7-1 Exponential Functions, Growth, and Decay

Example 1 Graphing Exponential Functions

Tell whether the function shows growth or decay. Then graph.

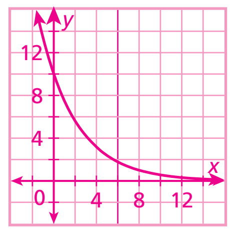
A. $f(x) = 10\left(\frac{3}{4}\right)^x$

Step 1 Find the value of the base.

$f(x) = 10\left(\frac{3}{4}\right)^x$ *The base, $\frac{3}{4}$, is less than 1. This is an exponential decay function.*

Step 2 Graph the function by using a table of values.

x	0	2	4	6	8	10	12
$f(x)$	10	5.6	3.2	1.8	1.0	0.6	0.3

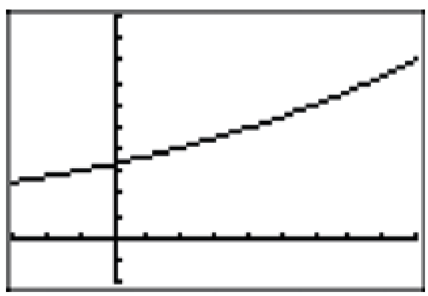


B. $g(x) = 100(1.05)^x$

Step 1 Find the value of the base.

$g(x) = 100(1.05)^x$ *The base, 1.05, is greater than 1. This is an exponential growth function.*

Step 2 Graph the function by using a graphing calculator.



ADDITIONAL EXAMPLES

7-1 Exponential Functions, Growth, and Decay

Example 2 Economics Application

Clara invests $5000 in an account that pays 6.25% interest per year. After how many years will her investment be worth $10,000?

Step 1 Write a function to model the growth in value of her investment.

$f(t) = a(1 + r)^t$ *Exponential growth function*

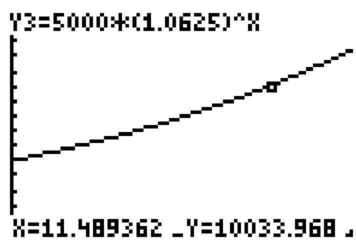
$f(t) = 5000(1 + 0.0625)^t$ *Substitute 5000 for a and 0.0625 for r.*

$f(t) = 5000(1.0625)^t$

Step 2 Graph the function.

When graphing exponential functions in an appropriate domain, you may need to adjust the range a few times to show the key points of the function.

Step 3 Use the graph to predict when the value of the investment will reach $10,000. Use the TRACE feature to find the t-value where $f(t) \approx 10{,}000$.



The function value is approximately 10,000 when $t \approx 11.43$. The investment will be worth $10,000 about 11.43 years after it was purchased.

7-1 Exponential Functions, Growth, and Decay

Example 3 Depreciation Application

A city population, which was initially 15,500, has been dropping by 3% a year. Write an exponential function and graph the function. Use the graph to predict when the population will drop below 8000.

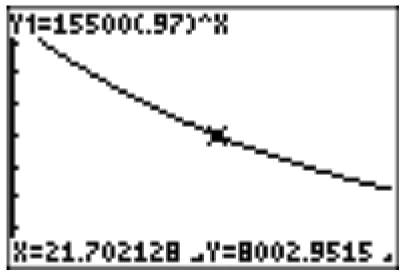
Write a function to model the decay in the city's population.

$f(t) = a(1 - r)^t$ *Exponential decay function*

$f(t) = 15{,}500(1 - 0.03)^t$ *Substitute 15,500 for a and 0.03 for r.*

$f(t) = 15{,}500(0.97)^t$ *Simplify.*

Graph the function. Use TRACE to find when the population will fall below 8000.



It will take about 21.7 years for the population to fall below 8000.