

1. Use the information to write the appropriate variation equation, and find  $y$  for the given values.

$y$  varies directly as  $x$  and inversely as  $z$ .  $y = \frac{35}{9}$  when  $x = 5$  and  $z = 3$ . Find  $y$  when  $x = 3$  and  $z = 6$ .

[A]  $y = \frac{7x}{3z}$ ;  $-\frac{7}{6}$

[B]  $y = \frac{3x}{7z}$ ;  $\frac{3}{14}$

[C]  $y = \frac{3z}{7x}$ ;  $\frac{6}{7}$

[D]  $y = \frac{7z}{3x}$ ;  $\frac{14}{3}$

2. The Crystal Glass Company found that the number of windows sold,  $N$ , varies directly as their advertising budget,  $A$ , and inversely as the price of each window,  $P$ . The Crystal Glass Company sold 4800 windows when \$20,000 was spent on advertising and the price of a window was set at \$50. Determine the number of windows sold when the amount spent on advertising is increased to \$60,000.

[A] 14,400

[B] 13,920

[C] 1152

[D] 1200

3. Determine whether the function is a rational function. If so, find the domain and identify the horizontal and vertical asymptotes, and any holes in the graph. If the function is not rational, state why not.

$$f(x) = \frac{4x+7}{x^2-x-2}$$

[A] rational;  $x \neq -2$  or  $1$ ; asymptotes at  $y = 0$ ,  $x = -2$  and  $x = 1$

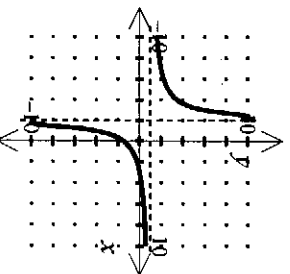
[B] rational;  $x \neq 2$  or  $-1$ ; asymptotes at  $y = 0$ ,  $x = 2$  and  $x = -1$

[C] rational;  $x \neq -\frac{7}{4}$  or  $2$ ; asymptotes at  $y = 4$ ,  $x = -\frac{7}{4}$  and  $x = 2$

[D] not rational; numerator is of lower degree than denominator

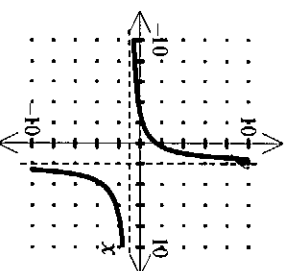
4. Which is the graph of the rational function  $f(x) = \frac{x+3}{x+2}$ ? Identify the vertical and horizontal asymptotes.

[A]



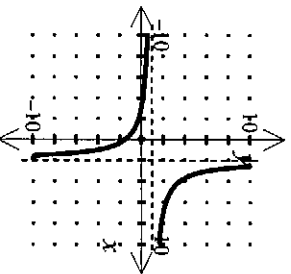
asymptotes:  $y = 1$ ,  $x = -2$

[B]



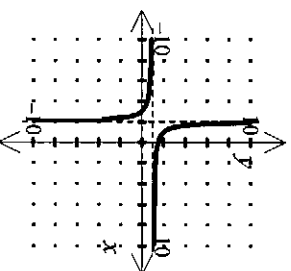
asymptotes:  $y = -1$ ,  $x = 2$

[C]



asymptotes:  $y = 1$ ,  $x = 2$

[D]



asymptotes:  $y = 1$ ,  $x = -2$

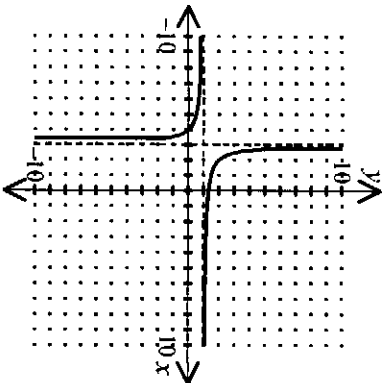
5. Which function matches the graph?

[A]  $f(x) = \frac{x+2}{x+5}$

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

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

[D]  $f(x) = \frac{x+5}{x+2}$



Simplify the rational expression.

6.  $\frac{x^2+9x+18}{x^2-9} + \frac{x+6}{x-6}$

[A]  $\frac{x-6}{x-3}$

[B]  $\frac{9x+6}{3}$

[C]  $\frac{x-7}{x-3}$

[D]  $\frac{x+3}{x-6}$

7.  $\frac{x^2-64}{5x} \cdot \frac{4x}{x+8}$

[A]  $\frac{(x+8)^2(x-8)}{20x^2}$

[B]  $\frac{4(x-8)}{5}$

[C]  $\frac{4(x+8)}{5}$

[D]  $\frac{(x-8)^2(x+8)}{20x^2}$

8.  $\frac{\frac{x^2-12x+36}{x-6}}{-4x}$

[A]  $-11x-6$

[B]  $\frac{x+36}{2x}$

[C]  $\frac{x+6}{2}$

[D]  $\frac{x-6}{2}$

Simplify.

9.  $\frac{-6x+4}{x^2-9} - \frac{-5x+1}{x^2-9}$

[A]  $-\frac{1}{x+3}$

[B]  $-\frac{1}{x-3}$

[C]  $\frac{-x+5}{x^2-9}$

[D]  $\frac{1}{x+3}$

10.  $\frac{x-2}{4x^2} - \frac{-2x-4}{9x} + \frac{5x}{24}$

[A]  $\frac{8x+4}{12x^3}$

[B]  $\frac{15x^3+16x^2+50x-36}{72x^2}$

[C]  $\frac{15x^3+16x^2-14x-36}{72x^2}$

[D]  $\frac{8x-4}{12x^3}$

11. Solve the equation or inequality.

$\frac{1}{x+2} - \frac{3}{x-1} = 0$

[A]  $x = \frac{5}{2}$

[B]  $x = -\frac{7}{2}$

[C]  $x = \frac{5}{4}$

[D] no solution

12. After taking 4 quizzes, your average is 79 out of 100. What must your average score be on the next five quizzes to increase your average to 84?

[A] 88

[B] 81

[C] 85

[D] 89

13. Evaluate the radical expression:  $-\frac{1}{9}(\sqrt[4]{16})^3$

[A]  $\frac{8}{81}$

[B]  $-\frac{8}{9}$

[C]  $\frac{4}{81}$

[D]  $-\frac{4}{9}$

14. Find the domain of the radical function.

[A]  $x \leq -2$

[B]  $x \geq 2$

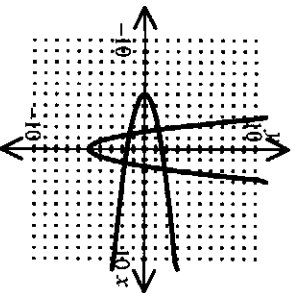
[C]  $x \leq 2$

[D]  $x \geq -2$

$$f(x) = \sqrt{2-x}$$

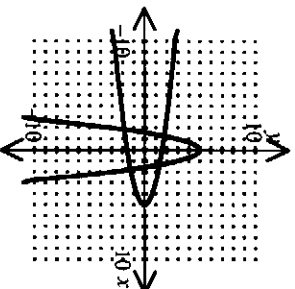
15. Which is the correct inverse of  $y = 2x^2 - 5$  and the graph of both  $y = 2x^2 - 5$  and its inverse on the same coordinate plane?

[A]



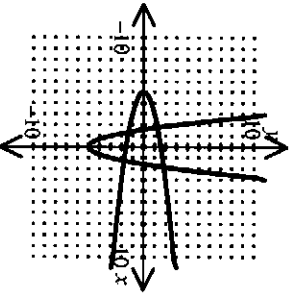
$$y = \pm \sqrt{\frac{x+5}{2}}$$

[B]

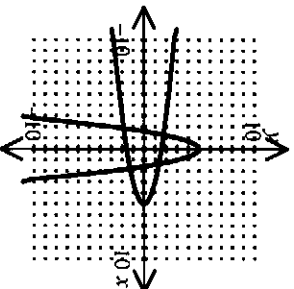


$$y = \pm \frac{\sqrt{-(x-5)}}{2}$$

[C]



[D]



$$y = \pm \frac{\sqrt{x+5}}{2}$$

$$y = \pm \sqrt{\frac{-(x-5)}{2}}$$

16. Simplify the sum, difference, product, or quotient. Assume that the value of any variable is positive.

$$\frac{\sqrt{32x^3b}}{\sqrt{8xb}}$$

[A]  $\frac{\sqrt{4}}{\sqrt{x}}$

[B]  $\sqrt{32x^3b}$

[C]  $\sqrt{x^2}$

[D]  $2\sqrt{x}$

Rationalize the denominator.

17.  $\frac{5}{\sqrt{7}}$

[A]  $\frac{5\sqrt{7}}{49}$

[B]  $\frac{\sqrt{5}}{7}$

[C]  $\frac{5\sqrt{7}}{7}$

[D]  $5\sqrt{7}$

18.  $\frac{\sqrt{5}}{8+\sqrt{7}}$

[A]  $\frac{8\sqrt{5}-\sqrt{35}}{57}$

[B]  $\frac{8\sqrt{5}-\sqrt{35}}{59}$

[C]  $\frac{7\sqrt{5}-\sqrt{40}}{41}$

[D]  $\frac{5\sqrt{5}-\sqrt{56}}{18}$

Solve the radical equation. If there is no real solution, write *no solution*.

19.  $x = \sqrt{10 - 3x}$  [A]  $\frac{5}{2}$  [B]  $-2$  [C]  $2$  [D] no real solution
20.  $2\sqrt{3x - 2} - 1 = \sqrt{12x + 1}$  [A]  $3$  [B]  $4$  [C]  $1$  [D] no solution
21. A population of 270 animals decreases at an annual rate of 11%. Find the multiplier for the rate of exponential decay.  
[A]  $0.11$  [B]  $0.89$  [C]  $1.11$  [D]  $1.89$
22. Erosion gradually reduces the size of a small Pacific island that has a current area of just 500 acres. If the island's area decreases at an annual rate of 0.11%. Find the multiplier for the rate of exponential decay.  
[A]  $0.89$  [B]  $1.11$  [C]  $1.0011$  [D]  $0.9989$
23. The inflation rate of the U.S. dollar is 3.4 percent. What this means is that every year, prices increase by 3.4 percent. If a quart of oil cost \$1.22 six years ago, what does it cost now?  
[A] \$1.26 [B] \$1.49 [C] \$0.99 [D] \$7.07
24. The function  $E(t) = 3^{\frac{3}{2}t}$  approximates the number of nematodes in a certain sample of fresh compost after  $t$  days. Find the initial number of nematodes when  $t = 0$ . How many nematodes are there after  $\frac{3}{2}$  days?  
[A] 0; 204,552 [B]  $3^{\frac{9}{2}}$ ; 204,552 [C]  $3^{\frac{9}{2}}$ ; 102,276 [D] 0; 102,276
25. Which function represents exponential decay?  
[A]  $y(x) = 3(0.28)^x$  [B]  $y(x) = 3(2.2)^x$  [C]  $y(x) = 3x + 7$  [D] none of these
26. Describe the value of  $b$  for the function  $y(x) = -\frac{1}{6}(b)^x$  to represent exponential decay.  
[A]  $b$  has any value between  $-1$  and  $1$  [B]  $b$  has any value between  $-6$  and  $6$   
[C]  $b$  has any value greater than 6 or less than  $-6$  [D]  $b$  has any value greater than 1 or less than  $-1$
27. If a principal of \$1340 is invested at an annual interest rate of 9% compounded annually, what is the account balance at the end of 7 years?  
[A] \$2450 [B] \$2247 [C] \$2184 [D] \$10,224
28. Find the final amount of the investment.  
\$1900 at 4% interest compounded monthly for 3 years.  
[A] \$2137.24 [B] \$2128.00 [C] \$1976.00 [D] \$2141.82
29. Write the equation  $\log_3 \frac{1}{27} = -3$  in exponential form.  
[A]  $3^3 = -\frac{1}{27}$  [B]  $3^{-3} = \frac{1}{27}$  [C]  $3^3 = -27$  [D]  $3^{-3} = 27$

30. Write the equation in logarithmic form.

$$4^{-3} = \frac{1}{64}$$

[A]  $\log_4 \frac{1}{64} = -3$

[B]  $\log_4 \frac{1}{64} = 3$

[C]  $\log_{-3} \frac{1}{64} = 4$

[D]  $\log_{-3} \frac{1}{64} = -4$

Solve the equation for x.

31.  $10^x = \frac{3}{10}$

[A] 0.68

[B] -0.52

[C] 3.66

[D] 3.52

32.  $2 = \log_x 36$

[A] 7

[B] 6

[C] 8

[D] 5

33. Evaluate  $\left(3^2\right)^{\log_3 10}$ .

[A] 10

[B] 2

[C] 9

[D] 1

34. Write the expression as a single logarithm, and simplify if possible.

$$\log_c 5x + 6(\log_c x - \log_c y)$$

[A]  $\log_c \frac{30x^2}{y}$

[B]  $\log_c \frac{11x}{6y}$

[C]  $\log_c \frac{5x^7}{y^6}$

[D]  $\log_c \frac{11x^2}{y}$

35. Solve  $\log_8 5 - \log_8 (x - 2) = \log_8 3$ , for x.

[A]  $\frac{7}{3}$

[B] 1

[C]  $\frac{11}{3}$

[D]  $-\frac{1}{3}$

36. Solve  $\log_4 (x + 2) - \log_4 (x - 1) = \log_4 4$  for x.

[A] 1

[B] 2

[C]  $\frac{2}{3}$

[D] -3

Solve the equation. Round your answers to the nearest hundredth.

37.  $3^x = 39$

[A] 0.3

[B] 1.59

[C] 0.48

[D] 3.33

38.  $7^{x-5} = 38$

[A] 5.53

[B] 6.58

[C] 5.85

[D] 6.87

Evaluate the logarithmic expression to the nearest thousandth.

39.  $\log_6 \frac{1}{5}$

[A] -0.268

[B] -9.657

[C] -0.898

[D] -2.884

40.  $\log_7 564$

[A] 44.345

[B] 0.905

[C] 3.256

[D] 2.026

Evaluate the expression to the nearest thousandth. If the expression is undefined, write *undefined*.

41.  $\ln 8673$

[A] 10.178

[B] 2.828

[C] 9.068

[D] 3.938

Evaluate the expression to the nearest thousandth. If the expression is undefined, write *undefined*.

42.  $3e^3$  [A] 73.394 [B] 24.465 [C] 60.257 [D] 59.439

43. The half-life of carbon-14 is 5700 years. Find the age to the nearest year of a sample in which 36% of the radioactive nuclei originally present have decayed.

[A] 2670 years [B] 3670 years [C] 3220 years [D] 3770 years

44. If \$9000 is invested at an interest rate of 10%, compounded continuously, determine the balance in the account after 2 years. Use the formula  $A = Pe^{rt}$ .

[A] \$66,501.50 [B] \$10,992.62 [C] \$10,890.00 [D] \$12,148.73

45. Solve the equation  $3^{3x} = 9^{x-1}$ . [A] -2 [B]  $-\frac{1}{2}$  [C] 0 [D]  $-\frac{1}{3}$

46. Solve the equation for x. Write the exact solution and the approximate solution to the nearest hundredth, when appropriate.  $\ln(6x - 9) = 5$

[A]  $\frac{e^5 - 9}{6} \approx 23.24$  [B]  $\frac{e^5 + 9}{6} \approx 26.24$  [C]  $\frac{e^{-9} - 6}{5} \approx -1.2$  [D]  $\frac{e^{-9} + 6}{5} \approx 1.2$

47. The magnitude of an earthquake is found by the equation  $M = \frac{2}{3} \log \frac{E}{10^{11.8}}$ , where  $M$  is the magnitude and  $E$  is the energy released. Find the magnitude of an earthquake that released  $10^{18.5}$  ergs of energy.

[A] 4.2 [B] 3.5 [C] 6.8 [D] 4.5

Use a graph, synthetic division, substitution, and factoring to solve the equation.

48.  $x^3 + 2x^2 - 48x = 0$  [A] 0, -8, -6 [B] 0, 8, -6 [C] 0, 8, 6 [D] 0, -8, 6

49.  $x^3 - 13x - 12 = 0$  [A] -5, -3, -1 [B] 5, -3, -1 [C] -4, -3, -1 [D] 4, -3, -1

Find the real zeros of the function. Give approximate values to the nearest hundredth, if necessary.

50.  $f(x) = x^4 + x^3 - 14x^2 - 2x + 24$   
[A] -3, -4,  $\pm 1.31$  [B] 3, -4,  $\pm 1.41$  [C] -3, 4,  $\pm 1.41$ ,  $\pm 1.31$  [D] 3, 4,  $\pm 1.31$ ,  $\pm 1.41$

51.  $f(x) = x^3 + x^2 + x + 1$  [A] -1, 2 [B] 2 [C] -1 [D] 2, 3

Find all the zeros of the polynomial function.

52.  $f(x) = x^3 + x^2 - x + 2$  [A] -2,  $\frac{1 \pm i\sqrt{3}}{2}$  [B] -2,  $-1 \pm i\sqrt{3}$  [C] 1, 2  $\pm \frac{i\sqrt{3}}{2}$  [D] 1, 2  $\pm i\sqrt{3}$

Find all the zeros of the polynomial function.

53.  $f(x) = x^2 + 10x + 41$

[A]  $5 \pm 8i$

[B]  $-5 \pm 4i$

[C]  $-5 \pm 8i$

[D]  $5 \pm 4i$

54. Write a polynomial equation in standard form by using the given information.

$P$  is of degree 2;  $P(0) = 34$ ; zeros:  $5 + 3i$ ,  $5 - 3i$

[A]  $P(x) = x^2 + 10x + 34$

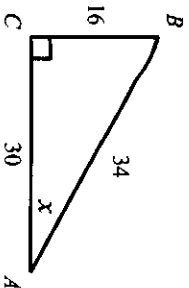
[B]  $P(x) = 2x^2 - 10x - 34$

[C]  $P(x) = x^2 - 10x + 34$

[D]  $P(x) = x^2 - 11x - 34$

Refer to  $\triangle ABC$  below to find the indicated value listed. Find the exact value and the value rounded to the nearest ten-thousandth, if necessary.

55. Find:  $\cos X$



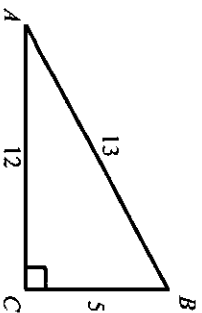
[A] 1 or 1.875

[B]  $\frac{8}{15}$  or 0.5333

[C]  $\frac{15}{17}$  or 0.8824

[D]  $\frac{8}{17}$  or 0.4706

56. Find:  $\sec A$



[A]  $\frac{5}{13}$  or 0.3846

[B]  $\frac{13}{5}$  or 2.6

[C]  $\frac{13}{12}$  or 1.0833

[D]  $\frac{12}{13}$  or 0.9231

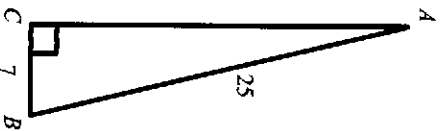
57. For  $\triangle ABC$ , find the measure of  $\angle A$  to the nearest degree.

[A]  $16^\circ$

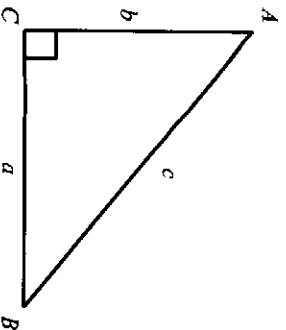
[B]  $74^\circ$

[C]  $44^\circ$

[D]  $6^\circ$



58. Use the following information to find the unknown sides and angles.  $m\angle B = 32^\circ$ ;  $b = 21$



[A]  $a = 34.1$ ;  $c = 39$ ;  $m\angle A = 58^\circ$ ;  $m\angle C = 90^\circ$

[B]  $a = 33.6$ ;  $c = 39$ ;  $m\angle A = 68^\circ$ ;  $m\angle C = 90^\circ$

[C]  $a = 33.6$ ;  $c = 39.6$ ;  $m\angle A = 58^\circ$ ;  $m\angle C = 90^\circ$

[D]  $a = 34.1$ ;  $c = 39.6$ ;  $m\angle A = 68^\circ$ ;  $m\angle C = 90^\circ$

59. Find the exact value of the sine, cosine, and tangent of  $-60^\circ$ .

[A]  $\sin = -\frac{\sqrt{3}}{2}$ ;  $\cos = \frac{1}{2}$ ;  $\tan = -\sqrt{3}$

[B]  $\sin = \frac{\sqrt{3}}{2}$ ;  $\cos = -\frac{1}{2}$ ;  $\tan = \frac{\sqrt{3}}{3}$

[C]  $\sin = -\frac{\sqrt{3}}{2}$ ;  $\cos = -\frac{1}{2}$ ;  $\tan = -\frac{\sqrt{3}}{3}$

[D]  $\sin = \frac{\sqrt{3}}{2}$ ;  $\cos = \frac{1}{2}$ ;  $\tan = \sqrt{3}$

60. Find  $\cos(-333^\circ)$ .

[A] 1.963

[B] 1.121

[C] 0.454

[D] 0.891

61. Find  $\sin(-347^\circ)$ .

[A] 0.455

[B] 0.225

[C] 0.974

[D] 0.231

62. Convert  $207^\circ$  to radians.

[A]  $\frac{23}{40}\pi$

[B]  $\frac{23}{30}\pi$

[C]  $\frac{23}{20}\pi$

[D]  $\frac{23}{10}\pi$

63. Convert  $\frac{7}{4}\pi$  to degrees.

[A]  $325^\circ$

[B]  $630^\circ$

[C]  $620^\circ$

[D]  $315^\circ$