# **Algebra 1 Unit Test Guide**

## Function Analysis Unit Test

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| **Item** | **Lesson Coverage** | **Objective** | **Mathematical Practice Standard** | **Assessment Item** |
| 1 | Lesson 2: Piecewise Linear Functions | In this section, you will graph piecewise linear functions given equations. | Model with mathematics.  | Is this the correct graph for the piecewise function:Correct Answer: 1 for yes[Function Analysis Unit Test Item #1 | Desmos](https://www.desmos.com/calculator/9bdurwktt6)[Function Analysis Unit Test Item #1 - GeoGebra](https://www.geogebra.org/calculator/vafj9ugs) |
| 2 | Lesson 2: Piecewise Linear Functions | In this section, you will write equations of piecewise linear functions from graphs. | Model with mathematics.  | What is the piecewise function for the graph?Correct Answer: Option #2[Function Analysis Unit Test Item #2 | Desmos](https://www.desmos.com/calculator/rlzirubbwr)[Function Analysis Unit Test Item #2 - GeoGebra](https://www.geogebra.org/calculator/yzayqyk9) |
| 3 | Lesson 3: Quadratic Functions in Vertex Form | In this section, you will graph quadratics given in vertex form. | Model with mathematics.  | What is the vertex form of the graphed equation?$$y=-2\left(x-  ?  \right)^{2}+?$$Correct Answer: -3, -1[Function Analysis Unit Test Item #3 | Desmos](https://www.desmos.com/calculator/npmfvdnskm)[Function Analysis Unit Test Item #3 - GeoGebra](https://www.geogebra.org/graphing/a3u5nnn2) |
| 4 | Lesson 3: Quadratic Functions in Vertex Form | In this section, you will write equations of quadratics in vertex form given a graph. | Model with mathematics. | Use the graph to write the equation of the quadratic function in vertex form. $y=-\frac{1}{2}\left(x- ?\right)^{2}+ ?$Correct Answer: 3, 2[Function Analysis Unit Test Item #4 | Desmos](https://www.desmos.com/calculator/4zr3pxettu)[Function Analysis Unit Test Item #4 - GeoGebra](https://www.geogebra.org/calculator/f5ragvf4) |
| 5 | Lesson 4: Quadratic Functions in Standard Form | In this section, you will graph quadratic functions given in standard form. | Model with mathematics.  | A soccer ball is kicked from the ground at an upward velocity of 25 feet per second. This situation can be represented by the function $f\left(x\right)=-16x^{2}+25x$. Graph the function. Identify the x-intercept(s) and interpret its meaning. Correct Answer: (1.563, 0) The soccer ball will return to the ground 1.563 seconds after it has been kicked.[Function Analysis Unit Test Item #5 | Desmos](https://www.desmos.com/calculator/t1lpldcbzu)[Function Analysis Unit Test Item #5 - GeoGebra](https://www.geogebra.org/calculator/d5ehwczt) |
| 6 | Lesson 4: Quadratic Functions in Standard Form | In this section, you will write quadratic equations in standard form given a graph.  | Model with mathematics.  | Determine the value of the constant term of the quadratic function in standard form, given its graph.The value of c in the standard form of the quadratic function $y=ax^{2}+bx+c$ is \_\_\_\_.Correct Answer: 6[Function Analysis Unit Test Item #6 | Desmos](https://www.desmos.com/calculator/rkctodeg9u)[Function Analysis Unit Test Item #6 - GeoGebra](https://www.geogebra.org/calculator/y3rmkzud) |
| 7 | Lesson 5: Exponential Functions | In this section, you will graph exponential functions given equations. | Model with mathematics.  | The function $y=4\left(6\right)^{x}$models the number of people who have watched a video after *t* days. Graph the function to determine how many people initially watched the video by finding the y-intercept.Correct Answer: 4 people[Function Analysis Unit Test Item #7 | Desmos](https://www.desmos.com/calculator/gqqxgfsch5)[Function Analysis Unit Test Item #7 - GeoGebra](https://www.geogebra.org/calculator/whwyqmfz) |
| 8 | Lesson 5: Exponential Functions | In this section, you will write equations for exponential functions given a graph. | Model with mathematics.  | Given the graph of the exponential equation, which option is the correct exponential equation for the graph?Option #1: $y=7\left(\frac{1}{2}\right)^{x}$Option #2: $y=49\left(\frac{2}{7}\right)^{x}$Option #3: $y=7\left(\frac{2}{7}\right)^{x}$Option #4: $y=49\left(\frac{7}{2}\right)^{x}$Correct Answer: Option #2 is the correct equation for the graph.[Function Analysis Unit Test Item #8 | Desmos](https://www.desmos.com/calculator/4gsygo0hsl)[Function Analysis Unit Test #8 - GeoGebra](https://www.geogebra.org/calculator/eah2pnqa) |
| 9 | Lesson 6: Square Root Functions | In this section, you will graph square root functions given equations. | Model with mathematics. | Graph the square root functions $f\left(x\right)=\sqrt{x-2}$ and $g\left(x\right)=\sqrt{2-x}$. Which function has a y-intercept? Enter the correct option number.Option 1: $f\left(x\right)$Option 2: $g\left(x\right)$Option 3: both $f\left(x\right) and g\left(x\right)$Correct Answer: Option 2[Function Analysis Unit Test Item #9 | Desmos](https://www.desmos.com/calculator/jpgxuylrta)[Function Analysis Unit Test Item #9 - GeoGebra](https://www.geogebra.org/calculator/byyyabzv) |
| 10 | Lesson 6: Square Root Functions | In this section, you will identify key features of square root functions from graphs and compare with related quadratic functions. | Model with mathematics. | What are the coordinates of the minimum point for the square root function that relates to the quadratic function $f\left(x\right)=\frac{1}{2}\left(x-11\right)^{2}+4$ Correct Answer: (4, 11)[Function Analysis Unit Test Item #10 | Desmos](https://www.desmos.com/calculator/2usmlzvajz)[Function Analysis Unit Test Item #10 - GeoGebra](https://www.geogebra.org/calculator/jrhpvepb) |
| 11 | Lesson 7: Cube Root Functions | In this section, you will graph cube root functions given equations. | Model with mathematics. | Does the graph of the function $y=3\sqrt[3]{\left(x-1\right)}$ show that the function is increasing or decreasing? Option 1: increasing Option 2: decreasingCorrect Answer: Option 1[Function Analysis Unit Test Item #11 | Desmos](https://www.desmos.com/calculator/co81jvwpy8)[Function Analysis Unit Test Item #11 - GeoGebra](https://www.geogebra.org/calculator/xanzs9zh) |
| 12 | Lesson 7: Cube Root Functions | In this section, you will identify key features from the graph of a cube root function and compare them to the features of the graph of a square root function. | Model with mathematics. | Compare the graphs of $f\left(x\right)=2\sqrt{\left(x+1\right)}$ and $g\left(x\right)=2\sqrt[3]{\left(x+1\right)}$. What is the y-intercept of both graphs?Correct Answer: 2[Function Analysis Unit Test Item #12 | Desmos](https://www.desmos.com/calculator/rwmmek2mh1)[Function Analysis Unit Test Item #12 - GeoGebra](https://www.geogebra.org/calculator/mv89gseh) |
| 13 | Lesson 8: Comparing Shapes of Functions | In this section, you will compare the shapes of linear, quadratic, exponential, and cubic functions. | Model with mathematics. |

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| $$x$$ | $$f(x)$$ | $$g(x)$$ |
| -2 | -1 | 3 |
| -1 | $$\frac{3}{4}$$ | $$\frac{3}{4}$$ |
| 0 | 1 | 0 |
| 1 | $$1\frac{3}{4}$$ | $$\frac{3}{4}$$ |
| 2 | 3 | 3 |

Compare the functions $f\left(x\right)$ and $g\left(x\right)$. When is $f\left(x\right)$ greater than $g\left(x\right)$?$f\left(x\right)$ is greater than $g\left(x\right)$ when \_\_\_\_\_$<x< $\_\_\_\_\_.Correct Answer: -1, 2[Function Analysis Unit Test Item #13 | Desmos](https://www.desmos.com/calculator/6dcvuep4oq)[Function Analysis Unit Tet Item #13 - GeoGebra](https://www.geogebra.org/calculator/wrhbfuc3) |
| 14 | Lesson 8: Comparing Shapes of Functions | In this lesson, you will compare the shapes of square root and cube root graphs. | Model with mathematics. | Select the option that matches the graph. Option #1: The graph of the function matches $f\left(x\right)=2\sqrt[3]{x}$Option #2: The graph of the function matches $f\left(x\right)=2\sqrt{x}$Correct Answer: Option #2[Function Analysis Unit Test Item #14 | Desmos](https://www.desmos.com/calculator/agxa9togwy)[Function Analysis Unit Test Item #14 - GeoGebra](https://www.geogebra.org/calculator/mxkvmntx) |
| 15 | Lesson 9: Average Rate of Change | In this lesson, you will calculate the average rate of change between two points using a variety of functions. | Model with mathematics.  | Use the formula $\frac{f\left(b\right)-f\left(a\right)}{b-a}$ to calculate the average rate of change over the interval [-2, -1] given the function table for $y=3^{x+2}$. Express your answer as an integer.

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| $$x$$ | $$f(x)$$ |
| -3 | $$\frac{1}{3}$$ |
| -2 | 1 |
| -1 | 3 |
| 0 | 9 |

Correct Answer: 2[Function Analysis Unit Test Item #15 | Desmos](https://www.desmos.com/calculator/shmghhxjfd)[Function Analysis Unit Test Item #15 - GeoGebra](https://www.geogebra.org/calculator/dgnv7kwa) |
| 16 | Lesson 9: Average Rate of Change | In this lesson, you will describe function graphs in terms of average rates of change.  | Model with mathematics.  | Describe the behavior of the function by determining over which interval the function has a negative average rate of change.The average rate of change is negative over the interval [\_\_\_\_, \_\_\_\_].Correct Answer: [1,2] |
| 17 | Lesson 10: Comparing Average Rates of Change | In this section, you will compare estimated average rates of change of quadratic and exponential functions.  | Model with mathematics. | Compare the estimated average rates of change of the exponential function pictured above and the quadratic function $f\left(x\right)=x^{2}-20$ over the interval [-9,2].Correct Answer: The magnitude of the estimated average rate of change of the exponential function over the interval [-9,2] is less than the magnitude of the estimated average rate of change of f(x) over the interval [-9,2].[Function Analysis Unit Test Item #17 | Desmos](https://www.desmos.com/calculator/nxdthasg1f)[Function Analysis Unit Test Item #17 - GeoGebra](https://www.geogebra.org/calculator/qps3efjp) |
| 18 | Lesson 10: Comparing Average Rates of Change | In this lesson, you will compare estimated average rates of change of square root and cube root functions.  | Model with mathematics. |

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| $$x$$ | $p\left(x\right)=√x$-5 | $$q\left(x\right)=5\sqrt[3]{x-1}$$ |
| 0 | -5 | -5 |
| 1 | -4 | 0 |
| 9 | -2 | 10 |

Compare the estimated average rates of change for the function $p\left(x\right)=\sqrt{x}-5$ and $q\left(x\right)=5\sqrt[3]{\left(x-1\right)}$ over the interval [0.1, 8.9].Correct Answer: The estimated average rate of change of $q\left(x\right)$ is greater than the estimated average rate of change of $p\left(x\right)$ over [0.1, 8.9].[Function Analysis Unit Test Item #18 | Desmos](https://www.desmos.com/calculator/fr2yqbaapb)[Function Analysis Unit Test Item #18 - GeoGebra](https://www.geogebra.org/calculator/xxrwkn5r) |
| 19 | Lesson 8: Comparing Shapes of Functions | In this section, you will compare the shapes of linear, quadratic, exponential, and cubic functions. | Model with mathematics. | Graph and compare the shapes and key features of the functions $f\left(x\right)=\left(x+2\right)^{2}$ and $g\left(x\right)=2x+4$ . In 3–5 sentences, explain how the two functions are similar and how they are different.Correct Answer: The student should explain that the function $f\left(x\right)=\left(x+2\right)^{2}$ is U-shaped while the function $g\left(x\right)=2x+4$ is a straight line. The two graphs have the same domain, which is all real numbers. However, the two graphs have a different range. The range of the linear function is all real numbers. The range of the quadratic function is $y\geq 0 $ . Also, the quadratic function has a minimum at (-2, 0), but the linear function does not have a minimum. Also, (-2,0) is the x-intercept for the linear equation. $f\left(x\right)=\left(x+2\right)^{2}$ and $g\left(x\right)=2x+4$ have the same y-intercept, (0,4).[Function Analysis Unit Test Item #19 | Desmos](https://www.desmos.com/calculator/adq6926wmk)[Function Analysis Unit Test Item #19 - GeoGebra](https://www.geogebra.org/calculator/hjrgh4sb) |
| 20 | Lesson 8: Comparing Shapes of Functions | In this lesson, you will compare the shapes of square root and cube root graphs. | Model with mathematics. | Compare the square root and cube root functions by completing the following: A) Complete an input-output table for the functions $f\left(x\right)=\sqrt{x}$ and $g\left(x\right)=\sqrt[3]{x}$ . You do not need to submit the tables. B) Graph the functions by plotting the points from the input-output table. You do not need to submit the graphs. C) In 3–5 sentences, discuss the similarities and differences between the graphs of the functions.Correct Answer:A) (For reference) The following is a sample input-output table for both functions.B) (For reference) The following are the plotted points and graphs of both functions.$$f\left(x\right)=\sqrt{x}$$$$g\left(x\right)=\sqrt[3]{x}$$C) Students should note the similarities and differences. Sample answers include the following: The square root function, $f\left(x\right)$ , is not defined for negative values of $x $. * The cube root function, $g\left(x\right)$ , is greater than $f\left(x\right)$ on the interval from 0 to 1.
* The graphs intersect at the points (0, 0) and (1, 1).
* After the intersection at $x=1 $ , the square root function, $f\left(x\right)$ , is greater than $g\left(x\right)$.
* Both graphs are smooth curves.
* Both functions are increasing.
* $g\left(x\right)$ curves up for $x<0 $ and curves down for $x>0 $ . $f\left(x\right)$ curves down for $x>0 $ .

[Function Analysis Unit Test Item #20 | Desmos](https://www.desmos.com/calculator/d15crnfgwv)[Function Analysis Unit Test Item #20 - GeoGebra](https://www.geogebra.org/calculator/qbewgrcp) |
| 21 | Lesso 9: Average Rate of Change | In this lesson, you will calculate the average rate of change between two points using a variety of functions. | Model with mathematics.  |

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| **Time (hours)** | 0 | 4 | 7 | 9 | 12 |
| **Distance (miles)** | 0 | 248 | 449 | 565 | 757 |

The Diaz family went on a road trip for vacation. The table includes a cumulative chart of the time they traveled compared to the distance they drove. Over which interval was their average speed the fastest: [0, 4], [4, 7], [7, 9], or [9, 12]? Explain your reasoning in 1–2 sentences.Correct Answer:* Over the first interval [0, 4], the average rate of change is:

 $\frac{248-0}{4-0}=62$ miles per hour.* Over the second interval [4,7], the average rate of change is: $\frac{449-248}{7-4}=67$ miles per hour.
* Over the third interval [7, 9], the average rate of change is: $\frac{565-449}{9-7}=58$ miles per hour.
* Over the fourth interval [9, 12], the average rate of change is: $\frac{757-565}{12-9}=64$ miles per hour.
* The family averaged the fastest speed of 67 miles per hour during the second interval of the trip [4, 7].
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| 22 | Lesson 9: Average Rate of Change | In this lesson, you will describe function graphs in terms of average rates of change. | Model with mathematics. | Riley is training to run a 5-mile race. The graph represents the distance (miles) she ran with respect to time (minutes) in her first training run. Over which time interval did she run the fastest, [0, 8] or [2, 11]? Justify your answer in 1–2 sentences.Correct Answer:* The average rate of change over the interval $\left[0, 8\right]=\frac{1-0}{8-0}=0.125$ miles per minute.
* The average rate of change over the interval $\left[2, 11\right]=\frac{1.5-0.4}{11-2}≈0.122$ miles per minute.
* Riley ran the fastest over the interval [0, 8].
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