

Name: _____

ALGEBRA 1 KEYSTONE

Module 1 and **Module 2** both have **23 multiple choice** questions and **4 CRQ** questions.

<u>Module 1 Topics</u>	<u>Module 2 Topics</u>
Numbers, Operations, Linear Equations, and Inequalities 1 - Compare and order rational/irrational numbers 2 - Simplify square roots 3 - GCF and LCM 4 - Simplifying expressions using properties of exponents 5 - Simplifying expressions using order of operations (including absolute value) 6 - Add and subtract polynomials 7 - Multiply polynomials 8 - Factor polynomials (GCF, Difference of 2 Squares, Quadratic Trinomials) 9 - Simplify rational expressions 10 - Solve linear equations and/or justify step in solving process 11 - Solve and graph one-variable inequalities on the number line 12 - Solve and graph compound inequalities on the number line (AND, OR, Absolute Value) 13 - Graphing linear equations and inequalities 14 - Write, solve, and interpret the solution to a system of equations 15 - Write, solve, and interpret solution to a system of inequalities	Coordinate Geometry & Data and Statistics 16 - Write and use function rule to describe pattern and predict the “nth” term 17 - Determine whether a relation is a function (table, ordered pairs, graph) 18 - Identify the domain and range of a function 19 - Calculate slope and use it in problem solving 20 - Write a linear equation given sufficient information (graph of a line, table, two points on the line, slope and a point on the line, word problem) 21 - Determine the slope/y-intercept given an equation or graph 22 - Identify/write/use the equation of a scatter plot’s line of best fit 23 - Analyze data displays for mean, median, mode, range, quartiles, interquartile range 24 - Make predictions from data displays 25 - Calculate the probability of compound events

TIPS FOR SUCCESS:

- Read the directions and each question carefully – there is no time limit!
- **Answer every single question, including all parts of CRQ. LEAVE NOTHING BLANK!**
- **Don’t spend too much time/brain power on one problem** - *star* difficult questions and come back to them after you have answered all the other questions
- **Annotate questions** –underline key words and circle numbers, for example: sum, mean, product, percent, etc.
- **USE YOUR FORMULA SHEET!**
- **USE THE GRAPHING CALCULATOR WHENEVER POSSIBLE!**
- **Eliminate answer choices you know are incorrect** (ex: if you are matching a line to an equation with a positive slope, eliminate all graphs that have negative slopes!)
- **If two answer choices are opposite** of each other, **chances are that one of them is correct.**
- If you have to guess, **choose an answer that is in the middle of the range**, not the highest or lowest number. (also, choosing the same letter for all the questions that you have to guess on will increase your chances of getting more right)
- If you can’t solve an equation, **substitute answer choices** to see which is correct.
- **Draw a picture/diagram!**

GRAPHING CALCULATOR TIPS

You should know how to do all of the following on your calculator!

<p>CLEAR CALCULATOR $2^{nd} + 7 1 2$</p>	<p>SIMPLIFY/CONVERT TO FRACTION MATH Select FRAC Press ENTER</p>	<p>ABSOLUTE VALUE Press MATH Press > to NUM Menu Select Option 1: Abs(*don't forget to close the parentheses!</p>
<p>GRAPHING LINES (LINEAR EQUATIONS) Press y = Enter equation under $Y_1=$ (don't forget the x!) Press Graph *You might need to press ZOOM and zoom in/out</p>	<p>GRAPHING LINEAR INEQUALITIES Press y = Enter inequality under $Y_1=$ (don't forget the x!) Change to an inequality by moving to the left of Y_1 and pressing Enter until shading is above/below (depending on inequality symbol) Press Graph *Remember > and < is dashed line and \geq and \leq is solid line</p>	
<p>GRAPHING/SOLVING SYSTEMS OF EQUATIONS GRAPH: Press y = Enter first equation onto $Y_1=$ Enter second equation on $Y_2 =$ Press Graph SOLVE: Press 2^{nd} Calc Select 5:Intersection Press Enter Enter Enter *Solution displayed at the bottom</p>	<p>GRAPHING/SOLVING SYSTEMS OF INEQUALITIES Press y = Enter first inequality onto $Y_1=$ Enter second equation on $Y_2 =$ Change both to inequalities by selecting correct shading Press Graph *Solution is the overlapping shaded area</p>	
<p>CENTRAL TENDENCIES, DISPERSION, AND QUARTILES Press STAT Select Edit Enter data into L_1 Press STAT Press > to the Calc Menu Select 1 Variable Stat *You might need to press enter again or select Calculate depending on your calculator *Scroll down to see 5 number summary</p>	<p>SCATTER PLOTS AND LINES OF BEST FIT Create Scatter Plot: Press STAT Select Edit Enter x-values into L_1 and y-values into L_2 Press 2^{nd} y = Select Plot 1 Turn Plot 1 On Calculate Line of Best Fit Equation Press STAT Press > to Calc Menu Select 4: LinReg(ax + b) Press Enter</p>	

MODULE 1

1. Rational/Irrational Numbers

- Convert everything to a decimal so that it can better be compared (think about ordering on a number line)
- You can always add zeros to the end of a decimal so that numbers can be more easily compared
- Know your inequality symbols and read starting from the variable! (> greater than, < less than)

2. Simplify Square Roots

- Write as product of biggest perfect square factor; remove perfect square factor as its square root

3. GCF/LCM

- GCF: Greatest Common Factor – BIGGEST shared factor and SMALLEST shared variable exponent
- LCM: Least Common Multiple – SMALLEST shared multiple and BIGGEST shared variable exponent

4. Simplifying with Order of Operations, Properties of Exponents and Absolute Value

- Follow GEMDAS (Grouping Symbols, Exponents, Multiplication/Division, Addition/Subtraction)
- Absolute value is always positive!

$$a^m \cdot a^n =$$

$$\left(\frac{a}{b}\right)^m =$$

$$(ab)^m =$$

$$a^0 =$$

$$(a^m)^n =$$

$$a^{-n} =$$

$$\frac{a^m}{a^n} =$$

$$\frac{1}{a^{-n}} =$$

5. Estimation

- Look out for key words like “approximately”, “about how many”, “closest estimate”, etc.
- Round numbers to the nearest whole/ten/hundred/etc. that they are easier to mentally work with

6. Adding and Subtracting Polynomial Expressions

- Add and subtract COEFFICIENTS OF LIKE TERMS only (same variable and exponent); DO NOT CHANGE EXPONENTS

- SUBTRACTING POLYNOMIALS: Distribute the negative to ALL terms in second polynomial
- PERIMETER questions are very common!

7. Multiplying Polynomial Expressions

- MULTIPLY coefficients and ADD exponents
- (Binomial)(Binomial)...Use FOIL and simplify!
- AREA/VOLUME questions are very common!

8. Factoring Polynomial Expressions (GCF, Diff. of 2 Squares, Quadratic Trinomials)

- Factoring means to un-do multiplication/put the parentheses back in!
- Always look for GCF first (and divide it out!)
- Difference of Two Squares: $x^2 - 49 \rightarrow (x + 7)(x - 7)$
- Quadratic Trinomial: $x^2 - 2x - 15 \rightarrow (x - 5)(x + 3)$ (2 numbers that multiply to make -15 and add to make -2)
- Finding DIMENSIONS from area/volume questions are very common!

9. Simplifying Rational Expressions

- **Rational Expression**: fraction with a polynomial in numerator and denominator
- Factor numerator and denominator; Cancel common factors
- Remember: the denominator cannot be equal to zero!

10. Solving Linear Equations

- Solving an equation means to **find the value of the variable that makes the equation true**
- Eliminate parentheses by distributing, collect variables on one side of equal side, solve with inverse operations in the opposite order of operations

11. Justifying any step in equation solving process

- What property allows you to remove parentheses? (Distributive Property!)
- What property allows you to add on both sides of equal sign? (Additive Property of Equality!)

***All properties are listed on your formula sheet!**

12. Solving and Graphing Inequalities on a Number Line (1 variable)

- Solve with inverse operations; **FLIP SIGN WHEN DIVIDE OR MULTIPLY BY A NEGATIVE**
- $>$ and $<$ OPEN CIRCLE, \geq and \leq CLOSED DOT
- Always write final inequality solution with variable on the left side; read from left to right
- Graph arrow points towards values included in solution ($x > 4$...arrow points towards numbers greater than 4)
- Eliminate answer choices based on open/closed and shading direction!

13. Solving and Graphing Compound Inequalities (and/or and absolute value)

- Identify compound inequality by seeing the words **AND**, **OR**, **ABSOLUTE VALUE SYMBOL**, OR **TWO INEQUALITY SYMBOLS**

- **AND**: whatever you un-do in the middle you must un-do on both sides of inequality symbols; graph is shaded between two points

- **OR**: solve inequalities separately; graph is in two opposite directions

- **ABSOLUTE VALUE INEQUALITIES ARE COMPOUND INEQUALITIES:** First inequality stays the same; 2nd inequality: flip inequality symbol and make right side opposite; GO LA (Greater Than...OR; Less Than, AND)

14. Systems of Equations (writing, solving, graphing, interpreting solution)

- Solving a system of equations means to **find the value of the two variables that make both equations true**
- **GRAPHING METHOD:** Graph and identify (x, y) intersection point (**best when:** both equations in $y = mx + b$)
- **SUBSTITUTION METHOD:** Substitute value of one variable into second equation and solve; back-substitute into either equation and solve for second variable (**best when:** one equation is $y =$ or $x =$)
- **ELIMINATION METHOD:** Add or subtract equations vertically to eliminate a variable; solve for remaining variable; back-substitute into either equation and solve for second variable) (**best when:** equations are in standard form and coefficients are the same or opposite; can always multiply one or both equations to create same/opposite coefficients)

15. Systems of Inequalities (writing, solving, graphing, interpreting solution)

- Two inequalities graphed on the same coordinate plane
- Graph just like an equation: plot y-intercept and use slope (rise/run) to find second point
 - > and < DASHED line
 - > and \geq Shade ABOVE
 - \geq and \leq SOLID LINE
 - < and \leq Shade BELOW
- Solution is any point in the **overlapping shaded area**

MODULE 2

16. Write and use function rules to describe a pattern and predict the nth term

- "n" represents the term number (it is the same thing as the "x")

Writing the function rule: Use the pattern to find the coefficient of "n" (AKA the slope); Reverse the pattern to find the "zero term" (AKA the y-intercept)

Predicting the nth term: Substitute the term number for "n" and simplify (looking for the 50th term? $n = 50$)

17. Determine whether a relation is a function

- You must be able to determine whether or not any relation (table, ordered pairs, graph) represents a function
- **Relation:** ANY set of input and output values
- **Function:** A special type of relation where every input (x-value) is paired with only one output (y-value);
- **Table/Ordered Pairs:** check to see that no x-values repeat
- **Graph:** apply the vertical line test (if a vertical line crosses more than once, it is NOT a function)

18. Domain and Range

- **Domain:** All of the **x-values**

- **Range:** All of the **y-values**

*open circles on graphs are NOT included in the domain or range

19. Slope and Slope Applications

Slope: The constant rate of change; the ratio of change between the output quantity and the input quantity

- You must know how to calculate slope given two points/table (formula), a graph (rise/run), a situation (constant rate of change)

- You must know how to interpret slope's meaning based on a graph or situation

20/21. Writing Linear Equations ($y = mx + b$)

- Write an equation in slope-intercept form ($y = mx + b$) given: a graph, table, 2 points on the line, slope and one point on the line, or situation

- **Slope and 1 point:** Substitute into point-slope form and convert to slope-intercept form (solve for y!)

- **2 points on the line:** Calculate slope with formula; Substitute slope and 1 point into point-slope form;

convert to slope-intercept form

- **Graph:** Y-intercept (b) is where graph crosses y-axis; Slope (m) is rise/run between two points on the line (PAY ATTENTION TO THE GRAPH'S SCALE!)

- **Situation:** Y-intercept (b) is the starting/initial amount; Slope (m) is the constant rate of change – look for key words like each, every, per, etc.

*Parallel lines have the SAME slope; Perpendicular lines have OPPOSITE RECIPROCAL slope

****Y-Intercept:** the y-value when the x-value is zero; where the graph crosses the y-axis

*****X-Intercept:** the x-value when the y-value is zero; where the graph crosses the x-axis

22. Scatter Plots/Lines of Best Fit

- **Line of Best Fit / Regression Line** – straight line that best represents the data and can be used to make predictions
- A line of best fit should represent the trend of the data so that the **sum of the distances of the points above the line is about equal to the sum of the distances of the points below the line**
- You can use your calculator to calculate the equation for a scatter plot's line of best fit
- Make sure to pay attention to units when using equation to predict for a given input or output

23. Mean, Median, Mode, and Range

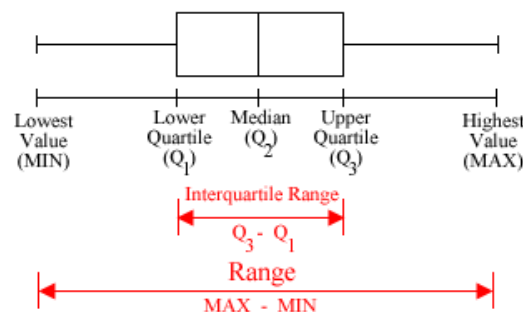
- **Mean:** the average of the data set (add all items and divide by number of items)
 - **Median:** the middle number when data is arranged in order (if there are two middle numbers, find the average)
 - **Mode:** the number that appears most often (can have more than one mode!)
 - **Range:** maximum – minimum
- *All can be found using **graphing calculator:** STAT EDIT, Input data into L₁, STAT CALC 1 Var Stat

24. Data Displays: Analysis and Predictions

- You must know how to read a **line graph, line plot, bar graph, double bar graph, circle graph, histogram, stem-and-leaf plot, and box-and-whisker plot**
- You must know how to **calculate mean/median/mode/range** from all of the above data displays
- You must know how to **make predictions** based on data (i.e. *if 48 of the 240 people surveyed chose vanilla ice cream, how many would you predict would choose vanilla if 600 people were surveyed? $48/240 = x/600$*)

Quartiles and Box-And-Whisker Plots

- **Quartile 2/Median:** Divides a data set into an upper and lower section; Q2/median is NOT part of upper or lower
- **Quartile 1/Lower Quartile:** Divides the lower half of the data set in half; 75% of data above Q1 and 25% below Q1
- **Quartile 3/Upper Quartile:** Divides the upper half of the data set in half; 25% of data above Q3 and 75% below Q3
- **Interquartile Range (IQR):** $Q_3 - Q_1$; 50% of the data lies between Q3 and Q1
- **Box and Whisker Plots:** Display the 5 Number Summary (Minimum, Q1, Q2/Median, Q3, Maximum)
- You should know how to determine the number of data items above or below any given quartile (i.e. *if the box-and-whisker plot represents 450 data items, how many items are below Q3? $.75(450)$*)



Stem-And-Leaf Plots

- **Stem-And-Leaf Plot:** Organizes data by place value; the stem is usually the last digit in the number and the leaves are the first digit(s); the number of leaves represents the number of items in the data set
- **Double stem-and-leaf plots** compare two sets of data and share the same stems
- Always use the key provided to help you read the stem and leaf plot!

Minutes spent on the Phone			
1 st period		3 rd period	
2	1 0	5 6	
	0 1	1 1 4	
6	1 2	3 4 6 6	
	3 3	5 5	
	4 4	7 9 9	
8	0 0	5 3 7	

Key:
| 2 | 3 means 23
and
0 | 5 | Means 50

25. Compound Probability

- **Probability:** The likelihood that an event(s) will occur; represented as a fraction, decimal, or percent
- You must know how to reduce fractions and convert between fraction/decimal/percent (don't forget about MATH Frac to reduce fractions and convert from decimal to fractions!)
- **Compound Probability:** The likelihood that two or more events will occur; can be AND or OR:

AND: MULTIPLY probabilities of each event (look out for replacement vs. without replacement)

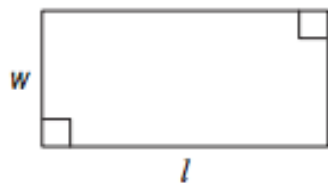
$$P_{(A \text{ and } B)} = P_{(A)} \times P_{(B \text{ after } A)}$$

OR: ADD probability of each event (subtract overlapping probability if necessary)

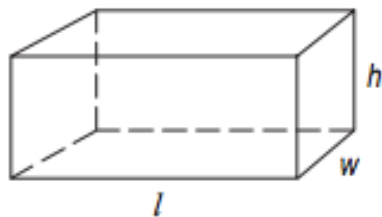
$$P_{(A \text{ or } B)} = P_{(A)} + P_{(B)} - P_{(A \text{ and } B \text{ overlap})}$$

FORMULA SHEET

Formulas that you may need to work questions in this document are found below.
You may use calculator π or the number 3.14.



$$A = lw$$



$$V = lwh$$

Linear Equations

Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$

Point-Slope Formula: $(y - y_1) = m(x - x_1)$

Slope-Intercept Formula: $y = mx + b$

Standard Equation of a Line: $Ax + By = C$

Arithmetic Properties

Additive Inverse: $a + (-a) = 0$

Multiplicative Inverse: $a \cdot \frac{1}{a} = 1$

Commutative Property: $a + b = b + a$
 $a \cdot b = b \cdot a$

Associative Property: $(a + b) + c = a + (b + c)$
 $(a \cdot b) \cdot c = a \cdot (b \cdot c)$

Identity Property: $a + 0 = a$
 $a \cdot 1 = a$

Distributive Property: $a \cdot (b + c) = a \cdot b + a \cdot c$

Multiplicative Property of Zero: $a \cdot 0 = 0$

Additive Property of Equality:
If $a = b$, then $a + c = b + c$

Multiplicative Property of Equality:
If $a = b$, then $a \cdot c = b \cdot c$