1. Solve the equation using only pencil and paper.

$$2^{5\sigma+2} = \sqrt[3]{2}$$

A. $\sigma = -\frac{22}{75}$

B. $\sigma = -\frac{7}{30}$

C. $\sigma = -\frac{1}{5}$

D. $\sigma = -\frac{11}{60}$

E. $\sigma = -\frac{4}{15}$

F. $\sigma = -\frac{2}{15}$

G. $\sigma = -\frac{1}{3}$

H. $\sigma = -\frac{17}{60}$

2. The strontium-90 in a nuclear reactor decays continuously. If 20 mg is present initially, the amount present after t years is given by $A(t) = 20e^{-0.0248t}$. Approximate to the nearest hundredth of a milligram the amount left after 60 years.

A. There will be approximately 5 mg left after 60 years.

B. There will be approximately 4.26 mg left after 60 years.

C. There will be approximately 5.45 mg left after 60 years.

D. There will be approximately 4.83 mg left after 60 years.

E. There will be approximately 5.39 mg left after 60 years.

F. There will be approximately 4.52 mg left after 60 years.

G. There will be approximately 3.61 mg left after 60 years.

H. There will be approximately 4.03 mg left after 60 years.

3. Solve the equation using only pencil and paper.

$$5^c = 125$$

A. $c = 5$

B. $c = 0$

C. $c = 1$

D. $c = 6$

E. $c = 2$

F. $c = 7$

G. $c = -1$

H. $c = 3$

4. Write the inverse of the function f.

x	$y = f(x)$
-8	-6
π	-4
-6	e
-4	3

A.

x	$y = f^{-1}(x)$
π	3
-6	-8
-4	π
e	-6

B.

x	$y = f^{-1}(x)$
π	-4
-6	e
-4	3
e	-8

C.

x	$y = f^{-1}(x)$
-6	-8
-4	π
e	-6
3	-4

D.

x	$y = f^{-1}(x)$
-4	3
e	-8
3	π
-8	-6

E.

x	$y = f^{-1}(x)$
3	-4
-8	e
π	3
-6	-8

F.

x	$y = f^{-1}(x)$
-8	-6
π	-4
-6	e
-4	3

G.

x	$y = f^{-1}(x)$
3	π
-8	-6
π	-4
-6	e

H.

x	$y = f^{-1}(x)$
-4	π
e	-6
3	-4
-8	e

5. Find the inverse f^{-1} of the function f.

$$f(x) = \sqrt[3]{x+4}$$

A. $f^{-1}(x) = (x+4)^3$

B. $f^{-1}(x) = x^3 - 4$

C. $f^{-1}(x) = x^3 + 4$

D. $f^{-1}(x) = (x-4)^3$

E. $f^{-1}(x) = x^3 + 64$

F. $f^{-1}(x) = \sqrt[3]{x-4}$

G. $f^{-1}(x) = \sqrt[3]{x+4}$

H. $f^{-1}(x) = x^3 - 64$

6. Consider the function f below. TRUE or FALSE: The inverse relation f^{-1} is also a function.

x	$y = f(x)$
$\heartsuit$	a
y	b
a	$-\pi$
b	$\spadesuit$

A. False

B. True

7. Approximate the value of the expression to the nearest hundredth.

$$\ln 60.65$$

A. 4.23

B. 4.11

C. 4.79

D. 4.06

E. 4.65

F. 3.68

G. 4.68

H. 3.89

8. Evaluate the logarithmic expression.

$$\log \sqrt[5]{1}$$

A. $-\frac{4}{5}$

B. $-\frac{3}{5}$

C. $\frac{4}{5}$

D. $-\frac{1}{5}$

E. 0

F. $\frac{2}{5}$

G. $\frac{1}{5}$

H. $-\frac{2}{5}$

9. Approximate the value of the expression to the nearest hundredth.

$$\ln 0.31$$

A. -1.17

B. -1.51

C. -1.21

D. -1.68

E. -1.06

F. -0.7

G. -0.84

H. -0.39

10. Solve the logarithmic equation.

$$\log_{10} x = -1$$

A. $x = 5$

B. $x = \frac{1}{10}$

C. $x = \frac{1}{6}$

D. $x = 6$

E. $x = \frac{1}{5}$

F. $x = \frac{1}{7}$

G. $x = 7$

H. $x = 10$

11. Solve the logarithmic equation.

$$\log_x 3 = \frac{1}{2}$$

A. $x = 36$

B. $x = \frac{1}{4}$

C. $x = 16$

D. $x = 4$

E. $x = \frac{1}{9}$

F. $x = \frac{1}{36}$

G. $x = 9$

H. $x = \frac{1}{16}$

12. Use the properties of logarithms to express the logarithm in terms of logarithms of simpler expressions. Each logarithmic term should have only one variable, and no exponents or radicals. Assume that the argument of each logarithm is a positive real number.

$$\log((3t-9)(5t+11))$$

A. $\log(3t-9)\cdot\log(5t+11)$

B. $\frac{\log(3t-9)}{\log(5t+11)}$

C. $\frac{\log(3t)-\log(9)}{\log(5t)+\log(11)}$

D. $\log(3t-9)+\log(5t+11)$

E. $\log(3t-9)-\log(5t+11)$

F. $(\log(3t)-\log(9))\cdot(\log(5t)+\log(11))$

G. $\log(3t)-\log(9)+\log(5t)+\log(11)$

H. $\log(3)\cdot\log(t)\cdot\log(9)\cdot\log(5t)\cdot\log(11)$

13. Combine the logarithmic terms into a single logarithmic expression with a coefficient of 1. Assume that the argument of each logarithm is a positive real number.

$$\frac{1}{5}\log(2\sigma-5)+\frac{1}{2}\log(5m-9)$$

A. $\log\left(\frac{\frac{1}{5}(2\sigma-5)}{\frac{1}{2}(5m-9)}\right)$

B. $\log\left(\frac{\sqrt[5]{2\sigma-5}}{\sqrt{5m-9}}\right)$

C. $\log(\sqrt[5]{2\sigma-5}-\sqrt{5m-9})$

D. $\log(\sqrt[5]{2\sigma-5}\sqrt{5m-9})$

E. $\log(\sqrt[5]{2\sigma-5}+\sqrt{5m-9})$

F. $\log(\frac{1}{5}(2\sigma-5)+\frac{1}{2}(5m-9))$

G. $\log(\frac{1}{5}(2\sigma-5)\cdot\frac{1}{2}(5m-9))$

H. $\log(\frac{1}{5}(2\sigma-5)-\frac{1}{2}(5m-9))$

14. Combine the logarithmic terms into a single logarithmic expression with a coefficient of 1. Assume that the argument of each logarithm is a positive real number.

$$6\log(\theta) + \frac{1}{4}\log(\phi)$$

A. $\log(\theta^6 - \sqrt[4]{\phi})$

B. $\log(6\theta + \frac{1}{4}\phi)$

C. $\log(\theta^6 + \sqrt[4]{\phi})$

D. $\log(6\theta - \frac{1}{4}\phi)$

E. $\log(6\theta \cdot \frac{1}{4}\phi)$

F. $\log\left(\frac{\theta^6}{\sqrt[4]{\phi}}\right)$

G. $\log(\theta^6 \sqrt[4]{\phi})$

H. $\log\left(\frac{6\theta}{\frac{1}{4}\phi}\right)$

15. Find the exact solution to the logarithmic equation.

$$\log(3\zeta - 2) = -1$$

A. $\zeta = \frac{9}{20}$

B. $\zeta = \frac{1}{30}$

C. $\zeta = \frac{11}{30}$

D. $\zeta = -\frac{13}{10}$

E. $\zeta = \frac{41}{30}$

F. $\zeta = \frac{7}{10}$

G. $\zeta = -\frac{1}{20}$

H. $\zeta = \frac{1}{5}$

16. Find the exact solution to the equation.

$$2e^{-8\varphi} = 7$$

A. $\varphi = -\frac{1}{8}\ln(\frac{7}{2})$

B. $\varphi = \frac{1}{8}\frac{\ln(2}{\ln(7)}$

C. $\varphi = \frac{1}{8}\ln(\frac{2}{7})$

D. $\varphi = \frac{1}{8}\frac{\ln(7)}{\ln(2)}$

E. $\varphi = -\frac{1}{8}\frac{\ln(7)}{\ln(2)}$

F. $\varphi = -\frac{1}{8}\ln(\frac{2}{7})$

G. $\varphi = \frac{1}{8}\ln(\frac{7}{2})$

H. $\varphi = -\frac{1}{8}\frac{\ln(2)}{\ln(7)}$

17. Find the exact solution to the equation.

$$8.39e^{-0.95q} = 7.51$$

A. $q = -\frac{1}{0.95}\ln(\frac{8.39}{7.51})$

B. $q = \frac{1}{0.95}\ln(\frac{7.51}{8.39})$

C. $q = \frac{1}{0.95}\frac{\ln(8.39)}{\ln(7.51)}$

D. $q = \frac{1}{0.95}\frac{\ln(7.51)}{\ln(8.39)}$

E. $q = -\frac{1}{0.95}\frac{\ln(7.51)}{\ln(8.39)}$

F. $q = -\frac{1}{0.95}\ln(\frac{7.51}{8.39})$

G. $q = -\frac{1}{0.95}\frac{\ln(8.39)}{\ln(7.51)}$

H. $q = \frac{1}{0.95}\ln(\frac{8.39}{7.51})$

18. Carbon-14 decays continuously at the rate of 0.01245% per year. An archaeologist has determined that only 7% of the original carbon-14 from a plant specimen remains. Estimate the age of this specimen.

A. The specimen is approximately 21350.52 years old.

B. The specimen is approximately 21301.52 years old.

C. The specimen is approximately 21404.52 years old.

D. The specimen is approximately 21327.52 years old.

E. The specimen is approximately 21359.52 years old.

F. The specimen is approximately 21338.52 years old.

G. The specimen is approximately 21406.52 years old.

H. The specimen is approximately 21300.52 years old.

19. The formula

$$\mathrm{pH} = -\log \mathrm{H}^+$$

expresses the pH of a solution in terms of its hydrogen ion concentration H^+. Determine the pH of a fruit juice that has a hydrogen ion concentration H^+ of 0.0007523 mol/L.

A. The pH of the juice is 3.12.

B. The pH of the juice is 3.85.

C. The pH of the juice is 2.69.

D. The pH of the juice is 3.74.

E. The pH of the juice is 3.23.

F. The pH of the juice is 3.78.

G. The pH of the juice is 3.46.

H. The pH of the juice is 2.94.

20. The formula

$$\mathrm{pH} = -\log \mathrm{H}^+$$

expresses the pH of a solution in terms of its hydrogen ion concentration H^+. A certain brand of shampoo has a pH of 9.11. What is the H^+ concentration in moles per liter?

A. The concentration is 6.3×10^{-10} moles per liter.

B. The concentration is 1×10^{-11} moles per liter.

C. The concentration is 1.07×10^{-9} moles per liter.

D. The concentration is 1.4×10^{-10} moles per liter.

E. The concentration is 1.59×10^{-9} moles per liter.

F. The concentration is 7.8×10^{-10} moles per liter.

G. The concentration is 1.62×10^{-9} moles per liter.

H. The concentration is 3.3×10^{-10} moles per liter.

Answers

1. G.
2. F.
3. H.
4. C.
5. B.
6. B.
7. B.
8. E.
9. A.
10. B.
11. G.
12. D.
13. D.
14. G.
15. F.
16. A.
17. F.
18. E.
19. A.
20. F.