## G.E.M.D.A.S

Grouping, Exponents, Multiplication, Division, Addition, Subtraction

## Term

A component of a logical or mathematical expression.

## Expression

A finite combination of symbols that are well-formed according to applicable rules.

## Variable

A symbol that represents a quantity in a mathematical expression, as used in many sciences.

## Constant

A non-varying value.

## Coefficient

A multiplicative factor in some term of a polynomial, a series, or any expression.

## LCM

Least Common Multiple

- < Less Than
- > Greater Than

## Absolute Value

The distance a number is from 0 on a number line. (Can never be negative.)

## Simple Interest Formula

I=Prt -P=principal (original amount of money) -r=interest rate (written as a decimal) -t=time (years) Slope-Intercept Form y=mx+b -m=slope -b=y-intercept Celcius to Fahrenheit Conversion Formula F=(9/5)C+32 -F=degrees (fahrenheit) -C=degrees (celsius) Function Notation

y=f(x), the value of the function when x is a certain value.

## Relation

A mapping, or pairing, of input values with output values.

## Domain

Set of all input values.

### Range

Set of all output values.

#### Function

A relation for which each input has exactly one output.

## Vertical Line Test

A relation is a function if and only if no vertical line intersects the graph of the relation at more than one point.

## Slope

Denoted by 'm,' of a non-vertical line is the ratio of the vertical change to the horizontal change.

## Parallel Lines

Lines are parallel if and only if they have the same slope.

## Perpendicular Lines

Lines are perpendicular if and only if they have negative reciprocal slopes.

## Rate of Change

Slope that represents how much one quantity changes on average, relative to the change in another quantity.

## Parent Function

The most basic function in a family. Standard Form of Linear Equations A linear equation in the form 'Ax+By=C.'

## Point-Slope Form

y – y1 = m(x – x1). -m=slope -(x1,y1)=a given point

## Absolute Value Graphs

General Equation of an Absolute Value Function y=a|x-h|+k -a=rate of change -(h,k)=vertex

### **Piecewise Functions**

A function that is defined by more than one function.

#### Substitution

#### Elimination

## Vertex Form of Quadratic Functions

y=a(x-h)^2 +k -a≠0 -the graph is a parabola -Parent Function is f(x)=x^2

#### Parabola

### Properties of Quadratics in Vertex Form

-The vertex is (h,k) -The axis of symmetry is x=h -If a > 0, the parabola opens up -If a < 0, the parabola opens down -If |a| > 1, the parabola is thinner than the parent -If |a| < 1, the parabola is wider than the parent Stepdard Form of Ourdratic Func-

### Standard Form of Quadratic Functions

y=ax^2 +bx+c -a≠0

### Properties of Quadratics in Standard Form

- -The vertex is (-b/2a , f(-b/2a))
- -The axis of symmetry is x=-b/2a
- -The y-intercept is C
- -If a > 0, the parabola opens up
- -If a < 0, the parabola opens down
- -If |a| > 1, the parabola is thinner than the parent
- -If |a| < 1, the parabola is wider than the parent

#### Zero Product Property

If AB=0, then A=0 or B=0.

### GCF

Greatest Common Factor

Difference of Squares

## Square Root

A number, 'r,' is a square root of a number, 's,' if r<sup>2</sup>=s. -3<sup>2</sup>=9 and (-3)<sup>2</sup>=9 so 3 and -3 are square roots of 9

## Principal Square Root

The positive square root.

#### Radical

Operator to the square root.

#### Radicand

Expression under the radical.

#### Conjugate

Used to rationalize the denominator of a fraction.

#### **Imaginary Numbers**

A complex number that can be written as a real number multiplied by the imaginary unit 'i.'

#### Properties of 'i'

-'i'='i' -'i^2'=-1 -'i^3'='-i'

## **Complex Numbers**

A number that can be expressed in the form 'a+bi,' where 'a' and 'b' are real numbers and 'i' is the imaginary unit, that satisfies the equation i^2=-1.

#### Completing the Square

#### Quadratic Formula

#### Discriminant

A function of a polynomial's coefficients, giving information about the nature of its roots.

-If b^2-4ac > 0, the (2) roots are positive

-If b^2-4ac < 0, the roots are negative and imaginary

-If b^2-4ac = 0, the (1) root equals zero

## Vertical Motion Quadratic Function

h(t)=-16t^2+vt+s

-h=height of object (feet)

-t=time (seconds)-v=initial velocity of object (ft/sec)-s=initial height of object (feet)

#### **Exponent Rules**

```
-a^{m} * a^{n} = a^{m+n}
-a^m / a^n = a^m-n. (a\neq0)
-(a^m)^n = a^mn
-(ab)^n = a^n * b^n
-(a/b)^n = a^n / b^n
-a^-n = 1/a^n
-a^0 = 1. (a\neq0)
```

#### Synthetic Substitution

#### Polynomial Long Division

## Synthetic Division

## Two-Step Factoring

First, factor out any GCF from the original problem, then factor normally.

Factoring by Grouping

The process of factoring four terms by grouping them in pairs, factoring the GCF from each pair, and looking for a common binomial factor.

Factoring Polynomials in Quadratic Form

It is sometimes necessary to factor out any factor that might be common to all terms first. The two terms in  $5x^2 - 10$ , for example, both contain the factor '5'. This means that the expression can be rewritten as  $5(x^2 - 2)$ .

### Factoring with Cube Patterns

## Polynomial Function

f(x)=ax^n +bx^n-1 +cx^n-2+...+dx+e

-a=leading coefficient

-n=degree

#### Polynomial Graphs

## Extrema

The collection of the largest and smallest values of a function.

#### Relative (Local) Extrema

The collection of the largest and smallest values of a function within a given range.

## Absolute (Global) Extrema

The collection of the largest and smallest values on the entire domain of a function.

## End Behavior

The behavior of the graph of f(x) as 'x' approaches positive infinity or negative infinity.

## Root / X-Intercept / Zero

Where a function crosses the x-axis. Annual Price of Gasoline Cubic Function  $c(t)=0.0007t^3 - 0.014t^2 + 0.08t + 0.96$ Radical Form to Rational Exponent Conversion  $\sqrt[4]{81=81^1/4}$ 

# Even Roots:

-a < 0: no real nth roots</li>
-a = 0: one real nth root (0)
-a > 0: two real nth roots

# Odd Roots:

one real nth root

# Rational Exponent Rules

 $-a^{m} * a^{n} = a^{m+n}$   $-(a^{m})^{n} = a^{m}$   $-(ab)^{m} = a^{m} * b^{m}$   $-a^{-m} = 1/a^{m}$   $-a^{m} / a^{n} = a^{m-n}$ .  $-(a/b)^{m} = a^{m} / b^{m}$  $-ax^{m} \pm bx^{m} = (a \pm b)x^{m}$ 

## Simplest Form of Radicals

No perfect nth powers as factors and any denominator has been rationalized.

### **Product Property of Radicals**

√ab = √a \* √b

### **Quotient Property of Radicals**

 $\sqrt{(a/b)} = (\sqrt{a}) / (\sqrt{b})$ 

### **Power Function**

y=ax^b, where 'a' is a real number and b is a rational number.

# Composition of a Function

h(x)=g(f(x)), the pointwise application of one function to the result of another to produce a third function.

# Inverse Relation

An interchange of the input and output values of the original relation.

## **Inverse Function**

When both the original relation and the inverse relation are functions.

-Written as f^-1(x)

☆ NOT A NEGATIVE EXPONENT!

## Horizontal Line Test

The inverse of a function 'f' is also a function if and only if no horizontal line intersects the graph of 'f' more than once.

## Square Root Function

 $f(x) = \sqrt{x}$ 

f(x)=√(x-h)

Translates square root function 'h' units horizontally.

 $f(x)=(\sqrt{x})+k$ 

Translates square root function 'k' units vertically.

## Cubic Root Function

 $f(x) = a(\sqrt[3]{(x-h)}) + k$ 

a:

-if |a|gets bigger, then there is a vertical stretch

-if |a| gets smaller, then there is a vertical shrink

-if a is negative, then the graph flips

h:

-translates graph 'h' units horizontally

k:

-translates graph 'k' units vertically

Exponential Function

 $y=a(b)^{x}$ , a function in which the variable is in the exponent.

-a=initial value

-b=growth/decay factor

## **Exponential Growth Function**

An exponential function that 'grows' away from the asymptote as you move left to right. -b > 1

# **Exponential Decay Function**

An exponential function that 'decays' towards the asymptote as you move left to right. -0 < b < 1

### Asymptote

An imaginary line that a graph approaches more and more closely.

## Percent Increase Model

```
y=a(1 + r)<sup>*</sup>t
-a=initial value
-r=% increase (or decrease)
-t=time
```

## Percent Decrease Model

```
y=a(1 - r)<sup>t</sup>
-a=initial value
-r=% increase (or decrease)
-t=time
```

#### е

The base of the natural logarithm. Approximately equal to 2.718281828459, it is the figurative asymptote of the function  $(1+1/n)^n$ .

## Periodic Compounding Interest Formula

A=P(1+r/n)^nt

-A=amount of money after 't' years

-P=principal (original amount of money)

-r=interest rate (written as a decimal)

-n=number of times the interest is compounded (paid) per year

### Continous Combounding Interest Formula

#### A=Pe^rt

-A=amount of money after 't' years

-P=principal (original amount of money)

-r=interest rate (written as a decimal)

### Logarithm

The inverse operation to exponentiation. y = log(b) x if and only if  $b^y = x$ 

-b > 0 -b ≠ 1 -x > 0

#### Common Logarithm

log(10) x written as log x

#### Natural Logarithm

log(e) x written as ln x

#### Logarithmic Functions

Properties of Logarithms

 $-\log(b) xy = \log(b) x + \log(b) y$ 

 $-\log(b) x/y = \log(b) x - \log(b) y$ 

 $-\log(b) x^{y} = y\log(b) x$ 

#### Change-Of-Base Formula

log(c) a = (log a) / (log c)

#### **Properties of Equality**

 $-b^{x} = b^{y}$  if and only if x=y -log(b) x = log(b) y if and only if x=y (b > 0, b  $\neq$  1)

## **Rational Functions**

y=(a/(x-h)) + k, a polynomial divided by a polynomial.

#### Finding Vertical Asymptotes of a Rational Function

Set denominator equal to zero.

### Finding Horizontal Asymptotes of a Rational Function

-If power on bottom is bigger, then set 'y' equal to zero

-If power on top is bigger, there is no asymptote

-If powers are the same, then asymptote is coefficients

### Finding X-Intercepts

Find 'x' when y=0 Finding Y-Intercepts Find 'y' when x=0

#### **Excluded Values**

Values that are left out. (Make the denominator zero.)

**Complex Fractions** 

## **Extraneous Solution**

A solution that emerges from the process of solving the problem but is not a valid solution to the original problem.

Distance Formula Midpoint Formula Vertex of a Parabola Axis of Symmetry

## Focus

A fixed point used with a directrix to define a parabola.

### Directrix

A fixed line used to define a parabola. Every point on the parabola is equidistant from the directrix and a fixed point called the focus.

## Transformational Form of a Parabola

 $-(x-h)^2 = 4p(y-k)$ , opens up or down with a vertex at (h,k).

 $-(y-k)^2 = 4p(x-h)$ , opens left or right with a vertex at (h,k).

р

Distance between the vertex and the focus. Also, the distance between the vertex and the directrix.

## Focal Width

The width of the parabola at the focus. The width is 4p.

# Ellipse

A regular oval shape, traced by a point moving in a plane so that the sum of its distances from two other points is constant, or resulting when a cone is cut by an oblique plane which does not intersect the base.

# Vertex of an Ellipse

The endpoints of the major axis of the ellipse. 'a' units from the center.

## Major Axis

Line through the widest part of an ellipse. '2a' units long.

### Minor Axis

The shorter axis of an ellipse and perpendicular bisector of the major axis with endpoints on the ellipse. '2b' units long.

## Co-Vertex of an Ellipse

The endpoints of the minor axis of the ellipse. 'b' units from the center.

Focus of an Ellipse

One of the two points that can be used to define an ellipse. For every point on an ellipse, the distance from the point to one focus, plus the distance from the point to the other focus, is equal to some constant value. Another name for a focus is a focal point. The plural of focus is foci. 'c' units from the center.  $c^2=a^2 - b^2$ .

## Standard Equation of a Horizontal Ellipse Standard Equation of a Vertical Ellipse

# Circle

The set of all points in a plane that are the same distance from a given point called the center.

# Standard Equation of a Circle

(x-h)<sup>2</sup> + (y-k)<sup>2</sup> = r<sup>2</sup> -(h,k)=any given point on the circle -r=radius

# Hyperbola

An open curve formed by a plane that cuts the base of a right circular cone. The set of all points in the plane such that the absolute value of the difference of the distances from two given points in the plane, called foci, is constant.

## Center of a Hyperbola

The point halfway between the vertices of a hyperbola, or the midpoint of the transverse axis of a hyperbola. The center of a hyperbola is the point where the asymptotes intersect.

# Foci of a Hyperbola

The absolute value of the difference of the distances from the two given points in the plane. 'c' units from center.  $c^2=a^2 + b^2$ .

### Transverse Axis

The axis of symmetry of a hyperbola that contains the vertices, and segment that connects the two vertices of the hyperbola.

## Conjugate Axis

The line segment of length '2b' that is perpendicular to the transverse axis and has the center of the hyperbola at its midpoint.

Vertices of a Hyperbola The endpoints of the transverse axis of the hyperbola. Standard Equation of a Horizontal Hyperbola Standard Equation of a Vertical Hyperbola Matrix A rectangular pattern of data with rows and columns.

#### Matrix Dimension

The dimensions of a matrix are read row by column.