1(r^2s^1-3) = 6r^3s^2-18r^s$

EX) $4t^2(3t^2+2t^1-5) = 12t^4+8t^3-20t^2$

Binomial x Binomial

First
Outside
Inside
Last

OR

two times over

two times under

$(2x^1+3)(5x^1+8)$

$10x^2+16x+15x+24$

Combine like terms

$10x^2+31x+24$

EX) $(3n-8)^2$ ← write out twice

$(3n^1-8)(3n^1-8)$

$9n^2-24n-24n+64$

$9n^2-48n+64$