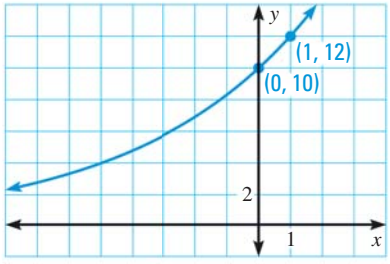
COMPARE GRAPHS When $a > 0$ and $0 < b < 1$, the function $y = ab^x$ represents **exponential decay**. The graph of an exponential decay function falls from left to right. In comparison, the graph of an exponential growth function $y = ab^x$ where $a > 0$ and $b > 1$ rises from the left.

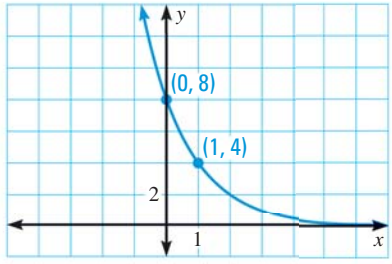
EXAMPLE 4 Classify and write rules for functions

Tell whether the graph represents *exponential growth* or *exponential decay*. Then write a rule for the function.

a.



b.



Solution

a. The graph represents exponential growth ($y = ab^x$ where $b > 1$). The y-intercept is 10, so $a = 10$. Find the value of b by using the point $(1, 12)$ and $a = 10$.

$y = ab^x$	**Write function.**
$12 = 10 \cdot b^1$	**Substitute.**
$1.2 = b$	**Solve.**

A function rule is $y = 10(1.2)^x$.

b. The graph represents exponential decay ($y = ab^x$ where $0 < b < 1$). The y-intercept is 8, so $a = 8$. Find the value of b by using the point $(1, 4)$ and $a = 8$.

$y = ab^x$	**Write function.**
$4 = 8 \cdot b^1$	**Substitute.**
$0.5 = b$	**Solve.**

A function rule is $y = 8(0.5)^x$.

ANALYZE GRAPHS
For the function $y = ab^x$, where $x = 0$, the value of y is $y = ax^0 = a$. This means that the graph of $y = ab^x$ has a y-intercept of a.

GUIDED PRACTICE for Example 4

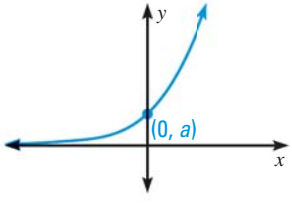
4. The graph of an exponential function passes through the points $(0, 10)$ and $(1, 8)$. Graph the function. Tell whether the graph represents *exponential growth* or *exponential decay*. Write a rule for the function.

CONCEPT SUMMARY *For Your Notebook*

Exponential Growth and Decay

Exponential Growth

$y = ab^x$, $a > 0$ and $b > 1$



Exponential Decay

$y = ab^x$, $a > 0$ and $0 < b < 1$