

Warm Up

Solve each exponential equation.

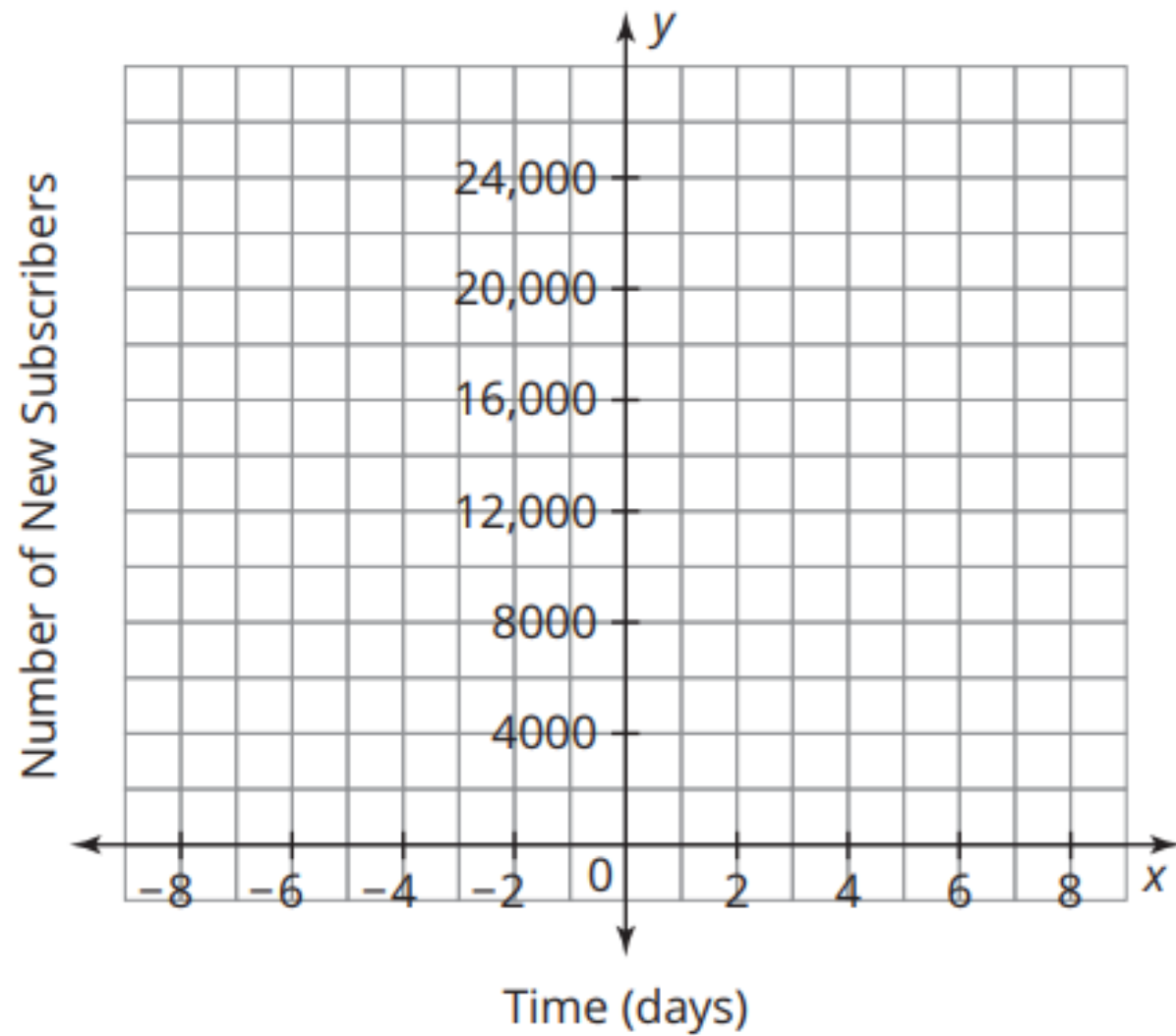
1. $2^x = 32$

2. $5^x = 625$

3. $x^3 = 27$

4. $x^7 = 128$

1. Write a function using the creator's estimate to model the number of new subscribers, P , who will be playing Bubblez Burst on day t . Use technology to graph your function and then sketch it on the coordinate plane.



- 2. Use your graph to approximate each answer and then verify algebraically. Show all work and explain your reasoning.**
- a. On what day will Bubblez Burst reach 4050 new subscribers?**
- b. On what day will Bubblez Burst reach 20,000 new subscribers?**

The **Change of Base Formula** states:

$$\log_b c = \frac{\log_a c}{\log_a b}, \text{ where } a, b, c > 0 \text{ and } a, b \neq 1.$$

1. Solve each exponential equation and explain the strategy you used.

a. $2^x = 64$

b. $y^3 = 125$

2. Solve each logarithmic equation and explain the strategy you used.

a. $\log_3 w = \log_3 20$

b. $\log_m 9 = \log_4 9$

4. Todd and Danielle each solved the exponential equation $4^{x-1} = 50$.

Todd



$$4^{x-1} = 50$$

$$x - 1 = \log_4(50)$$

$$x - 1 = \frac{\log 50}{\log 4}$$

$$x - 1 \approx 2.822$$

$$x \approx 3.822$$

Danielle



$$4^{x-1} = 50$$

$$\log(4^{x-1}) = \log 50$$

$$(x - 1) \log 4 = \log 50$$

$$x - 1 = \frac{\log 50}{\log 4}$$

$$x = \frac{\log 50}{\log 4} + 1$$

$$x \approx 3.822$$

5. Solve the exponential equation $8^x = 38.96$ using both Todd's and Danielle's methods. Round to the nearest thousandth and check your work.

1. John, Bobbi, and Randy each solved the equation $9^{x+4} = 27$.

John



$$\begin{aligned} 9^{x+4} &= 27 \\ x + 4 &= \log_9 27 \\ x + 4 &= \frac{\log 27}{\log 9} \\ x + 4 &= 1.5 \\ x &= -2.5 \end{aligned}$$

Bobbi



$$\begin{aligned} 9^{x+4} &= 27 \\ \log(9^{x+4}) &= \log 27 \\ (x + 4)\log 9 &= \log 27 \\ x + 4 &= \frac{\log 27}{\log 9} \\ x + 4 &= 1.5 \\ x &= -2.5 \end{aligned}$$

Randy



$$\begin{aligned} 9^{x+4} &= 27 \\ (3^2)^{x+4} &= 3^3 \\ 3^{2(x+4)} &= 3^3 \\ 2(x + 4) &= 3 \\ 2x + 8 &= 3 \\ 2x &= -5 \\ x &= -2.5 \end{aligned}$$

2. Ameet and Neha each took the logarithm of both sides of the equation to solve $24^x = 5$.

Ameet



$$24^x = 5$$

$$\ln(24^x) = \ln 5$$

$$x \ln 24 = \ln 5$$

$$x = \frac{\ln 5}{\ln 24}$$

$$x \approx 0.506$$

Check:

$$24^x \stackrel{?}{=} 5$$

$$24^{0.506} \stackrel{?}{=} 5$$

$$4.99 \approx 5$$

Neha



$$24^x = 5$$

$$\log(24^x) = \log 5$$

$$x \log 24 = \log 5$$

$$x = \frac{\log 5}{\log 24}$$

$$x \approx 0.506$$

Check:

$$24^x \stackrel{?}{=} 5$$

$$24^{0.506} \stackrel{?}{=} 5$$

$$4.99 \approx 5$$

Practice

1. Ten volunteers begin recruiting people to be volunteers for a large fundraising event. After 1 week, the total number of volunteers has doubled to 20. Each subsequent week, the total number of volunteers doubles.
 - a. Write a function to model the total number of volunteers, V , in the group after t weeks.
 - b. How many weeks will it take for the total number of volunteers to reach 1280?
 - c. How many weeks will it take for the volunteers to reach their goal of 15,000 total volunteers?
2. A group of citizens established a new political party called the People's Party. The number of members in the party, P , can be modeled by the function $P(m) = 500 \cdot 1.2^m$, where m represents the number of months since the founding of the party.
 - a. How many months will it take for the membership of the party to grow to 10,000 members?
 - b. How many years will it take for the membership of the party to grow to 200,000 members?
3. Solve each exponential equation. Round your answer to the nearest hundredth.

a. $9^{x+2} + 3 = 52$

b. $\frac{7^{3x-2}}{5} = 2$