Modeling with Functions

Pre-Assessment

Circle the letter of the best answer.

1. Martha measured the perimeter of a painting as 212 centimeters. If framing boards are labeled in inches, which board length will give her enough material to frame the painting? *Note*: 1 inch = 2.54 centimeters.

   a. 96 inches
   c. 48 inches
   b. 72 inches
   d. 36 inches

2. Thallium-201 has a half-life of 72.912 hours. How much of a 1 mg sample would remain after 2 weeks?

   a. 0.0001 mg
   c. 0.9812 mg
   b. 0.8754 mg
   d. 0.0410 mg

3. Which table row represents data points on the graph of a logarithmic function?

x	–2	–1	0	1	2
Q	—	—	—	0.70	1
R	0.08	0.4	2	10	50
S	–18	–0.5	0	0.5	18
T	–2	–1	0	1	2

   a. Q
   c. S
   b. R
   d. T

4. Which exponential function corresponds to the logarithmic expression $\log_4 g(x) = x + 3$?

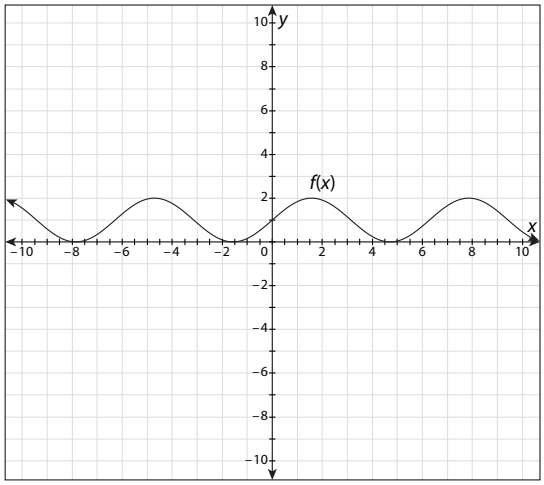
   a. $g(x) = 3 \bullet 4^x$
   c. $g(x) = 4^{3x}$
   b. $g(x) = 4 \bullet x^3$
   d. $g(x) = 4^{x+3}$

5. What is the equation of a sine function that has no horizontal displacement, rises 2 units above its midline, is at $y = 3$, and has a period of $\frac{\pi}{4}$?

   a. $f(x)=2\sin\left(\frac{\pi}{4}x\right)+3$
   c. $f(x) = 2 \sin (8x) + 3$
   b. $f(x)=2\sin\left(\frac{\pi}{4}x+3\right)$
   d. $f(x) = 2 \sin (8x + 3)$

continued

6. Which function does the graph represent?



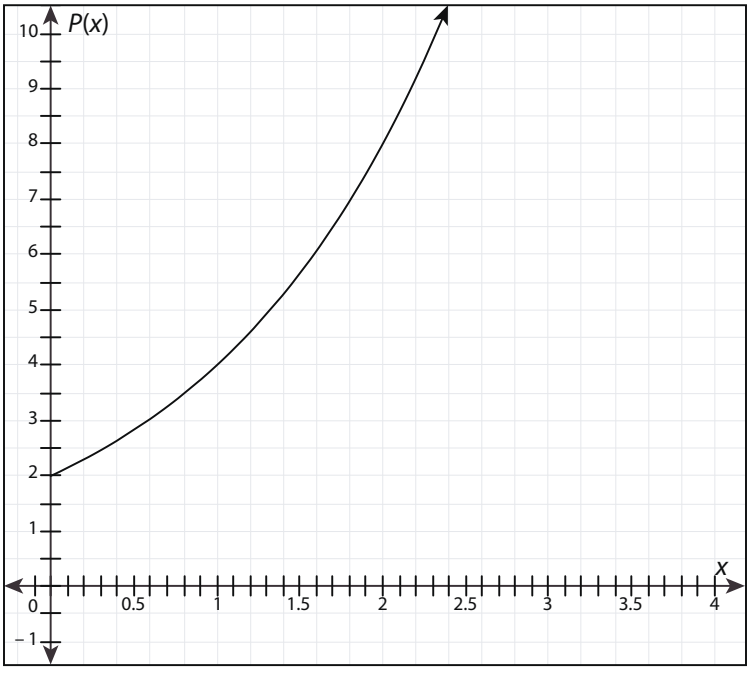
a. $f(x) = -\sin x - 1$

b. $f(x) = \sin x - 1$

c. $f(x) = \sin x + 1$

d. $f(x) = -\sin x + 1$

7. The graph shows the growth of a ground squirrel population in an ecosystem in which there are no predators. Which function models this data?



a. $P(x) = 2^{x+1}$

b. $P(x) = 2^{x}$

c. $P(x) = 2 + 2^{x}$

d. $P(x) = 2^{x-1}$

continued

8. An object without a parachute is dropped from a plane. For a few seconds, the object falls with a speed that is modeled by the function $v(t)=\sqrt{16t}$, in which v is the velocity and t is the time before the object reaches its terminal speed. The terminal speed is the constant speed reached by the object due to air resistance. It is described by the function $v_f(t)=\frac{h}{t}$, in which h is the height at which the terminal speed is reached, and t is the time it takes for the object to fall to the ground. Which combined function represents this situation?
   a. $(v + v_f)(t)$ over the domain of t
   b. $v(t)$ for one restricted domain of t and $v_f(t)$ for another restricted domain of t
   c. $(v - v_f)(t)$ over the domain of t
   d. $v(t)$ for the domain of t, less $v_f(t)$ for a restricted domain of t

9. Which of the following is an example of variable reassignment?
   a. $X = 1; X = 2$
   b. $X = X + 1$
   c. both a and b
   d. none of these

10. Rachel created the following algorithm, which is intended to always output a number greater than or equal to 1.

> Step 1: Input X.
>
> Step 2: Condition: Is $X < 0$?
>
> If yes, redefine $X = -X$ and repeat step 2.
>
> If no, proceed to step 3.
>
> Step 3: Condition: Is $X < 1$?
>
> If yes, output 1/X. If no, output X.

Which statement is true?
   a. The algorithm fails if $X = 1$ because of an infinite loop.
   b. The algorithm fails if $X = -1$ because of an infinite loop.
   c. The algorithm fails if $X = 0$ because of an infinite loop.
   d. all of the above