

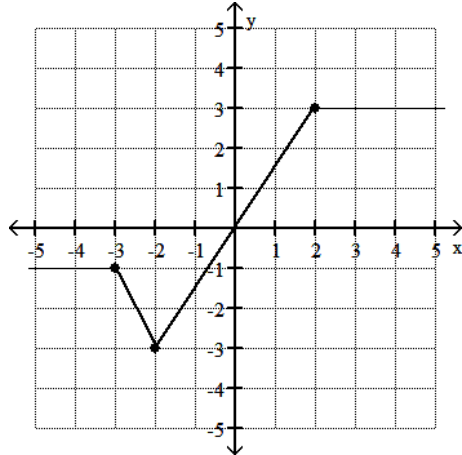
Name _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Identify the intervals where the function is changing as requested.

1) Increasing

1) _____



A) $(-2, \infty)$

B) $(-2, 2)$

C) $(-3, \infty)$

D) $(-3, 3)$

Answer: B

Find and simplify the difference quotient $\frac{f(x+h) - f(x)}{h}$, $h \neq 0$ for the given function.

2) $f(x) = x^2 + 2x - 3$

2) _____

A) $\frac{2x^2 + 2x + 2xh + h^2 + h - 6}{h}$

B) 1

C) $2x + h + 2$

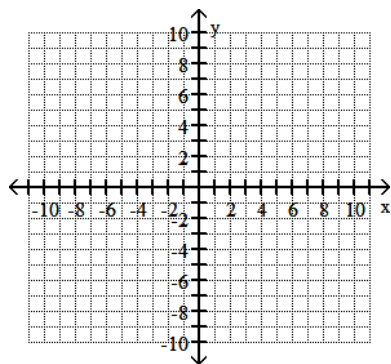
D) $2x + h - 3$

Answer: C

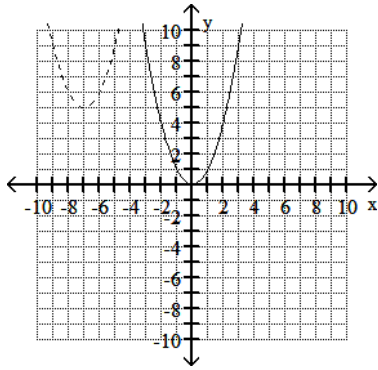
Begin by graphing the standard quadratic function $f(x) = x^2$. Then use transformations of this graph to graph the given function.

3) $h(x) = (x + 7)^2 - 5$

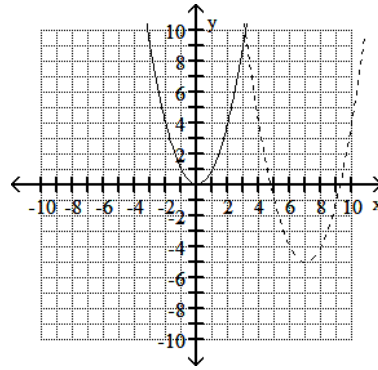
3) _____



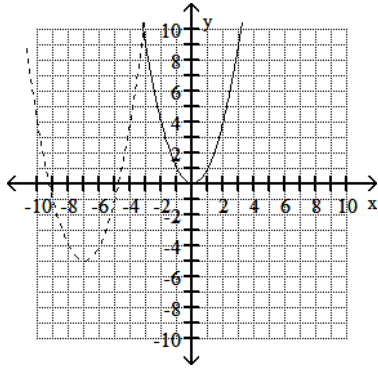
A)



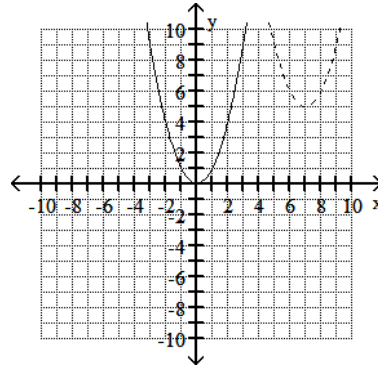
B)



C)



D)

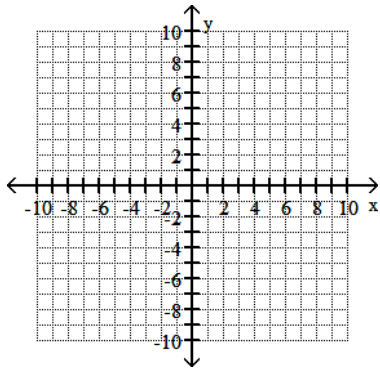


Answer: C

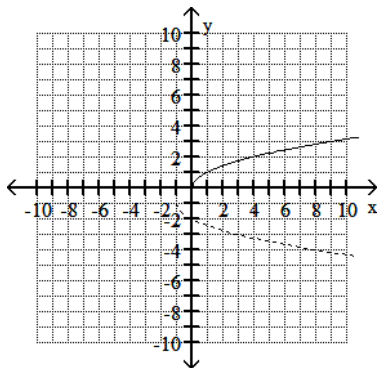
Begin by graphing the standard square root function $f(x) = \sqrt{x}$. Then use transformations of this graph to graph the given function.

4) $g(x) = -\sqrt{x+1} - 1$

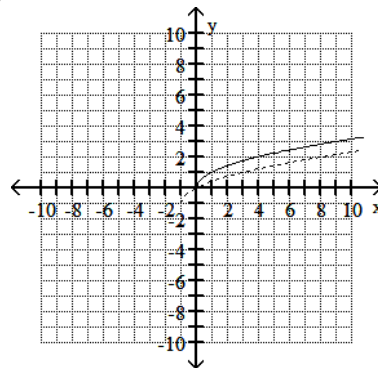
4) _____



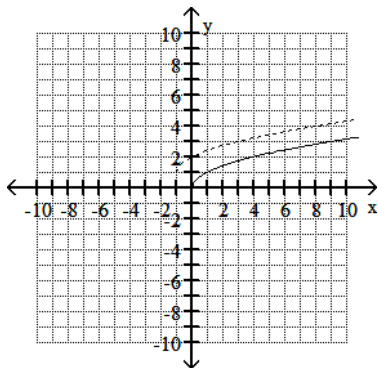
A)



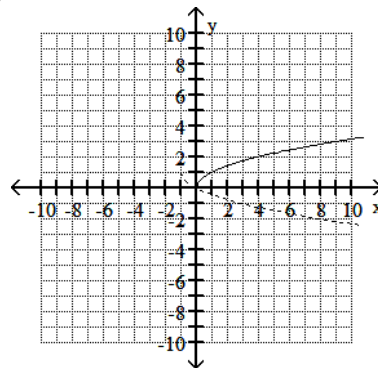
B)



C)



D)



Answer: A

Find the domain of the composite function $f \circ g$.

5) $f(x) = \frac{3}{x+8}$, $g(x) = \frac{24}{x}$

5) _____

A) $(-\infty, -8)$ or $(-8, -3)$ or $(-3, 0)$ or $(0, \infty)$

B) $(-\infty, \infty)$

C) $(-\infty, -3)$ or $(-3, 0)$ or $(0, \infty)$

D) $(-\infty, -8)$ or $(-8, 0)$ or $(0, \infty)$

Answer: C

Find functions f and g so that $h(x) = (f \circ g)(x)$.

6) $h(x) = |4x + 6|$

A) $f(x) = -|x|, g(x) = 4x + 6$

C) $f(x) = |x|, g(x) = 4x + 6$

Answer: C

B) $f(x) = |-x|, g(x) = 4x - 6$

D) $f(x) = x, g(x) = 4x + 6$

6) _____

Find the inverse of the one-to-one function.

7) $f(x) = \frac{6x - 7}{5}$

A) $f^{-1}(x) = \frac{5}{6x - 7}$

B) $f^{-1}(x) = \frac{5}{6x + 7}$

C) $f^{-1}(x) = \frac{5x + 7}{6}$

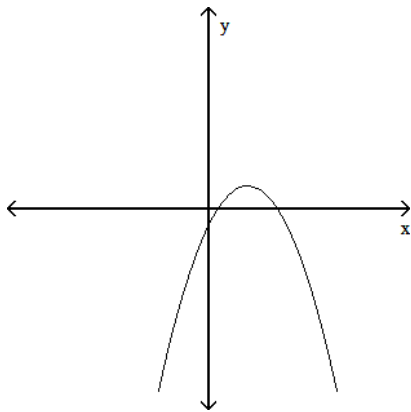
D) $f^{-1}(x) = \frac{5x - 7}{6}$

Answer: C

7) _____

Does the graph represent a function that has an inverse function?

8)



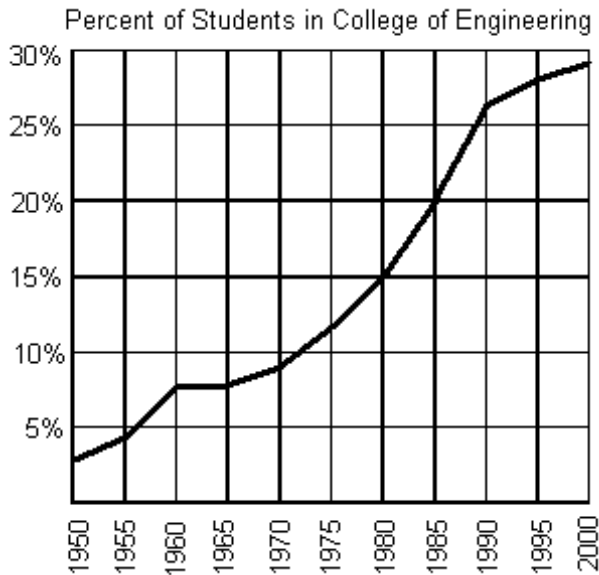
A) Yes

B) No

Answer: B

8) _____

The graph below shows the percentage of students enrolled in the College of Engineering at State University. Use the graph to answer the question.



9) Does the graph represent a function?

A) no

B) yes

9) _____

Answer: B

10) If f represents the function, find $f(1990)$.

A) approximately 28%

B) approximately 22.5%

C) approximately 26%

D) approximately 21%

10) _____

Answer: C

Find the zeros for the polynomial function and give the multiplicity for each zero. State whether the graph crosses the x-axis or touches the x-axis and turns around, at each zero.

11) $f(x) = x^3 + 8x^2 + 20x + 16$

A) -2, multiplicity 2, crosses the x-axis;
-4, multiplicity 1, touches the x-axis and turns around

B) 2, multiplicity 1, crosses the x-axis;
-2, multiplicity 2, touches the x-axis and turns around;
-4, multiplicity 1, crosses the x-axis.

C) -2, multiplicity 2, touches the x-axis and turns around;
-4, multiplicity 1, crosses the x-axis.

D) 2, multiplicity 1, crosses the x-axis;
-2, multiplicity 1, crosses the x-axis;
-4, multiplicity 1, crosses the x-axis.

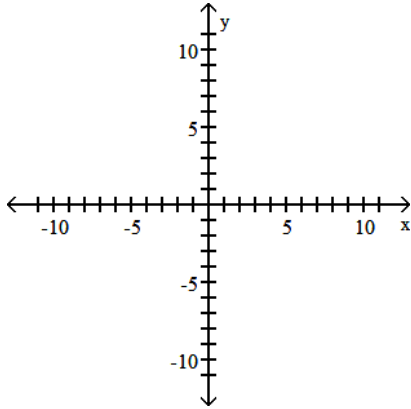
11) _____

Answer: C

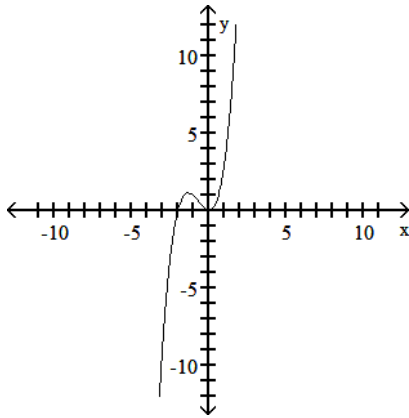
Graph the polynomial function.

12) $f(x) = 2x^2 - x^3$

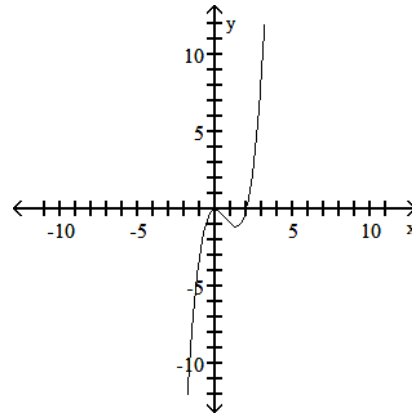
12) _____



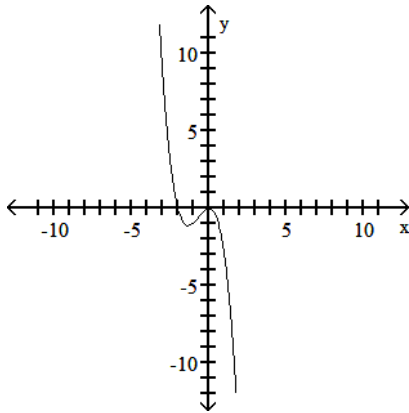
A)



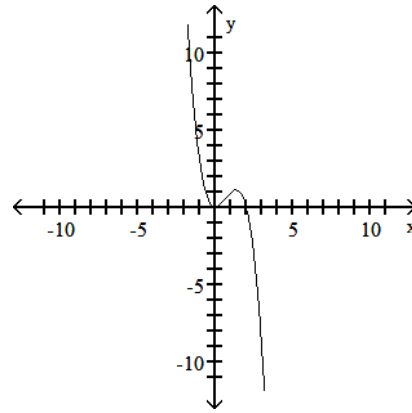
B)



C)



D)



Answer: D

Use synthetic division to show that the number given to the right of the equation is a solution of the equation, then solve the polynomial equation.

13) $x^3 + 3x^2 - 10x - 24 = 0$; -2

13) _____

A) {3, -4, -2}

B) {-3, 4, -2}

C) {3, 4, -2}

D) {-3, -4, -2}

Answer: A

Divide using long division.

14) $(-5x^5 - x^3 - 2x^2 + 24x + 4) \div (x^2 - 2)$

14) _____

A) $-5x^3 - 11x - 2 - \frac{2x}{x^2 - 2}$

B) $-5x^3 - 11x - 2 + \frac{2x + 8}{x^2 - 2}$

C) $-5x^3 - 11x - 2 + \frac{2x}{x^2 - 2}$

D) $-5x^3 - 11x + 2 + \frac{2x}{x^2 - 2}$

Answer: C

Solve the polynomial equation. In order to obtain the first root, use synthetic division to test the possible rational roots.

15) $3x^3 - 19x^2 + 30x - 8 = 0$

15) _____

A) $\left\{\frac{4}{3}, 1, 2\right\}$

B) $\left\{-\frac{4}{3}, 1, -2\right\}$

C) $\left\{-\frac{1}{3}, 2, -4\right\}$

D) $\left\{\frac{1}{3}, 2, 4\right\}$

Answer: D

Find an nth degree polynomial function with real coefficients satisfying the given conditions.

16) $n = 3$; 3 and i are zeros; $f(2) = 10$

16) _____

A) $f(x) = 2x^3 - 6x^2 + 2x - 6$

B) $f(x) = 2x^3 - 6x^2 - 2x + 6$

C) $f(x) = -2x^3 + 6x^2 + 2x - 6$

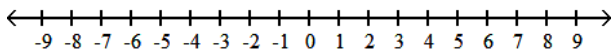
D) $f(x) = -2x^3 + 6x^2 - 2x + 6$

Answer: D

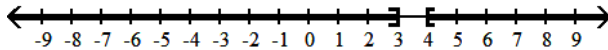
Solve the polynomial inequality and graph the solution set on a number line. Express the solution set in interval notation.

17) $x^2 - 7x \geq -12$

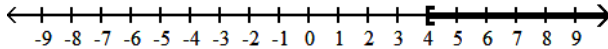
17) _____



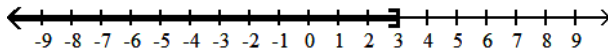
A) $(-\infty, 3] \cup [4, \infty)$



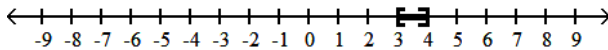
B) $[4, \infty)$



C) $(-\infty, 3]$



D) $[3, 4]$

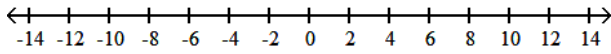


Answer: A

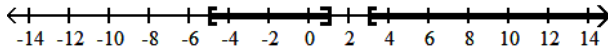
Solve the rational inequality and graph the solution set on a real number line. Express the solution set in interval notation.

18) $\frac{(x + 5)(x - 3)}{x - 1} \geq 0$

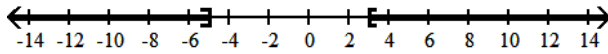
18) _____



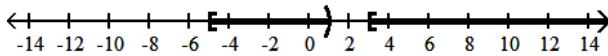
A) $[-5, 1] \cup [3, \infty)$



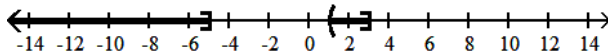
B) $(-\infty, -5] \cup [3, \infty)$



C) $[-5, 1) \cup [3, \infty)$



D) $(-\infty, -5] \cup (1, 3]$



Answer: C

Solve the problem.

- 19) A company that produces scooters has costs given by the function $C(x) = 30x + 15,000$, where x is the number of scooters manufactured and $C(x)$ is measured in dollars. The average cost to manufacture each scooter is given by

19) _____

$$\bar{C}(x) = \frac{30x + 15,000}{x}$$

What is the horizontal asymptote for the function \bar{C} ? Describe what this means in practical terms.

- A) $y = 30$; \$30 is the least possible cost for producing each scooter.
- B) $y = 15,000$; \$15,000 is the least possible cost for running the company.
- C) $y = 30$; 30 is the minimum number of scooters the company can produce.
- D) $y = 15,000$; 15,000 is the maximum number of scooters the company can produce.

Answer: A

- 20) A drug is injected into a patient and the concentration of the drug is monitored. The drug's concentration, $C(t)$, in milligrams per liter after t hours is modeled by

20) _____

$$C(t) = \frac{7t}{2t^2 + 3}$$

Estimate the drug's concentration after 4 hours. (Round to the nearest hundredth.)

- A) 0.80 milligrams per liter
- B) 2.69 milligrams per liter
- C) 2.55 milligrams per liter
- D) 0.94 milligrams per liter

Answer: A

Use the compound interest formulas $A = P\left(1 + \frac{r}{n}\right)^{nt}$ and $A = Pe^{rt}$ to solve.

- 21) Find the accumulated value of an investment of \$800 at 12% compounded quarterly for 2 years. 21) _____
 A) \$1003.52 B) \$992.00 C) \$1013.42 D) \$848.72

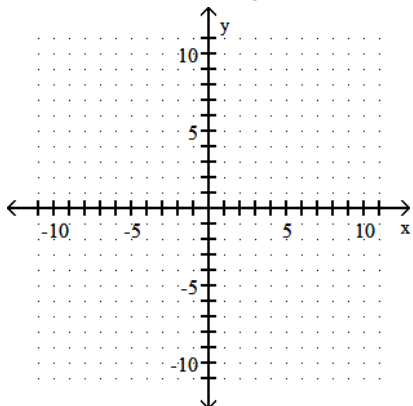
Answer: C

- 22) Find the accumulated value of an investment of \$7000 at 7% compounded continuously for 6 years. 22) _____
 A) \$10,505.11 B) \$10,753.73 C) \$9940.00 D) \$10,653.73

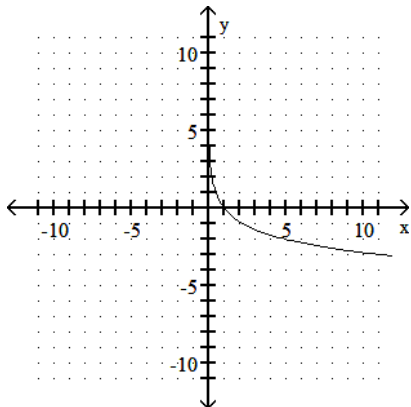
Answer: D

Graph the function.

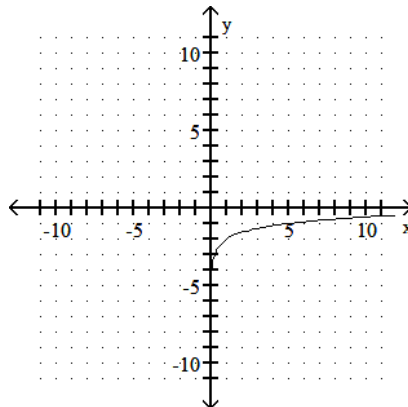
- 23) Use the graph of $\log_5 x$ to obtain the graph of $f(x) = -2 + \log_5 x$. 23) _____



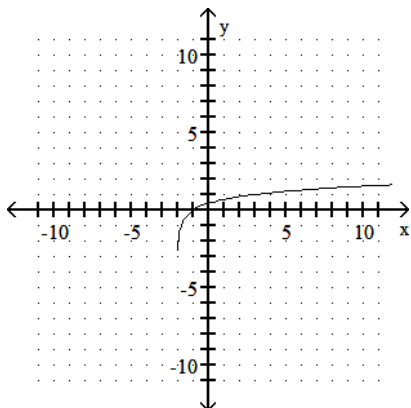
A)



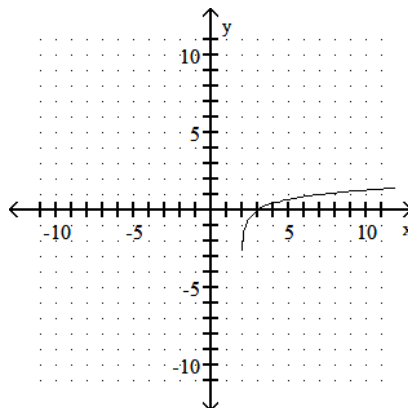
B)



C)



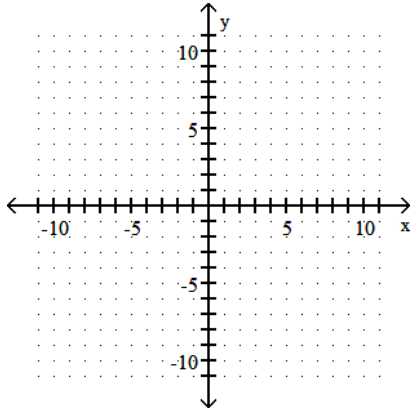
D)



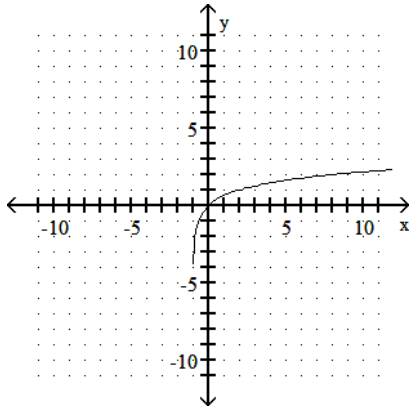
Answer: B

24) Use the graph of $\log_3 x$ to obtain the graph of $f(x) = \log_3 (x - 1)$.

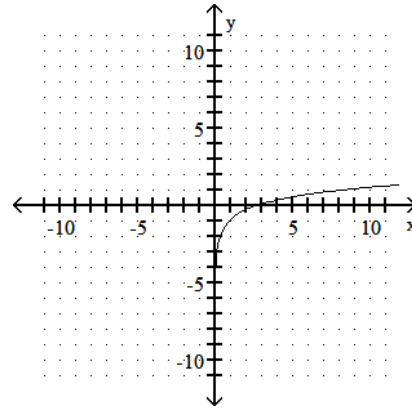
24) _____



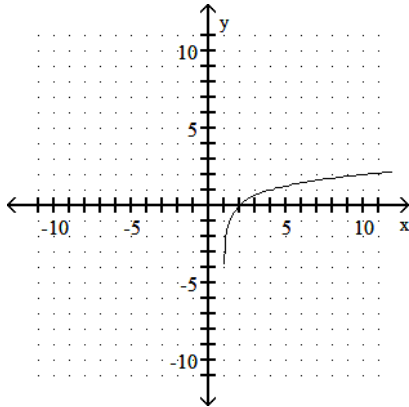
A)



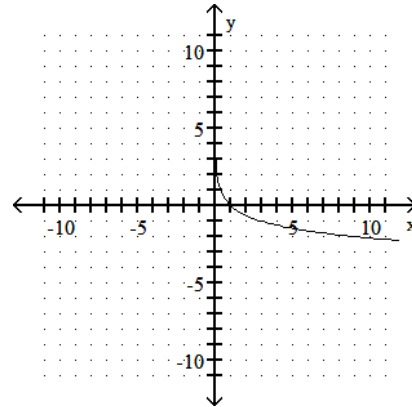
B)



C)



D)



Answer: C

Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1. Where possible, evaluate logarithmic expressions.

25) $5 \ln (x - 8) - 4 \ln x$

25) _____

A) $\ln x^4(x - 8)^5$

B) $\ln \frac{(x - 8)^5}{x^4}$

C) $\ln 20x(x - 8)$

D) $\ln \frac{5(x - 8)}{4x}$

Answer: B

Use common logarithms or natural logarithms and a calculator to evaluate to four decimal places

- 26) $\log_{\pi} 16$ 26) _____
A) 1.7013 B) 0.4129 C) 2.4220 D) 0.7070
Answer: C

Solve.

- 27) The function $A = A_0e^{-0.01386x}$ models the amount in pounds of a particular radioactive material stored in a concrete vault, where x is the number of years since the material was put into the vault. If 400 pounds of the material are initially put into the vault, how many pounds will be left after 120 years? 27) _____
A) 480 pounds B) 76 pounds C) 300 pounds D) 83 pounds
Answer: B

Solve the problem.

- 28) The logistic growth function $f(t) = \frac{640}{1 + 11.8e^{-0.12t}}$ describes the population of a species of butterflies t months after they are introduced to a non-threatening habitat. How many butterflies are expected in the habitat after 20 months? 28) _____
A) 641 butterflies B) 309 butterflies
C) 12,800 butterflies D) 1000 butterflies
Answer: B

- 29) Find out how long it takes a \$3100 investment to double if it is invested at 8% compounded semiannually. Round to the nearest tenth of a year. Use the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$. 29) _____
A) 9.2 years B) 9 years C) 8.6 years D) 8.8 years
Answer: D

- 30) The size of the bear population at a national park increases at the rate of 4.8% per year. If the size of the current population is 177, find how many bears there should be in 8 years. Use $y = y_0e^{0.048t}$ and round to the nearest whole number. 30) _____
A) 262 B) 258 C) 260 D) 264
Answer: C

Write the augmented matrix for the system of equations.

- 31) $6x + 5z = 32$
 $7y + 7z = 49$
 $2x + 7y + 3z = 71$ 31) _____
A) $\left[\begin{array}{ccc|c} 6 & 5 & 0 & 32 \\ 7 & 7 & 0 & 49 \\ 2 & 7 & 3 & 71 \end{array} \right]$ B) $\left[\begin{array}{ccc|c} 6 & 0 & 5 & 32 \\ 0 & 7 & 7 & 49 \\ 2 & 7 & 3 & 71 \end{array} \right]$ C) $\left[\begin{array}{ccc|c} 6 & 0 & 2 & 32 \\ 0 & 7 & 7 & 49 \\ 5 & 7 & 3 & 71 \end{array} \right]$ D) $\left[\begin{array}{ccc|c} 6 & 0 & 5 & 32 \\ 0 & 7 & 7 & 49 \\ 2 & 7 & 3 & 71 \end{array} \right]$
Answer: D

Solve the system of equations using matrices. Use Gaussian elimination with back-substitution.

$$\begin{aligned} 32) \quad & 4x - y + 8z = 45 \\ & -7x + 3z = -40 \\ & 9y + z = 66 \end{aligned}$$

32) _____

- A) $\{(7, 3, 7)\}$ B) $\{(-7, 14, 7)\}$ C) $\{(-7, 7, 14)\}$ D) $\{(7, 7, 3)\}$

Answer: D

Use Gaussian elimination to find the complete solution to the system of equations, or state that none exists.

$$\begin{aligned} 33) \quad & x + y + z + w = 7 \\ & 3x - 2z + 5w = 11 \\ & -4x + 3y + w = 4 \\ & -x - y - z - w = 6 \end{aligned}$$

33) _____

- A) $\{(-11, \frac{7}{19}, \frac{6}{19}, -4)\}$ B) $\{(\frac{3}{2}, 1, \frac{1}{3}, -2)\}$
 C) $\{(\frac{7}{4}, -\frac{1}{2}, 5, -\frac{1}{6})\}$ D) \emptyset

Answer: D

$$\begin{aligned} 34) \quad & 3x + y + z - 2w = 10 \\ & 2x + 3y + 3z + w = -5 \\ & 2x + y + 4z + 11w = 11 \end{aligned}$$

34) _____

- A) $\{(7, -1, -6, 2)\}$ B) $\{(w + 5, 3w - 7, -4w + 2, w)\}$
 C) $\{(2w + 3, 6w - 7, -10w + 8, w)\}$ D) $\{(6, -4, -2, 1)\}$

Answer: B

Find the inverse of the matrix, if possible.

$$35) \quad A = \begin{bmatrix} 2 & 0 \\ -2 & 6 \end{bmatrix}$$

35) _____

- A) $\begin{bmatrix} \frac{1}{2} & 0 \\ \frac{1}{6} & \frac{1}{6} \end{bmatrix}$ B) $\begin{bmatrix} \frac{1}{2} & 0 \\ -\frac{1}{6} & \frac{1}{6} \end{bmatrix}$ C) $\begin{bmatrix} \frac{1}{6} & 0 \\ \frac{1}{6} & \frac{1}{2} \end{bmatrix}$ D) No inverse

Answer: A

Solve the system using the inverse that is given for the coefficient matrix.

$$\begin{aligned} 36) \quad & x + 2y + 3z = -7 \\ & x + y + z = -11 \\ & x - 2z = -5 \end{aligned} \quad \text{The inverse of } \begin{bmatrix} 1 & 2 & 3 \\ 1 & 1 & 1 \\ 1 & 0 & -2 \end{bmatrix} \text{ is } \begin{bmatrix} -2 & 4 & -1 \\ 3 & -5 & 2 \\ -1 & 2 & -1 \end{bmatrix}.$$

36) _____

- A) $\{(-63, -86, -34)\}$ B) $\{(-14, 17, -10)\}$ C) $\{(-25, 24, -10)\}$ D) $\{(-7, 0, 0)\}$

Answer: C

Evaluate the determinant.

37)

$$\begin{vmatrix} -4 & -4 & -2 \\ -4 & 0 & -3 \\ 5 & 0 & -5 \end{vmatrix}$$

A) 20

B) 140

C) -140

D) -20

Answer: B

37) _____

Use Cramer's rule to solve the system.

38) $3x + 2y = 2$

$6x + 5y = 1$

A) $\{(-3, \frac{8}{3})\}$

B) $\{(\frac{8}{3}, -3)\}$

C) $\{(\frac{3}{8}, -\frac{1}{3})\}$

D) $\{(\frac{4}{9}, \frac{5}{9})\}$

Answer: B

38) _____

Solve the problem using matrices.

39) A company that manufactures products A, B, and C does both assembly and testing. The hours needed to assemble and test each product are shown in the table below.

	Hours needed weekly to assemble	Hours needed weekly to test
Product A	1	4
Product B	1	5
Product C	2	10

The company has exactly 25 hours per week available for assembly and 113 hours per week available for testing. If the company must produce t units of Product C this week, how many units of Products A and B can they produce?

A) 12t of Product A; $2t + 13$ of Product B

B) $t + 12$ of Product A; $t + 13$ of Product B

C) 12 of Product A; 13 of Product B

D) 12 of Product A; $-2t + 13$ of Product B

Answer: D

39) _____

Encode or decode the given message, as requested, numbering the letters of the alphabet 1 through 26 in their usual order.

40) Use the coding matrix $A = \begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix}$ and its inverse $A^{-1} = \begin{bmatrix} 3 & -1 \\ -5 & 2 \end{bmatrix}$ to decode the cryptogram $\begin{bmatrix} 9 & 6 \\ 25 & 17 \end{bmatrix}$.

A) DARE

B) CURB

C) CARE

D) BEAD

Answer: D

40) _____

Find the indicated sum.

41) $\sum_{i=3}^6 (4i - 3)$

A) 60

B) 33

C) 51

D) 63

Answer: A

41) _____

Write the first four terms of the sequence defined by the recursion formula.

42) $a_1 = -6$ and $a_n = -4a_{n-1}$ for $n \geq 2$

A) 6, -24, 96, -384

B) -6, -24, -96, -384

C) -6, 24, -96, 384

D) -6, 26, -98, 386

Answer: C

42) _____

Write a formula for the general term (the n th term) of the arithmetic sequence. Then use the formula for a_n to find a_{20} , the 20th term of the sequence.

43) $3, 15, 27, 39, 51, \dots$

A) $a_n = 9n - 3$; $a_{20} = 177$

C) $a_n = 12n - 3$; $a_{20} = 237$

B) $a_n = 9n - 12$; $a_{20} = 168$

D) $a_n = 12n - 9$; $a_{20} = 231$

43) _____

Answer: D

Find the indicated sum.

44) Find the sum of the first 60 terms of the arithmetic sequence: $14, 23, 32, 41, \dots$

A) 16,770

B) 554

C) 16,779

D) 17,040

44) _____

Answer: A

Use the formula for the general term (the n th term) of a geometric sequence to find the indicated term of the sequence with the given first term, a_1 , and common ratio, r .

45) Find a_{10} when $a_1 = -3$, $r = 3$.

A) -177,147

B) 24

C) -59,045

D) -59,049

45) _____

Answer: D

Find the sum of the infinite geometric series, if it exists.

46) $3 + \frac{3}{4} + \frac{3}{16} + \frac{3}{64} + \dots$

A) 4

B) $\frac{3}{4}$

C) $\frac{15}{4}$

D) does not exist

46) _____

Answer: A

Find the term indicated in the expansion.

47) $(x + 2y)^8$; 6th term

A) $896x^5y^3$

B) $1792x^3y^5$

C) $896x^3y^6$

D) $1792x^5y^3$

47) _____

Answer: B

Evaluate the given binomial coefficient.

48) $\binom{8}{4}$

A) 1680

B) 35

C) 70

D) 140

48) _____

Answer: C

Solve the problem.

49) A theater has 26 rows with 20 seats in the first row, 24 in the second row, 28 in the third row, and so forth. How many seats are in the theater?

A) 3744 seats

B) 3640 seats

C) 1820 seats

D) 1872 seats

49) _____

Answer: C

50) A job pays a salary of 29,000 the first year. During the next 9 years, the salary increases by 3% each year. What is the salary for the 10th year? What is the total salary over the 10-year period? (Round to the nearest cent.)

A) \$38,973.58; \$294,647.41

B) \$38,973.58; \$371,426.08

C) \$37,838.42; \$332,452.5

D) \$37,838.42; \$294,614.08

50) _____

Answer: C