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3rdd 6 Weeks Benchmark

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.)

|  |  |  |
| --- | --- | --- |
| Rate | Standard |  |
|  | **A.APR.1** | ***Understand that polynomials form a system analogous to the integers, namely, they are closed  under the operations of addition, subtraction, and multiplication; add, subtract, and multiply  polynomials***  \*\* ***when adding, subtracting or multiplying polynomials, the sum, difference, or product is also a polynomial. Polynomials are not closed under division because in some cases the result is a rational expression rather than a polynomial.***  Ex. If the radius of a circle is kilometers, what would the area of the circle be?  Ex. Explain why does not equal . |
|  | **A-SSE.1.a** | **Refer to 1st Benchmark document** |
|  | **A-SSE.1.b** | Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret as the product of P and a factor not depending on P.*  \* ***Students group together parts of an expression to reveal underlying structure. For example, consider the expression that represents income from a concert where p is the price per ticket. The equivalent factored form, , shows that the income can be interpreted as the price times the number of people in attendance based on the price charged.***  Ex. Without expanding, explain how the expression can be viewed as having the structure of a quadratic expression. |
|  | **A-SSE.2** | Use the structure of an expression to identify ways to rewrite it. *For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).*  ***Students rewrite algebraic expressions by combining like terms or factoring to reveal equivalent forms of the same expression***.  Ex. Expand the expression to show that it is a quadratic expression of the form . |
|  | **A.SSE.3a** | **Factor a quadratic expression to reveal  the zeros of the function it defines**  Students factor quadratic expressions and find the zeros of the quadratic function they represent. Zeroes are the *x-*values that yield a *y*-value of 0. Students should also explain the meaning of the zeros as they relate to the problem. For example, if the expression *x*2 – 4*x* + 3 represents the path of a ball that is thrown from one person to another, then the expression (*x* – 1)(*x* – 3) represents its equivalent factored form. The zeros of the function, (*x* – 1)(*x* – 3) = *y* would be *x* = 1 and *x* = 3, because an *x*-value of 1 or 3 would cause the value of the function to equal 0. This also indicates the ball was thrown after 1 second of holding the ball, and caught by the other person 2 seconds later.  Ex. The expression is the income gathered by promoters of a rock concert based on the ticket price, *m*. For what value(s) of *m* would the promoters break even? |
|  | **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)  (**exponential)**  **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)   (2.3, 5) |
|  | **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. |
|  | **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. |
|  | **F-BF.1.a** | Write a function that describes a relationship between two quantities.★  \****Determine an explicit expression, a recursive process, or steps for calculation from a context. Recognize when a relationship exists between two quantities and write a function to describe them. Use steps, the recursive process, to make the calculations from context in order to write the explicit expression that represents the relationship.***  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-BF.1.b** | Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.  ***Students should take standard function types such as constant, linear and exponential functions and add, subtract, multiply and divide them. Also explain how the function is effected and how it relates to the model.***  Ex. Suppose Kevin had $10,000 to invest in a CD account paying 8% interest compounded yearly. The function representing this situation is . When the constant function y=50 is added to the function, what effect does it have on the exponential function? What does that mean in the context of the problem? |
|  | **F-BF.2** | Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★  ***Write the recursive and explicit forms of the arithmetic and geometric sequences. Translate between the recursive and explicit forms. Use the recursive and explicit forms of arithmetic and geometric sequences to model real-world situations.***  ***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.***  *Connect arithmetic sequences to linear functions and geometric sequences to exponential functions. At this level, formal recursive notation is not used. Instead, use of informal recursive notation (such as NEXT = NOW + 5, starting at 3) is intended.*  Ex. A concert hall has 58 seats in Row 1, 62 seats in Row 2, 66 seats in Row 3, and so on. The concert hall has 34 rows of seats. Write a recursive formula to find the number of seats in each row. How many seats are in row 5? Write the explicit formula to determine which row has 94 seats? |
|  | **F.BF.3** | **Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs.**  Know that when adding a constant, k, to a function, it moves the graph of the function vertically. If k is positive, it translates the graph up, and if k is negative, it translates the graph down.  If k is either added or subtracted from the x-value, it translates the graph of the function horizontally. If we add k, the graph shifts left and if we subtract k, the graph shifts right. The expression (x + k) shifts the graphs k units to the left because when x + k = 0, x = -k.  Use the calculator to explore the effects these values have when applied to a function and explain why the values affect the function the way it does. The calculator visually displays the function and its translation making it simple for every student to describe and understand translations.  Ex. Given g(x) = x2 describe the changes in the graph of g(x) , that occurred to create f(x) = 2(x – 5)2 + 7.  Ex. If f(x) represents a diver’s position from the edge of a pool as he dives from a 5ft. long board 25ft. above the water. If his second dive was from a 10ft. long board that is 10ft above the water, what happens to my equation of f(x) to model the second dive? |
|  | **F-IF.4** | **See Benchmark Document #1** |
|  | **F-IF.5** | **See Benchmark Document #1** |
|  | **F-IF.7a** | **See Benchmark Document #1** |
|  | **F-IF.7e** | **graph exponential functions, showing intercepts and end behavior.**   1. ***Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.*** |
|  | **F-IF.8.a** | Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.   1. ***Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.***   ***8 Students should take a function and manipulate it in a different form so that they can show and explain special properties of the function such as; zeros, extreme values, and symmetries.***  ***Students should factor and complete the square to find special properties and interpret them in the context of the problem. Keep in mind when completing the square, the coefficient on the x2 variable must always be one and what you add in to the problem, you must also subtract from the problem. In other words, we are adding zero to the problem in order to manipulate it and get it in the form we want. At this level, only factoring expressions of the form ax2 + bx + c, is expected. Completing the square is not addressed.***  Ex. Suppose you have a rectangular flower bed whose area is 24ft2. The shortest side is (x-4)ft and the longest side is (2x)ft. Find the length of the shortest side.  Ex. The Falling Freely Skydiving Company charges a basic price of $150 per person for each jump. However, business is slow and to attract more clients, the company reduces the price of each jump by $5 for each person in the group. The larger the group, the less each person pays.  a. Define variables and write an equation for the price of a single jump.  b. If you and a group of your friends decided to go skydiving, what would the equation be for the total price the company charges?  c. What is the total price of a jump for a group of 6 people?  d. The company reports that the cost of the skydiving trip was $1000.00, How many people were on the trip?  e. What limitations on group size should the skydiving company use in order to make a profit? |
|  | **F-IF.8.b** | **Use the properties of exponents to interpret expressions for exponential functions.**  Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay.*  Ex. Suppose a single bacterium lands on one of your teeth and starts reproducing by a factor of 2 every hour.   1. Write an equation for the situation above. 2. How do you know you have the correct equation? Justify you reasoning. 3. After how many hours will there be at least 100,000 bacteria present in the new colony? 4. What is the rate of change for this situation? Does the rate represent growth or decay? |
|  | **F-LE.1.a** | Distinguish between situations that can be modeled with linear functions and with exponential functions.  a. ***Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.***  ***Decide whether a situation can be represented using a linear model or an exponential model.***  ***\*Recursive forms of functions will show that linear models grow by a constant rate over equal intervals, and exponential models grow by equal factors over equal intervals. These can also be seen through NOW-NEXT equations. 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.***  Ex. If one person does good deeds for three new people, then the three new people each do good deeds for three more new people. Next, nine people each do good deeds for three more new people, and so on. Does this situation represent a linear or exponential model? Why or why not?  Ex. Describe the similarities and differences of a linear and an exponential NOW- NEXT equation.  \*\****Given a linear function, use a table or graph to locate points that are at equal intervals of x. Calculate the difference between values of f(x), showing that these differences are the same. Hence linear functions grow by equal differences over equal intervals.***  ***\*\*\* Given an exponential function, use a table or graph to locate points that are at equal intervals of x. Calculate the ratio of the sequential values of f(x) for these points, showing that these ratios are the same. This ratio represents the constant factor that is used as the base of the function. In NOW-NEXT form, the base is the factor that is multiplied by NOW to get to NEXT value. Hence exponential functions grow by equal factors over equal intervals.***  Ex. Describe how you decide whether a problem situation is represented by a linear or an exponential model? |
|  | **F.LE.1b** | **Recognize situations in which one quantity changes at a constant rate per unit interval relative to**  **another.**  \*\****Given a real-life relationship between two quantities, determine whether one quantity changes at a constant rate per unit interval of the other quantity. When working with symbolic form of the relationship, if the equation can be rewritten in the form y = mx + b, then the relationship is linear and the constant rate per unit interval is m. When working with a table or graph, either write the corresponding equation and see if it is linear or locate at least two pairs of points and calculate the rate of change for each set of points. If these rates are the same, the function is linear. If the rates are not all the same, the function is not linear.***  Ex. Describe and compare the rates of change of a linear function to that of an exponential function. |
|  | **F-LE.1c** | Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another  ***Given a real-life relationship between two quantities, determine whether one quantity changes at a constant percent rate per unit interval of the other quantity. When working with symbolic form of the relationship, if the equation can be rewritten in the form y = a(1 + r)x, then the relationship is exponential and the constant percent rate per unit interval is r. When working with a table or graph, either write the corresponding equation and see if it is exponential or locate at least two pairs of points and calculate the percent rate of change for each set of points. If these percent rates are the same, the function is exponential. If the percent rates are not all the same, the function is not exponential.***  Ex. Town A adds 10 people per year to its population, and town B grows by 10% each year. In 2006, each town has 145 residents. For each town, determine whether the population growth is linear or exponential. Explain. Report the constant rate per unit interval (linear) or the constant percent rate per unit interval (exponential). |
|  | **F-LE.2** | Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).  \*\****Students use graphs, a verbal description, two-points(in the linear case), and reading from a table of values to write the linear or exponential function that each of these representations describes. Also include arithmetic and geometric sequences because an arithmetic sequence is linear in pattern and a geometric sequence has an exponential pattern.***  Ex. Suppose a single bacterium lands in a cut on your hand. It begins spreading an infection by growing and splitting into two bacteria every 10 minutes. The table below represents the number of bacteria in the cut after several 10-minute intervals.   |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | Number of 10-minute periods | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | Bacteria Count | 2 | 4 | 8 | 16 | 32 | 64 | 128 |  1. Use NOW-NEXT to write a rule relating the number of bacteria at one time to the number 10 minutes later. 2. Write an equation showing how the number of bacteria can be calculated from the number of stages in the growth and division process. |
|  | **F-LE.3** | Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.  \*\****When students compare graphs of various functions, such as linear, exponential, quadratic, and polynomial they should see that any values that increase exponentially eventually increases or grows at a faster rate than values that increase linearly, quadratically, or any polynomial function.***  Ex. Carrie and Elizabeth applied for a job at the local seafood market. Carrie asked for $2 and hour, but the boss proposed giving them $.010 for the first hour, $.020 for the second hour, $.040 for the third hour, $.080, and so on. Below is a table of the hours worked per week and the pay for each hour for each of the two pay plans. When would you want to use Carrie’s plan and when would you use the Boss’s plan? Why?   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Hours worked in a week | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Earnings for Carrie’s Plan | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | | Earnings for the Boss’s Plan | 0.10 | 0.30 | 0.70 | 1.50 | 3.10 | 6.30 | 12.70 | 25.50 | 51.10 | 102.30 | |
|  | **F.LE.5** | **Interpret the parameters in a linear or exponential function in terms of a context.**  ***Understand the difference between the practical and the non-practical domain in linear and exponential situations and explain their meaning in terms of their context. Identify any values for which the exponential function may approach but does not reach and interpret its meaning in terms of the context it’s in.***  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? |
|  | **G-CO.1** | Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.  ***\* Know that a point has position, no thickness or distance. A line is made of infinitely many points, and a line segment is a subset of the points on a line with endpoints. A ray is defined as having a point on one end and a continuing line on the other.***  ***An angle is determined by the intersection of two rays.***  ***A circle is the set of infinitely many points that are the same distance from the center forming a circular are, measuring 360 degrees.***  ***Perpendicular lines are lines in the interest at a point to form right angles.***  ***Parallel lines that lie in the same plane and are lines in which every point is equidistant from the corresponding point on the other line.***  Ex. How would you determine whether two lines are parallel or perpendicular? |
|  | **G-GMD.1** | Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri’s principle, and informal limit arguments.  ***Understanding the formula for the circumference of a circle, you can either begin with the measure of the diameter or the measure of the radius. Take those measurements and measure around the outside of a circle. The diameter will go around a little over 3 times, which indicates C=πd. The radius will go around half of the circle a little over 3 times, therefore C=2πr. This can either be done using pipe cleaners or string and a measuring tool.***  ***Understanding the formula for the circumference of a circle can be taught using the diameter of the circle or the radius of the circle. Measure either the radius or diameter with a string or pipe cleaner. As you measure the distance around the circle using the measure of the diameter, you will find that it’s a little over three, which is pi. Therefore the circumference can be written as C=πd. When measuring the circle using the radius, you get a little over 6, which is 2π. Therefore, the circumference of the circle can also be expressed using C=2πr.***  ***Understanding the formula for the area of a circle can be shown using dissection arguments. First dissect portions of the circle like pieces of a pie. Arrange the pieces into a curvy parallelogram as indicated below.***    ***Understanding the volume of a cylinder is based on the area of a circle, realizing that the volume is the area of the circle over and over again until you’ve reached the given height, which is a simplified version of Cavalieri’s principle. In Cavalieri’s principle, the cross-sections of the cylinder are circles of equal area, which stack to a specific height. Therefore the formula for the volume of a cylinder is V=Bh. Informal limit arguments are not the intent at this level.***  ***Informal arguments for the volume of a pyramid and cone*** |
|  | **G-GMD.3** | **3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.  At this level formulas for pyramids, cones and spheres will be given**  Ex. Given the formula , for the volume of a cone, where B is the area of the base and H is the height of the. If a cone is inside a cylinder with a diameter of 12in. and a height of 16 in., find the volume of the cone. |
|  | **G-GPE.4** | Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).  \****Use the concepts of slope and distance to prove that a figure in the coordinate system is a special geometric shape.***  Ex. The coordinates are for a quadrilateral, (3, 0), (1, 3), (-2, 1), and (0,-2). Determine the type of quadrilateral made by connecting these four points? Identify the properties used to determine your classification. You must give confirming information about the polygon. .  Ex. If Quadrilateral ABCD is a rectangle, where A(1, 2), B(6, 0), C(10,10) and D(?, ?) is unknown.   1. Find the coordinates of the fourth vertex. 2. Verify that ABCD is a rectangle providing evidence related to the sides and angles. |
|  | **G-GPE.7** | **Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g.,  using the distance formula**  Students should find the perimeter of polygons and the area of triangles and rectangles using coordinates on the coordinate plane.  Ex. John was visiting three cities that lie on a coordinate grid at (-4, 5), (4, 5), and (-3, -4). If he visited all the cities and ended up where he started, what is the distance in miles he traveled? |
|  | **N-RN.1** | Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define to be the cube root of 5 because we want to hold, so must equal 5.*  ***In order to understand the meaning of rational exponents, students can initially investigate them by considering a pattern such as:***  ***What is the pattern for the exponents? They are reduced by a factor of each time. What is the pattern of the simplified values? Each successive value is the square root of the previous value. If we continue this pattern, then .***  ***Once the meaning of a rational exponent (with a numerator of 1) is established, students can verify that the properties of integer exponents hold for rational exponents as well.***  Example:  since  since  Ex. Use an example to show why holds true for expressions involving rational exponents like or . |
|  | **N-RN.2** | **Rewrite expressions involving radicals and rational exponents using the properties of exponents**  Students should be able to use the properties of exponents to rewrite expressions involving radicals as expressions using rational exponents.  Ex. Simplify the following.      Students should be able to use the properties of exponents to rewrite expressions involving rational exponents as expressions using radicals. *At this level, focus on fractional exponents with a numerator of 1.*  Ex. Simplify the following. |

Suggestions: