Q1. If $5^x = 6$, what does 5^{-2x} equal?

- ○ a. 1/36
- ○ b. 36
- ○ c. 1/12
- ○ d. -36

Q2. Solve the equation $3^x = 81$.

- ○ a. {27}
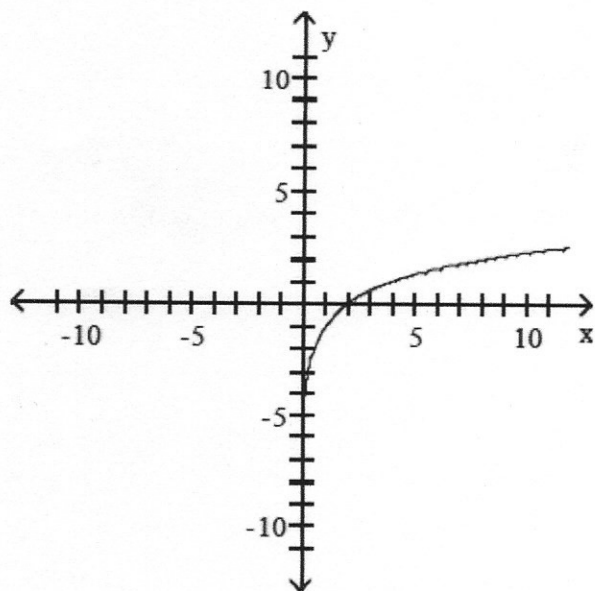- ○ b. {5}
- ○ c. {4}
- ○ d. {3}

Q3. Change the exponential expression $5^{-3} = 1/125$ to an equivalent expression involving a logarithm.

- ○ a. $\log_{-3} 1/125 = 5$
- ○ b. $\log_5 1/125 = -3$
- ○ c. $\log_5 -3 = 1/125$
- ○ d. $\log_{1/125} 5 = -3$

Q4. Find the exact value of the logarithmic expression ln e.

- ○ a. 0
- ○ b. -1
- ○ c. 1
- ○ d. e

Q5. The graph of a logarithmic function is shown. Select the function which matches the graph.

○ a. $y = \log_2(x + 1)$
○ b. $y = \log_2(x - 1)$
○ c. $y = \log_2 x$
○ d. $y = \log_2 x - 1$

Q6. Find the inverse of the function and state its domain and range.
{(-3, 4), (-1, 5), (0, 2), (2, 6), (5, 7)}
○ a. {(3, 4), (1, 5), (0, 2), (-2, 6), (-5, 7)}; D = {3, 1, 0, -2, -5}; R = {2, 4, 5, 6, 7}
○ b. {(-3, -4), (-1, -5), (0, -2), (2, -6), (5, -7)}; D = {-3, -1, 0, 2, 5}; R = {-7, -6, -5, -4, -2}
○ c. {(4, -3), (5, -1), (2, 0), (6, 2), (7, 5)} D = {2, 4, 5, 6, 7}; R = {-3, -1, 0, 2, 5}
○ d. {(3, -4), (1, -5), (0, -2), (-2, -6), (-5, -7)}; D = {3, 1, 0, -2, -5}; R = {-7, -6, -5, -4, -2}

Q7. Find the amount that results from the investment of $480 invested at 6% compounded quarterly after a period of 3 years.
○ a. $573.90
○ b. $93.9
○ c. $565.42
○ d. $571.69

Q8. Write $\log_7 \sqrt{(xy)}/15$ as the sum and/or difference of logarithms. Express powers as factors.
○ a. $(1/2) \log_7 xy - (1/2) \log_7 15$
○ b. $(1/2) \log_7 x \cdot (1/2) \log_7 y \div (1/2) \log_7 15$
○ c. $(1/2) \log_7 x + (1/2) \log_7 y - (1/2) \log_7 15$
○ d. $(1/2) \log_7 x + (1/2) \log_7 y - \log_7 15$

Q9. The value of a particular investment follows a pattern of exponential growth. You invested money in a money market account. The value of your investment t years after your initial investment is given by the exponential growth model $A = 5100e^{0.047t}$. How much did you initially invest in the account?
○ a. $2550.00
○ b. $5345.42
○ c. $5100.00
○ d. $239.70

Q10. In 1990, the population of a country was estimated at 4 million. For any subsequent year the population, P(t) (in millions), can be modeled by the equation $P(t) = 240/(5 + 54.99e^{-0.0208t})$,
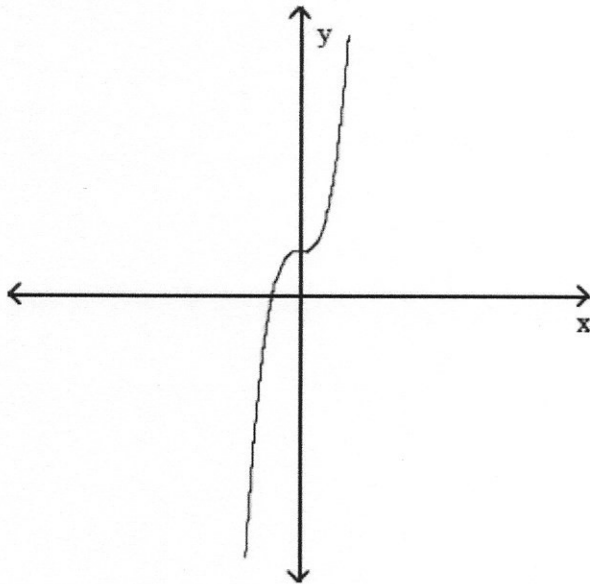
where t is the number of years since 1990. Estimate the year when the population will be 21 million.
- a. approximately the year 2093
- b. approximately the year 2041
- c. approximately the year 2088
- d. approximately the year 2016

Q11. Solve the equation log $_{72}$ (x^2 - x) = 1.
- a. {-8, -9}
- b. {1, 72}
- c. {8, 9}
- d. {-8, 9}

Q12. Use the horizontal line test to determine whether the function is one-to-one.

- a. Yes
- b. No

Q13. Find the amount that results from the investment of $12,000 invested at 5% compounded quarterly after a period of 8 years.
- a. $5857.57
- b. $17,729.47
- c. $17,857.57
- d. $17,637.10

Q14. Suppose that ln 2 = a and ln 5 = b. Use properties of logarithms to write ln 10 in terms of a and b.
- a. ab
- b. a - b
- c. a + b
- d. ln a + ln b

Q15. The half-life of silicon-32 is 710 years. If 100 grams is present now, how much will be present in 200 years? (Round your answer to three decimal places.)
- a. 14.192
- b. 82.263
- c. 98.066

Q16. Express 6log $_b$ m - log $_b$ n as a single logarithm.

a. log $_b$ m^6 ÷ log $_b$ n

b. log $_b$ (m^6 - n)

c. log $_b$ (m^6/n)

d. log $_b$ (6m/n)

Q17. Find functions f and g so that f ∘ g = H(x) = (5 - 2x^3)^2.

a. f(x) = 5 - 2x^3 ; g(x) = x^2

b. f(x) = (5 - 2x)^3 ; g(x) = x^2

c. f(x) = x^2 ; g(x) = 5 - 2x^3

d. f(x) = x^3 ; g(x) = (5 - 2x)^2

Q18. Solve the equation (1/3) log $_2$ (x + 6) = log $_8$ (3x).

a. {9}

b. {3, 0}

c. {3}

d. ø

Q19. A size 6 dress in Country C is size 52 in Country D. A function that converts dress sizes in Country C to those in Country D is f(x) = 2(x + 20). Find a formula for the inverse of the function described.

a. f $^{-1}$(x) = (x - 20)/2

b. f $^{-1}$(x) = x - 20

c. f $^{-1}$(x) = (x/2) - 20

d. f $^{-1}$(x) = (x/2) + 20

Q20. Find the exact value of the logarithmic expression log $_4$ 1/64.

a. -1/3

b. -3

c. 1/3

d. 3

Q21. Find the value of the determinant.

$$\begin{vmatrix} 9 & 3 \\ 3 & 4 \end{vmatrix}$$

a. 45

b. 27

c. 15

d. -27

Q22. Find the value of the determinant.

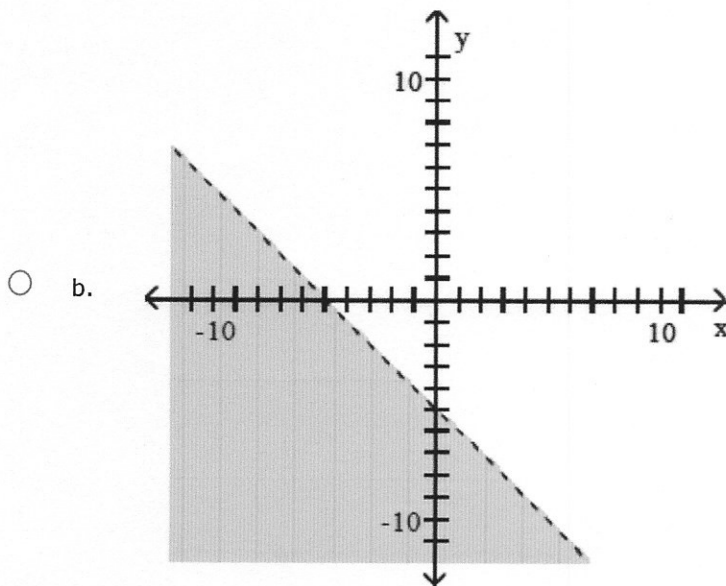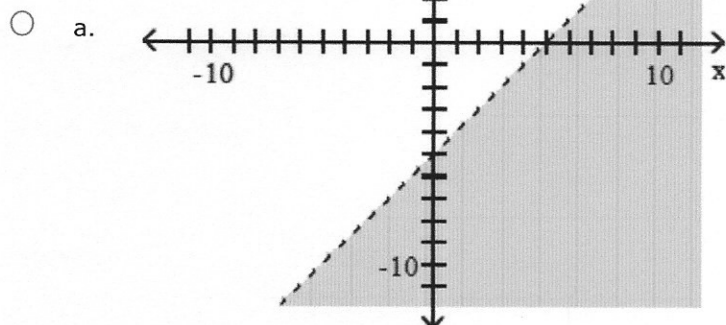$$\begin{vmatrix} 4 & 2 & 2 \\ 2 & 5 & 3 \\ 4 & 1 & 6 \end{vmatrix}$$

a. 224

b. 24

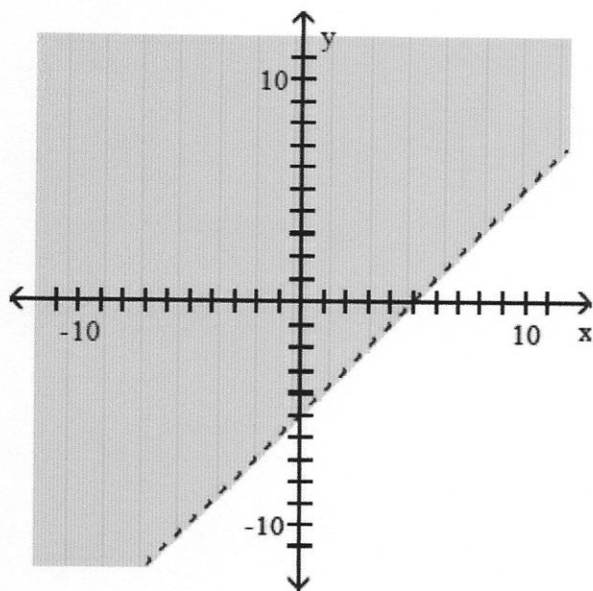**Q23. Write the partial fraction decomposition of the rational expression $x/(x^2 - 9x + 20)$.**

a. $-4/(x - 4) + 5/(x - 5)$

b. $-5/(x - 4) + 4/(x - 5)$
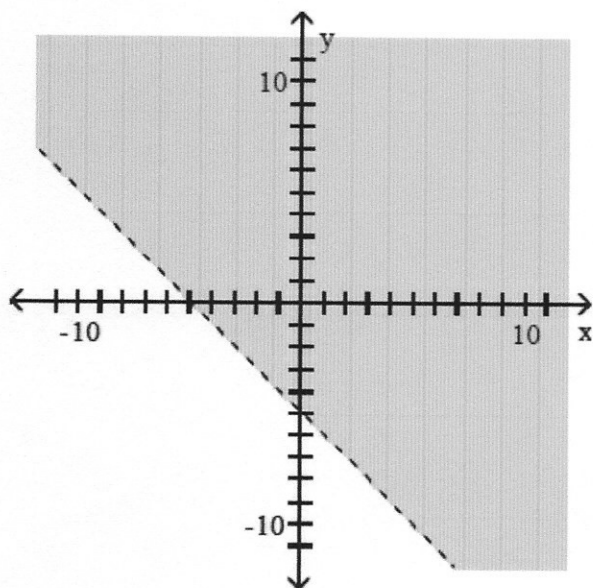
c. $4/(x - 4) + -5/(x - 5)$

d. $-4/(x - 4) + -5/(x - 5)$

Q24. Graph the inequality $x + y < -5$.

a.

b.

c.

d.

Q25. Find the inverse of the matrix. Be sure to check your answer.

$$\begin{bmatrix} 10 & 1 \\ -1 & 0 \end{bmatrix}$$

- a. $\begin{bmatrix} 0 & -1 \\ -1 & 10 \end{bmatrix}$

- b. $\begin{bmatrix} 0 & 1 \\ 1 & 10 \end{bmatrix}$

- c. $\begin{bmatrix} 0 & 1 \\ -1 & 10 \end{bmatrix}$

○ d. $\begin{bmatrix} 0 & -1 \\ 1 & 10 \end{bmatrix}$

Q26. A dietitian needs to purchase food for patients. She can purchase an ounce of chicken for $0.25 and an ounce of potatoes for $0.03. Let x = the number of ounces of chicken and y = the number of ounces of potatoes purchased per patient. Write the objective function that describes the total cost per patient per meal.

○ a. z = 3y + 25y

○ b. z = 0.25x + 0.03y

○ c. z = 25x + 3y

○ d. z = 0.03x + 0.25y

Q27. Let $A = \begin{bmatrix} 8 & 6 & 6 \\ 9 & -2 & 8 \\ -2 & 4 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & -3 & -1 \\ 8 & 7 & 6 \\ 7 & 9 & 8 \end{bmatrix}$. Find 2A + 2B.

○ a. $\begin{bmatrix} 14 & 9 & 11 \\ 26 & 3 & 22 \\ 3 & 17 & 20 \end{bmatrix}$

○ b. $\begin{bmatrix} 6 & 3 & 5 \\ 17 & 5 & 14 \\ 5 & 13 & 14 \end{bmatrix}$

○ c. $\begin{bmatrix} 6 & 17 & 5 \\ 3 & 5 & 13 \\ 5 & 14 & 14 \end{bmatrix}$

○ d. $\begin{bmatrix} 12 & 6 & 10 \\ 34 & 10 & 28 \\ 10 & 26 & 28 \end{bmatrix}$

Q28. Solve the system of equations using substitution.

$$\begin{cases} xy = 42 \\ x + y = -13 \end{cases}$$

○ a. x = -6, y = 7; x = -7, y = 6 or (-6, 7), (-7, 6)

○ b. x = -6, y = -7; x = -7, y = -6 or (-6, -7), (-7, -6)

○ c. x = 6, y = -7; x = 7, y = -6 or (6, -7), (7, -6)

○ d. x = 6, y = 7; x = 7, y = 6 or (6, 7), (7, 6)

Q29. Write the augmented matrix for the system.

$$\begin{cases} \dfrac{5}{2}x + \dfrac{2}{11}y = -\dfrac{1}{2} \\[2mm] \dfrac{2}{11}x - \dfrac{1}{2}y = \dfrac{1}{2} \end{cases}$$

○ a.
$$\left[\begin{array}{cc|c} \dfrac{5}{2} & \dfrac{2}{11} & \dfrac{1}{2} \\[3mm] \dfrac{2}{11} & \dfrac{1}{2} & \dfrac{1}{2} \end{array}\right]$$

○ b.
$$\left[\begin{array}{cc|c} \dfrac{5}{2} & \dfrac{2}{11} & -\dfrac{1}{2} \\[3mm] \dfrac{2}{11} & \dfrac{1}{2} & -\dfrac{1}{2} \end{array}\right]$$

○ c.
$$\left[\begin{array}{cc|c} \dfrac{5}{2} & \dfrac{2}{11} & -\dfrac{1}{2} \\[3mm] \dfrac{2}{11} & -\dfrac{1}{2} & \dfrac{1}{2} \end{array}\right]$$

○ d.
$$\left[\begin{array}{ccc|c} \dfrac{5}{2} & \dfrac{2}{11} & -\dfrac{1}{2} & 0 \\[3mm] \dfrac{2}{11} & -\dfrac{1}{2} & \dfrac{1}{2} & 0 \end{array}\right]$$

Q30. Solve the system of equations using substitution.

$$\begin{cases} y = x + 2 \\ y^2 = 8x \end{cases}$$

○ a. x = 2, y = 4; x = 2, y = -4; x = -2, y = 0 or (2, 4), (2, -4), (-2, 0)
○ b. x = 2, y = 4; x = -2, y = 0 or (2, 4), (-2, 0)
○ c. x = 2, y = 4; x = 2, y = -4 or (2, 4), (2, -4)
○ d. x = 2, y = 4 or (2, 4)

Q31. A flat rectangular piece of aluminum has a perimeter of 58 inches. The length is 7 inches
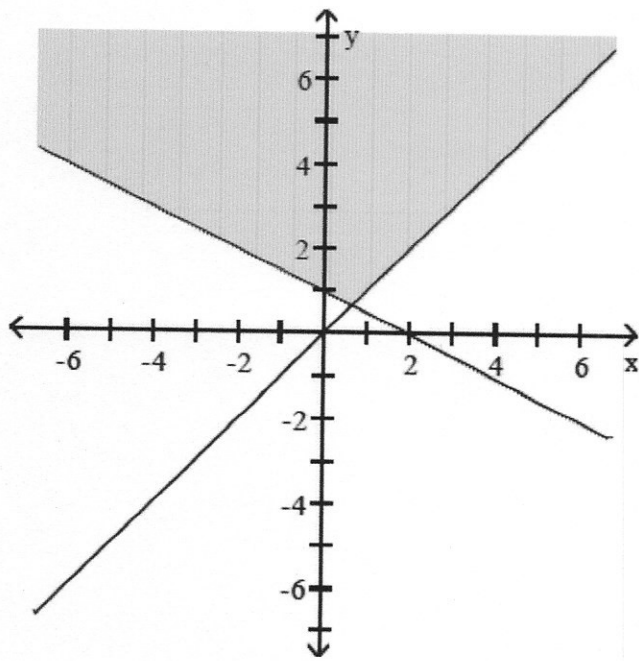
Q32. The perimeter of a rectangle is 20 inches and its area is 21 square inches. What are its dimensions?

- ○ a. 2 in. by 6 in.
- ○ b. 3 in. by 7 in.
- ○ c. 4 in. by 6 in.
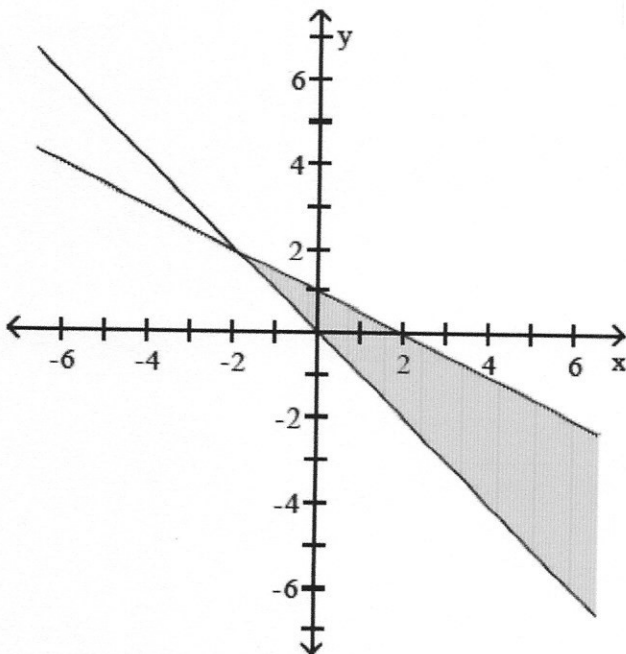- ○ d. 2 in. by 8 in.

Q33. Graph the solution set of the system of inequalities or indicate that the system has no solution.

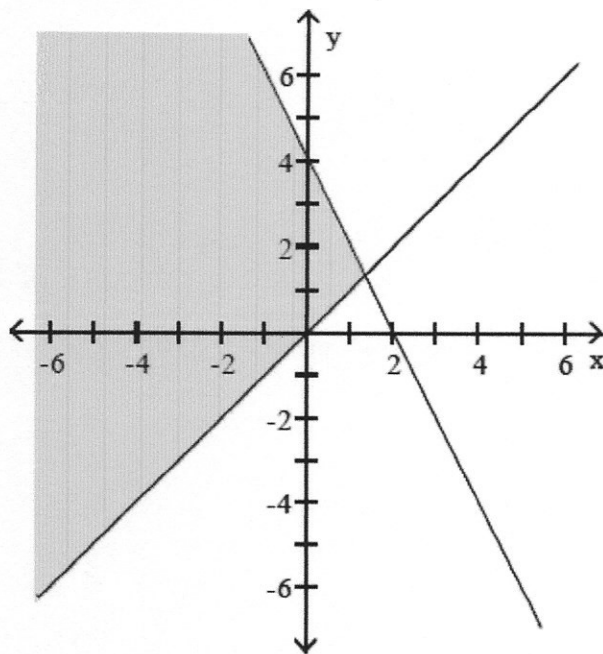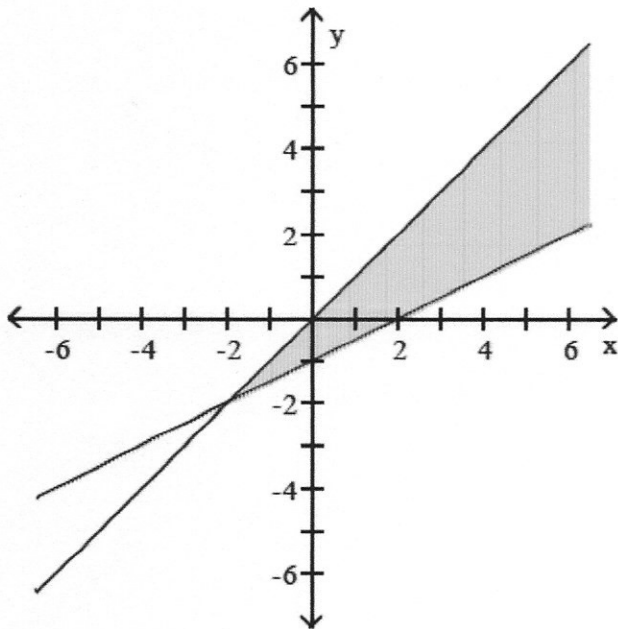$$\begin{cases} x + 2y \geq 2 \\ x - y \leq 0 \end{cases}$$

○ a.

○ b.

c.

d.

Q34. Write the partial fraction decomposition of the rational expression (125 - 19x)/(x³ - 10x² + 25x).

- a. $5/x + -5/(x - 5) + 12/(x - 5)^2$
- b. $-5/x + 5/(x - 5) + 6/(x - 5)^2$
- c. $5/x + 6/(x - 5) + -5/(x - 5)^2$
- d. $5/x + -5/(x - 5) + 6/(x - 5)^2$

Q35. Solve the system of equations using matrices (row operations). If the system has no solution, say that it is inconsistent.

$$\begin{cases} x - y + 5z = -9 \\ 3x \quad + z = -2 \\ x + 3y + z = -5 \end{cases}$$

- ○ a. x = -2, y = -1, z = 0; (-2, -1, 0)
- ○ b. x = -2, y = 0, z = -1; (-2, 0, -1)
- ○ c. x = 0, y = -2, z = -1; (0, -2, -1)
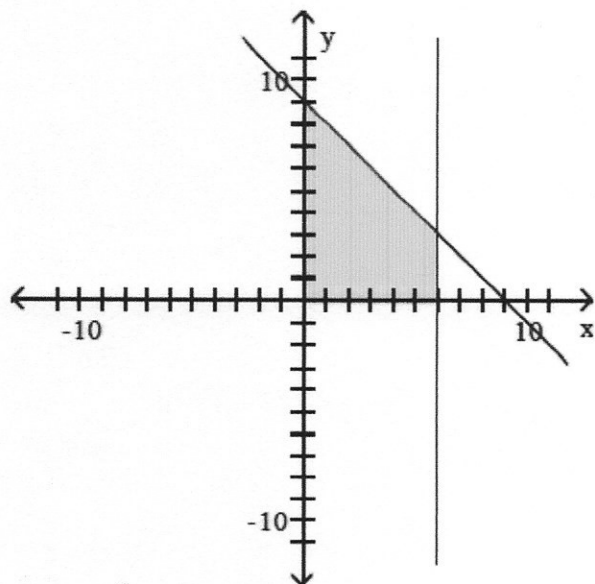- ○ d. x = 0, y = -1, z = -2; (0, -1, -2)

Q36. Write the partial fraction decomposition of the rational expression $(14x + 1)/[(x - 1)(x^2 + x + 1)]$.

- ○ a. $5/(x - 1) + (4x - 5)/(x^2 + x + 1)$
- ○ b. $5/(x - 1) + (-5x + 4)/(x^2 + x + 1)$
- ○ c. $5/(x - 1) + -5/(x + 1) + 4/(x - 1)$
- ○ d. $-5/(x - 1) + (5x + 4)/(x^2 + x + 1)$

Q37. Solve the linear programming problem. Minimize z = 11x + 6y + 7 subject to: x = 0, y = 0, x + y = 1.

- ○ a. minimum: 7
- ○ b. minimum: 18
- ○ c. minimum: 24
- ○ d. minimum: 13

Q38. Write a system of linear inequalities that has the given graph.

- ○ a.
$$\begin{cases} y \geq 0 \\ x \geq 0 \\ x \leq 9 \\ y + x \leq 6 \end{cases}$$

○ b.
$$\begin{cases} y \geq 0 \\ x \geq 0 \\ x \leq 6 \\ y + x \geq 9 \end{cases}$$

○ c.
$$\begin{cases} x \leq 6 \\ y + x \leq 9 \end{cases}$$

○ d.
$$\begin{cases} y \geq 0 \\ x \geq 0 \\ x \leq 6 \\ y + x \leq 9 \end{cases}$$

Q39. Solve the system of equations using Cramer's Rule if it is applicable.

$$\begin{cases} 3x + 8z = 64 \\ -6x + 2y + 7z = -5 \\ 4x - 4y = 16 \end{cases}$$

○ a. x = 9, y = 2, z = 5; (9, 2, 5)
○ b. x = 8, y = 4, z = 5; (8, 4, 5)
○ c. x = 4, y = 5, z = 4; (4, 5, 4)
○ d. x = 8, y = -4, z = -5; (8, -4, -5)

Q40. Solve the system of equations by substitution.

$$\begin{cases} 5x - 2y = -1 \\ x + 4y = 35 \end{cases}$$

○ a. x = 2, y = 9; (2, 9)
○ b. x = 3, y = 9; (3, 9)
○ c. x = 3, y = 8; (3, 8)
○ d. x = 2, y = 8; (2, 8)