

- The value of a rare book is increasing linearly. It was worth \$54 in 1981 and \$62 in 1983. What is the formula for the value (v) of the book t years after 1980?
A. $v = 50 + 4t$ B. $v = 48 + 3t$ C. $v = 50 + 3t$ D. $v = 51 + 4t$ E. None of the above
- Determine $(g \circ f)(x)$ for the following functions: $f(x) = 1 - \sqrt{x}$ and $g(x) = \frac{1}{x}$
A. $-\sqrt{x}$ B. $1 - \sqrt{\frac{1}{x}}$ C. $1 - \sqrt{x}$ D. $\frac{1}{1-\sqrt{x}}$ E. $\frac{1}{\sqrt{x}}$
- If $\frac{x}{x^2 + 1}$ find $\frac{1}{f(3)}$
A. $\frac{3}{10}$ B. $\frac{3}{16}$ C. $\frac{16}{3}$ D. $\frac{10}{3}$ E. None of the above
- If $f(x) = \frac{1}{3x - 2}$, find the inverse function $f^{-1}(x)$.
A. $f^{-1}(x) = 3x + 2$ B. $f^{-1}(x) = \frac{1 + 2x}{3x}$ C. $f^{-1}(x) = \frac{1}{2 - 3x}$
D. $f^{-1}(x) = \frac{3}{x + 6}$ E. None of the above
- If $f(x) = x^2 - 2x + 4$ then $\frac{f(x + h) - f(x)}{h} =$
A. $2x + h - 2$ B. $x + 2h - 2$ C. $x + 2h + 2$ D. $2x - h - 2$ E. $2x - h + 2$
- A square of side x is inscribed in a circle. Express the area A of the circle as a function of x
A. $A = \frac{\pi}{2}x^2$ B. $A = x^2$ C. $A = \pi x^2$ D. $A = \frac{\pi}{4}x^2$ E. None of the above
- An aquarium in the shape of a rectangular box is to have a height of 1.5 feet and a volume of 6 cubic feet. Let x denote the length of the base a y the width of the base. Express y as a function of x .
A. $y = 1.5x$ B. $y = \frac{4}{x}$ C. $y = x^2$ D. $y = \frac{6}{x}$ E. $y = 9x$
- Find the vertex of the parabola $x^2 - 4x - 2y - 4 = 0$
A. $(2, -2)$ B. $(2, -4)$ C. $(-4, 2)$ D. $(-2, 4)$ E. $(-2, 2)$
- Find an equation of a quadratic function whose graph has the points $(1, 0)$, $(-1, 0)$ and $(0, 2)$
A. $y = 2x^2 + 2$ B. $y = -2x^2 + 2$ C. $y = -2x^2 - 2$
D. $y = 2x^2 - 2$ E. $y = -(x - 2)^2$
- Express as one logarithm: $\log_b y^3 + \log_b y^2 - \log_b y^4$.
A. $\log_b y^2$ B. $\log_b y$ C. $\log_b (y^3 + y^2 - y^4)$ D. $\log_b \frac{y^3 + y^2}{y^4}$ E. None of the above

11. Which are true of the function $f(x) = \log_a x$ if $a > 1$?
- I. f is an increasing function II. f has a as an x -intercept
 III. f has 1 as a y -intercept IV. The domain of f is $(0, \infty)$
- A. I, II and III B. I and II C. II and III D. I and IV E. I and III
12. Which of the following is equal to $\log\left(\frac{432}{\sqrt{0.095}\sqrt[3]{72.1}}\right)$?
- A. $\log 432 - \frac{1}{2}\log 0.095 - 3\log 72.1$ B. $\log 432 - \frac{1}{2}\log 0.095 - \frac{1}{3}\log 72.1$
 C. $\log 432 - 2\log 0.095 + 3\log 72.1$ D. $\log 432 - \frac{1}{2}\log 0.095 + \frac{1}{3}\log 72.1$
 E. $\log 732 - 2\log 0.095 - 3\log 72.1$
13. If $\log_x 2 = 5$, solve for x to four decimal places
- A. 2.2361 B. 1.4142 C. 0.6990 D. 1.1487 E. 0.3010
14. Evaluate $\frac{\log_5 \frac{1}{8}}{\log_5 2}$
- A. -4 B. $-\frac{1}{3}$ C. $-\frac{1}{4}$ D. -3 E. None of the above
15. Solve for $x : 3^{x-5} = 4$
- A. $x = \log 4 + 5\log 3$ B. $x = 5 + \log(4/3)$ C. $x = 5 + \frac{\log 4}{\log 3}$
 D. $x = 5 + \log 4$ E. $x = \frac{5 + \log 4}{\log 3}$
16. Solve for $x : \log_3 \sqrt{2x+3} = 2$
- A. $x = 5/2$ B. $x = 3/2$ C. $x = 39$ D. $x = 17$ E. $x = 3$
17. Given that $\log_3 m = 8$, $\log_3 n = 10$ and $\log_3 p = 6$, calculate $\log_3 \left(\frac{\sqrt{mn}}{p^3}\right)$
- A. -9 B. $\frac{2\sqrt{5}}{27}$ C. 22 D. -56 E. -4
18. A radioactive substance decays according to $q(t) = q_0 e^{-0.0063t}$ where q_0 is the initial amount of the substance and t is the time in days. Find the half-life of the substance to the nearest tenth of a day.
- A. 110.0 days B. 47.8 days C. 0.5 days D. 2.0 days E. Cannot be determined
19. The graph of $y = 2 + 2^x$ crosses the y -axis at
- A. 0 B. 1 C. 2 D. 3 E. 4
20. Determine where the graphs of the equations $x + 4y = 3$ and $2x - 6y = 8$ intersect.
- A. $(-\frac{12}{5}, \frac{6}{5})$ B. $(\frac{1}{3}, \frac{4}{9})$ C. $(\frac{2}{7}, \frac{5}{7})$ D. $(\frac{1}{8}, \frac{2}{5})$ E. None of the above
21. Determine where the graphs of the equations $x^2 + y^2 = 16$ and $2y - x = 4$ intersect.
- A. $(-4, 0), (\frac{12}{5}, \frac{16}{5})$ B. $(0, 2), (\frac{16}{5}, \frac{18}{5})$ C. $(-4, 0), (-\frac{2}{7}, \frac{1}{4})$
 D. $(4, 0), (-\frac{12}{5}, \frac{16}{5})$ E. None of the above

22. Solve the following system of equations for z .

$$x + y - z = -1$$

$$4x - 3y + 2z = 16$$

$$2x - 2y - 3z = 5$$

A. $z = \frac{13}{17}$ B. $z = 1$ C. $z = -2$ D. $z = -\frac{29}{27}$ E. $z = 2$

23. Find the quotient $q(x)$ and remainder $r(x)$ if $x^4 - 2x^2 - 3$ is divided by $x^2 - 6x$

A. $q(x) = x^2 - x + 5, r(x) = 3x + 2$ B. $q(x) = x^2 - 2, r(x) = x + 5$
C. $q(x) = x^2 + 6x + 34, r(x) = 204x - 3$ D. $q(x) = x^2 - 6x + 4, r(x) = 24x - 3$
E. None of the above

24. List all places where the graph of $f(x) = \frac{x^2 - 9}{x^2 + 2x}$ has vertical asymptotes.

A. $x = 0$ B. $x = 2$ C. $x = 0, x = -2$ D. $x = 3, x = -3$ E. None of the above

25. Given $f(x) = x^2(x - 1)(x + 1)^2$, for what values of x is $f(x) < 0$?

A. $(-\infty, -1) \cup (-1, 0) \cup (0, 1)$ B. $(-\infty, -1) \cup (-1, 0) \cup (1, \infty)$ C. $(-1, 0) \cup (1, \infty)$
D. $(-\infty, -1) \cup (-1, 1)$ E. None of the above

26. Considering the graph of $f(x) = \frac{x - 2}{x + 2}$, which statement is true?

A. $f(x)$ is decreasing and has a range of $(-\infty, -1) \cup (-1, \infty)$
B. $f(x)$ is decreasing and has a range of $(-\infty, 1) \cup (1, \infty)$
C. $f(x)$ is increasing and has a range of $(-\infty, 2) \cup (2, \infty)$
D. $f(x)$ is decreasing and has a range of $(-\infty, 2) \cup (2, \infty)$
E. $f(x)$ is increasing and has a range of $(-\infty, 1) \cup (1, \infty)$

27. If θ is in the second quadrant and $\sin \theta = 0.6$, find $\cos \theta$.

A. -0.75 B. 0.2 C. -0.8 D. 0.8 E. None of the above

28. The angles with measures listed are all coterminal except:

A. $\frac{\pi}{3}$ B. $-\frac{5\pi}{3}$ C. -300° D. 420° E. -60°

29. The radian measure of an angle of 135° is

A. $\frac{5\pi}{4}$ B. $\frac{3\pi}{2}$ C. $\frac{3\pi}{4}$ D. $\frac{7\pi}{8}$ E. None of the above

30. Use a calculator to find $\sec 126^\circ$ correct to four decimal places

A. 1.2361 B. -0.5878 C. -1.7013 D. -1.2361 E. None of the above

31. The point $(12, -16)$ is on the terminal side of the angle θ . Find $\tan \theta$.

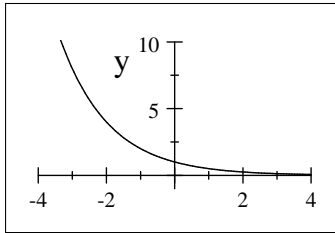
A. $\frac{5}{3}$ B. $-\frac{5}{4}$ C. $\frac{4}{3}$ D. $\frac{4}{5}$ E. None of the above

32. Find the exact value of $\tan 120^\circ$.

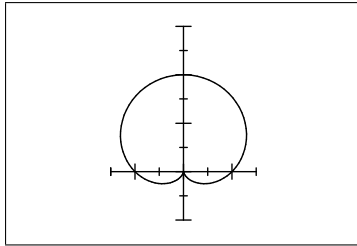
A. $-\sqrt{3}$ B. $-\frac{1}{\sqrt{3}}$ C. $\sqrt{3}$ D. $\frac{1}{\sqrt{3}}$ E. None of the above

33. If the diameter of a circle is 4, find the length of the arc cut off by a central angle of 30° . Give your answer to 3 decimal places
A. 1.047 B. 2.361 C. 3.142 D. 3.681 E. None of the above
34. The graph of $y = 3 + \sin x$
I. Crosses the y -axis at 3 II. crosses the x -axis at multiples of π III. is always above the x -axis IV. has a period of 2π
A. I and II B. I, III, and IV C. I, II, and IV D. II and IV E. None of the above
35. Give the domain D and the range R of $f(x) = \cos x$
A. $d = (-\infty, \infty), R = [-1, 1]$ B. $D = [0, \infty), R = (-\infty, \infty)$ C. $D = [0, 2\pi], R = [-1, 1]$
D. $D = (-\infty, \infty), R = [0, 2\pi]$ E. None of the above
36. The expression $\frac{\tan^2 x}{1 + \sec x}$ is identically equal to
A. 1 B. $\sec x - 1$ C. $\tan x + \sin x$ D. $\tan^2 x + \sin x \tan x$ E. $\csc x + \sin x$
37. Simplify: $\frac{\tan x \cos x \csc x}{\cot x \sec x \sin x}$
A. $\tan^2 x \cos^2 x \sin^2 x$ B. 1 C. $\csc^2 x$ D. 0 E. $\tan^2 x$
38. Given $\cos \theta = 3/4$ and $270^\circ < \theta < 360^\circ$, find $\sin 2\theta$.
A. $-\frac{3\sqrt{7}}{8}$ B. $-\frac{\sqrt{7}}{4}$ C. $-\frac{1}{8}$ D. $\frac{1}{8}$ E. $\frac{3\sqrt{7}}{8}$
39. A wire is attached to the top of a radio antenna and to a point on horizontal ground that is 40.0 meters from the base of the antenna. If the wire makes an angle of $58^\circ 20'$ with the ground, approximate the length of the wire to the nearest tenth of a meter.
A. 47.0 m B. 76.2 m C. 47.1 m D. 75.9 m E. None of the above
40. From a point P on level ground the angle of elevation to the top of the tower is $26^\circ 50'$. From a point 25.0 meters closer to the tower and on the same line with P and the base of the tower, the angle of elevation to the top of the tower is $43^\circ 30'$. Find the height of the tower correct to one decimal place.
A. 39.3 m B. 12.6 m C. 27.1 m D. 23.7 m E. None of the above
41. Give the polar coordinates of a point whose rectangular coordinates are $(-2, 3)$
A. $(\sqrt{13}, -56.3^\circ)$ B. $(\sqrt{13}, 123.7^\circ)$ C. $(13m - 33, 7^\circ)$
D. $(13, 146.3^\circ)$ E. $(\sqrt{13}, 146.3^\circ)$
42. Find a polar equation which has the same graph as the equation $x^2 - 2x + y^2 = 0$.
A. $r = 1$ B. $r = 2$ C. $r = 2 \sin \theta$ D. $r = 2 \cos \theta$ E. $r = \sqrt{2 \cos \theta}$

43. The figure below most closely resembles the graph of which function?



- A. $y = (\frac{1}{2})^x$ B. $y = 2^x$ C. $y = -2^x$ D. $y = -(\frac{1}{2})^x$ E. $y = 1 - 2^x$
44. Which polar equation best describes the graph given below?



- A. $r = (1 + \sin \theta)$ B. $r = (1 + \cos \theta)$ C. $r = (1 - \sin \theta)$
 D. $r = 2 \cos \theta$ E. $r = 2 \sin \theta$
45. If $\sin \theta = a$ and $0 < \theta < \frac{\pi}{2}$, find $\tan(\frac{\theta}{2})$.
- A. $\frac{a}{1 + \sqrt{1 - a^2}}$ B. $\frac{a}{1 - \sqrt{1 - a^2}}$ C. $\frac{a}{\sqrt{1 - a^2}}$ D. $\frac{2a}{\sqrt{1 - a^2}}$ E. $\frac{a}{2\sqrt{1 - a^2}}$
46. From a point A that is 10 feet above ground, the angle of elevation to the top of a building is 62° and the angle of depression to the base of the building is 17° . Find the height of the building to the nearest foot.
- A. 72 ft. B. 48 ft. C. 74 ft. D. 68 ft. E. 62 ft.
47. The expression $\frac{\sin(2\theta) + \sin^2 \theta + \cos(2\theta)}{\cos^2 \theta}$ is identically equal to
- A. $\sin(2\theta) + \tan^2 \theta + \cos(2\theta)$ B. $2 \tan \theta + 1$ C. $\sin(2\theta) + \sin \theta + 1$
 D. $2 \tan \theta \sec \theta + \tan^2 \theta + 2 \sec \theta$ E. $2 \sin \theta \cos \theta + 1$

ANSWERS

1. A; 2. D; 3. D; 4. B; 5. A; 6. A; 7. B; 8. B; 9. B; 10. B; 11. D; 12. B; 13. D; 14. D;
 15. C; 16. C; 17. A; 18. A; 19. D; 20. E $(\frac{25}{7}, -\frac{1}{7})$; 21. A; 22. B; 23. C; 24. C; 25. A; 26.
 E; 27. C; 28. E; 29. C; 30. C; 31. E $[-4/3]$; 32. A; 33. A; 34. B; 35. A; 36. B; 37. B; 38.
 A; 39. B; 40. C; 41. B; 42. D; 43. A; 44. A; 45. A; 46. A; 47. B