Math 1 Unit 1 EOC Review

Solving Equations (including Literal Equations)

- Get the variable by itself to show what it equals to satisfy the equation or inequality
- Steps (each step only where necessary):

$3(x+2)=5x+10$ | $4x+5-8=3x$

1. Distribute — $3x+6=5x+10$ | —
2. Same Side Combine (like terms) — — | $4x-3=3x$
3. Opposite Sides Cancel (a variable) — $6=2x+10$ | $-3=-x$
4. Solve two-step equation — $-4=2x$, $\boxed{-2=x}$ | $\boxed{3=x}$

Concept Questions:

1. Why do we use "opposite" operations to solve an equation?

Sample: To either add 0 or multiply times 1 in the equation so the variable can be isolated

2. What does the solution to an equation represent?

Sample: The value that gives the same amount on both sides to be a true statement.

3. What key words in a word problem can help determine the operations to set up an equation?

Sample: Total - Multiply or Add   Less than - Subtract

Each - Divide   More than - Add

Parts of Expressions

Coefficient - Number beside a variable   Variable - Letter that represents a number

Constant - Number by itself   Exponent - Raised number, represents a power

In the expression $5x^3 - 7x^2 + 4$, name the: Term(s) - $5x^3$, $-7x^2$, 4

Coefficient(s) - 5, -7   Variable(s) - x   Constant(s) - 4   Exponent(s) - 3, 2

Concept Question:

1. What is the difference between how terms are separated in expressions and how factors are separated?

Sample: Terms are separated by + or -, factors are multiplied

Function Intro

A function is a rule in which each input (usually x) yields exactly one output (usually y).

Domain - All x-coordinates Range - All y-coordinates

When we evaluate functions, we substitute the input variable and evaluate the expression.

Example: Evaluate h(4) for $h(t) = -4.9t^2 + 20t + 3$.

$h(4) = -4.9(4)^2 + 20(4) + 3$

$h(4) = 4.6$

Concept Question: Write a mathematical relation that is NOT a function (has more than one y for an x) and explain.

Sample:

x	-2	-1	0	1	2	2
y	8	3	13	-2	5	4

When x = 2, y = 5 and 4 - NOT a function.

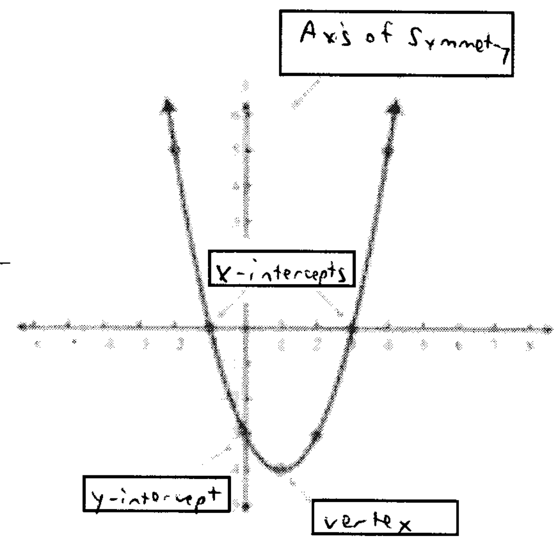
Key Features of Graphs

Intercepts: Points where a graph intersects the x or y axis.

Vertex: minimum or maximum

point on a function

Axis of Symmetry: Line that cuts a function "in half" so it reflects on itself



A.

Concept Questions:

1. What is the x-value for every y-intercept? What is the y-value for every x-intercept? Why are these the case?

0 Like (0, 2)

0 Like (-3, 0)

Y-intercept - Point does not move across, so x = 0

X-intercept - Point does not move up or down, so y = 0

2. Does the graph of a line have a vertex? Why or why not?

No, because it has a constant slope forever with no minimum or maximum

Math 1 Unit 2 EOC Review

Linear Equation

$$y = mx + b$$

(x, y) – Points on the line with x = x-coordinate and y = y-coordinate

m – Slope (or rate of change) – constant rate by which dependent variable increases or decreases as the independent variable increases

b – Y-Intercept – value of the equation when $X = 0$

Concept Questions:

1. In a linear function f(x) = mx + b, what are the terms, coefficients, variables, and constant?

Terms: mx, b Coefficient - m Variables - f(x), x Constant - b

Slope/Rate of Change

Rate of change - $\frac{\text{Change in } Y}{\text{Change in } X}$ for any defined region. Give two points, use the formula $\frac{Y_2 - Y_1}{X_2 - X_1}$

In a line, the rate of change (called slope) is constant.

Concept Questions:

1. Why does a line have a constant slope but a parabola does not?

In a line, the independent variable (x) is multiplied (repeated addition) by the same amount. In a parabola, the rate of change increases as the independent variable increases or decreases.

2. What are some clues in word problems that would help indicate the slope?

Sample: Per, Every

Graphs of Linear Equations

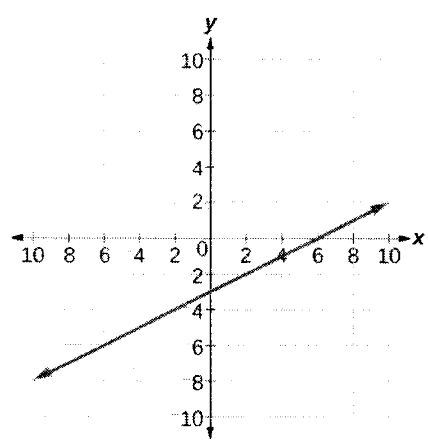
For the graph to the right:

x-intercept = 6 y-intercept = -3

Slope = $\frac{1}{2}$ Equation = $y = \frac{1}{2}x - 3$

Table of values:

x	-2	-1	0	3	6	9
y	-4	-3.5	-3	-1.5	0	1.5



Concept Questions:

1. How can the x-intercept help determine the equation of the line?

It has the point with coordinates (x, 0) to help find the slope.

2. Write a word problem that could be solved using the graph above.

You owe a friend $3, and you pay him $.50/day. How many days will it take until you are even?

Math 1 Unit 3 EOC Review

Midpoint and Distance Formulas

Distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ Midpoint = $(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})$

Concept Questions:

1. How is the distance formula the same as the Pythagorean Theorem?

If you use the points to draw a right triangle, $(x_2 - x_1)$ and $(y_2 - y_1)$ find the length of the legs. The distance represents the hypotenuse.

2. Why do we divide by 2 to compute the midpoint?

You are finding the middle, or average, of the coordinates, so add them and divide by 2.

Parallel and Perpendicular Slopes

Parallel lines - Never intersect, have Same slope

Perpendicular lines – Intersect at a right angle, have opposite reciprocal slopes

(For a perpendicular line, flip the fraction, flip the Sign)

Concept Question:

1. If a triangle has two sides with opposite reciprocal slopes, what kind of triangle is it? How do you know?

Right triangle, because two sides are perpendicular

Graphing Inequalities

To graph inequalities, first graph the line that represents the bound for the inequality.

If the inequality is < or >, use a dashed line. If the inequality is ≤ or ≥, use a solid line.

Then, shade above if y > or ≥ the expression, shade below if y < or ≤ the expression.

Concept Question:

1. How many solutions are there for an inequality? Why?

Infinite, because the solution is every point that is > or < a value.

2. To solve a system of two inequalities by graphing, how can you tell which region represents the solution?

The overlap of the half-planes created by the graphs of the two inequalities

Arithmetic Sequences

Arithmetic Sequence – sequence of numbers that increases or decreases by a constant rate, called the common difference.

Explicit Sequence: $a_n = a_1 + (n-1)d$ Recursive Sequence: $a_n = a_{n-1} + d$

n = number of the term a_1 = first term a_n = n_{th} term d = common difference

a_{n-1} = term before the n_{th} term

Conceptual Questions:

1. Could the function f(x) = 3x + 2 be an arithmetic sequence? What would be a_1 and d?

Yes, because it has a constant slope. $d = 3$, $a_1 = 2$ (when $x = 0$)

2. Why are arithmetic sequences and linear functions taught in the same unit?

They both increase or decrease by a constant value (slope or common difference).

Scatter Plots/Correlation

Calculator Steps for Linear Regression/Plotting Scatter Plots/Getting Line of Best Fit:

1. Push STAT-EDIT-enter all (x, y) values into table (X in L_1, Y in L_2)
2. To get equation of best-fit line, STAT-CALC-LinReg (#4) r is the correlation coefficient
3. To graph scatterplot, 2^{nd} – STAT PLOT – Plot1…On, then choose options

Concept Questions:

1. How can a linear regression (line of best fit) help solve problems?

It tells the slope and y-intercept to determine an equation for future values based on the data.

2. If most of the points on a scatterplot are far from the line of best fit, what will the r value be close to? How do you know?

0, because there will be a weak correlation

Solving Systems of Equations

System of Equations - Two equations with the same solutions

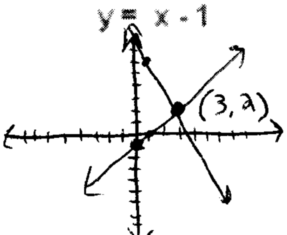
Methods to solve:

Graphing	Substitution	Elimination
- Graph both equations - The solution to the system is the intersection of the two graphs.	- Solve one equation for a variable - Substitute the expression for the variable in the other equation - Solve the equation for the first variable, then substitute again to solve for the second variable	- Multiply one or both equations if necessary to get same or opposite terms - Add or subtract the two equations (Same terms subtract, Opposite terms add) - Solve the "answer" equation for the first variable, then substitute to solve for the second variable

Systems that are parallel lines have no solutions, while systems with the same line have infinite solutions.

Examples: $y = -2x + 8$

$y = x - 1$



$7x + 6y = -9$
$y = -2x + 1$
$7x + 6(-2x+1) = -9$
$7x - 12x + 6 = -9$
$-5x + 6 = -9$
$x = 3$
$y = -2(3) + 1$
$y = -5$
$(3, -5)$

$2x + 4y = 36$
$+\ 3x - 4y = -6$
$5x = 30$
$x = 6$
$3(6) - 4y = -6$
$18 - 4y = -6$
$y = 6$
$(6, 6)$

Concept Question:

1. When is it easiest to solve a system by graphing, substitution, or elimination? Why?

Graphing - Both equations solved for y
Substitution - One equation solved for one variable
Elimination - Given same or opposite terms

Geometric Shapes Review

Quadrilateral: Polygon with four sides

Parallelogram: Quadrilateral with opposite sides equal AND parallel

Rectangle: Quadrilateral with four right angles, opposite sides equal and parallel

Square: Quadrilateral with all sides equal, opposite sides parallel, and all right angles

Rhombus: Quadrilateral with all sides equal and opposite sides parallel

Trapezoid: Quadrilateral with one pair of parallel sides

Math 1 Unit 4 EOC Review

Exponential Function Form

$y = ab^x$ (Growth or Decay)

y = dependent variable

a = initial (starting) value

b = rate of growth or decay

x = independent variable (often time)

When the rate is given as a percent, convert it to a decimal and write as $1+r$ for growth and $1-r$ for decay.

Concept questions:

1. Why do we use 1 ± r for the b value when r is given as a percent?

The rate starts at 100%, or 1, and adds or subtracts the r percentage.

2. Why is the rate of change for an exponential function NOT constant as it is for a linear function?

The independent variable multiplies as it increases, not adds or subtracts.

3. Which increases faster – exponential functions or linear functions? Why?

Exponential, because repeated multiplication will increase faster eventually than repeated addition.

Rewriting Exponents

Exponent Rules: $x^a \cdot x^b = X^{(a+b)}$ $\quad \frac{x^a}{x^b} = X^{(a-b)}$ $\quad (x^a)^b = X^{ab}$

$x^{-a} = \frac{1}{X^a}$ $\quad \sqrt{x^a} = X^{\frac{a}{2}}$

Concept Questions:

1. Why does the power rule $(x^a)^b = x^{ab}$ apply for exponents with common bases?

Example: $(X^2)^3 = X^2 \cdot X^2 \cdot X^2 = (x \cdot x) \cdot (x \cdot x) \cdot (x \cdot x) = X^6$

2. Why does taking the square root of an exponent divide the exponent by 2?

$$\sqrt{X^a} = (X^a)^{\frac{1}{2}} = X^{\frac{a}{2}}$$

Geometric Sequences

Geometric Sequence – sequence of numbers that multiplies by the same number to compute the next term. The number multiplied is called the common ratio.

Explicit Sequence: $a_n = a_1(r)^{n-1}$ Recursive Sequence: $a_n = ra_{n-1}$

n = number of term a_1 = first term a_n = n_{th} term r = common ratio

a_{n-1} = term before the n_{th} term

Conceptual Questions:

1. Could the function f(x) = $3(2)^x$ be an arithmetic sequence? What would be a_1 and r?

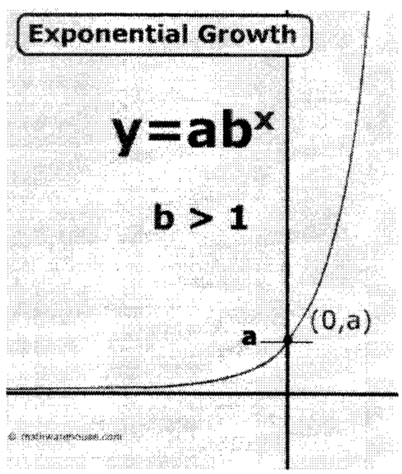
Yes, because it multiplies times a common factor. $r=2$, $a_1=3$ (when $x=0$)

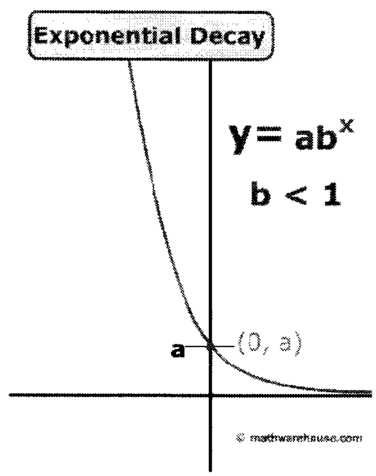
2. Why are geometric sequences and exponential functions taught in the same unit?

Both are multiplying by a common factor (common ratio or rate of change).

Exponential Graphs

Exponential functions are positive, with the parent function either increasing to infinity or decreasing to the x-axis.





Concept Questions:

1. Why is the *a* value the y-intercept of the parent function for exponential functions?

When $x=0$, the b^0 factor $=1$, so $a \cdot 1 = a$. $y=ab^0 \rightarrow y=a\cdot 1 \rightarrow y=a$

2. Why does a *b* value between 0 and 1 decrease?

The function gets a smaller value as it multiplies by a number between 0 and 1.
$100(\frac{1}{2}) = 50(\frac{1}{2}) = 25$, etc.

3. Why does an exponential parent function not have negative values?

Multiplying a positive a times a positive factor always gives a positive answer.

Math 1 Unit 5 EOC Review

Polynomial Operations

Multiplying: Distribute terms times EVERY other term

To distribute exponents, write the polynomial in parentheses and multiply out.

Adding or subtracting: Combine like terms.

Remember, you can NOT operate with variables in the calculator!

Example 1: $(2x-3)^2$

$(2x-3)(2x-3)$

$4x^2-6x-6x+9$

$4x^2-12x+9$

Concept Questions:

1. What is the difference between 2x + 2x and 2x(2x)?

$2x+2x=4x$ $\quad 2x(2x)=2\cdot2\cdot x\cdot x=4x^2$

2. Write two polynomials that you can NOT multiply using the "FOIL" trick, and explain why not.

$(x+3)(x^2+3x+2)$ because there are too many terms

Factoring

GCF	x^2+bx+c	ax^2+bx+c	Perfect Squares	
$10x^2-5x$	$x^2-9x-22$	$3x^2-13x-10$	x^2-49	$5x^3+500x$
$5x(2x-1)$	$-11+2=-9$	$-5=$	$\sqrt{x^2}=x$	$5x(x^2+100)$
	$-11\cdot2=-22$	-30, -13, $\frac{-15}{3}$, $\frac{2}{3}$	$\sqrt{49}=7$	Can't factor further
	$(x-11)(x+2)$	$(x-5)(x+\frac{2}{3})$	$(x+7)(x-7)$	
		$(x-5)(3x+2)$		

Concept Questions:

1. Why is a^2-b^2 NOT the same as $(a-b)^2$?

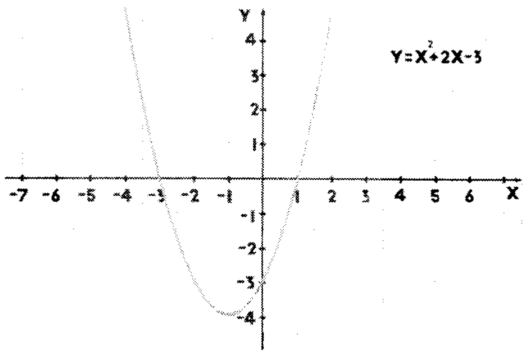
$(a-b)^2=(a-b)(a-b)=a^2-ab-ab+b^2 \rightarrow$ Middle terms aren't opposites

2. Why can we NOT just find two numbers that add to *b* and multiply to *c* to factor a trinomial with a > 1?

When the first term (ax) distributes, it will not equal the b value

Quadratic Graphs

The shape of the graph of a quadratic function (with degree, or highest exponent, of 2) is a parabola (U)



$f(x) = ax^2 + bx + c$

$f(x) = x^2 + 2x - 3$

X-Intercepts	Y-Intercept	Open Up or Down	Vertex	Axis of Symmetry
$-3, 1$	-3	$a > 0$ - up	$(-1, -4)$	$x = -1$
Solve = 0	C value	$a < 0$ - down	$x = \frac{-B}{2a}$	$x = \frac{-B}{2a}$, x-coordinate of vertex
$3 + -1 = 2$		$a = 1$, so up	$x = \frac{-2}{2(1)} = -1$	
$3 \cdot -1 = -3$			$y = (-1)^2 + 2(-1) - 3 = -4$	
$(x+3)(x-1) = 0$				
$x = -3 \quad x = 1$				

Concept Questions:

1. Why is the y-intercept equal to the *c* value?

   When $x = 0$, the other terms $(ax^2 + bx) = 0$, so $y = C$

2. Why are the x-intercepts the same as the solutions equal to 0?

   Where the equation $= 0$, $Y = 0$.

Solving by Factoring

To solve a quadratic by factoring, set the expression equal to 0, factor, and Solve Factors = 0.

You will get 2 solutions when solving a quadratic equation.

If both solutions are the same, the solution is a double root, and the vertex is on the x-axis.

Example: $x^2 - 5x = 14$

$x^2 - 5x - 14 = 0$

$-7 + 2 = -5$

$-7 \cdot 2 = -14$

$(x-7)(x+2) = 0$

$x - 7 = 0 \quad x + 2 = 0$

$\boxed{x = 7} \quad \boxed{x = -2}$

Concept Questions:

1. Why is it necessary to set the quadratic equal to 0 before solving?

   You know you will get a true statement because 0 times anything = 0, so the factors = 0 will make the equation true.

Math 1 Unit 6 EOC Review

Representations of Data

Very large quantities of data can be seen much easier using a box plot or histogram than a dot plot.

We can create these using our calculators to easily interpret the data.

Histograms are preferable for showing actual values within the data.

Box Plots are preferable for showing the spread of the data.

Concept question:

1. Why are dot plots not preferable for a survey of an entire high school with 2000 students?

   2,000 dots would get very confusing and tedious to count.

Measures of Central Tendency (Mean, Median, IQ Range, SD)

Mean - $\bar{x}$, Statistical Average, Add the Values and divide by the number of values

Median - Med, Middle Value, 50% of values are above and 50% are below

Interquartile Range - $Q_3 - Q_1$, represents range of middle 50% of values

Standard Deviation - Measure of the spread of a data set

Concept Question:

1. Explain the potential relationship between the IQR and standard deviation for a box plot with very short whiskers and long boxes.

   This data set could have a high IQR but low standard deviation, as most of the data is concentrated near the middle 50%.

Outlier Effects

Outlier - A data value farther than 1.5 (IQR) from the median.

An outlier generally has a larger effect on the mean and standard deviation of a data set than the median and interquartile range.

Concept Question:

1. Why does an outlier not greatly affect a median, but it can have a great effect on a mean?

   The median represents one value (the middle) in relation to the others, but the mean is an average of all values in a dataset.