10-5 Exponential Functions *(Pages 554–560)*

Exponential Function	An exponential function is a function that can be described by an equation of the form $y = a^x$, where $a > 0$ and $a \neq 1$.

You can use ordered pairs to graph exponential functions. When you've graphed enough ordered pairs, connect the points to form a smooth curve. The y-intercept of an exponential function is the y-coordinate of the point at which the graph crosses the y-axis.

Examples

a. Graph the equation $y = 2^{x + 1}$ and state the y-intercept.

Make a table of values and then graph the function.

x	-3	-2	-1	0	1	2
y	0.25	0.5	1	2	4	8

The y-intercept is 2.

b. Determine whether the data in the table display exponential behavior.

x	3	5	7	9
y	3	9	27	91

The domain values are at regular intervals of 2.

$$3 \quad 9 \quad 27 \quad 91$$
$$\times 3 \quad \times 3 \quad \times 3$$
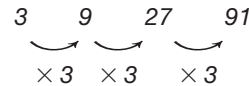
Since the domain values are at regular intervals and the range values have a common factor, the data are probably exponential.

Practice

Graph each function. State the y-intercept.

1. $y = 2^x$

2. $y = 2^{x - 3}$

3. $y = 2^x - 3$

4. $y = \left(\dfrac{1}{2}\right)^x$

5. $y = \left(\dfrac{1}{2}\right)^{x + 1}$

6. $y = \left(\dfrac{1}{2}\right)^x + 1$

Determine whether each set of data displays exponential behavior.

7.

x	5	10	15	20
y	3	6	9	12

8.

x	2	4	6	8
y	5	25	125	625

9.

x	4	5	6	7
y	40	35	30	25

10.

x	10	20	30	40
y	64	32	16	8

11. **Standardized Test Practice** Compare the graphs of $y = 2^x$ and $y = 2^x + 1$.

   A The graph of $y = 2^x$ is steeper than the graph of $y = 2^x + 1$.

   B The graph of $y = 2^x + 1$ is steeper than the graph of $y = 2^x$.

   C The graph of $y = 2^x + 1$ is the graph of $y = 2^x$ translated 1 unit up.

   D The graph of $y = 2^x + 1$ is the graph of $y = 2^x$ translated 1 unit down.

Answers: 1–6. For graphs, see Answer Key. **1.** 1 **2.** $\frac{1}{8}$ **3.** -2 **4.** 1 **5.** $\frac{1}{2}$ **6.** 2 **7.** no **8.** yes **9.** no **10.** yes **11.** C

79