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| 1st 6 Weeks Benchmark Analysis  Math I  In the box to the left of the standard, rate our understanding of it on a scale from 1-5. (1= I do not know what this means;3 = I remember the concept but need to revisit; 5= I do not have to learn about this again because I know it so well.) | | | |
|  | Rating | Standard |  |
|  |  | A.CED.4 | Rearrange formulas to highlight a quantity of interest, using the same reasoning  as  in  solving equations.  ***Solve multi-variable formulas or literal equations, for a specific variable. Explicitly connect this to the process of solving equations using inverse operations. Limit to formulas which are linear in the variable of interest or to formulas involving squared or cubed variables.***  Ex. If  , solve for T2 |
|  |  | A.REI.10 | Understand that the graph of an equation in two variables is the set of all its  solutions Plotted  in the coordinate plane, often forming a curve  (which could be a  line)  (**linear)**  **Understand that all points on the graph of a two-variable equation are solutions because when substituted into the equation, they make the equation true. *At this level, focus on linear and exponential equations***  Ex. Which of the following points are on the graph of the equation How many points are on this graph? Explain.   1. (4, 0) 2. (0, 10) 3. (-1, 7.5) 4. (2.3, 5) |
|  |  | A.REI.12 | **Graph the solutions to a linear inequality** in two variables as a half‐ plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities  in two variables as the intersection of two corresponding  half‐ planes  \****Understand that all points on a half-plane are solutions to a linear inequality.***  Ex. How do we use a graph to represent the solutions to a linear inequality? Why do we use a graph instead of listing the solutions (as we do when solving equations)?  ***\*\*Determine whether the boundary line should be included as part of the solution set.***  Ex. Decide whether the boundary line should be included for the following inequalities. How many solutions does each inequality have? |
|  |  | F.IF.4 | For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key  features given a verbal description of the relationship  \****When given a table or graph of a function that models a real-life situation, explain the meaning of the characteristics of the graph in the context of the problem. The characteristics described should include rate of change, intercepts, maximums/minimums, symmetries, and intervals of increase and/or decrease.***  Ex. Below is a table that represents the relationship between daily profit, P for an amusement park and the number of paying visitors in thousands, n.   |  |  | | --- | --- | | n | P | | 0 | 0 | | 1 | 5 | | 2 | 8 | | 3 | 9 | | 4 | 8 | | 5 | 5 | | 6 | 0 |  1. What are the x-intercepts and y-intercepts and explain them in the context of the problem. 2. Identify any maximums or minimums and explain their meaning in the context of the problem. 3. Determine if the graph is symmetrical and identify which shape this pattern of change develops. 4. Describe the intervals of increase and decrease and explain them in the context of the problem.   Ex. A rocket is launched from 180 feet above the ground at time *t* = 0. The function that models this situation is given by *h(t)* = – 16*t*2 + 96*t* + 180, where *t* is measured in seconds and *h* is height above the ground measured in feet.  a. What is the practical domain for *t* in this context? Why?  b. What is the height of the rocket two seconds after it was launched?  c. What is the maximum value of the function and what does it mean in context?  d. When is the rocket 100 feet above the ground?  e. When is the rocket 250 feet above the ground?  f. Why are there two answers to part e but only one practical answer for part d?  g. What are the intercepts of this function? What do they mean in the context of this problem?  h. What are the intervals of increase and decrease on the practical domain? What do they mean in the context of the problem?  **\*\**When given a verbal description of the relationship between two quantities, sketch a graph of the relationship, showing key features.***  Ex. Elizabeth and Joshua tried to get a monthly allowance from their mother. If their mother initially paid them a penny and 2 pennies for the first day of the month, 4 pennies for the second day, and so on. How much would their mother have to pay on the 10th, 20th, and 30th day of the month? Sketch the graph of the relationship between the two quantities and explain what the point (0, 1) represents. |
|  |  | F.IF.6 | Calculate and interpret the average rate of change of a function  (presented symbolically or as a table) over a specified interval. Estimate the rate of change form a graph.  \****Interpret what the average rate of change means in terms of the context it is in. At this level, focus on linear functions and exponential functions whose domain is a subset of the integers****.*  Ex. What is the average rate at which this bicycle rider traveled from four to ten minutes of her ride? |
|  |  | F.IF.7a | Graph linear and quadratic functions and show intercepts, maxima, and minima.  ***Students should graph functions given by an equation and show characteristics such as but not limited to intercepts, maximums, minimums, and intervals of increase or decrease. Students may use calculators or a CAS for more difficult cases.***  Ex. Graph , identifying it’s intercepts and maximum or minimum.  Ex. Graph , identifying it’s intercepts. |
|  |  | S.ID.7 | Interpret the slope (rate of change) and the intercept (constant term) of a linear  model  in the context of the data  \****Understand that the key feature of a linear function is a constant rate of change. Interpret in the context of the data, i.e. as x increases (or decreases) by one unit, y increases (or decreases) by a fixed amount.***  ***\*\*Interpret the y-intercept in the context of the data, i.e. an initial value or a one-time fixed amount.***  Ex. The equation represents a pay plan offered to employees who collect credit card applications. What do the numbers in the rule tell you about the relationship between daily pay and the number of credit card applications collected? |
|  |  | A-SSE.1.a | Interpret expressions that represent a quantity in terms of its context.★   1. Interpret parts of an expression, such as terms, factors, and coefficients.   *\*****Students manipulate the terms, factors, and coefficients in difficult expressions to explain the meaning of the individual parts of the expression. Use them to make sense of the multiple factors and terms of the expression.***  For example, consider the expression 10,000(1.055)5. This expression can be viewed as the product of 10,000 and 1.055 raised to the 5th power. 10,000 could represent the initial amount of money I have invested in an account. The exponent tells me that I have invested this amount of money for 5 years. The base of 1.055 can be rewritten as (1 + 0.055), revealing the growth rate of 5.5% per year  Ex. The expression *20(4x) + 500* represents the cost in dollars of the materials and labor needed to build a square fence with side length *x* feet around a playground. Interpret the constants and coefficients of the expression in context. |
|  |  | A-CED.1 | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions  *\*****From contextual situations, write equations and inequalities in one variable and use them to solve problems. Include linear and exponential functions.***  Ex. The Tindell household contains three people of different generations. The total of the ages of the three family members is 85.   1. Find reasonable ages for the three Tindells.   Find another reasonable set of ages for them.   1. One student, in solving this problem, wrote C + (C+20)+ (C+56) = 85 2. What does C represent in this equation? 3. What do you think the student had in mind when using the numbers 20 and 56? 4. What set of ages do you think the student came up with?   Ex. A salesperson earns $700 per month plus 20% of sales. Write an equation to find the minimum amount of sales needed to receive a salary of at least $2500 per month.  Ex. A scientist has 100 grams of a radioactive substance. Half of it decays every hour. Write an equation to find how long it takes until 25 grams are left. |
|  |  | A-CED.2 | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.  ***\*Given a contextual situation, write equations in two variables that represent the relationship that exists between the quantities. Also graph the equation with appropriate labels and scales. Make sure students are exposed to a variety of equations arising from the functions they have studied.***  Ex. In a woman’s professional tennis tournament, the money a player wins depends on her finishing place in the standings. The first-place finisher wins half of $1,500,000 in total prize money. The second-place finisher wins half of what is left; then the third-place finisher wins half of that, and so on.   1. Write a rule to calculate the actual prize money in dollars won by the player finishing in nth place, for any positive integer n. 2. Graph the relationship that exists between the first 10 finishers and the prize money in dollars. 3. What pattern do you notice in the graph? What type of relationship exists between the two variables? |
|  |  | A-REI.1 | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.  ***\*Relate the concept of equality to the concrete representation of the balance of two equal quantities. Properties of equality are ways of transforming equations while still maintaining equality/balance. Assuming an equation has a solution, construct a convincing argument that justifies each step in the solution process with mathematical properties.***  Ex. Solve 5(x+3)-3x=55 for x. Use mathematical properties to justify each step in the process. |
|  |  | A-REI.3 | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.  \****Solve linear equations in one variable, including coefficients represented by letters.***  Ex. Solve, Ax +B =C for x. What are the specific restrictions on A?  Ex. What is the difference between solving an equation and simplifying an expression?  Ex. Grandma’s house is 20 miles away and Johnny wants to know how long it will take to get there using various modes of transportation.   1. Model this situation with an equation where time is a function of rate in miles per hour. 2. For each mode of transportation listed below, determine the time it would take to get to Grandma’s.  |  |  |  | | --- | --- | --- | | Mode of Transportation | Rate of Travel in mph | Time of Travel hrs. | | bike | 12mph |  | | car | 55mph |  | | walking | 4mph |  |     Ex. A parking garage charges $1 for the first half-hour and $0.60 for each additional half-hour or portion thereof. If you have only $6.00 in cash, write an inequality and solve it to find how long you can park.  Ex. Compare solving an inequality in one variable to solving an equation in one variable, also compare solving a linear inequality to solving a linear equation. |
|  |  | A-REI.11 | Explain why the x coordinates of the points where the graphs of the equations y=f(x) and y=g(x) intersect are the solutions of the equation f(x)=g(x); find the  solutions approximately e.g.,  **using technology to graph the  functions,  make  tables of values, or find  successive  approximations.**  Include cases where f(x) and/or g(x) are **linear**, and exponential  functions  \* ***Understand that solving a one-variable equation of the form f(x) = g(x) is the same as solving the two-variable system y = f(x) and y = g(x). When solving by graphing, the x-value(s) of the intersection point(s) of y = f(x) and y = g(x) is the solution of f(x) = g(x) for any combination of linear and exponential functions. Use technology, entering f(x) in y1 and g(x) in y2, graphing the equations to find their point of equality. At this level, focus on linear and exponential functions.***  Ex. How do you find the solution to an equation graphically?    ***\*\*Solve graphically, finding approximate solutions using technology. At this level, focus on linear and exponential functions.***  Ex. Solve the following equations by graphing. Give your answer to the nearest tenth.  10x +5 = -x +8  \*\*\****Solve by making tables for each side of the equation. Use the results from substituting previous values of x to decide whether to try a larger or smaller value of x to find where the two sides are equal. The x-value that makes the two sides equal is the solution to the equation. At this level, focus on linear and exponential functions.***  Ex. Solve the following equations by using a table. Give your answer to the nearest tenth. |
|  |  | F-IF.1 | Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f(x)* denotes the output of *f* corresponding to the input x. The graph of f is the graph of the equation *y = f(x)*.  ***\*The domain of a function is the set of all x-values, which you control and therefore is called the independent variable. The range of a function is the set of all y- values and is dependent on a particular x-value, thus called the dependent variable.***  Ex. When is an equation a function? Explain the notation that defines a function.    Ex. Describe the domain and range of a function and compare the concept of domain and range as it relates to a function. |
|  |  | F-IF.2 | Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.  ***\*Using function notation, evaluate functions and explain values based on the context in which they are in. At this level, focus on linear and exponential functions.***  Ex. Evaluate for the function .  Ex. The function describes the height *h* in feet of a tennis ball *x* seconds after it is shot straight up into the air from a pitching machine. Evaluate and interpret the meaning of the point in the context of the problem. |
|  |  | F-IF.3 | Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*  ***In an arithmetic sequence, each term is obtained from the previous term by adding the same number each time. This number is called the common difference. In a geometric sequence, each term is obtained from the previous term by multiplying by a constant amount, called the common ratio.***  ***NOW-NEXT equations are equations that show how to calculate the value of the next term in a sequence from the value of the current term. The arithmetic sequence NEXT = NOW  C is the recursive form of a linear function. The common difference C corresponds to the slope m in the explicit form of a linear function, y = mx + b. The initial value of the sequence corresponds to the y-intercept, b. The geometric sequence NEXT = B  NOW is the recursive form of an exponential function. The common ratio B corresponds to the base b in the explicit form of an exponential function, y = abx. The initial value corresponds to the y-intercept, a.***  ***NOW-NEXT equations are the first step in the process of formalizing a sequence using function notation. The NOW-NEXT representation allows students to explore and understand the concept of a recursive function before being introduced to symbolic notation such as An = An-1 + 6 or f(n) = f(n-1) + 6.***  Ex. You just got a pair of baby rabbits for your birthday – one male and one female. You decide that you will breed the rabbits, but need to plan a budget for the upcoming year. To help prepare your budget, you need an estimate of how many rabbits you will have by the end of the year. In order to build a mathematical model of this situation, you make the following assumptions:   * A rabbit will reach sexual maturity after one month. * The gestation period of a rabbit is one month. * Once a female rabbit reaches sexual maturity, she will give birth every month. * A female rabbit will always give birth to one male rabbit and one female rabbit. * Rabbits never die.   So how many male/female rabbit pairs are there after one year (12 months)?  Ex. In August 2011, the population in the United States was approximately 312 million. Suppose that in recent trends the birth rate was 1.7% of the total population. Use the word NOW to represent the population of the United States in any given year and the word NEXT to represent the population the following year. Using NOW-NEXT, write a rule that shows how to calculate next year’s population from the current population. What is the initial value of this sequence?  Ex. A single bacterium is placed in a test tube and splits in two after one minute. After two minutes, the resulting two bacteria split in two, creating four bacteria. This process continues for one hour until test tube is filled up. How many bacteria are in the test tube after 5 minutes? 15 minutes? Write a recursive rule to find the number of bacteria in the test tube after *n* minutes. Convert this rule into explicit form. How many bacteria are in the test tube after one hour? |
|  |  | F-IF.5 | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★  ***\*From a graph students will identify the domain. In context, students will identify the domain, stating any restrictions and why they are restrictions.***  Ex. If Jennifer buys a cell phone and the plan she decided upon charged her $50 for the phone and $0.10 for each minute she is on the phone. What would be the appropriate domain that describes this relationship? Describe what is meant by the point (10, 51).  Ex. Graph the function and determine the domain and range, identifying any restrictions on that exist. |
|  |  | F-LE.5 | **Interpret the parameters in a linear function in terms of a context. *Understand the difference between the practical and the non-practical domain in linear situations and explain their meaning in terms of their context.***  Ex. A function of the form *f*(*n*) = *P*(1 + *r*)*n* is used to model the amount of money in a savings account that earns 8% interest, compounded annually, where *n* is the number of years since the initial deposit. What is the value of *r*? What does it mean in terms of the savings account? What is the meaning of the constant *P* in terms of the savings account?Explain your reasoning. Will n or f(n) ever take on the value 0? Why or why not? |