EXAMPLE 2 Graph an exponential function

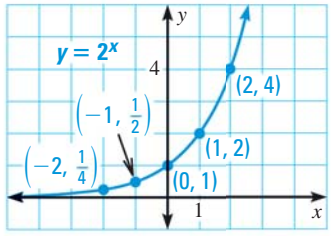
Graph the function $y = 2^x$. Identify its domain and range.

Solution

READ A GRAPH
Notice that the graph has a y-intercept of 1 and that it gets closer to the negative x-axis as the x-values decrease.

STEP 1 **Make** a table by choosing a few values for x and finding the values of y. The domain is all real numbers.

x	-2	-1	0	1	2
y	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4



STEP 2 **Plot** the points.

STEP 3 **Draw** a smooth curve through the points. From either the table or the graph, you can see that the range is all positive real numbers.

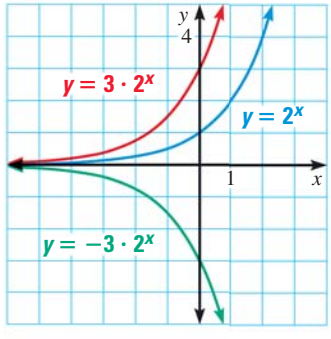
EXAMPLE 3 Compare graphs of exponential functions

Graph the functions $y = 3 \cdot 2^x$ and $y = -3 \cdot 2^x$. Compare each graph with the graph of $y = 2^x$.

Solution

To graph each function, make a table of values, plot the points, and draw a smooth curve through the points.

x	$y = 2^x$	$y = 3 \cdot 2^x$	$y = -3 \cdot 2^x$
-2	$\frac{1}{4}$	$\frac{3}{4}$	$-\frac{3}{4}$
-1	$\frac{1}{2}$	$\frac{3}{2}$	$-\frac{3}{2}$
0	1	3	-3
1	2	6	-6
2	4	12	-12



Because the y-values for $y = 3 \cdot 2^x$ are 3 times the corresponding y-values for $y = 2^x$, the graph of $y = 3 \cdot 2^x$ is a vertical stretch of the graph of $y = 2^x$.

Because the y-values for $y = -3 \cdot 2^x$ are -3 times the corresponding y-values for $y = 2^x$, the graph of $y = -3 \cdot 2^x$ is a vertical stretch with a reflection in the x-axis of the graph of $y = 2^x$.

GUIDED PRACTICE for Examples 2 and 3

2. Graph $y = 5^x$ and identify its domain and range.

3. Graph $y = \frac{1}{3} \cdot 2^x$. Compare the graph with the graph of $y = 2^x$.

4. Graph $y = -\frac{1}{3} \cdot 2^x$. Compare the graph with the graph of $y = 2^x$.