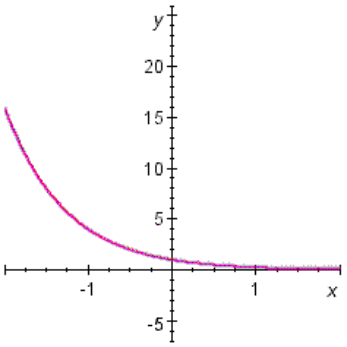
Chapter 4 Quiz

Multiple Choice
Identify the choice that best completes the statement or answers the question.

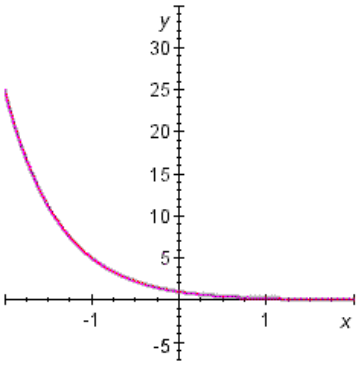
____ 1. Sketch the graph of the function by making a table of values. Use a calculator if necessary.

$$f(x) = \left(\frac{1}{8}\right)^x$$

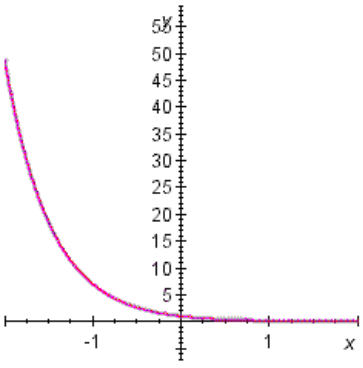
a.



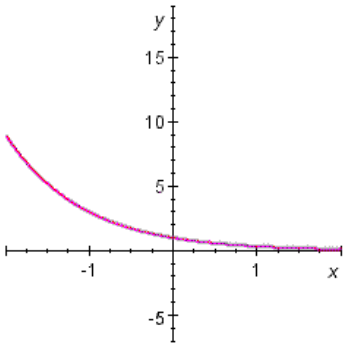
b.



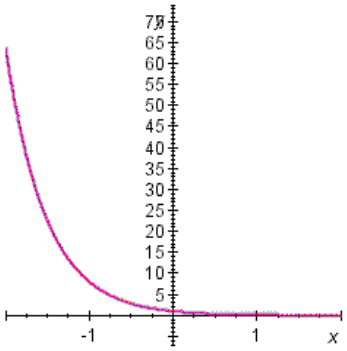
c.



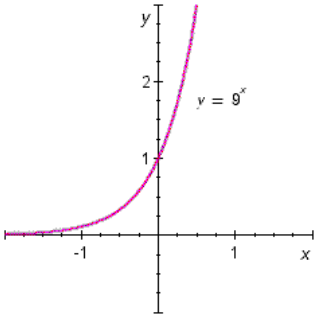
d.



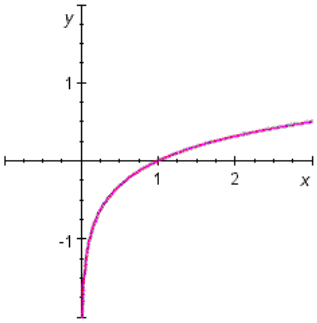
e.



____ 2. Graph the function, not by plotting points, but by starting from the graph in the figure. State the domain, range, and asymptote. $f(x) = 9^{-x}$

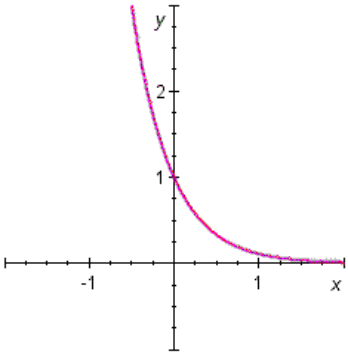


a.



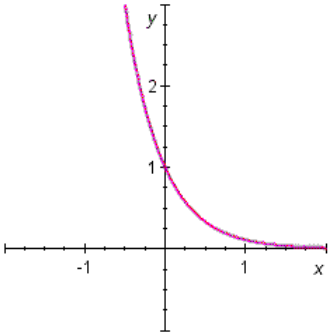
Domain: $(0, \infty)$. Range: $(-\infty, \infty)$.
Asymptote: $y = 0$.

b.



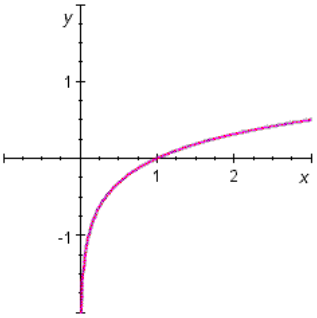
Domain: $(-\infty, \infty)$. Range: $(0, \infty)$.
Asymptote: $y = 0$.

c.



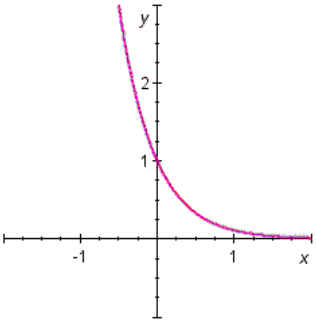
Domain: $(0, \infty)$. Range: $(-\infty, \infty)$.
Asymptote: $y = 0$.

d.



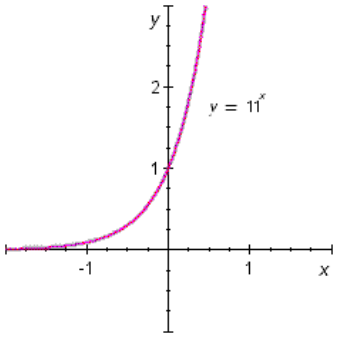
Domain: $(-\infty, \infty)$. Range: $(0, \infty)$.
Asymptote: $x = 0$.

e.

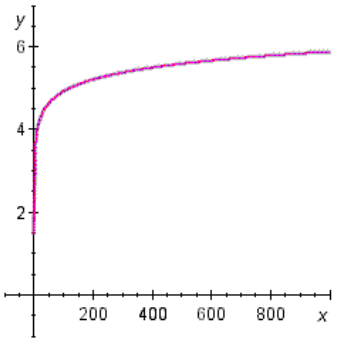


Domain: $(0, \infty)$. Range: $(-\infty, \infty)$.
Asymptote: $x = 0$.

____ 3. Graph the function, not by plotting points, but by starting from the graph in the figure. State the domain, range, and asymptote. $f(x) = 11^{x+3}$

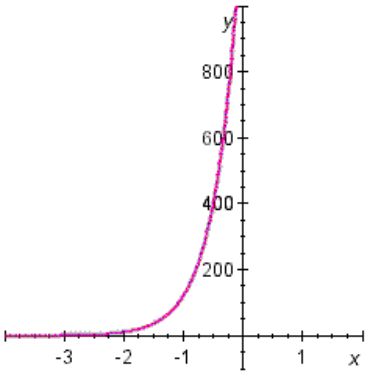


a.



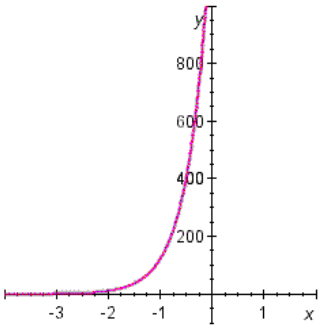
Domain: $(-\infty, \infty)$. Range: $(0, \infty)$.
Asymptote: $y = 0$.

b.



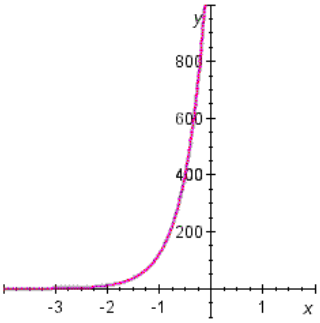
Domain: $(-\infty, \infty)$. Range: $(0, \infty)$.
Asymptote: $x = 0$.

c.



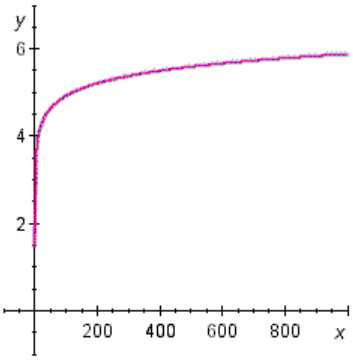
Domain: $(-\infty, \infty)$. Range: $(0, \infty)$.
Asymptote: $y = 0$.

d.



Domain: $(0, \infty)$. Range: $(-\infty, \infty)$.
Asymptote: $y = 0$.

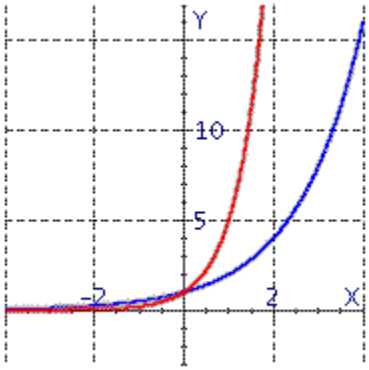
e.



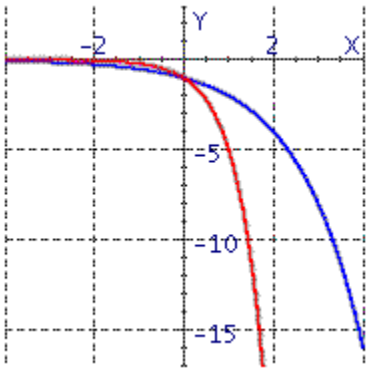
Domain: $(0, \infty)$. Range: $(-\infty, \infty)$.
Asymptote: $y = 0$.

____ 4. Identify the graphs of the functions $y = 2^x$ (blue) and $y = 5^x$ (red or dashed).

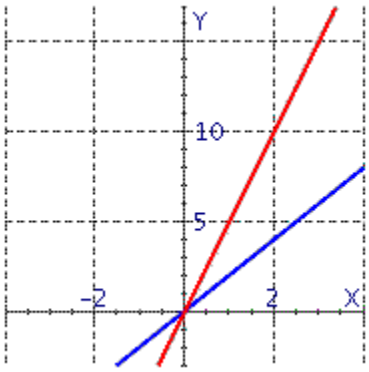
a.



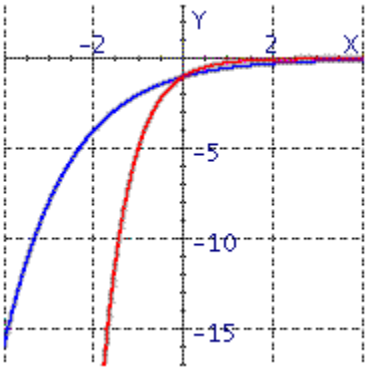
b.



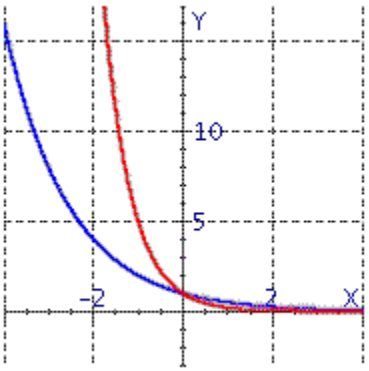
c.



d.

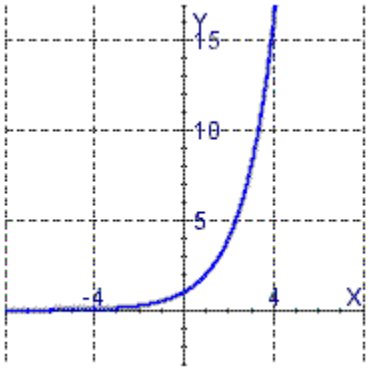


e.

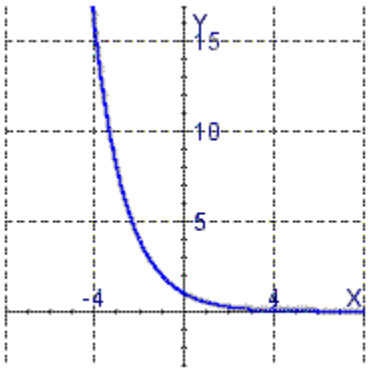


____ 5. Identify the graph of the function $y = 2^x$.

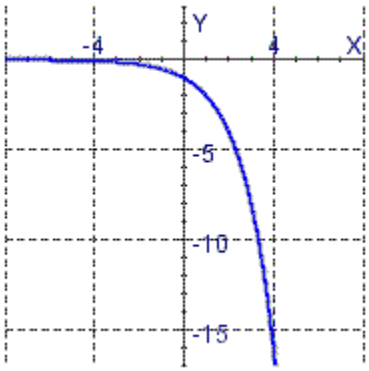
a.



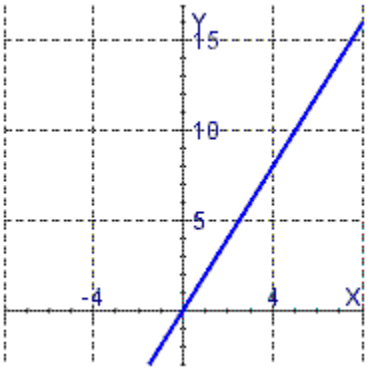
b.



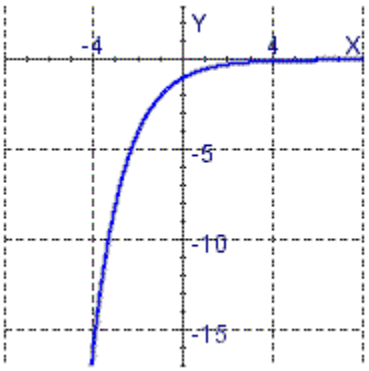
c.



d.

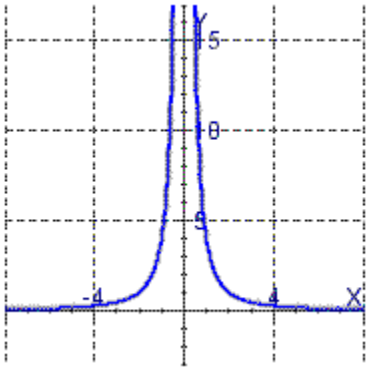


e.

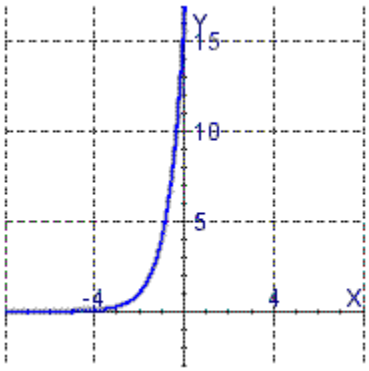


____ 6. Determine the graph of the function $y = 4^{x+2}$.

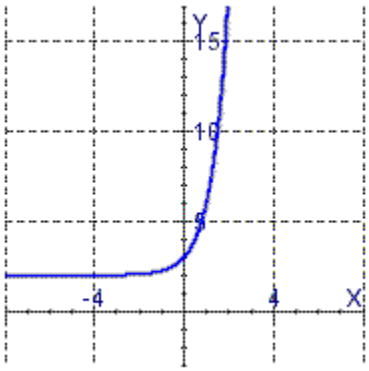
a.



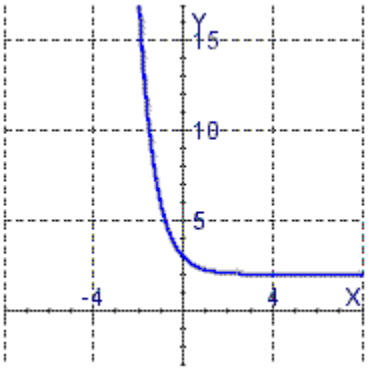
b.



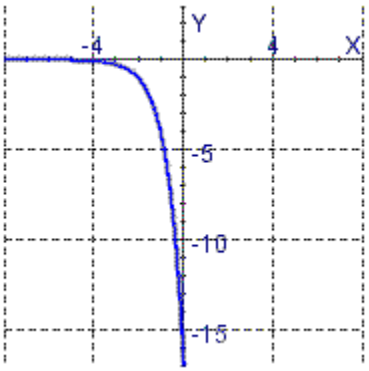
c.



d.



e.



____ 7. State the domain of the function $f(x) = -3^x$.

a. $(-\infty, \infty)$
b. $(-\infty, 3)$
c. $(-3, 3)$
d. $(-\infty, -3)$
e. $(3, \infty)$

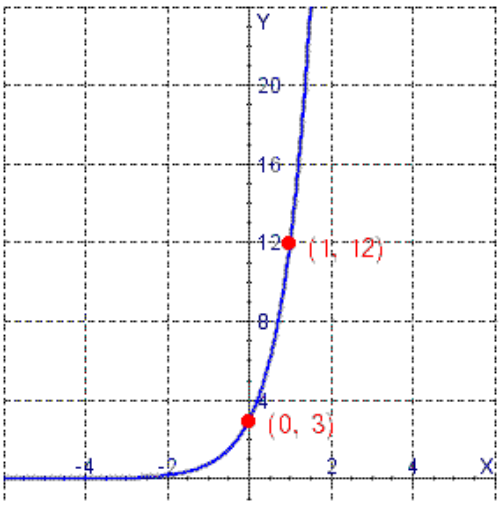
____ 8. State the range of the function $h(x) = 2 + \left(\frac{1}{7}\right)^x$

a. $(0, \infty)$
b. $(-2, \infty)$
c. $(-\infty, \infty)$
d. $(2, \infty)$
e. (–2, 2)

____ 9. What is the asymptote of the function $y = e^{x-2} + 3$?

a. $x = 2$
b. $y = 3$
c. $y < 3$
d. $y = 2$
e. $x > 2$

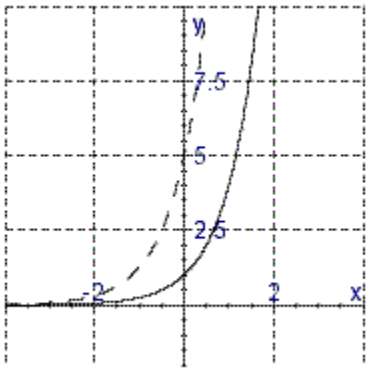
____ 10. Find the function of the form $f(x) = Ca^x$ whose graph is given.



a. $f(x) = 4\left(3^{-x}\right)$
b. $f(x) = 3\left(4^{-x}\right)$
c. $f(x) = 3\left(4^{x}\right)$
d. $f(x) = 4\left(3^{x}\right)$
e. $f(x) = 3\left(3^{x}\right)$

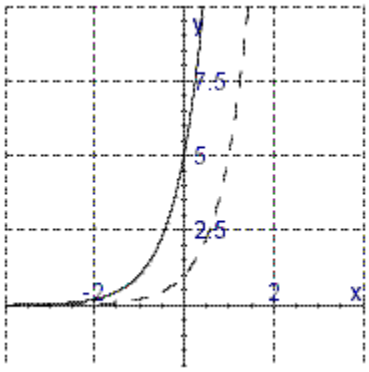
____ 11. Select the graphs of $f(x) = 4^x$ (solid) and $g(x) = 5\left(4^x\right)$ (dashed).

a.

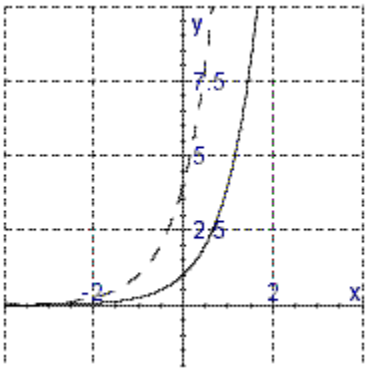


b. None of these!

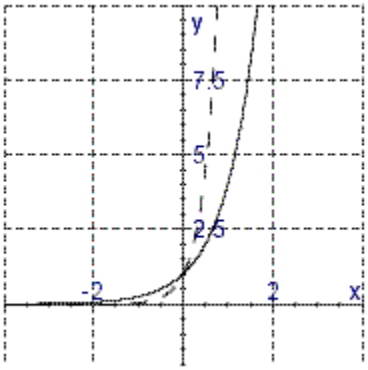
c.



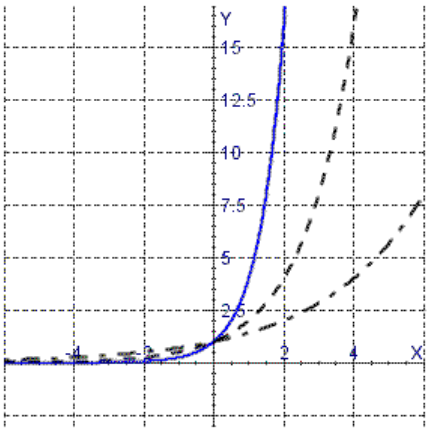
d.

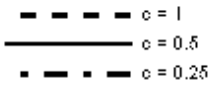


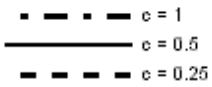
e.

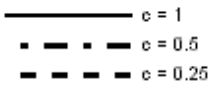


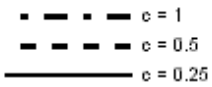
____ 12. The following graph shows the family of functions $f(x) = 4^{cx}$ for c = 1, 0.5, and 0.25. Select the graph which corresponds to each value of c.

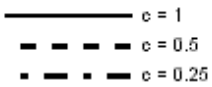


a. 

b. 

c. 

d. 

e. 

____13. Extra Credit! Find the value of x at which the local minimum occurs for the function $f(x) = e^{x} + e^{-5x}$.

a. –0.40
b. –0.50
c. 0.50
d. 4.55
e. 0.27

____ 14. If $1,000 is invested at an interest rate of 10% per year, compounded monthly, find the amount of the investment at the end of 4 years.

a. $1493
b. $1105
c. $1477
d. $1464
e. $1489

____ 15. Express the equation in logarithmic form. $3^4 = 81$

a. none of these
b. $\log_4 3 = 81$
c. $\log_3 81 = 4$
d. $\log_4 81 = 3$
e. $\log_{81} 3 = 4$

____ 16. Evaluate the expression $\log_7 343$.

a. 343
b. 7
c. none of these
d. 3
e. 49

____ 17. Evaluate the expression. $10^{\log \pi}$

a. $\log \pi$
b. none of these
c. π
d. 1
e. π^{10}

____ 18. Use the definition of the logarithmic function to find *x*. $\log_6 x = 3$

a. $x = 18$
b. none of these
c. $x = 6$
d. $x = 729$
e. $x = 216$

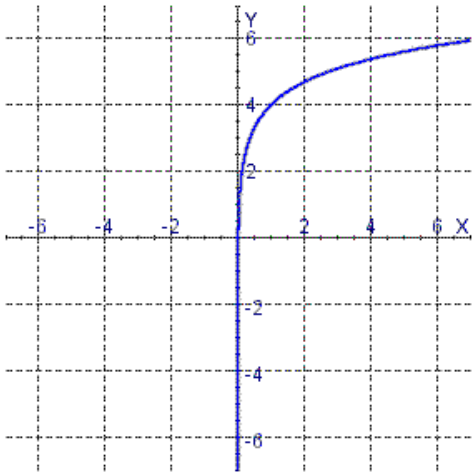
____ 19. Use the definition of the logarithmic function to find *x*. $\log_x 81 = 4$

a. $x = 81$
b. $x = 4$
c. $x = 3$
d. none of these
e. $x = 5$

____ 20. Use a calculator to evaluate the expression. $\ln\left(1 + \sqrt{5}\right)$

a. none of these
b. 0.9395
c. 0.4697
d. 2.8185
e. 1.1744

____ 21. Identify the logarithmic function corresponding to the graph.



a. $y = \ln (4 + x)$

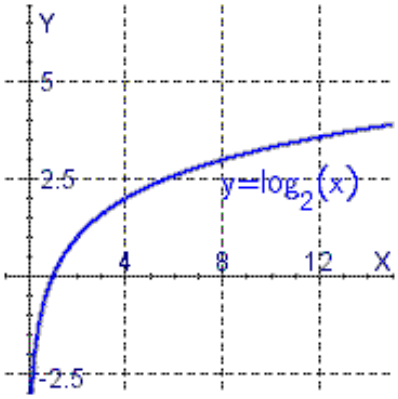
b. $y = \ln (x) + 4$

c. none of these

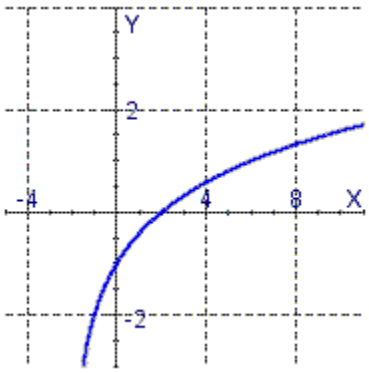
d. $y = \ln (x) - 4$

e. $y = \ln (4 - x)$

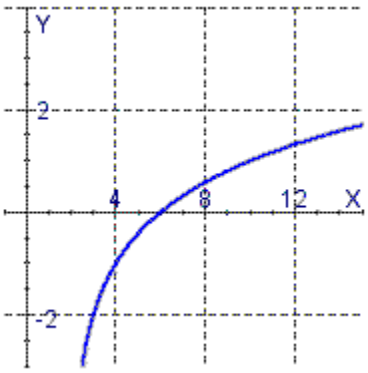
____ 22. Identify the graph of the function $y = \log_2 (x - 2) - 2$ using the graph shown below.



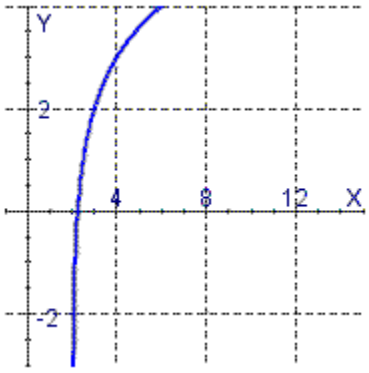
a.



d.

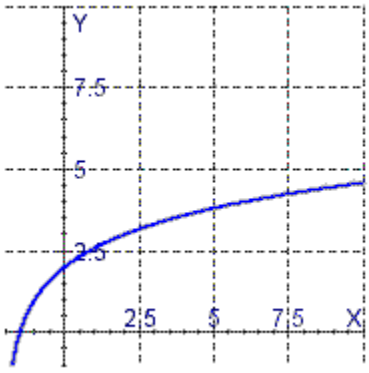


b.



e. none of these

c.



____ 23. The age of an ancient artifact can be determined by the amount of radioactive carbon-14 remaining in it. If D_0 is the original amount of carbon-14 and *D* is the amount remaining, then the artifact's age *A* (in years) is given by $A = -8,267 \ln\left(\frac{D}{D_0}\right)$. Find the age of an object if the amount *D* of carbon-14 that remains in the object is 74% of the original amount D_0.

a. approximately 2700 years
b. approximately 2900 years
c. approximately 2200 years
d. approximately 2500 years
e. approximately 2400 years

____ 24. The rate at which a battery charges is slower the closer the battery is to its maximum charge C_0. The time (in hours) required to charge a fully discharged battery to a charge *C*, is given by $t = -k \ln\left(1 - \frac{C}{C_0}\right)$, where *k* is a positive constant that depends on the battery. For a certain battery, $k = 0.23$. If this battery is fully discharged, how long will it take to charge that is 81% of its maximum charge C_0? Round to four decimal places.

a. 0.4020 hour
b. 0.3520 hour
c. 0.3420 hour
d. 0.3820 hour
e. 0.3920 hour

____ 25. Use the Laws of Logarithms to rewrite the expression below in a form with no logarithm of a product, quotient, or power. $\log_4\left(x(x-9)\right)$

a. $\log_4 x + \log_4 x - 9$
b. $\log_4 x + \log_4 (x - 9)$
c. $\log_4 x^2 - 9x$
d. $2 \log_4 x - \log_4 9$
e. $\log_4 x - \log_4 (x - 9)$

____ 26. Use the Laws of Logarithms to rewrite the expression below in a form with no logarithm of a product, quotient, or power. $\log_7 \sqrt[8]{x^2 + 5}$

a. $\frac{1}{8}\log_7\left(x^2 + 5\right)$
b. $\frac{1}{8}\left(2\log_7 s + \log_7 5\right)$
c. $\log_7 \frac{x^2 + 5}{8}$
d. $\sqrt{\log_7\left(x^2 + 5\right)}$
e. $8\log_7\left(x^2 + 5\right)$

____ 27. Use the Laws of Logarithms to rewrite the expression below in a form with no logarithm of a product, quotient, or power. $\ln \sqrt[9]{3r^8 s}$

a. $\frac{1}{9}\ln 3 + \frac{8}{9}\ln r + \frac{1}{9}\ln s$
b. $\frac{1}{9}\ln 3 + \frac{1}{9}\ln r + \frac{1}{9}\ln s$
c. $\frac{8}{9}\ln 3 + \frac{8}{9}\ln r + \frac{8}{9}\ln s$
d. $\ln 3 + \frac{8}{9}\ln r + \ln s$
e. $\ln 3 + \frac{8}{9}\ln r + \frac{1}{9}\ln s$

____ 28. Rewrite the expression as a single logarithm. $\log_3 2 + 2 \log_3 2$

a. $\log_3 8$
b. $\log_8 3$
c. $\log_3 4$
d. 1
e. $\ln 8$

____ 29. Use the Change of Base Formula and a calculator to evaluate the logarithm, correct to six decimal places. Use either natural or common logarithms. $\log_{18} 2.3$

a. 3.470213
b. 0.287467
c. 0.288167
d. 0.374617
e. 0.289167

____ 30. Solve the logarithmic equation for x. $\ln x = 5$

a. $x = 54.5982$
b. $x = 74.2066$
c. $x = 5$
d. $x = -25$
e. $x = 148.4132$

____ 31. Solve the logarithmic equation for x. $\log (9x + 6) = 2$

a. $x = 11.62$
b. $x = 10.44$
c. $x = 2.61$
d. none of these
e. $x = 5.22$

____ 32. Solve the logarithmic equation for x. $\log_3 (4 - x) = 7$

a. $x = -2183$
b. $x = 2191$
c. $x = -2191$
d. $x = -2187$
e. $x = 2187$

____ 33. Solve the logarithmic equation for x. $\log_2 2 + \log_2 x = \log_2 3 + \log_2 (x - 5)$

a. $x = 15$
b. $x = 3.9$
c. $x = 17$
d. $x = 30$
e. $x = 12$

____ 34. Solve the logarithmic equation for x. $\log_3 (x + 4) - \log_3 (x - 4) = 3$

a. $x = 14$
b. $x = 0.23$
c. $x = 3$
d. $x = 4.31$
e. $x = 3.71$

____ 35. For what value of x is the following true? $\log (x + 9) = \log x + \log 9$

a. $x = 10$
b. $x = 1.125$
c. $x = 4.5$
d. $x = 0.051$
e. $x = -7.875$

____ 36. Solve the inequality. $\log (x - 2) + \log (9 - x) < 1$

a. $x \in (2, 4) \cup (7, 9)$
b. $x \in (4, 7)$
c. $x \in (-\infty, 4) \cup (7, \infty)$
d. $x \in (2, 9)$
e. $x \in (-\infty, 2) \cup (9, \infty)$

____ 37. Solve the inequality. $2 < 10^x < 8$

a. $x \in (-\log 2, 0) \cup (0, \log 8)$
b. $x \in (-\log 8, -\log 2)$
c. $x \in (-\log 8, \log 8)$
d. $x \in (\log 2, \log 8)$
e. $x \in (-\log 8, \log 2)$

____ 38. A man invests $5,000 in an account that pays 8% interest per year, compounded quarterly. Find the amount after 5 years.

a. $5,520.40
b. $7,346.64
c. none of these
d. $7,429.74
e. $23,304.79

____ 39. A sum of $3,000 was invested for 4 years, and the interest was compounded semiannually. If this sum amounted to $5,000 in the given time, what was the interest rate?

a. 13.19 %
b. none of these
c. 13.62 %
d. 12.98 %
e. 14.62 %

____ 40. A small lake is stocked with a certain species of fish. The fish population is modeled by the function

$$P = \frac{12}{1 + 4e^{-0.8t}}$$

where P is the number of fish in thousands and t is measured in years since the lake was stocked. After how many years will the fish population reach 5,000 fish?

a. 0.96 years
b. 1.31 years
c. 1.17 years
d. 1.53 years
e. 1.72 years

____ 41. Suppose you're driving your car on a cold winter day (17°F outside) and the engine overheats (at about 218°F). When you park, the engine begins to cool down. The temperature T of the engine t minutes after you park satisfies the equation

$$\ln\left(\frac{T-17}{201}\right) = -0.11t.$$

Find the temperature of the engine after 20 min (t = 20).

a. approximately $39°F$
b. approximately $37°F$
c. approximately $36°F$
d. approximately $43°F$
e. approximately $40°F$

____ 42. The population of a certain city was 118,000 in 1994, and the observed relative growth rate is 3% per year. In what year will the population reach 219,000?

a. 2012
b. 2014
c. 2011
d. none of these
e. 2015

____ 43. The population of California was 10,290,518 in 1940 and 23,626,378 in 1985. Assume the population grows exponentially. Find the time required for the population to double (in years).

a. 37.53 yr
b. 0.83 yr
c. 54.14 yr
d. 108.28 yr
e. 41.23 yr

____ 44. An infectious strain of bacteria increases in number at a relative growth rate of 200% per hour. When a certain critical number of bacteria are present in the bloodstream, a person becomes ill. If a single bacterium infects a person, the critical level is reached in 33 hours. How long (in hours) will it take for the critical level to be reached if the same person is infected with 16 bacteria?

a. 31.61 h
b. 34.39 h
c. 30.23 h
d. 35.77 h
e. 64.61 h

____ 45. The half-life of cesium-137 is 30 years. Suppose we have a 17-g sample. Find a function that models the mass remaining after t years.

a. $m(t) = 20e^{-0.03t}$
b. $m(t) = 17e^{-0.024t}$
c. $m(t) = 30e^{-0.023t}$
d. $m(t) = 20e^{-0.02t}$
e. $m(t) = 17e^{-0.023t}$

____ 46. Radium-221 has a half-life of 30 s. How long will it take for 95% of a sample to decay?

a. 129.66 s
b. 44.94 s
c. 89.87 s
d. 1.54 s
e. 2.22 s

____ 47. The burial cloth of an Egyptian mummy is estimated to contain 56% of the carbon-14 it contained originally. How long ago was the mummy buried? (The half-life of carbon-14 is 5730 years.)

a. 3,322 yr
b. 4,877 yr
c. 1,661 yr
d. 4,793 yr
e. 3,305 yr

____ 48. An unknown substance has a hydrogen ion concentration of $\left[H^+\right] = 6.1 \times 10^{-3} M$. Find the pH.

a. pH = 2.2
b. pH = 3.0
c. pH = 12.9
d. pH = 5.1
e. none of these

____ 49.If one earthquake is 16 times as intense as another, how much larger is its magnitude on the Richter scale?

a. 2.13 larger on the Richter scale
b. 1.20 larger on the Richter scale
c. 1.50 larger on the Richter scale
d. 1.90 larger on the Richter scale
e. 2.77 larger on the Richter scale

____ 50. The noise from a power mower was measured at 102 dB. The noise level at a rock concert was measured at 122 dB. Find the ratio of the intensity of the rock music to that of the power mower.

a. 7.4
b. 25.0
c. 121.0
d. 20.0
e. 100.0