

## Exponential Equations (Advanced)

1. A ball is dropped from an initial height of 20 feet and bounces repeatedly. The maximum height reached after each bounce is 80% of the previous maximum height. Which of the following functions models the maximum height  $h(n)$ , in feet, of the ball after it bounces  $n$  times, where  $n$  is an integer?

A)  $h(n) = 80(.2)^n$   
B)  $h(n) = 20(.2)^n$   
C)  $h(n) = 80(.8)^n$   
D)  $h(n) = 20(.8)^n$

2.  $A(t) = 50(2)^t$

The function  $A(t)$  models the number of liters of a fluid in a tank after  $t$  hours. Which of the following models the number of liters of the fluid in the tank after  $m$  minutes?

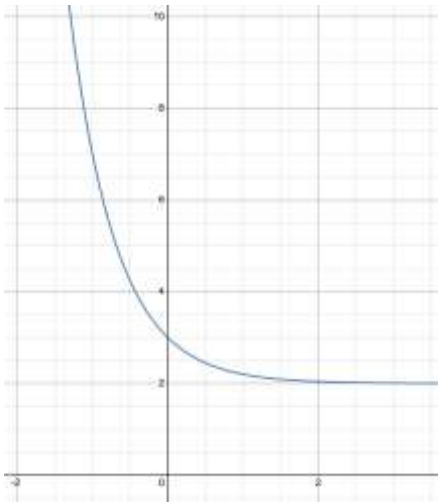
A)  $A(m) = 50(2)^{60m}$   
B)  $A(m) = 50(2)^{\frac{60}{m}}$   
C)  $A(m) = 50(2)^m$   
D)  $A(m) = 50(2)^{\frac{m}{60}}$

3.  $d(t) = 40(2)^{\frac{t}{10}}$

The given function models the number of DNA fragments produced in a solution, where  $t$  represents the time, in minutes, and  $t \leq 600$ . Which of the following is the best interpretation of the number 40 in this context?

A) There are 40 DNA fragments in the solution at  $t = 0$ .  
B) There are exactly 2 DNA fragments in the solution at  $t = 40$ .  
C) The number of DNA fragments in the solution increases by 40 every 2 minutes.  
D) There are 0 DNA fragments in the solution at  $t = 40$ .

4.



What is the equation of the graph shown?

- A)  $y = \left(\frac{1}{5}\right)^x$
- B)  $y = \left(\frac{1}{5}\right)^x + 2$
- C)  $y = \left(\frac{6}{5}\right)^x$
- D)  $y = \left(\frac{6}{5}\right)^x + 2$

5. In the  $xy$ -plane, what is the  $y$ -intercept of the graph of  $y = c(14)^x - d$ , where  $c$  and  $d$  are positive constants?

- A)  $(0, c)$
- B)  $(0, -d)$
- C)  $(0, -cd)$
- D)  $(0, c - d)$

6.  $M = 1,200(1.03)^t$

The equation above models the number of members,  $M$ , of a gym  $t$  years after the gym opens. Of the following, which equation models the number of members of the gym  $h$  half years after the gym opens?

- A)  $M = 1,200(1.03)^{\frac{h}{2}}$
- B)  $M = 1,200(1.03)^{2h}$
- C)  $M = 1,200(1.015)^{2h}$
- D)  $M = 1,200(1.015)^{\frac{h}{2}}$

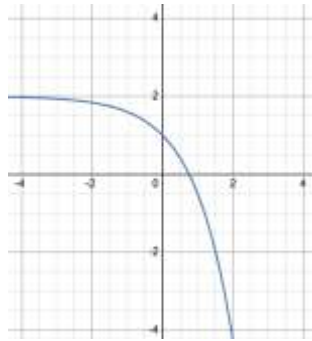
7. Radioactive substances decay over time. The mass  $M$ , in grams, of a particular radioactive substance,  $d$  days after the beginning of an experiment, is shown in the table below.

Number of days, $d$	Mass, $M$ (grams)
0	140
40	121.93
80	106.2
120	92.5

If this relationship is modeled by the function  $M(d) = a \cdot 10^{bd}$ , which of the following could be the values of  $a$  and  $b$ ?

- A)  $a = 14$  and  $b = 0.0132$   
 B)  $a = 14$  and  $b = -0.0132$   
 C)  $a = 140$  and  $b = 0.0015$   
 D)  $a = 140$  and  $b = -0.0015$

8.



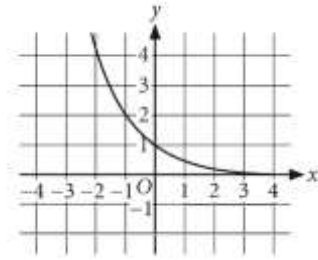
What is the equation of the graph shown?

- A)  $y = -2^x + 2$   
 B)  $y = -(0.4)^{-x} + 2$   
 C)  $y = (0.4)^{-x} + 1$   
 D)  $y = -2^x$

9. A biologist grows a culture of bacteria as part of an experiment. At the start of the experiment, there are 60 bacteria in the culture. The biologist observes that the population of bacteria doubles every 20 minutes. Which of the following equations best models the number,  $n$ , of bacteria  $t$  hours after the start of the experiment?

- A)  $n = 60(2)^{\frac{t}{20}}$   
 B)  $n = 60(2)^{\frac{t}{3}}$   
 C)  $n = 60(2)^{3t}$   
 D)  $n = 60(2)^{20t}$

10.



An equation of the curve shown in the  $xy$ -plane is  $y = k\left(\frac{1}{3}\right)^x$ , where  $k$  is a positive constant. What is the value of  $k$ ?

- A) 0
- B) 1
- C) 3
- D) 10

11. Light intensity below the surface of a lake,  $P(x)$ , expressed as a percentage of the intensity at the surface, can be modeled with an exponential function, where  $x$  is the depth in meters below the surface. For every 3 meters the depth increases, the light intensity decreases by 40%. Which function best models this situation?

- A)  $P(x) = 100(0.4)^{\frac{x}{3}}$
- B)  $P(x) = 100(0.6)^{\frac{x}{3}}$
- C)  $P(x) = 100(1.4)^{\frac{x}{3}}$
- D)  $P(x) = 100(1.6)^{\frac{x}{3}}$

12. Tian measure the temperature of a cup of tea placed in a room with a constant temperature of 20 degrees Celsius ( $^{\circ}\text{C}$ ). The temperature of the tea was  $98^{\circ}\text{C}$  at 3:00 P.M. when it started cooling. The temperature of the tea was approximately  $79^{\circ}\text{C}$  at 3:10 PM and approximately  $64^{\circ}\text{C}$  at 3:20 P.M. The temperature of the tea continued to decrease. Of the following functions, which best models the temperature  $T(m)$ , in degrees Celsius, of Tian's hot chocolate  $m$  minutes after it started cooling?

- A)  $T(m) = 98(1.18)^m$
- B)  $T(m) = 98(0.8)^m$
- C)  $T(m) = (98 - 20)(.75)^{\frac{m}{10}}$
- D)  $T(m) = 20 + 78(.75)^{\frac{m}{10}}$