


**Linear function and exponential function**

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## Linear function and exponential function

A linear function and an exponential function are shown below. Linear function and exponential function similarities. When  $x=3$  the linear function and the exponential function are equal. The graph below shows a linear function and an exponential function. An exponential function and a linear function are graphed below. The graph of an exponential function and a linear function are shown below. Difference between linear function and exponential function. The points on the graph represent both an exponential function and a linear function.

This page Industry standards:Construct and compare linear, quadratic, and exponential models and solve problems.CCSS.Math.Content.HSF.LE.A.2Construct linear and exponential functions, including arithmetic and geometric sequences, with a graph, a description of a relationship, or two input-output pairs (in close the reading from a table).CCSS.Math.Content.HSF.LE.A.3Observe using graphs and tables that an exponentially increasing quantity eventually exceeds a linear, quadratic or (more generally) increasing quantity as a polynomial function.CCSS.Math.Content.HSF.LE.A.4For exponential models, express as logarithm the solution abc = d where a, c and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. Nonlinear Functions Learning Objectives Define the nonlinear function. Define inverse functions and recognize them in equations, tables and graphs. Define quadratic functions and recognize them in equations, tables and graphs. Define exponential functions and recognize them in equations, tables and graphs. Introduction Have you ever made cookies? You can't touch a right one when it comes out of the oven, or you'll burn yourself. It doesn't take long to cool down enough to eat them, but they'll still stay warm for a long time. And they don't get colder than room temperature. If we were to draw a graph of the cookie cooling process, something like this, the output variable would keep at the beginning and drop rapidly after some point. The cooled cookie has reached room temperature. This is an example of a non-linear function. A graph is an important representation of a function. It shows how the dependent value of an input changes as the independent value of an input changes. Determining the output given an input depends on the type of function defined by the input, and what happens if the inputs change? Can the outputs also change? But it is not a linear function because the rate of change is not constant. A straight line graph, since it does follow a straight line. Each nonlinear function has its own unique shape. The graph of a function that represents a curve is called a curved line. It should be easy to remember the name! There are many kinds of nonlinear functions. We will explore just a few of these. Reverse Variation Function A type of nonlinear function is called reverse variation. In these functions, the dependent variable, or value, changes as the independent variable, or value, changes. These functions have a constant product. For example, if y varies inversely with x, then xy = k, where k is a constant. Symbolically, this is the equation ay=k/x, where ay is the dependent variable, ak is the constant, and ax is the independent variable. Compare this with the equation for a function that has a direct variation between like La function function in which the input times a constant equals output. formula of 'y = kx'. the only difference is that the reverse of the entry is used for the functions of inverse variation (another name that makes perfectly sense.) an example of a non-linear function reverse function is speed vs time. Speed is measured in miles per hour, while time is measured in hours. The reciprocal of independent variables a constant is equivalent to the dependent variable, as in 'y = k / x'. is the speed necessary to travel between two cities in a certain amount of time. we say you have to drive from boston to chicago, which is about ~1,000 miles. The longer you have, the slower you can go. If you want to get to "20 years, you must go 50 miles per hour, because "(1,000 / 20 = 50". but if you can take "40 years to get there, you only have to average 25 miles per hour, since (1,000 / 40 = 25. the equation to understand how quickly to drive from the amount of time you have is "text (speed) = text (mile) / text (time)" ora ¨ s = (1,000 / t) ". see ... this is the same form as the function formula of reverse variation, y = k / x . here is a table that shows several times that meet the equation: the speed (time mile per hour) 1 000 ¸ 5 200 10 ¸ 15 66 2 ÷ 3 ¸ 16 62 12 ¸ 20 50 ¸ 40 25 ¸ now if we draw those points, let's see that the chart is definitely not a straight line, an important part of the functions and their graphs is determining the output given an input. Now look at the center of the chart, the chart is becoming more superficial here, a change of an hour is not going to make much difference in speed. If you need for "15 years" you will need to go almost" 67 mph. add an extra hour and this time the required speed decreases only on "4 miles per hour. the rate of change in this chart is not constant. starts very high, so the chart is very steep. but since the speed of the change chart becomes smaller, the chart is out. in a reverse function, what happens to output as the input becomes smaller? becomes bigger. oita is a constant uniform for the entrance. therefore, since the input decreases, the constant is divided by a smaller and lower number and the oita increases. square functions another type of non-linear function is a square function of the module "y = a² + 2bx + c" where "a" is not equal to zero ... in a square function, the independent variable ("x") is multiplied alone ... in many cases, is square. (the name comes from the word)/for Square. This is not nearly useful as non-linear and reverse, is it? Look at the simplest square function, which has the equation of "y = x²". A table of the values of the "X" is "y" this function might look like this: "xy" -3 ¸ 9 - Yes, "1 ¸ 0" "0 ¸ 1" "1 ¸ 2" "4 ¸ 4" "3 ¸ 9" On a graph, these values form a curved, U-shaped line called parabola/U-shaped graph which is produced by a quadratic equation. All quadratic functions form a parabola on a graph. The parabola can open upwards as the letter U or downwards as an upper side downwards, be wide or narrow, be symmetrical around the "y"-axis or lie on one of the quadrants. Quadratic functions are used to describe things with smooth symmetrical curves, such as the path of a bouncing ball or the arc of a bridge. A quadratic function can have the equation "y = x squared". But other quadratic function formulas are more complex, these are all quadratic equations: y = ax squared + bx + c y = (ax + b)² y = a (x+b)² + c The important thing to note here is that in any equation, the independent variable is multiplied by itself. The letters "a", "b", "c" and "d" are coefficients. Their presence in the equation changes the shape and position of the parabola... confused? Try this!The interactive graph below allows you to modify the values of 'a', 'b' and 'c' in the standard quadratic formula "y = ax² + bx + c". Click and drag the cursors to change the values of each coefficient. Watch the parabola move and change shape as you alter the values. When you're done, click the button labeled "Graph" to plot the new parabola. Remember that the sign of the coefficient matters. A) The ball rises faster than it falls. D) The ball falls faster than it rises. B) The height of the ball changes at a constant speed. That's not correct. The curved line of the graph indicates that the ball does not move at a constant speed, its height changes rapidly just after it is thrown, so the rate of change slows down as it approaches the maximum height. The change in height then picks up the speed again as it falls down slowly. The correct answer is that the higher the ball, the slower it moves. C) The ball rises faster than it falls. That's not correct. The curve is symmetrical around the maximum height, which means that the changes in height over time on the downward road mirror those on the upward road. The correct answer is that the higher the ball, the slower it moves. D) The ball falls faster than it rises. That's not correct. The curve is symmetrical around the height which means that the changes in height over time on the way up mirror those on the way down. The correct answer is that the higher the ball, the slower it moves. Exponential Functions Another type of nonlinear function is the exponential functionA exponential function is a function whose value grows or shrinks by a fixed percentage over a fixed interval of time. The exponential function formula has the shape a^t = m \* y = ab ^ ct. Since a^ln = y is the exponent, if a^ln = y is greater than a^ln = 1, the output will grow very quickly for each small increase in the input value. Exponential functions are used for things like population growth and radioactive decay. Here is a table that shows the values a^ln = y for the equation a^ln = y = 2^n \* x. "a" x"a^ln = y"2-a^ln=0.25-"a" ln=0.5-a^ln=a^ln=0.8-a^ln=a^ln=1-a^ln=a^ln=2-2-a^ln=4-4-a^ln=8-8-a^ln=16-16-a^ln=32-32-a^ln=64-64-a^ln=128-128-a^ln=256-256-a^ln=512-512-a^ln=1024-1024-a^ln=2048-2048-a^ln=4096-4096-a^ln=8192-8192-a^ln=16384-16384-a^ln=32768-32768-a^ln=65536-65536-a^ln=131072-131072-a^ln=262144-262144-a^ln=524288-524288-a^ln=1048576-1048576-a^ln=2097152-2097152-a^ln=4194304-4194304-a^ln=8388608-8388608-a^ln=16777216-16777216-a^ln=33554432-33554432-a^ln=67108864-67108864-a^ln=134217728-134217728-a^ln=268435456-268435456-a^ln=536870912-536870912-a^ln=1073741824-1073741824-a^ln=2147483648-2147483648-a^ln=4294967296-4294967296-a^ln=8589934592-8589934592-a^ln=17179869184-17179869184-a^ln=34359738368-34359738368-a^ln=68719476736-68719476736-a^ln=137438953472-137438953472-a^ln=274877906944-274877906944-a^ln=549755813888-549755813888-a^ln=1099511627776-1099511627776-a^ln=2199023255552-2199023255552-a^ln=4398046511104-4398046511104-a^ln=8796093022208-8796093022208-a^ln=17592186044416-17592186044416-a^ln=35184372088832-35184372088832-a^ln=70368744177664-70368744177664-a^ln=140737488355328-140737488355328-a^ln=281474976710656-281474976710656-a^ln=562949953421312-562949953421312-a^ln=1125899906842624-1125899906842624-a^ln=2251799813685248-2251799813685248-a^ln=4503599627370496-4503599627370496-a^ln=9007199254740992-9007199254740992-a^ln=18014398509481984-18014398509481984-a^ln=36028797018963968-36028797018963968-a^ln=72057594037927936-72057594037927936-a^ln=144115188075855872-144115188075855872-a^ln=288230376151711744-288230376151711744-a^ln=576460752303423488-576460752303423488-a^ln=1152921504606846976-1152921504606846976-a^ln=2305843009213693952-2305843009213693952-a^ln=4611686018427387904-4611686018427387904-a^ln=9223372036854775808-9223372036854775808-a^ln=18446744073709551616-18446744073709551616-a^ln=36893488147419103232-36893488147419103232-a^ln=73786976294838206464-73786976294838206464-a^ln=147573952589676412928-147573952589676412928-a^ln=295147905179352825856-295147905179352825856-a^ln=590295810358705651712-590295810358705651712-a^ln=1180591620717411303424-1180591620717411303424-a^ln=2361183241434822606848-2361183241434822606848-a^ln=4722366482869645213696-4722366482869645213696-a^ln=9444732965739290427392-94447329657392904

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