Exam

Name________________________________

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

Compute the indicated values of the given function.

1) $f(x) = 2x - 9; f(0), f(-5), f(8)$ 1) ________

A) $f(0) = -9; f(-5) = -14; f(8) = -1$
B) $f(0) = -9; f(-5) = -19; f(8) = 7$
C) $f(0) = 0; f(-5) = -14; f(8) = -1$
D) $f(0) = 0; f(-5) = -19; f(8) = 7$

Answer: B

2) $h(t) = \sqrt{t^2 + 2t + 25};\ h(-5),\ h(0),\ h(5)$ 2) ________

A) $h(-5) = 2\sqrt{10};\ h(0) = 25;\ h(5) = 2\sqrt{13}$
B) $h(-5) = \sqrt{10};\ h(0) = 25;\ h(5) = 2\sqrt{15}$
C) $h(-5) = \sqrt{10};\ h(0) = 25;\ h(5) = 2\sqrt{13}$
D) $h(-5) = 2\sqrt{10};\ h(0) = 5;\ h(5) = 2\sqrt{15}$

Answer: D

3) $f(t) = \dfrac{10}{\sqrt{6 - 5t}};\ f(1), f(-6), f(0)$ 3) ________

A) $f(1) = 10; f(-6) = \dfrac{5}{3}; f(0) = \dfrac{10}{\sqrt{6}}$
B) $f(1) = 10; f(-6) = \dfrac{10}{\sqrt{6}}; f(0) = \dfrac{5}{3}$
C) $f(1) = \dfrac{1}{10}; f(-6) = \dfrac{10}{\sqrt{6}}; f(0) = \dfrac{5}{3}$
D) $f(1) = \dfrac{1}{10}; f(-6) = \dfrac{5}{3}; f(0) = \dfrac{10}{\sqrt{6}}$

Answer: A

4) $h(x) = \begin{cases} -4x - 5 & \text{if } x \le -3 \\ x^2 + 9 & \text{if } x > -3 \end{cases};\ h(-2),\ h(-3),\ h(0),\ h(2)$ 4) ________

A) $h(-2) = 3;\ h(-3) = 18;\ h(0) = -5;\ h(2) = -13$
B) $h(-2) = 3;\ h(-3) = 18;\ h(0) = 9;\ h(2) = 13$
C) $h(-2) = 13;\ h(-3) = 7;\ h(0) = -5;\ h(2) = -13$
D) $h(-2) = 13;\ h(-3) = 7;\ h(0) = 9;\ h(2) = 13$

Answer: D

Determine the domain of the given function.

5) $g(x) = \dfrac{x^2 + 3}{x - 7}$ 5) ________

A) All real numbers x except $x = 7$
B) All real numbers x except $x = -3$
C) All real numbers x except $x = -7$
D) All real numbers x except $x = 3$

Answer: A

6) $f(x) = \sqrt{5x + 20}$ 6) ________

A) All real numbers x for which $x \geq 0$
B) All real numbers x for which $x < -4$
C) All real numbers x for which $x \geq -4$
D) All real numbers x for which $x \leq -4$

Answer: C

Find the composite function $f(g(x))$.

7) $f(u) = (-6u - 12)^2$, $g(x) = x - 2$ 7) ________

A) $f(g(x)) = 36x^2 + 144x + 142$
B) $f(g(x)) = -6x$
C) $f(g(x)) = -6x^2$
D) $f(g(x)) = 36x^2$

Answer: D

Find the difference quotient, $\frac{f(x+h) - f(x)}{h}$.

8) $f(x) = 5x - x^2$ 8) ________

A) $\frac{f(x+h) - f(x)}{h} = 5 - 2x - h$
B) $\frac{f(x+h) - f(x)}{h} = 5 - 2x - h^2$
C) $\frac{f(x+h) - f(x)}{h} = 5 + 2x + h^2$
D) 1

Answer: A

Find the indicated composite function.

9) $f(x - 1)$ where $f(x) = x^2 + 5$ 9) ________

A) $f(x - 1) = x^2 + 6$
B) $f(x - 1) = x^2 + 4$
C) $f(x - 1) = x^2 - 2x + 6$
D) $f(x - 1) = x^2 - 2x + 1$

Answer: C

Find functions $h(x)$ and $g(u)$ such that $f(x) = g(h(x))$.

10) $f(x) = \frac{11}{x^2 - 5}$ 10) ________

A) $h(x) = 11$; $g(u) = \frac{1}{u^2 - 5}$
B) $h(x) = x^2 - 5$; $g(u) = \frac{11}{u - 5}$
C) $h(x) = x^2 - 5$; $g(u) = \frac{11}{u}$
D) $h(x) = \frac{11}{x}$; $g(u) = u^2 - 5$

Answer: C

Solve the problem.

11) Suppose the total cost of manufacturing q units of a certain product is $C(q)$ thousand dollars, where $C(q) = 0.03q^2 + 0.6q + 4$. Find the total cost and the average cost of producing 10 units. 11) ______

A) $C(10) = \$13$; $AC = \$1.30$ per unit
B) $C(10) = \$13{,}000$; $AC = \$1300$ per unit
C) $C(10) = \$130{,}000$; $AC = \$13{,}000$ per unit
D) $C(10) = \$13{,}000$; $AC = \$130{,}000$ per unit

Answer: B

12) The demand function $p = D(x) = -0.3x + 33$ and the total cost function $C(x) = 1.2x^2 + 9.2x + 65$ for a particular commodity are given in terms of the level of production x. 12) ______

a. Find the revenue $R(x)$ and profit $P(x)$.
b. Find all values of x for which production of the commodity is profitable.

A) **a.** $R(x) = -0.3x^2 + 33x$; $P(x) = 1.5x^2 - 23.8x + 65$
b. $x > 3.51$
B) **a.** $R(x) = -0.3x^2 + 33x$; $P(x) = -1.5x^2 + 23.8x - 65$
b. $3.51 < x < 12.36$
C) **a.** $R(x) = -0.3x^2 + 33$; $P(x) = 1.5x^2 - 23.8x + 65$
b. $3.51 < x < 12.36$
D) **a.** $R(x) = -0.3x^2 + 33$; $P(x) = -1.5x^2 + 23.8x - 65$
b. $x > 3.51$

Answer: B

13) In the year 2003, Digicorp, a data management firm, began transferring files from antiquated databases and storing them on more modern systems. Measured in years after 2013, the function $R(t) = 29\sqrt{6 - t}$ represents the number of databases remaining to be transferred. 13) ______

a. What is the domain of R?
b. How many databases were present when Digicorp began the transfer?

A) **a.** All real numbers t for which $t > 6$
b. $29\sqrt{6}$
B) **a.** All real numbers t for which $-10 \le t \le 6$
b. 116
C) **a.** All real numbers t for which $t > 6$
b. 116
D) **a.** All real numbers t for which $-10 \le t \le 6$
b. $29\sqrt{6}$

Answer: B

14) In the year 1996, Digicorp, a data management firm, began transferring files from antiquated databases and storing them on more modern systems. Measured in years after 2006, the function $R(t) = 25\sqrt{6 - t}$ represents the number of databases remaining to be transferred. 14) _______

a. How many databases still needed to be transferred in 2003?

b. The data transfer was scheduled to be complete by 2011. Will the engineers accomplish this goal?

A) **a.** 75 databases
b. Yes

B) **a.** 125 databases
b. No. In 2011, 25 databases will remain to be transferred.

C) **a.** 75 databases
b. No. In 2011, 25 databases will remain to be transferred.

D) **a.** 125 databases
b. Yes

Answer: C

15) A company produces popular laptops and tablets. The company was not always as wildly successful, however. Taking into account stock splits, prices (in dollars) for the company's shares can be represented by the following piecewise-defined function: 15) _______

$$S(t) = \begin{cases} 21 + 0.6t & \text{if } t \le 4 \\ 12.9t^2 - 119t + 295 & \text{if } t > 4 \end{cases}$$

where t is the number of years after 2000.

a. When does the company's shares FIRST reach the \$175 level?

b. What share value does the function predict for AAPL in the year 2009?

A) **a.** 2001 and 2008
b. \$26.40

B) **a.** 2001 and 2008
b. \$268.90

C) **a.** 2008
b. \$26.40

D) **a.** 2008
b. \$268.90

Answer: D

16) Arthur, the manager of a furniture factory, finds that the cost of producing q bookcases during the morning production run is $C(q) = q^2 + q + 500$ dollars. On a typical workday, $q(t) = 20t$ bookcases are produced during the first t hours of a production run for $0 \le t \le 5$. 16) _______

a. Express the production cost C in terms of t.

b. Arthur's budget allows no more than \$4000 for production during the morning production run. When will this limit be reached?

A) **a.** $C(t) = 20t^2 + 20t + 10{,}000$
b. $t = 2.93$ hrs

B) **a.** $C(t) = 400t^2 + 20t + 500$
b. $t = 2.98$ hrs

C) **a.** $C(t) = 20t^2 + 20t + 10{,}000$
b. $t = 2.98$ hrs

D) **a.** $C(t) = 400t^2 + 20t + 500$
b. $t = 2.93$ hrs

Answer: D

17) Suppose that during a nationwide program to immunize the population against a new strain of influenza, public health officials found that the cost of inoculating x% of the population was approximately $C(x) = \frac{200x}{225 - x}$ million dollars. 17) _______

a. For what values of x does $C(x)$ have a practical interpretation in this context?
b. What was the cost of inoculating the first 75% of the population?

A) **a.** All real numbers x for which $0 \le x \le 100$
b. $100,000,000

B) **a.** All real numbers x for which $0 \le x \le 100$
b. $100,000

C) **a.** All real numbers x except $x = 225$
b. $100,000

D) **a.** All real numbers x except $x = 225$
b. $100,000,000

Answer: A

18) Suppose that during a nationwide program to immunize the population against a new strain of influenza, public health officials found that the cost of inoculating x% of the population was approximately $C(x) = \frac{150x}{200 - x}$ million dollars. 18) _______

a. What was the cost of inoculating the last 50% of the population?
b. What percentage of the population had been inoculated by the time 37.5 million dollars had been spent?

A) **a.** $50,000,000
b. $x = 40\%$

B) **a.** $100,000,000
b. $x = 60\%$

C) **a.** $50,000,000
b. $x = 60\%$

D) **a.** $100,000,000
b. $x = 40\%$

Answer: D

19) Observations suggest that for herbivorous mammals, the number of animals N per square kilometer can be estimated by the formula $N = \frac{87.6}{m^{0.73}}$ where m is the average mass of the animal in kilograms. 19) ______

a. Assuming that the average elk on a particular reserve has mass 315 kilograms, approximately how many elk would you expect to find per square kilometer in the reserve?

b. Using this formula, it is estimated that there is less than one animal of a certain species per square kilometer. How large can the average animal of this species be?

A) **a.** 0.17 elk per square kilometer
b. at least 458 kg.

B) **a.** 0.17 elk per square kilometer
b. less than 458 kg.

C) **a.** 1.31 elk per square kilometer
b. less than 458 kg.

D) **a.** 1.31 elk per square kilometer
b. at least 458 kg.

Answer: D

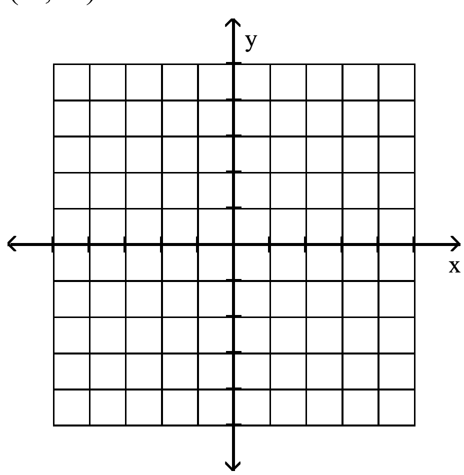
20) Observations show that on an island of area A square miles, the average number of animal species is approximately equal to $s(A) = 3.8\sqrt[3]{A}$. If s_1 is the average number of species on an island of area A and s_2 is the average number of species on an island of area $7A$, what is the relationship between s_1 and s_2? 20) ______

A) $s_2 = \sqrt[3]{7}s_1$ B) $s_2 = 3.8\sqrt[3]{7}s_1$ C) $s_2 = 343s_1$ D) $s_1 = \sqrt[3]{7}s_2$

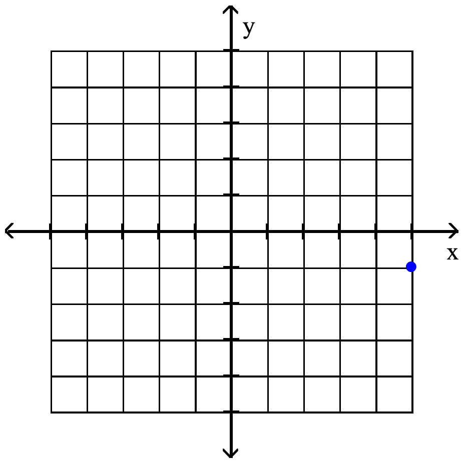
Answer: A

Plot the given point in a rectangular coordinate plane.

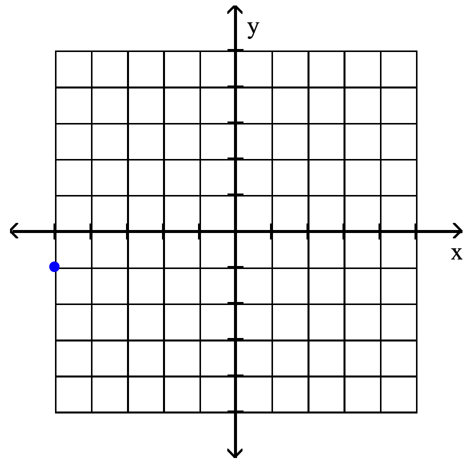
21) (-5, -1) 21) ______



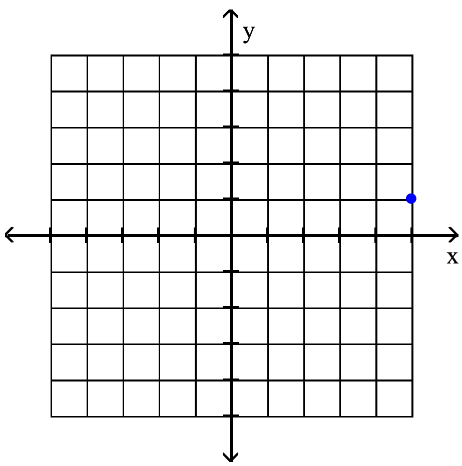
A)



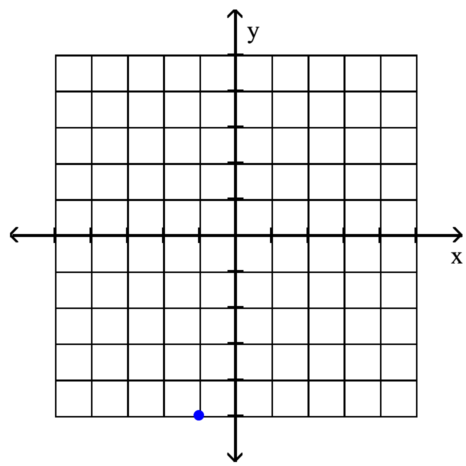
B)



C)



D)



Answer: B

Find the distance between the given points.

22) (8, 9) and (-5, -7) 22) _______

A) $D = \sqrt{5}$ B) $D = \sqrt{13}$ C) $D = 5\sqrt{17}$ D) $D = \sqrt{421}$

Answer: C

Classify each function as a polynomial, a power function, or a rational function. If the function is not one of these type, classify it as "different."

23) **a.** $f(x) = x^{2.3}$ 23) _______

b. $g(x) = (3x - 5)(7 - x)^2$

A) **a.** Power function
b. Different

B) **a.** Rational function
b. Polynomial

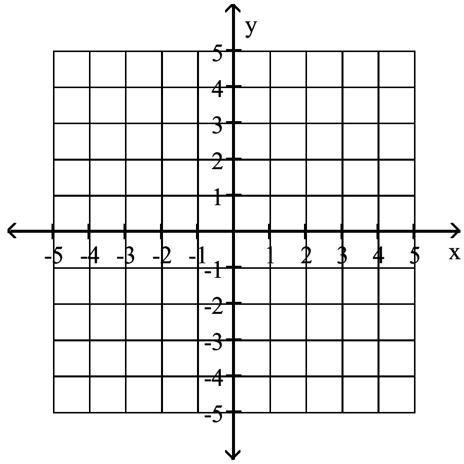
C) **a.** Rational function
b. Different

D) **a.** Power function
b. Polynomial

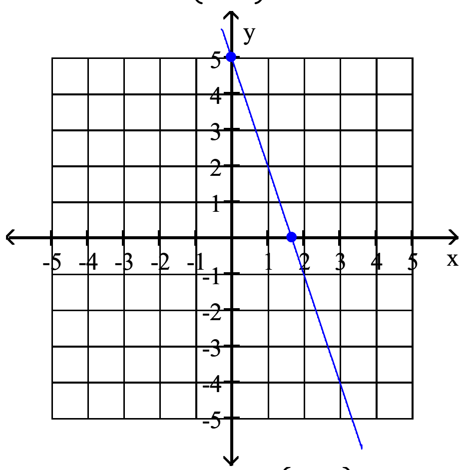
Answer: D

Sketch the graph of the given function. Include all *x* and *y* intercepts.

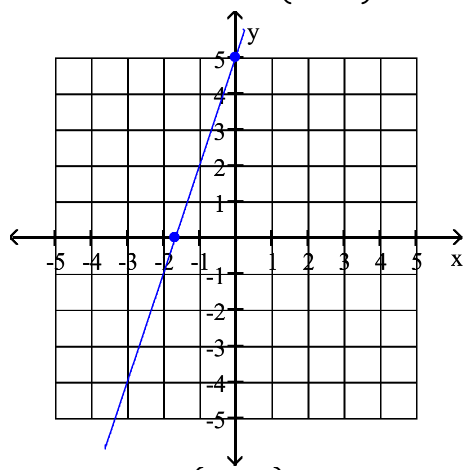
24) $f(x) = 3x + 5$ 24) _______



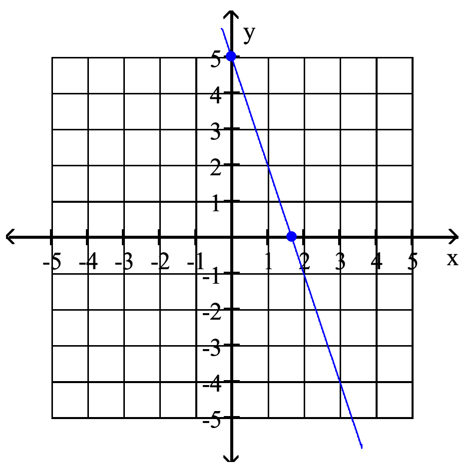
A) $f(x) = 3x + 5; \left(\frac{5}{3}, 0\right); (0, 5)$



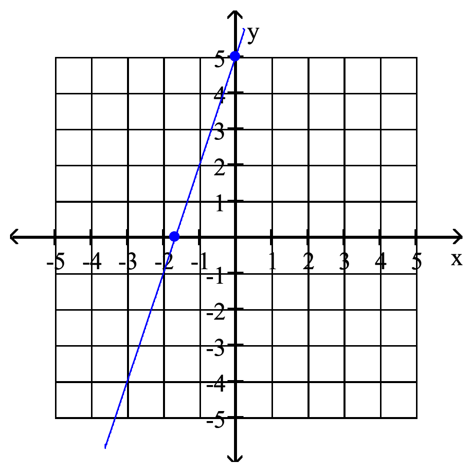
B) $f(x) = 3x + 5; (5, 0); \left(0, -\frac{5}{3}\right)$



C) $f(x) = 3x + 5; (5, 0); \left(0, \frac{5}{3}\right)$

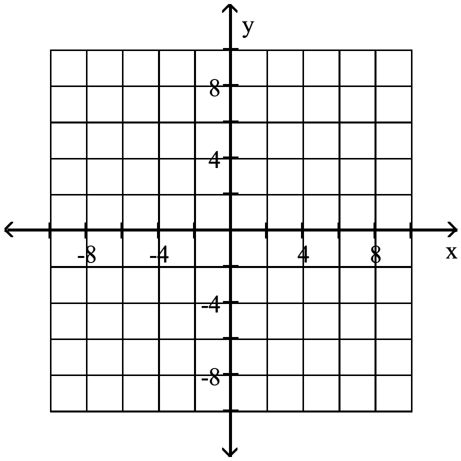


D) $f(x) = 3x + 5; \left(-\frac{5}{3}, 0\right); (0, 5)$

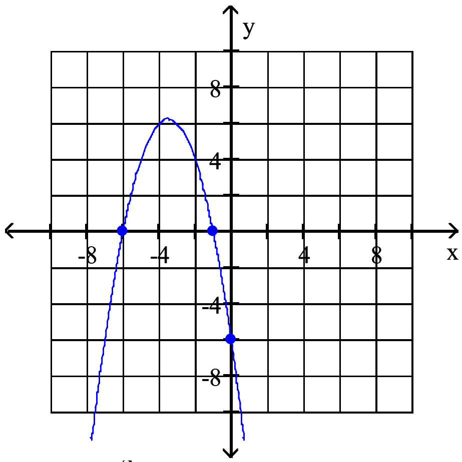


Answer: D

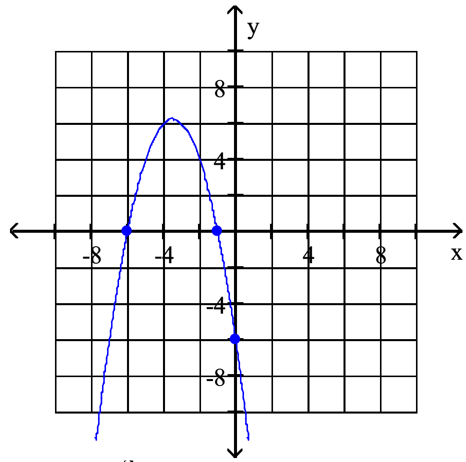
25) $f(x) = -x^2 + 7x - 6$ 25) _______



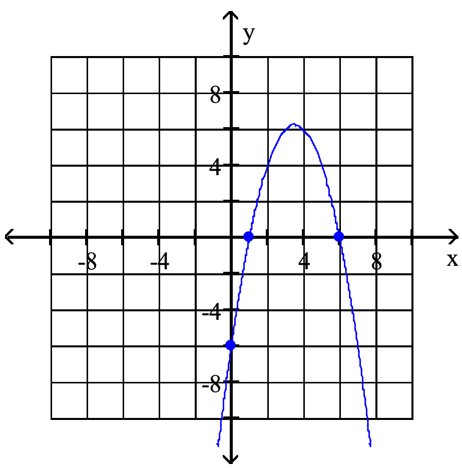
A) $f(x) = -x^2 + 7x - 6$
(-6, 0); (0, -6), (0, -1)



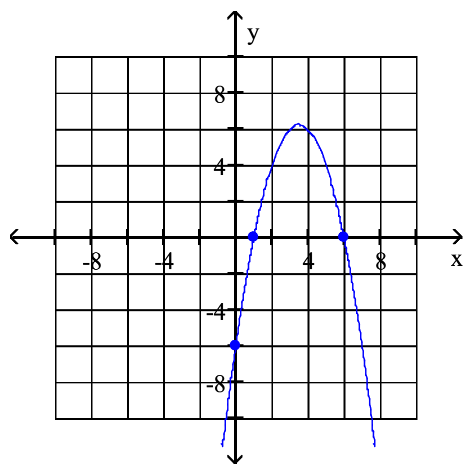
B) $f(x) = -x^2 + 7x - 6$
(-6, 0), (-1, 0); (0, -6)



C) $f(x) = -x^2 + 7x - 6$
(-6, 0); (0, 1), (0, 6)

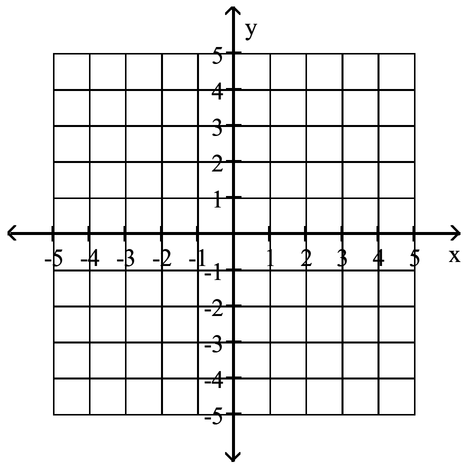


D) $f(x) = -x^2 + 7x - 6$
(1, 0), (6, 0); (0, -6)

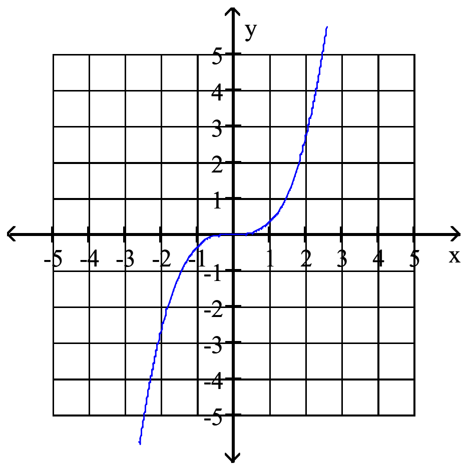


Answer: D

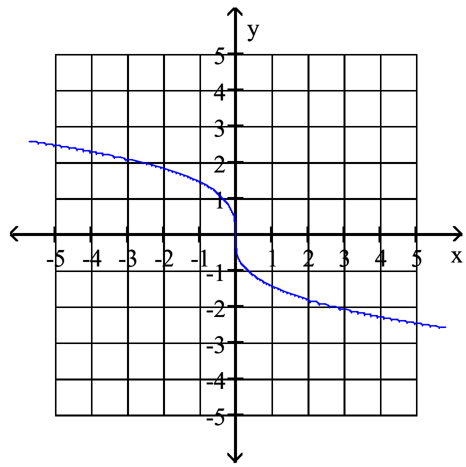
26) $f(x) = -\frac{1}{3}x^3$ 26) _______



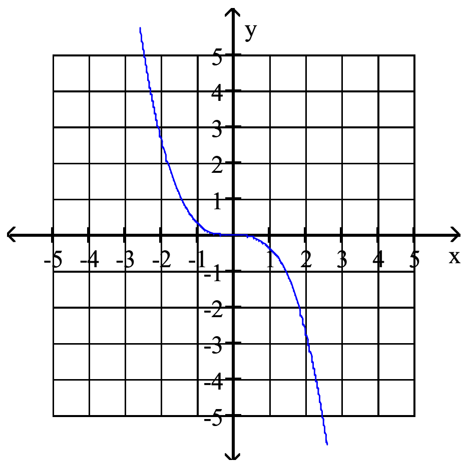
A) $f(x) = -\frac{1}{3}x^3$; (0, 0)



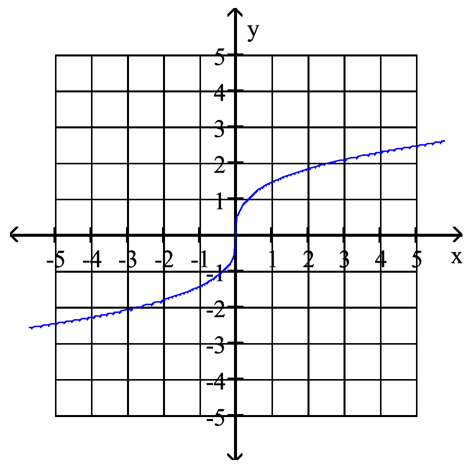
B) $f(x) = -\frac{1}{3}x^3$; (0, 0)



C) $f(x) = -\frac{1}{3}x^3$; (0, 0)

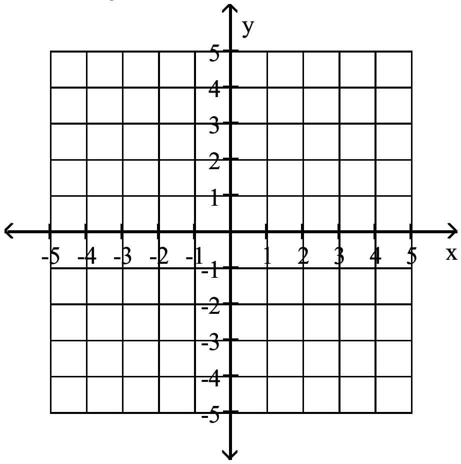


D) $f(x) = -\frac{1}{3}x^3$; (0, 0)



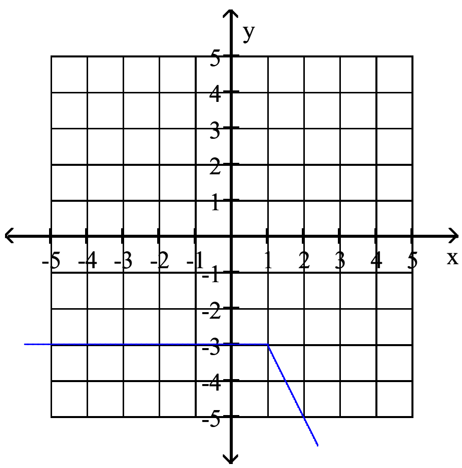
Answer: C

27) $f(x) = \begin{cases} -2x - 1 & \text{if } x < 1 \\ -3 & \text{if } x \geq 1 \end{cases}$ 27) _______



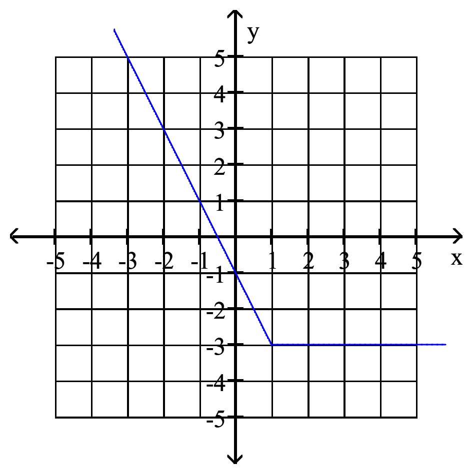
A) $f(x) = \begin{cases} -2x - 1 & \text{if } x < 1 \\ -3 & \text{if } x \geq 1 \end{cases}$

x intercept -3



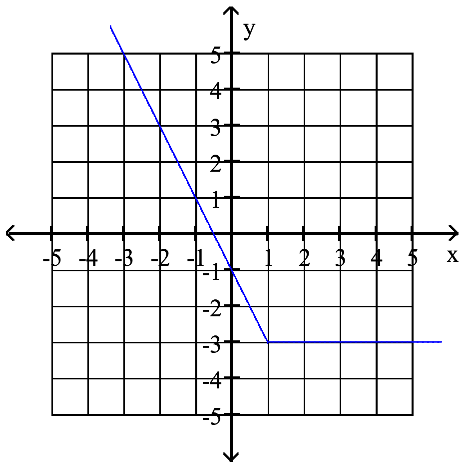
B) $f(x) = \begin{cases} -2x - 1 & \text{if } x < 1 \\ -3 & \text{if } x \geq 1 \end{cases}$

x intercept $-\frac{1}{2}$; y intercept -1



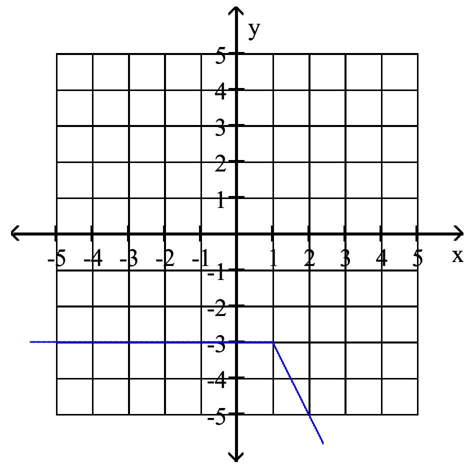
C) $f(x) = \begin{cases} -2x - 1 & \text{if } x < 1 \\ -3 & \text{if } x \geq 1 \end{cases}$

x intercept -1; y intercept $-\dfrac{1}{2}$



D) $f(x) = \begin{cases} -2x - 1 & \text{if } x < 1 \\ -3 & \text{if } x \geq 1 \end{cases}$

y intercept -3

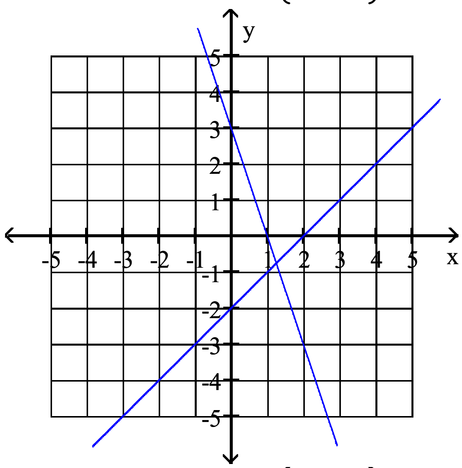


Answer: B

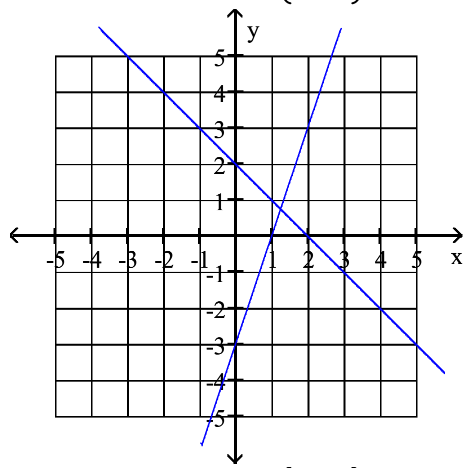
Find the points of intersection (if any) of the given pair of curves and draw the graphs.

28) $y = -3x + 3$ and $y = x - 2$ 28) _______

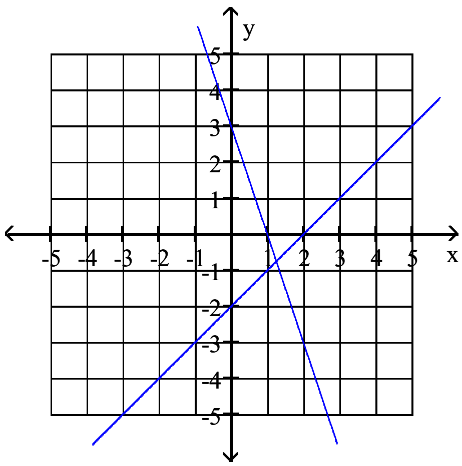
A) Point of intersection: $\left(-\frac{3}{4}, \frac{5}{4}\right)$



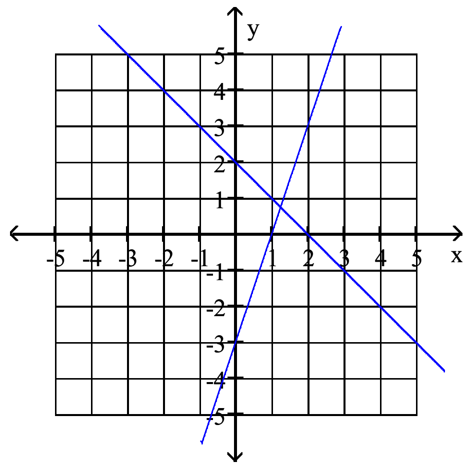
B) Point of intersection: $\left(\frac{3}{4}, \frac{5}{4}\right)$



C) Point of intersection: $\left(\frac{5}{4}, -\frac{3}{4}\right)$



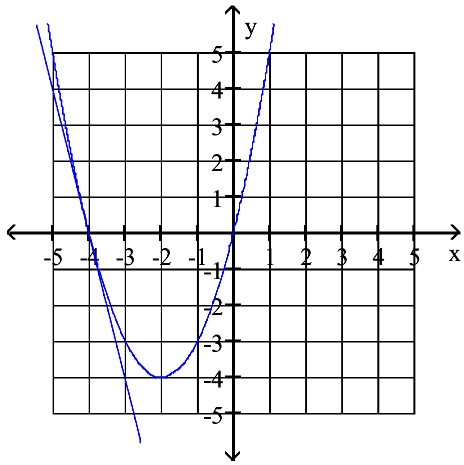
D) Point of intersection: $\left(\frac{5}{4}, \frac{3}{4}\right)$



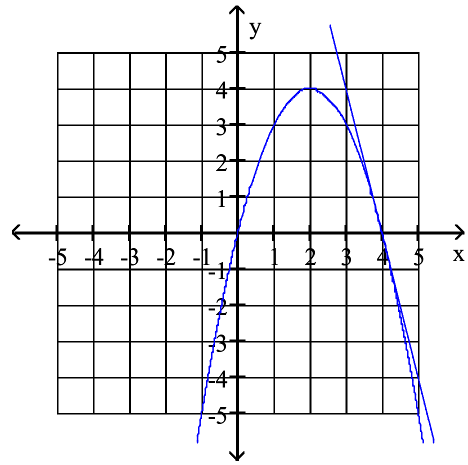
Answer: C

29) $y = x^2 + 4x$ and $y = -4x - 16$ 29) ______

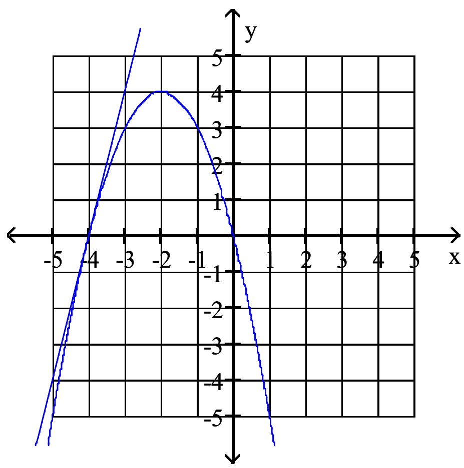
A) Point of intersection: (-4, 0)



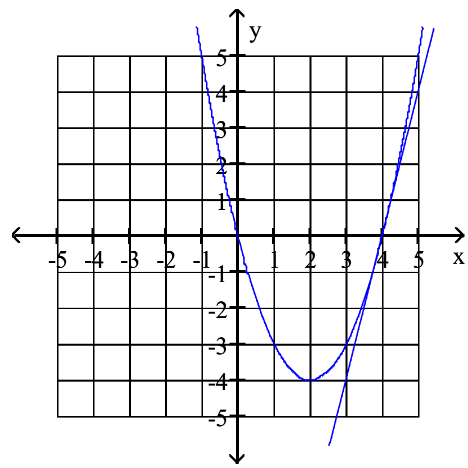
B) Point of intersection: (4, 0)



C) Point of intersection: (-4, 0)



D) Point of intersection: (4, 0)



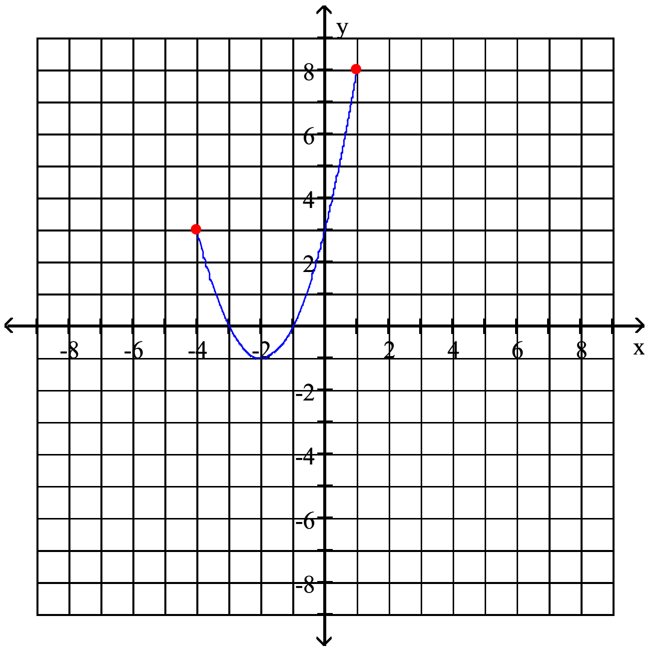
Answer: A

The graph of a function *f*(*x*) is given. In each case find:

a. The *y* intercept(s).

b. The *x* intercept(s).

30) 30) _______



A) **a.** (3, 0)
b. (0, -3) and (0, -1)

B) **a.** (0, 3)
b. (-4, 3) and (1, 8)

C) **a.** (0, 3)
b. (-3, 0) and (-1, 0)

D) **a.** (-4, 3) and (1, 8)
b. (0, 3)

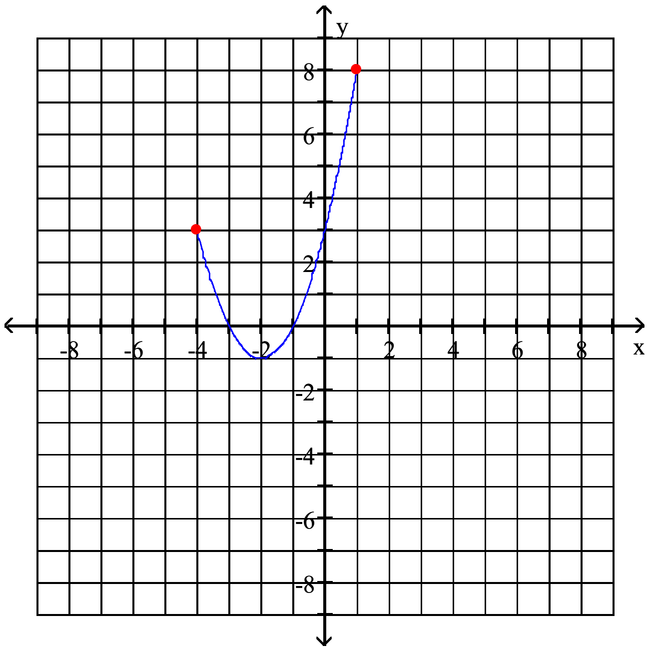
Answer: C

The graph of a function $f(x)$ is given. In each case find:

a. The largest value of $f(x)$ and the value(s) of x for which it occurs.

b. The smallest value of $f(x)$ and the value(s) of x for which it occurs.

31) 31) _______



A) **a.** Largest value of 1 at $x = 8$.
b. Smallest value of 3 at $x = -4$.

B) **a.** Largest value of 8 at $x = 1$.
b. Smallest value of -1 at $x = -2$.

C) **a.** Largest value of 8 at $x = 1$.
b. Smallest value of 3 at $x = -4$.

D) **a.** Largest value of 1 at $x = 8$.
b. Smallest value of -1 at $x = -2$.

Answer: B

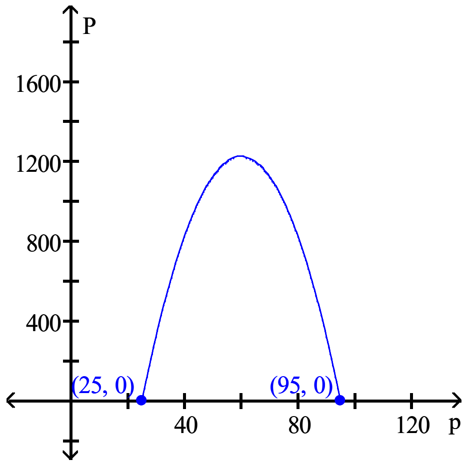
Solve the problem.

32) Vicki's company can produce digital recorders at a cost of $35 apiece. It is estimated that if the recorders are sold for p dollars apiece, consumers will buy $95 - p$ of them a month. Express Vicki's monthly profit as a function of price. 32) _______

A) $P(p) = 3325 - p^2$
B) $P(p) = (p - 35)(95 - p)$
C) $P(p) = p(95 - p) - 35p$
D) $P(p) = (p - 35)(p - 95)$

Answer: B

33) Vicki's company can produce digital recorders at a cost of \$25 apiece. It is estimated that if the recorders are sold for p dollars apiece, consumers will buy 95 - p of them a month. The graph of Vicki's monthly profit as a quadratic is shown below. Estimate the optimal profit. 33) ______

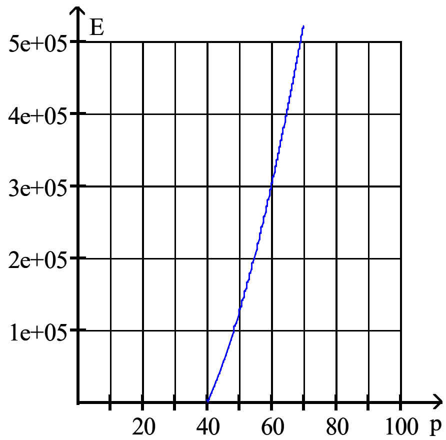


A) Optimal profit ≈ \$95
B) Optimal profit ≈ \$1025
C) Optimal profit ≈ \$1225
D) Optimal profit ≈ \$60

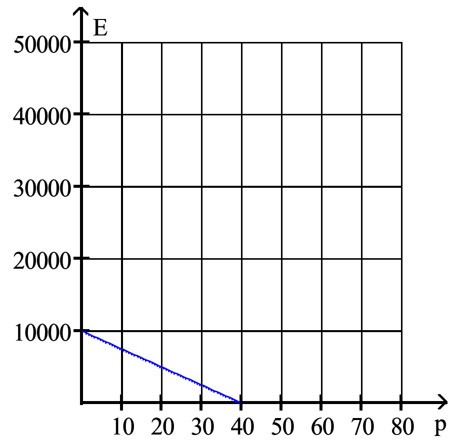
Answer: C

34) Suppose $x = -250p + 10{,}000$ units of a particular commodity are sold each month when the market price is p dollars per unit. The total monthly consumer expenditure E is the total amount of money spent by consumers during each month. Express the total monthly consumer expenditure E as a function of the unit price p, and sketch the graph of $E(p)$. 34) _______

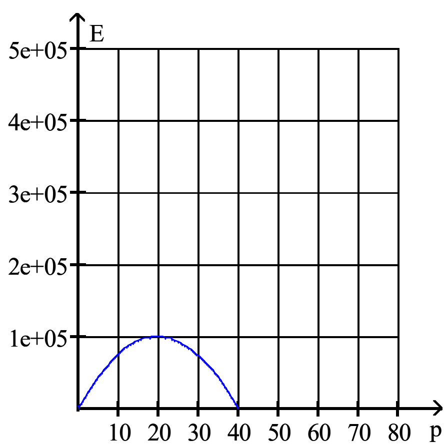
A) $E(p) = 250p^2 + -10{,}000p$



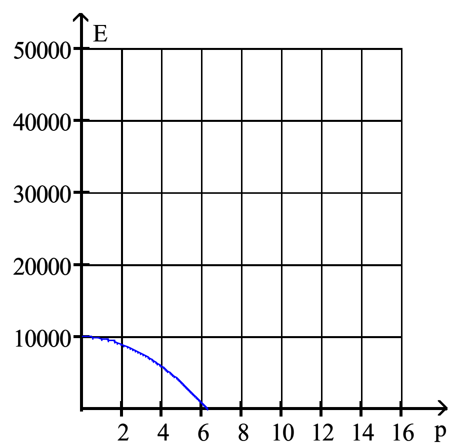
B) $E(p) = -250p + 10{,}000$



C) $E(p) = -250p^2 + 10{,}000p$



D) $E(p) = -250p^2 + 10{,}000$



Answer: C

35) Suppose $x = -150p + 12{,}000$ units of a particular commodity are sold each month when the market price is p dollars per unit. The total monthly consumer expenditure E is the total amount of money spent by consumers during each month. 35) ______

a. Discuss the economic significance of the p intercepts of the expenditure function $E(p)$.

b. Use a graph to determine the market price that generates the greatest total monthly consumer expenditure.

A) **a.** The p intercepts represent prices at which consumers spend no money on the commodity.
b. $40 per unit

B) **a.** The p intercepts represent the customer expenditures at which price is zero.
b. $80 per unit

C) **a.** The p intercepts represent the customer expenditures at which price is zero.
b. $40 per unit

D) **a.** The p intercepts represent prices at which consumers spend no money on the commodity.
b. $80 per unit

Answer: A

36) Suppose that when the price of a certain commodity is p dollars per unit, then x units will be purchased by consumers, where $p = -0.25x + 39$. The cost of producing x units is $C(x) = 0.02x^2 + 5x + 577.33$ dollars. Find the average profit AP when the price is $29 per unit. 36) ______

A) $6.26/unit B) $8.77/unit C) $7.52/unit D) $876.68/unit

Answer: B

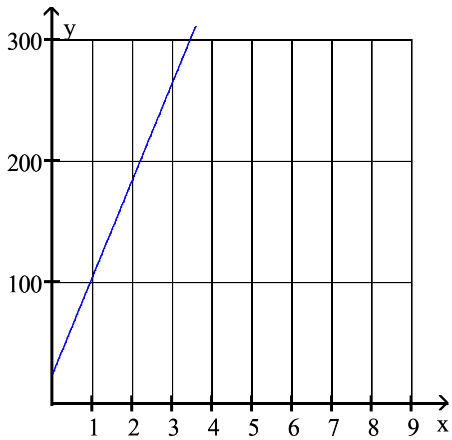
37) It costs \$80 to rent a piece of equipment plus \$23 for every day of use. 37) ______

a. Write an algebraic expression representing the cost y as a function of the number of days x.

b. Graph the expression in part (**a**).

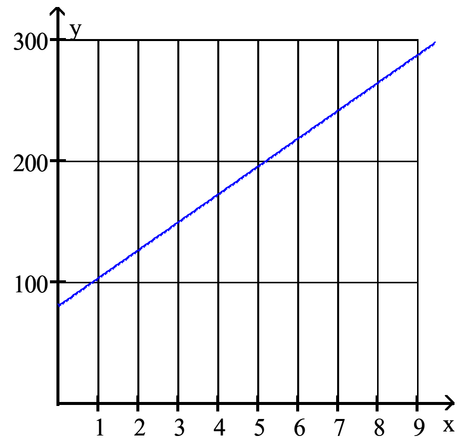
A) **a.** $C(x) = 80 + 23x$

b.



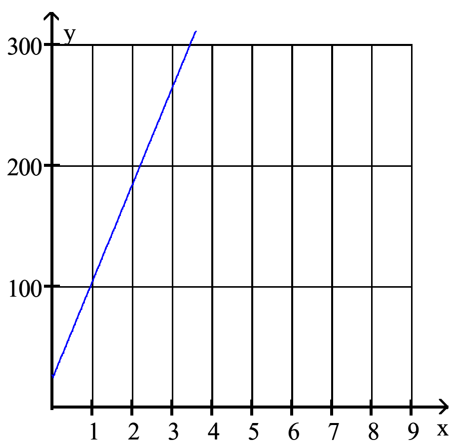
B) **a.** $C(x) = 23 + 80x$

b.



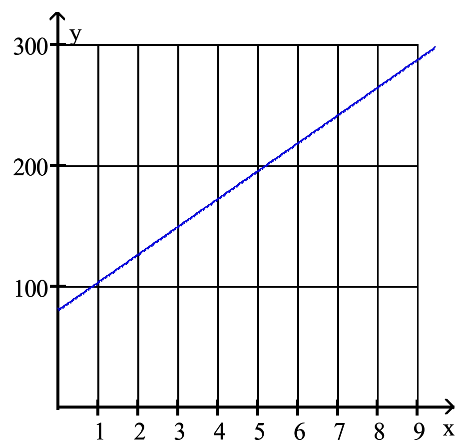
C) **a.** $C(x) = 23 + 80x$

b.



D) **a.** $C(x) = 80 + 23x$

b.



Answer: D

38) Chuck owns several hot dog carts in a large downtown area. He finds that he can sell x hot dogs per day when the price of each hot dog is $p = 5.18 - 0.01x$ dollars. The cost of preparing x hot dogs per day is $C(x) = 0.004x^2 + 26$ dollars. What price p should Chuck charge to maximize profit? 38) ______

A) \$2.63 B) \$3.33 C) \$1.85 D) \$3.89

Answer: B

39) A pay-as-you-go cell phone company offers a monthly plan for \$29 that includes 150 minutes of calls. After that, calls are an additional 7 cents per minute up to a maximum of 1200 minutes. Let $C(m)$ be the cost in dollars of making m minutes of calls with a phone on this plan, for $0 \le m \le 1200$. Write $C(m)$ as a piecewise-defined function. 39) ______

A) $C(m) = \begin{cases} 29 & \text{if } 0 \le m \le 150 \\ 29 + 0.07(m - 150) & \text{if } 150 < m \le 1200 \end{cases}$

B) $C(m) = \begin{cases} 29 & \text{if } 0 \le m \le 150 \\ 7(m - 150) & \text{if } 150 < m \le 1200 \end{cases}$

C) $C(m) = \begin{cases} 29 & \text{if } 0 \le m \le 150 \\ 29 + 7(m - 150) & \text{if } 150 < m \le 1200 \end{cases}$

D) $C(m) = \begin{cases} 29 & \text{if } 0 \le m \le 150 \\ 0.07(m - 150) & \text{if } 150 < m \le 1200 \end{cases}$

Answer: A

40) Lead emissions are a major source of air pollution. Using data gathered by the U.S. Environmental Protection Agency in the 1990s, it can be shown that the formula 40) ______

$N(t) = -37t^2 + 292t + 3383$

estimates the total amount of lead emission N (in thousands of tons) occurring in the a particular country t years after the base year 1990.

a. Approximately how much lead emission did the formula predict for the year 1995?

b. Based on this formula, when during the decade 1990–2000 would you expect the maximum lead emission to have occurred?

A) **a.** 3918 thousand tons
b. 3.95 years after 1990

B) **a.** 4658 thousand tons
b. 3.95 years after 1990

C) **a.** 4658 thousand tons
b. 7.89 years after 1990

D) **a.** 3918 thousand tons
b. 7.89 years after 1990

Answer: A

Find the slope (if defined) of the line that passes through the given pair of points.

41) (-2, -6) and (1, 0) 41) ______

A) $m = 2$ B) $m = -2$ C) $m = -\frac{1}{2}$ D) $m = \frac{1}{2}$

Answer: A

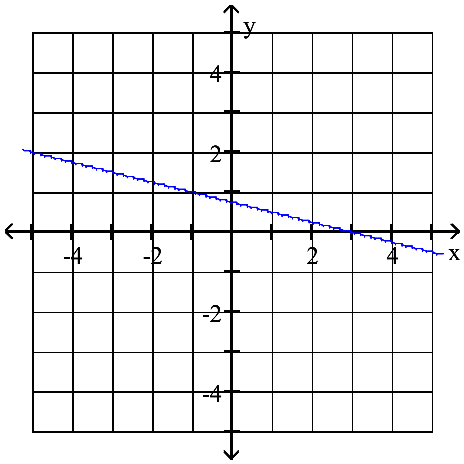
42) $\left(\frac{1}{6}, -4\right)$ and $\left(-\frac{2}{3}, -4\right)$ 42) ______

A) $-\frac{75}{4}$ B) $m = 0$ C) $-\frac{4}{75}$ D) undefined

Answer: B

Find an equation for the line.

43) 43) _______

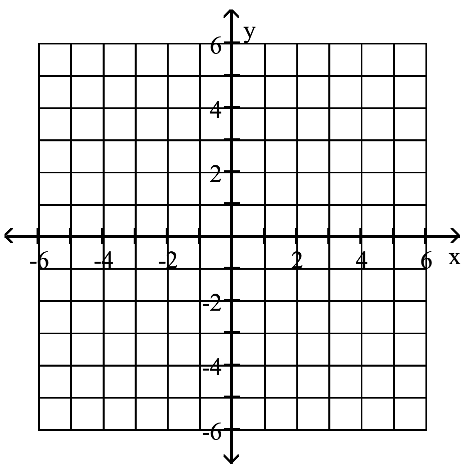


A) $y = 4x + \frac{3}{4}$ B) $y = -4x - \frac{3}{4}$ C) $y = -\frac{1}{4}x - \frac{3}{4}$ D) $y = -\frac{1}{4}x + \frac{3}{4}$

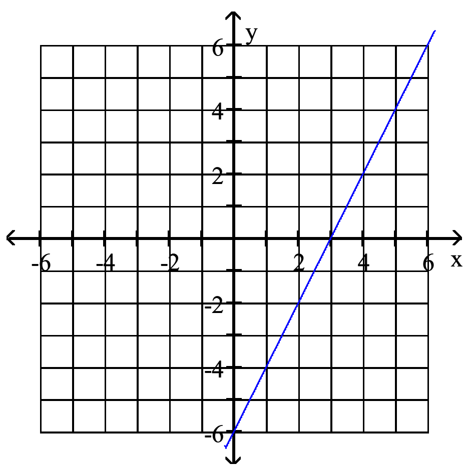
Answer: D

Find the slope and intercepts of the line whose equation is given and sketch the graph of the line.

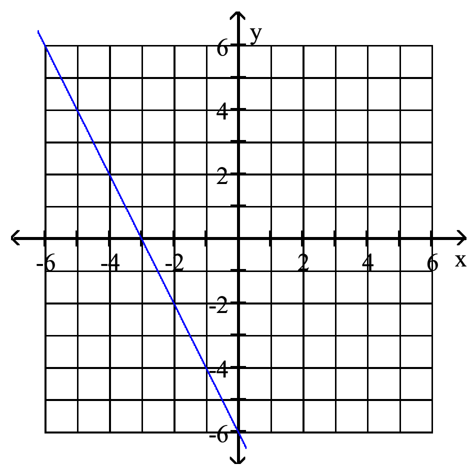
44) $y = -2x - 6$ 44) _______



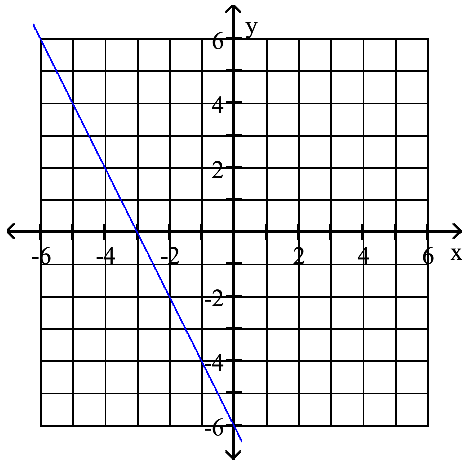
A) Slope: 2; intercepts: (3, 0), (0, -6)



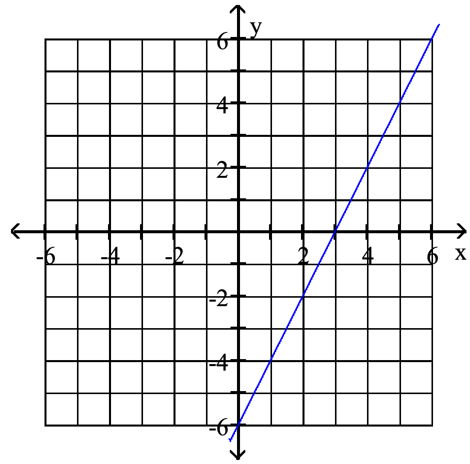
B) Slope: -2; intercepts: (-6, 0), (0, -3)



C) Slope: -2; intercepts: (-3, 0), (0, -6)

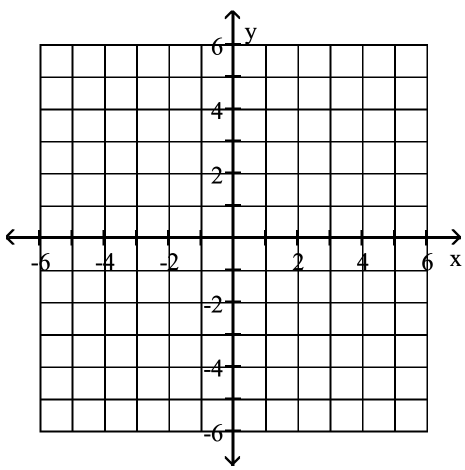


D) Slope: 2; intercepts: (-6, 0), (0, 3)

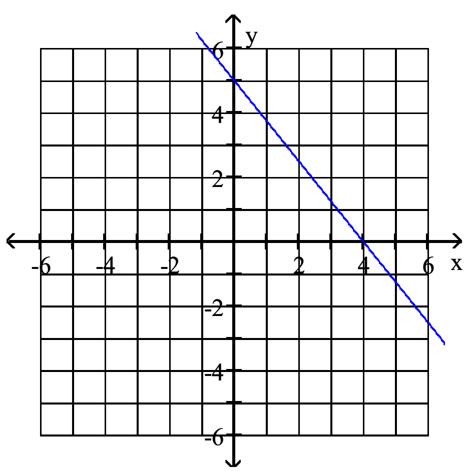


Answer: C

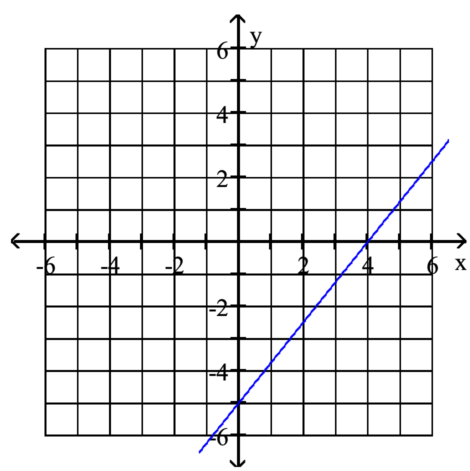
45) $-5x - 4y = 20$ 45) _______



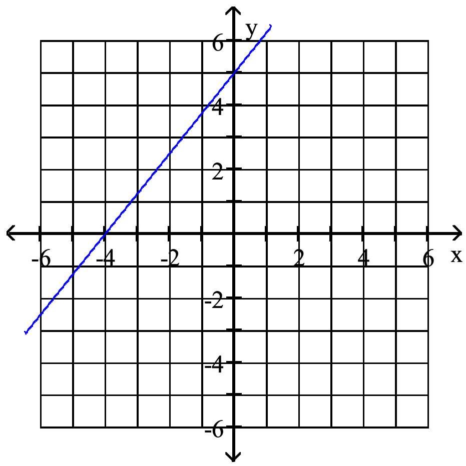
A) Slope: $-\frac{5}{4}$; intercepts: (4, 0), (0, 5)



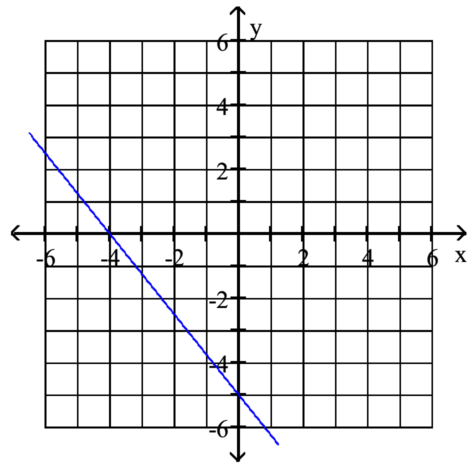
B) Slope: $\frac{5}{4}$; intercepts: (4, 0), (0, -5)



C) Slope: $\frac{5}{4}$; intercepts: (-4, 0), (0, 5)



D) Slope: $-\frac{5}{4}$; intercepts: (-4, 0), (0, -5)



Answer: D

Write an equation for the line with the given properties.

46) Through (-3, 0) with slope 1 46) _______

A) $y = 3x + 9$ B) $y = x + 3$ C) $y = -3x - 9$ D) $y = x - 3$

Answer: B

47) Through (1, -1) with slope $\frac{1}{3}$ 47) _______

A) $y = -\frac{4}{3}x + \frac{1}{3}$ B) $y = \frac{1}{3}x - \frac{4}{3}$ C) $y = \frac{1}{3}x - 1$ D) $y = -\frac{4}{3}x - 1$

Answer: B

48) Through (2, 7) and parallel to the x axis 48) _______

A) $x = 7$ B) $y = 2$ C) $y = 7$ D) $x = 2$

Answer: C

49) Through (-3, -5) and (0, -2) 49) _______

A) $y = x - 2$ B) $y = -\frac{7}{3}x + 2$ C) $y = \frac{7}{3}x - 2$ D) $y = -x + 2$

Answer: A

50) Through (3, -4) and parallel to the line $-2x + y = 1$ 50) _______

A) $y = 2x - 10$ B) $y = 2x - 2$ C) $y = -2x + 2$ D) $y = -2x - 10$

Answer: A

51) Through (-6, 4) and perpendicular to the line $x + y = 1$ 51) _______

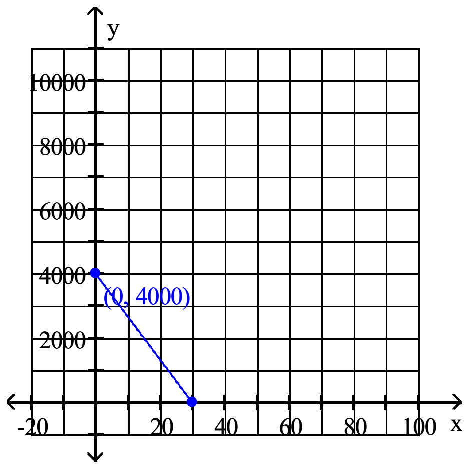
A) $y = x + 4$ B) $y = -x - 2$ C) $y = x + 10$ D) $y = -x + 10$

Answer: C

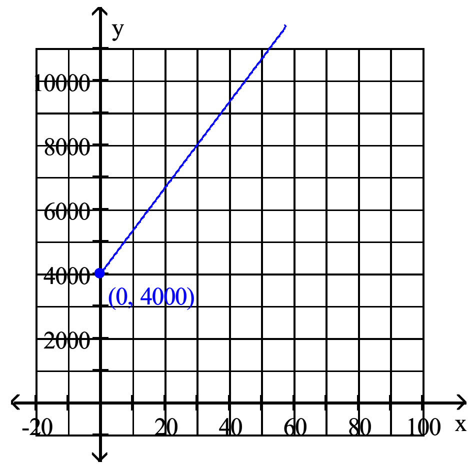
Solve the problem.

52) A manufacturer's total cost consists of a fixed overhead of $4000 plus production costs of $30 per unit. Express the total cost as a function of the number of units produced, and sketch its graph. 52) ______

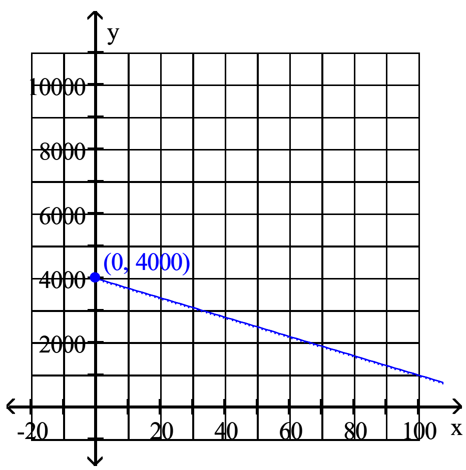
A) $y = C(x) = -30x + 4000$



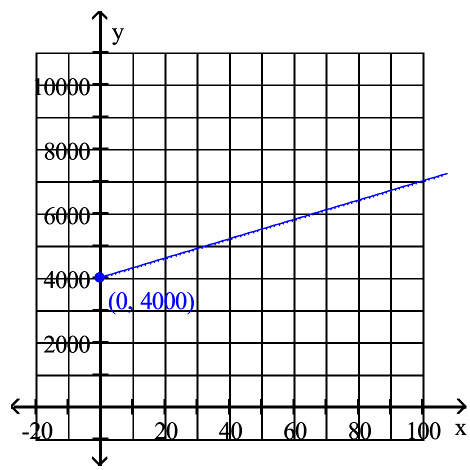
B) $y = C(x) = 30x + 4000$



C) $y = C(x) = -30x + 4000$



D) $y = C(x) = 30x + 4000$



Answer: D

53) A manufacturer's total cost consists of a fixed overhead of $6000 plus production costs of $20 per unit. Find the average cost function $AC(x)$. What is the average cost of producing 20 units? 53) ______

A) $AC(x) = \dfrac{6000 + 20}{x}$; $AC(20) = \$301/\text{unit}$

B) $AC(x) = \dfrac{6000}{x} + 20$; $AC(20) = \$320/\text{unit}$

C) $AC(x) = \dfrac{6000 + 20}{x}$; $AC(20) = \$6400/\text{unit}$

D) $AC(x) = 20x + 6000$; $AC(20) = \$6400/\text{unit}$

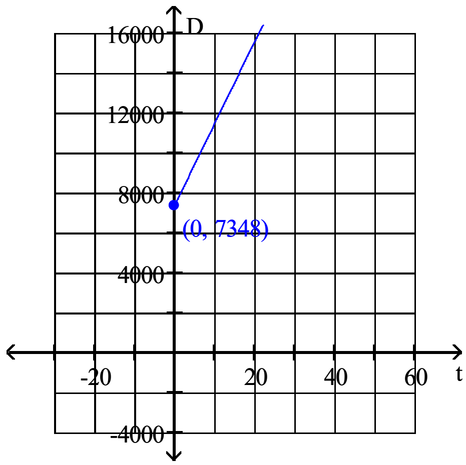
Answer: B

54) A credit card company estimates that the average cardholder owed $7348 in the year 2005 and $9400 in 2010. Suppose average cardholder debt D grows at a constant rate. 54) ______

a. Express D as a linear function of time t, where t is the number of years after 2005. Draw the graph.

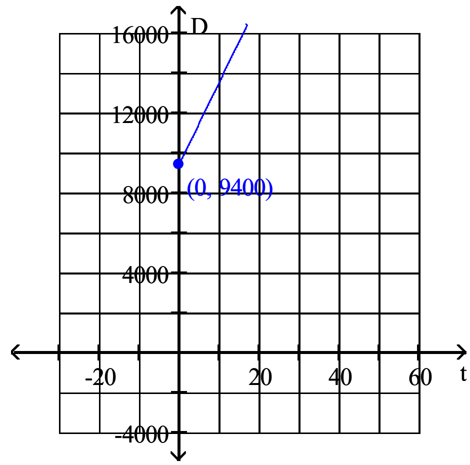
b. Use the function in part (**a**) to predict the average cardholder debt in the year 2015.

A) **a.** $y = D(t) = 410.4t + 7348$



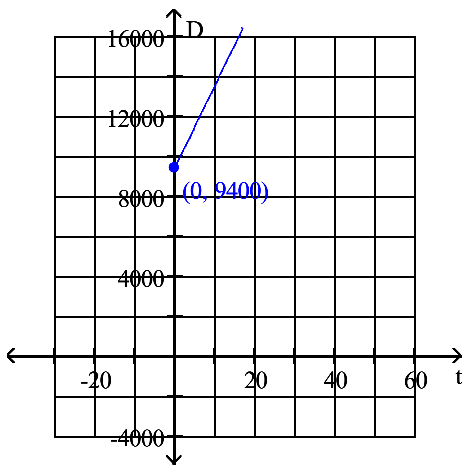
b. $13,504

B) **a.** $y = D(t) = 410.4t + 9400$



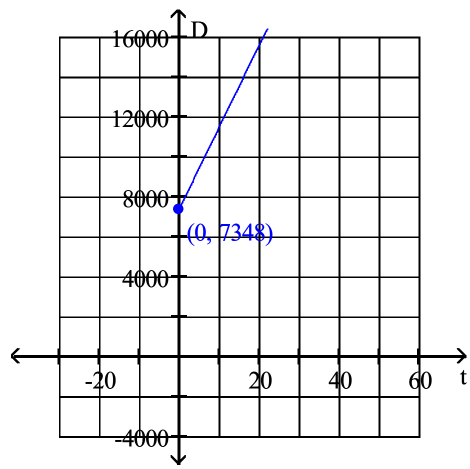
b. $15,556

C) **a.** $y = D(t) = 410.4t + 9400$



b. $13,504

D) **a.** $y = D(t) = 410.4t + 7348$

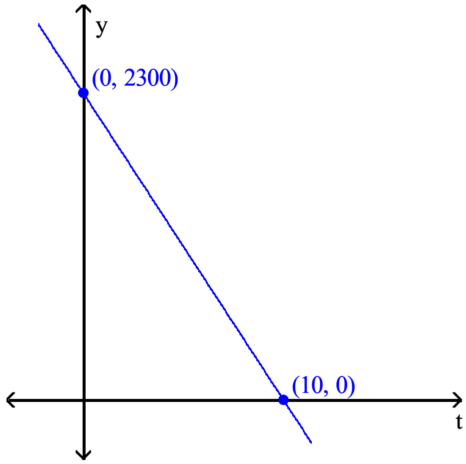


b. $11,452

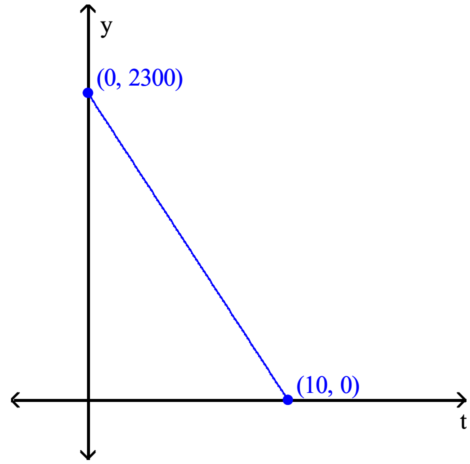
Answer: D

55) Dr. Adams owns $2300 worth of medical books which, for tax purposes, are assumed to depreciate linearly to zero over a 10-year period. That is, the value of the books decreases at a constant rate so that it is equal to zero at the end of 10 years. Express the value of the doctor's books as a function of time, and draw the graph. 55) ______

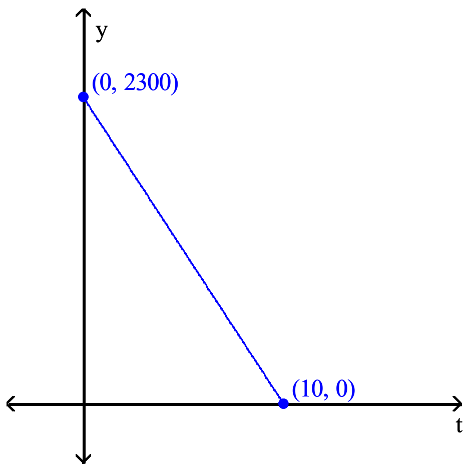
A) $f(t) = -230t + 2300$



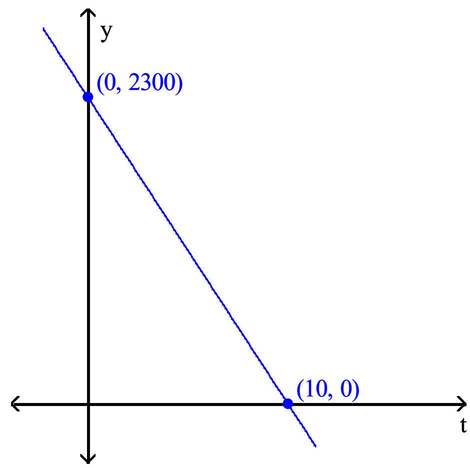
B) $f(t) = 230t + 2300$



C) $f(t) = -230t + 2300$



D) $f(t) = 230t + 2300$

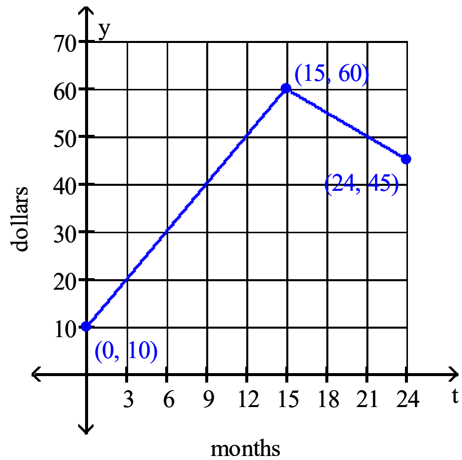


Answer: C

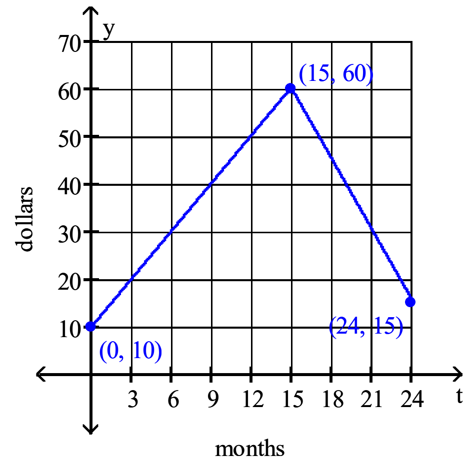
56) A certain stock had an initial public offering (IPO) price of $10 per share and is traded 24 hours a day. Sketch the graph of the share price over a 2-year period for the following case: 56) ______

The price increases steadily to 60 a share over the first 15 months and then decreases steadily to $15 per share over the next 6 months.

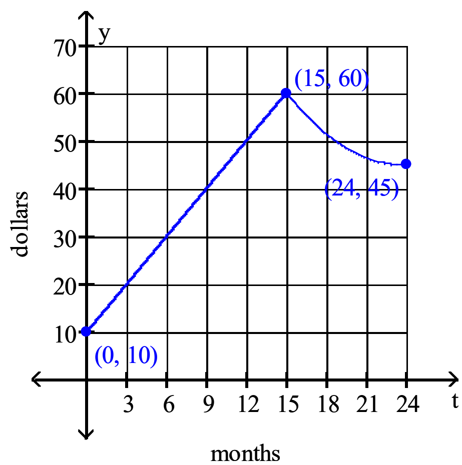
A)



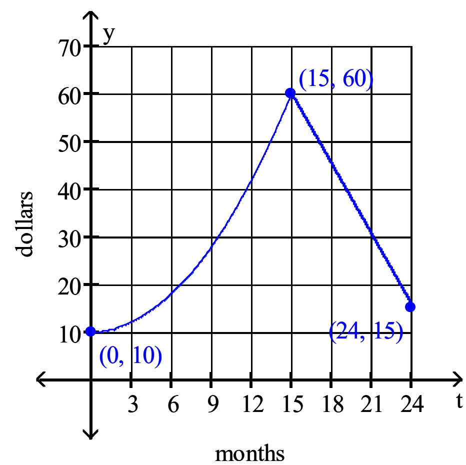
B)



C)



D)

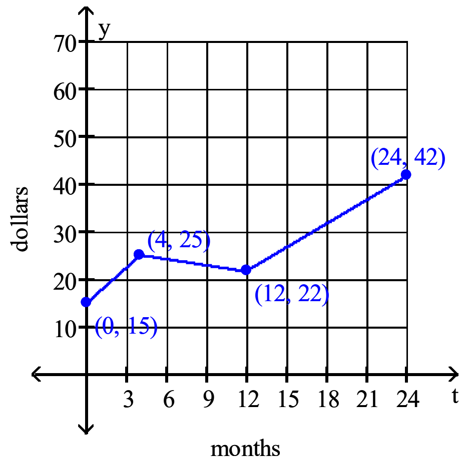


Answer: B

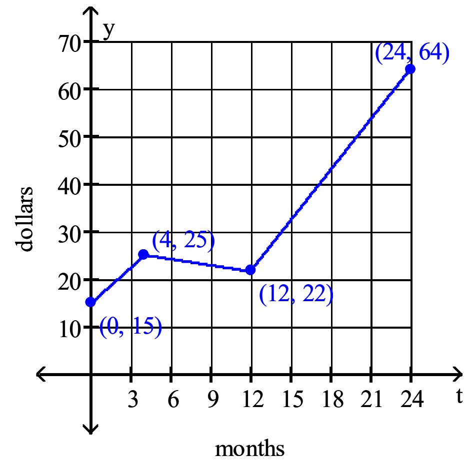
57) A certain stock had an initial public offering (IPO) price of $15 per share and is traded 24 hours a day. Sketch the graph of the share price over a 2-year period for the following case: 57) ______

The price takes just 4 months to rise at a constant rate to $25 a share and then slowly drops to $22 over the next 12 months before steadily rising to $42.

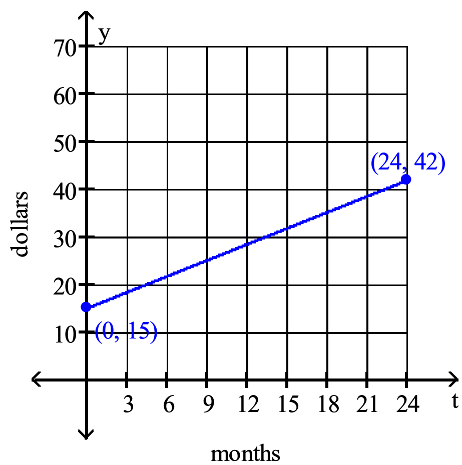
A)



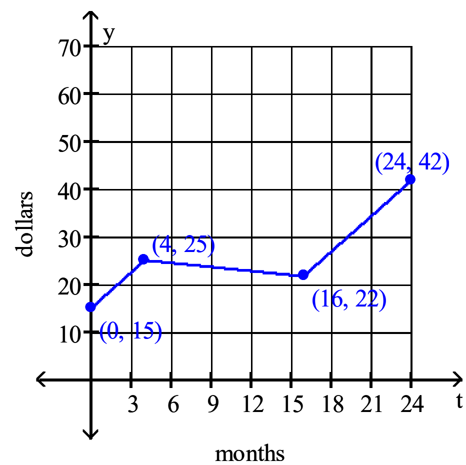
B)



C)



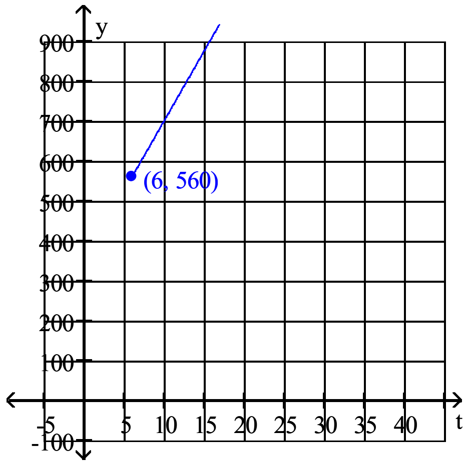
D)



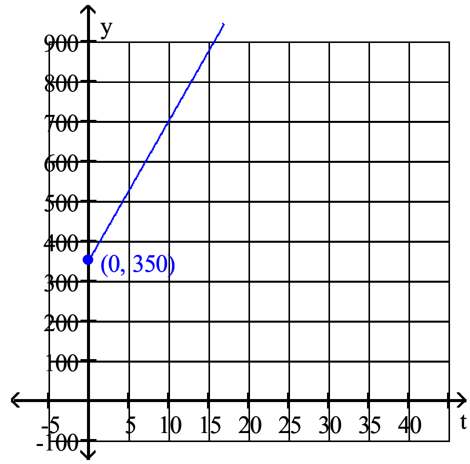
Answer: D

58) Students at a state college may preregister for their fall classes by mail during the summer. Those who do not preregister must register in person in September. The registrar can process 35 students per hour during the September registration period. Suppose that after 6 hours in September, a total of 560 students (including those who preregistered) have been registered. Express the number of students registered as a function of time and draw the graph. 58) _______

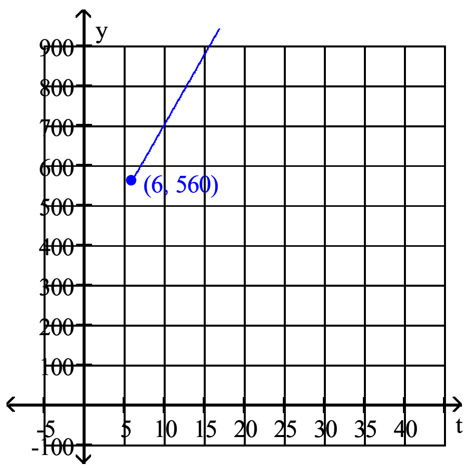
A) $y = f(t) = 35t + 350$



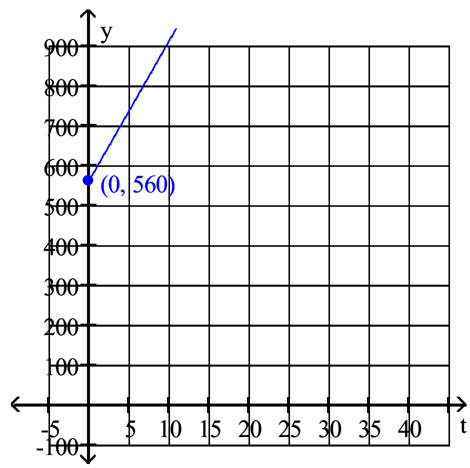
B) $y = f(t) = 35t + 350$



C) $y = f(t) = 35t + 560$



D) $y = f(t) = 35t + 560$



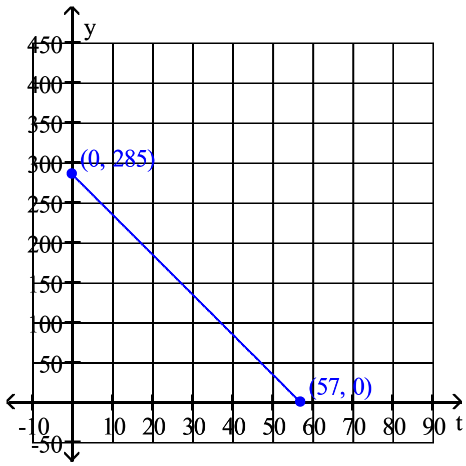
Answer: B

59) Since the beginning of the month, a local reservoir has been losing water at a constant rate. On the 14th of the month the reservoir held 215 million gallons of water, and on the 28st it held only 145 million gallons. 59) ______

a. Express the amount of water in the reservoir as a function of time, and draw the graph.

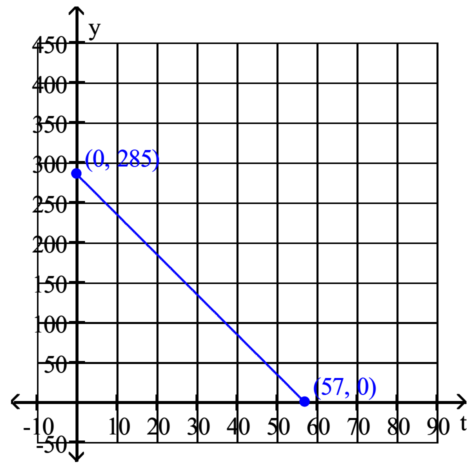
b. How much water was in the reservoir on the 6th of the month?

A) **a.** $y = f(t) = -5t + 285$



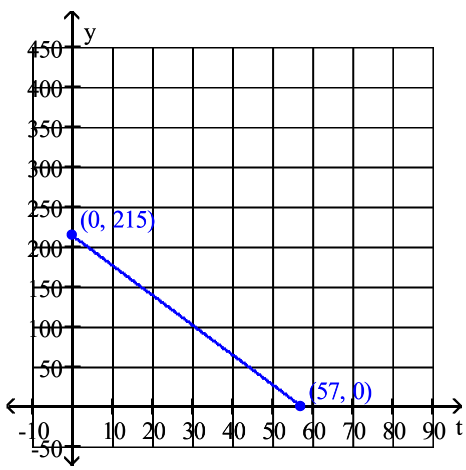
b. 255 million gallons

B) **a.** $y = f(t) = -5t + 285$



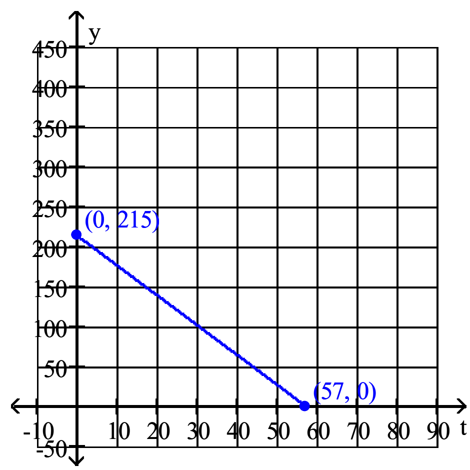
b. 260 million gallons

C) **a.** $y = f(t) = -5t + 215$



b. 190 million gallons

D) **a.** $y = f(t) = -5t + 215$

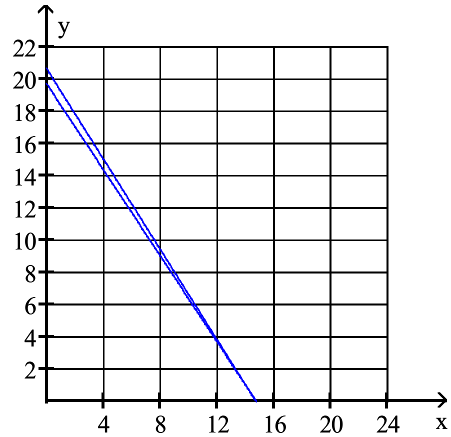


b. 185 million gallons

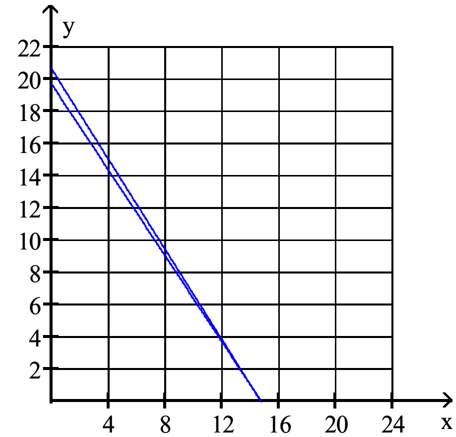
Answer: A

60) Each ounce of Food I contains 4 g of carbohydrate and 5 g of protein, and each ounce of Food II contains 3 g of carbohydrate and 7 g of protein. Suppose x ounces of Food I are mixed with y ounces of Food II. The foods are combined to produce a blend that contains exactly 59 g of carbohydrate and 103 g of protein. An equation for the total amount of carbohydrate in the blend would be $4x + 3y = 59$. Find a similar equation for protein. Sketch the graphs of both equations. 60) _______

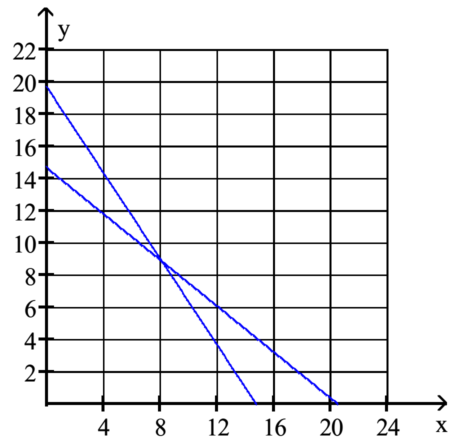
A) $5x + 7y = 103$



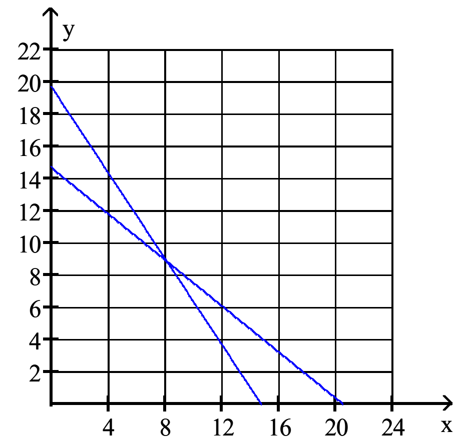
B) $7x + 5y = 103$



C) $7x + 5y = 103$



D) $5x + 7y = 103$



Answer: D

61) Each ounce of Food I contains 4 g of carbohydrate and 3 g of protein, and each ounce of Food II contains 3 g of carbohydrate and 5 g of protein. Suppose x ounces of Food I are mixed with y ounces of Food II. The foods are combined to produce a blend that contains exactly 79 g of carbohydrate and 84 g of protein.If you create an equation for the carbohydrate in the blend and another equation for the protein in the blend, where do the graphs of the two equations intersect? Interpret the significance of this point of intersection. 61) _______

A) (9, 13);
The blend contains 9 ounces of Food I and 13 ounces of Food II
B) (9, 13);
The blend contains 13 ounces of Food I and 9 ounces of Food II
C) (13, 9);
The blend contains 13 ounces of Food I and 9 ounces of Food II
D) (13, 9);
The blend contains 9 ounces of Food I and 13 ounces of Food II

Answer: C

62) The product of two numbers is 208. Express the sum of the numbers as a function of the smaller number. 62) _______

A) $S = 208x$ B) $S = \frac{208}{x}$ C) $S = \frac{x + 208}{x}$ D) $S = x + \frac{208}{x}$

Answer: D

63) In the absence of environmental constraints, population grows at a rate proportional to its size. Express the rate of population growth as a function of the size of the population. 63) _______

A) $R(p) = \frac{k}{p}$; $R(p)$ = rate of growth; p = size of population; k = constant of proportionality
B) $R(p) = kp$; $R(p)$ = rate of growth; p = size of population; k = constant of proportionality
C) $R(p) = k^p$; $R(p)$ = rate of growth; p = size of population; k = constant of proportionality
D) $R(p) = p^k$; $R(p)$ = rate of growth; p = size of population; k = constant of proportionality

Answer: B

64) A farmer wishes to fence off a rectangular field with 1560 feet of fencing. If the long side of the field is along a stream (and does not require fencing), express the area of the field as a function of its width. 64) _______

A) $A = 1560 - w^2$ B) $A = w(780 - w)$
C) $A = 2w(780 - w)$ D) $A = w(1560 - w)$

Answer: C

65) The rate at which the temperature of an object changes is proportional to the difference between its own temperature and the temperature of the surrounding medium. Express this rate as a function of the temperature of the object. 65) ______

A) $R = kT_0 - T_e$; R = rate of temperature change; T_0 = temperature of object; T_e = temperature of surrounding medium.

B) $R = \frac{k}{T_0 - T_e}$; R = rate of temperature change; T_0 = temperature of object; T_e = temperature of surrounding medium.

C) $R = \frac{k}{T_0} - T_e$; R = rate of temperature change; T_0 = temperature of object; T_e = temperature of surrounding medium.

D) $R = k(T_0 - T_e)$; R = rate of temperature change; T_0 = temperature of object; T_e = temperature of surrounding medium.

Answer: D

66) The rate at which an epidemic spreads through a community is jointly proportional to the number of people who have caught the disease and the number who have not. Express this rate as a function of the number of people who have caught the disease. 66) ______

A) $R(q) = kqn - q$; n = the population size; q = the number of people who caught the disease; k = constant of proportionality

B) $R(q) = \frac{kq}{n} - q$; n = the population size; q = the number of people who caught the disease; k = constant of proportionality

C) $R(q) = \frac{kq}{n - q}$; n = the population size; q = the number of people who caught the disease; k = constant of proportionality

D) $R(q) = kq(n - q)$; n = the population size; q = the number of people who caught the disease; k = constant of proportionality

Answer: D

67) At a certain factory, setup cost is directly proportional to the number of machines used and operating cost is inversely proportional to the number of machines used. Express the total cost as a function of the number of machines used. 67) ______

A) $C(x) = k_1x + \frac{k_2}{x}$; x = number of machines used; k_1 and k_2 are constants of proportionality

B) $C(x) = \frac{k(x+1)}{x}$; x = number of machines used; k is the constant of proportionality

C) $C(x) = \frac{k_1x + k_2}{x}$; x = number of machines used; k_1 and k_2 are constants of proportionality

D) $C(x) = kx + \frac{k}{x}$; x = number of machines used; k is the constant of proportionality

Answer: A

68) Rafael estimates that it costs \$13 to produce each unit of a particular commodity that sells for \$27 per unit. There is also a fixed cost of \$1300. Express the cost $C(x)$, the revenue $R(x)$, and the profit $P(x)$ as functions of the number of units x that are produced and sold. 68) ______

A) $C(x) = 13x + 1300$; $R(x) = 27x$; $P(x) = 14x - 1300$
B) $C(x) = 13x + 1300$; $R(x) = 27x$; $P(x) = 14x + 1300$
C) $C(x) = 13x$; $R(x) = 14x - 1300$; $P(x) = 27x$
D) $C(x) = 13x$; $R(x) = 27x - 1300$; $P(x) = 14x$

Answer: A

69) Rafael estimates that it costs \$13 to produce each unit of a particular commodity that sells for \$21 per unit. There is also a fixed cost of \$1300. What is the average profit function $AP(x)$? What is the average profit when 2000 units are produced? 69) ______

A) $AP(x) = 8x - 1300$; \$14,700/unit
B) $AP(x) = 21 - \frac{1300}{x}$; \$20.35/unit
C) $AP(x) = 8 - \frac{1300}{x}$; \$7.35/unit
D) $AP(x) = 8x + 1300$; \$40,700/unit

Answer: C

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

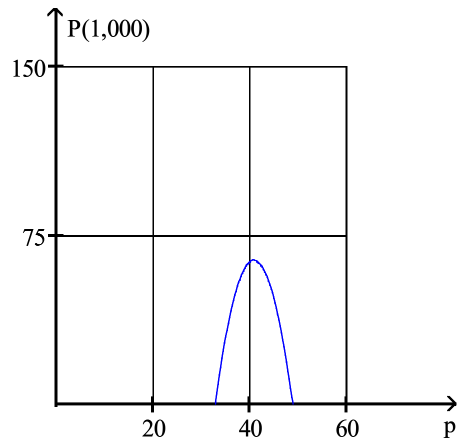
70) A manufacturer estimates that each unit of a particular commodity can be sold for \$6 more than it costs to produce. There is also a fixed cost of \$19,000 associated with the production of the commodity. What is the smallest number of units that must be sold for production to be profitable? 70) ____________

Answer: 3167 units

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

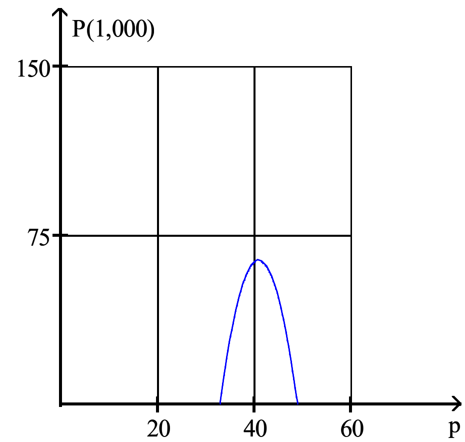
71) Sally's company has been selling lamps at the price of \$45 per lamp, and at this price consumers have been buying 4000 lamps a month. Sally wishes to lower the price and estimates that for each \$1 decrease in the price, 1,000 more lamps will be sold each month. She can produce the lamps at a cost of \$33 per lamp. Express Sally's monthly profit as a function of the price that the lamps are sold, draw the graph, and estimate the optimal selling price. 71) ______

A) $P(p) = (49{,}000 - 1{,}000p)(p - 33)$



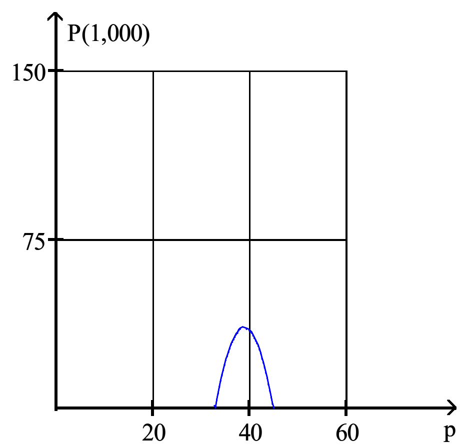
Optimal price is \$64.

B) $P(p) = (49{,}000 - 1{,}000p)(p - 33)$



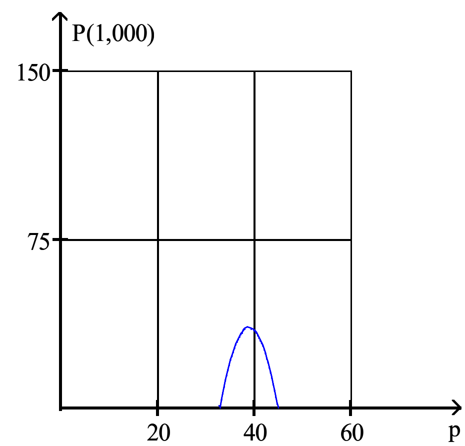
Optimal price is \$41.

C) $P(p) = (45{,}000 - 1{,}000p)(p - 33)$



Optimal price is \$39.

D) $P(p) = (45{,}000 - 1{,}000p)(p - 33)$

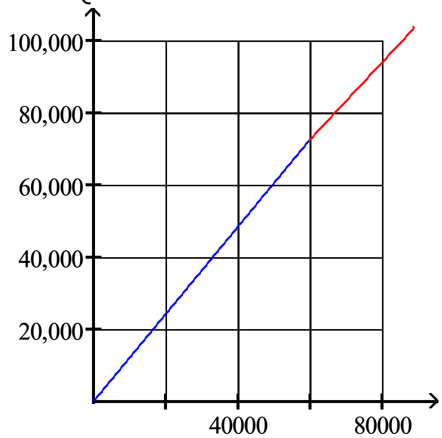


Optimal price is \$36.

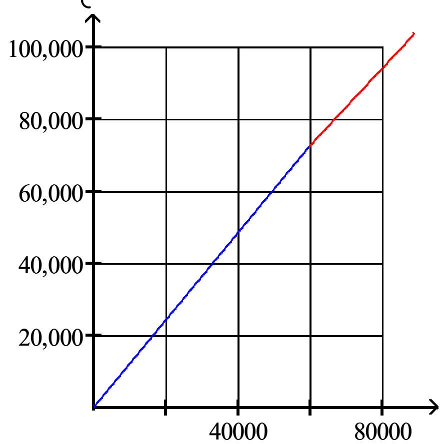
Answer: B

72) Usually, when you purchase a lot in an auction, you pay not only your winning bid price but also a buyer's premium. At one auction house, the buyer's premium is 21% of the winning bid price for purchases up to \$60,000. For larger purchases, the buyer's premium is 21% of the first \$60,000 plus 7% of the purchase price above \$60,000. Express the total purchase price of a lot at this auction house as a function of the final (winning) bid price. Sketch the graph of this function. 72) ______

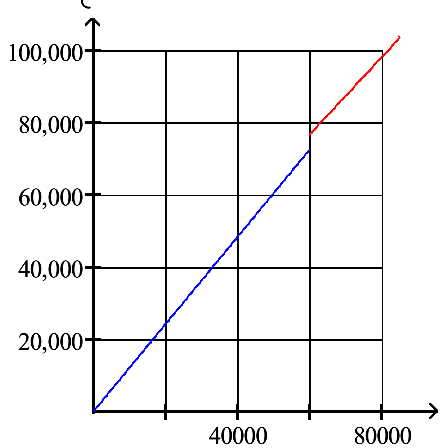
A) $P(x) = \begin{cases} 1.21x & \text{if } x \le 60{,}000 \\ 1.07x + 8400 & \text{if } x > 60{,}000 \end{cases}$



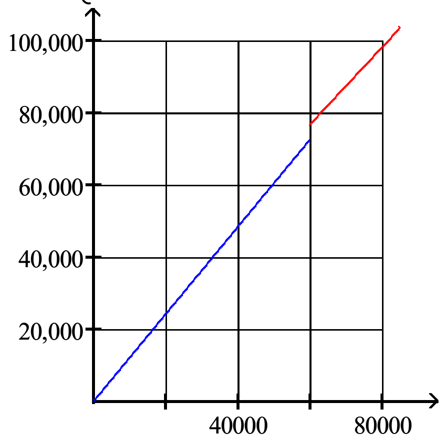
B) $P(x) = \begin{cases} 1.21x & \text{if } x \le 60{,}000 \\ 1.07x + 12{,}600 & \text{if } x > 60{,}000 \end{cases}$



C) $P(x) = \begin{cases} 1.21x & \text{if } x \le 60{,}000 \\ 1.07x + 8400 & \text{if } x > 60{,}000 \end{cases}$



D) $P(x) = \begin{cases} 1.21x & \text{if } x \le 60{,}000 \\ 1.07x + 12{,}600 & \text{if } x > 60{,}000 \end{cases}$



Answer: A

73) The charge for maintaining a checking account at bank A is $12 per month plus 11 cents for each check that is written. Bank B charges $8 per month plus 13 cents per check. Find a criterion for deciding which bank offers the better deal. 73) _______

A) If fewer than 200 checks are written bank B offers the better deal. If more than 200 checks will be written, bank A is more economical.

B) If fewer than 200 checks are written bank A offers the better deal. If more than 200 checks will be written, bank B is more economical.

C) If fewer than 100 checks are written bank B offers the better deal. If more than 100 checks will be written, bank A is more economical.

D) If fewer than 100 checks are written bank A offers the better deal. If more than 100 checks will be written, bank B is more economical.

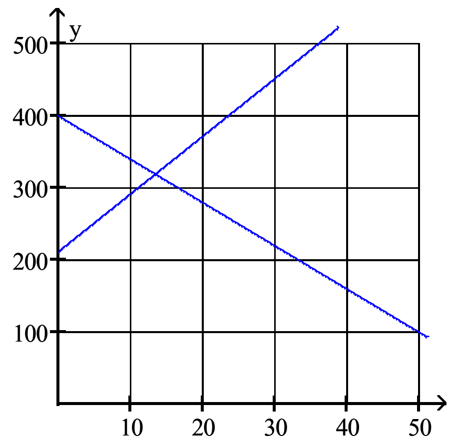
Answer: A

74) Supply and demand functions, $S(x)$ and $D(x)$, are given for a particular commodity in terms of the level of production x. 74) ______

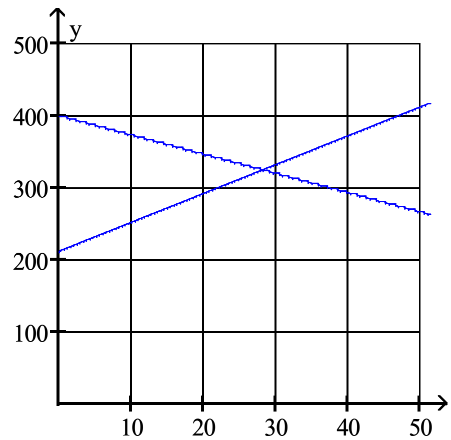
$S(x) = 6x + 210$ and $D(x) = -4x + 400$

Sketch the graphs of the supply and demand curves, $p = S(x)$ and $p = D(x)$, on the same graph.

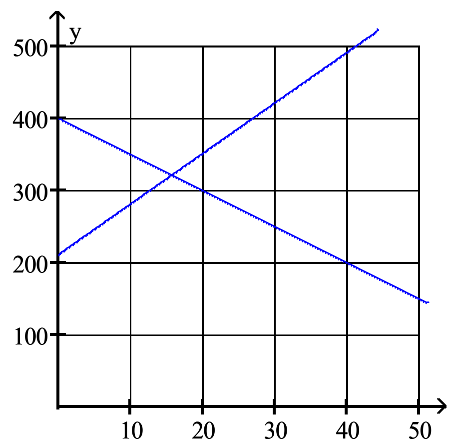
A)



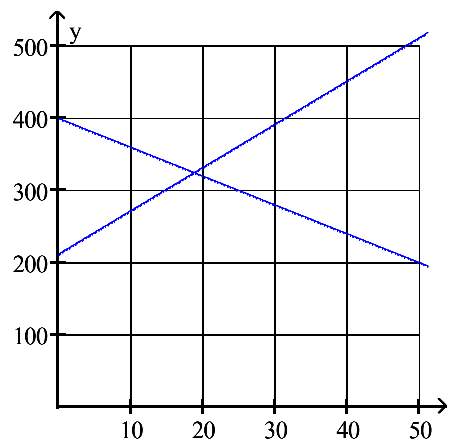
B)



C)



D)



Answer: D

75) Supply and demand functions, $S(x)$ and $D(x)$, are given for a particular commodity in terms of the level of production x. In each case: 75) ______

$S(x) = 6x + 240$ and $D(x) = -4x + 420$

a. For what values of x is there a market shortage?
b. For what values of x is there a market surplus?

A) **a.** $x > 348$; **b.** $0 < x < 348$
B) **a.** $x > 18$; **b.** $0 < x < 18$
C) **a.** $0 < x < 18$; **b.** $x > 18$
D) **a.** $0 < x < 348$; **b.** $x > 348$

Answer: C

76) When electric blenders are sold for p dollars apiece, manufacturers will supply $\frac{p^2}{10}$ blenders to local retailers, while the local demand will be $50 + 4p$ blenders. At what market price will the manufacturers' supply of electric blenders be equal to the consumers' demand for the blenders? How many blenders will be sold at this price? 76) ______

A) \$50 per blender; 2500 blenders
B) \$50 per blender; 250 blenders
C) \$10 per blender; 90 blenders
D) \$10 per blender; 900 blenders

Answer: B

77) Producers will supply x units of a certain commodity to the market when the price is $p = S(x)$ dollars per unit, and consumers will demand (buy) x units when the price is $p = D(x)$ dollars per unit, where 77) ______

$$S(x) = 5x + 16 \text{ and } D(x) = \frac{381}{x + 3}$$

Where does the supply curve cross the y axis? Describe the economic significance of this point.

A) (0, 3.20); When the price is zero, the supply is \$3.20 units.
B) (0, 16); No units will be produced until the price is at least \$16.
C) (0, 16); When the price is zero, the supply is 16 units.
D) (0, 3.20); No units will be produced until the price is at least \$3.20.

Answer: B

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

78) Julia can sell a certain product for \$75 per unit. Total cost consists of a fixed overhead of \$4000 plus production costs of \$50 per unit. How many units must be sold for Julia to break even? 78) ______________

Answer: 160

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

79) Several different formulas have been proposed for determining the appropriate dose of a drug for a child in terms of the adult dosage. Suppose that A milligrams (mg) is the adult dose of a certain drug and C is the appropriate dosage for a child of age N years. Then Cowling's rule says that 79) ______

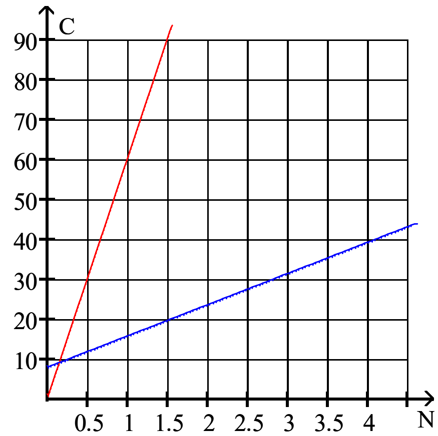
$$C = \left(\frac{N + 1}{24}\right)A$$

while Friend's rule says that

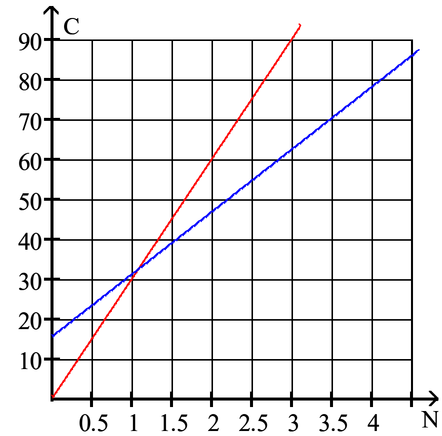
$$C = \frac{2NA}{25}$$

Assume an adult dose of $A = 375$ mg, so that Cowling's rule and Friend's rule become functions of the child's age N. Sketch the graphs of these two functions.

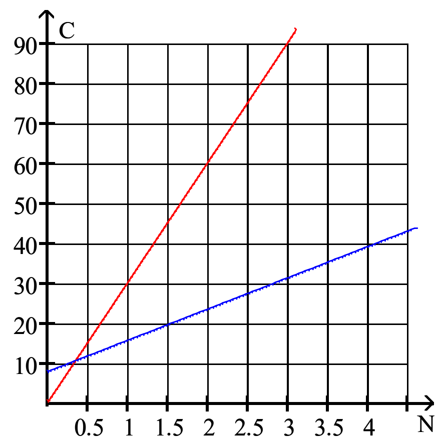
A)



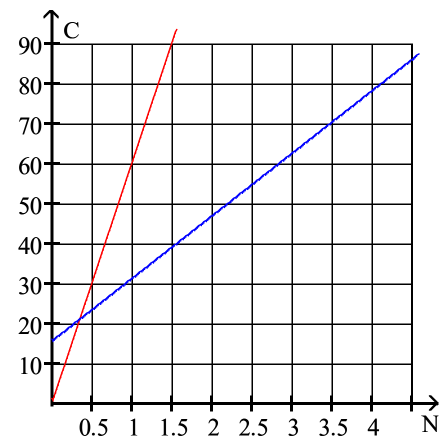
B)



C)



D)



Answer: B

80) Several different formulas have been proposed for determining the appropriate dose of a drug for a child in terms of the adult dosage. Suppose that A milligrams (mg) is the adult dose of a certain drug and C is the appropriate dosage for a child of age N years. Then Cowling's rule says that 80) ______

$$C = \left(\frac{N+1}{24}\right)A$$

while Friend's rule says that

$$C = \frac{2NA}{25}$$

For what child's age is the dosage suggested by Cowling's rule the same as that predicted by Friend's rule? For what ages does Cowling's rule suggest a larger dosage than Friend's rule? For what ages does Friend's rule suggest the larger dosage?

A) About 11 months old. If N is larger, Cowling's rule suggest the higher dosage. If N is smaller, Friend's rule suggest the higher dosage.

B) About 1 year, 1 month old. If N is smaller, Cowling's rule suggest the higher dosage. If N is larger, Friend's rule suggest the higher dosage.

C) About 1 year, 1 month old. If N is larger, Cowling's rule suggest the higher dosage. If N is smaller, Friend's rule suggest the higher dosage.

D) About 11 months old. If N is smaller, Cowling's rule suggest the higher dosage. If N is larger, Friend's rule suggest the higher dosage.

Answer: B

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

81) Several different formulas have been proposed for determining the appropriate dose of a drug for a child in terms of the adult dosage. Suppose that A milligrams (mg) is the adult dose of a certain drug and C is the appropriate dosage for a child of age N years. Then Cowling's rule says that 81) ______________

$$C = \left(\frac{N+1}{24}\right)A$$

while Friend's rule says that

$$C = \frac{2NA}{25}$$

As an alternative to Friend's rule and Cowling's rule, pediatricians sometimes use the formula

$$C = \frac{SA}{1.7}$$

to estimate an appropriate drug dosage for a child whose surface area is S square meters, when the adult dosage of the drug is A milligrams (mg). In turn, the surface area of the child's body is estimated by the formula

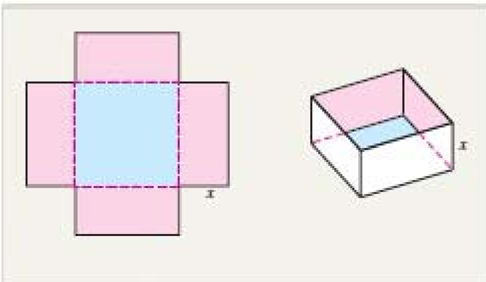
$$S = 0.0072W^{0.425}H^{0.725}$$

where W and H are, respectively, the child's weight in kilograms (kg) and height in centimeters (cm). The adult dosage for a certain drug is 250 mg. How much of the drug should be given to a child who is 100 cm tall and weighs 22 kg?

Answer: 111 mg

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

82) An open box is to be made from a square piece of cardboard, 24 inches by 24 inches, by removing a small square from each corner and folding up the flaps to form the sides. Express the volume of the resulting box as a function of the length x of a side of the removed squares. 82) _______



A) $V(x) = 2x(12 - x)^2$

B) $V(x) = 4x(12 - x)^2$

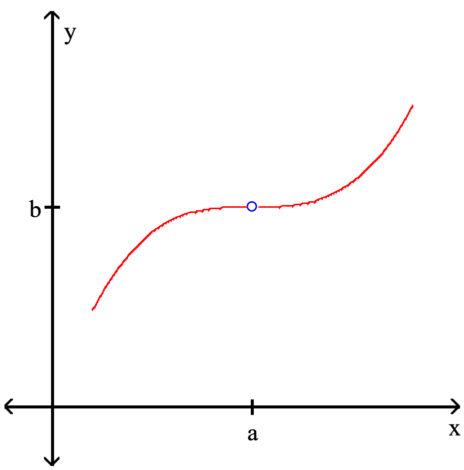
C) $V(x) = 12x^3$

D) $V(x) = x(24 - x)^2$

Answer: B

Find $\lim\limits_{x \to a} f(x)$ if it exists.

83) 83) _______



A) The limit fails to exist.

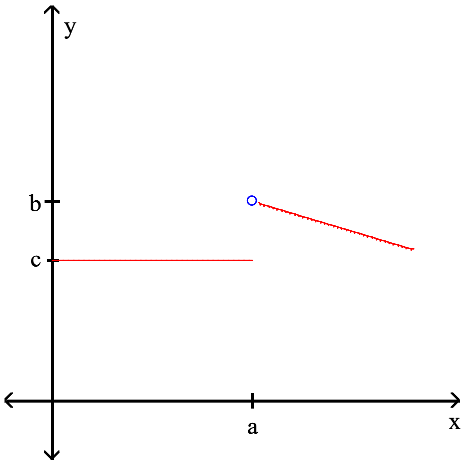
B) $\lim\limits_{x \to a} f(x) = 0$

C) $\lim\limits_{x \to a} f(x) = a$

D) $\lim\limits_{x \to a} f(x) = b$

Answer: D

84)



84) _______

A) $\lim_{x \to a} f(x) = b$

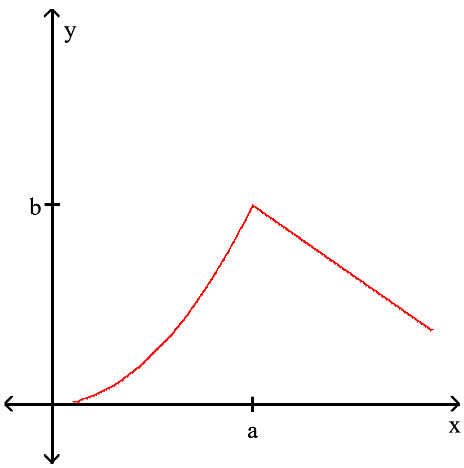
B) The limit fails to exist.

C) $\lim_{x \to a} f(x) = c$

D) $\lim_{x \to a} f(x) = a$

Answer: B

85)



85) _______

A) a

B) b

C) 0

D) The limit fails to exist.

Answer: B

Find the indicated limit if exists.

86) $\lim_{x \to 0} (x^5 + 5x^4 + 2)$

86) _______

A) The limit fails to exist.

B) 1

C) 0

D) 2

Answer: D

87) $\lim_{x \to 8} \frac{5x - 2}{x + 8}$ 87) _______

A) 5
B) $\frac{19}{8}$
C) The limit fails to exist.
D) $-\frac{1}{4}$

Answer: B

88) $\lim_{x \to 4} \frac{x^2 - 16}{x - 4}$ 88) _______

A) 0
B) 8
C) The limit fails to exist.
D) 4

Answer: B

89) $\lim_{x \to 0} \frac{x(x^2 - 36)}{x^2}$ 89) _______

A) 0
B) 6
C) 36
D) The limit fails to exist.

Answer: D

Find $\lim_{x \to +\infty} f(x)$ and $\lim_{x \to -\infty} f(x)$. If the limiting value is infinite, indicate whether it is $+\infty$ or $-\infty$.

90) $f(x) = -3 - x + 7x^2 - 3x^3$ 90) _______

A) $\lim_{x \to +\infty} f(x) = -3$; $\lim_{x \to -\infty} f(x) = -3$
B) $\lim_{x \to +\infty} f(x) = -3$; $\lim_{x \to -\infty} f(x) = 3$
C) $\lim_{x \to +\infty} f(x) = +\infty$; $\lim_{x \to -\infty} f(x) = -\infty$
D) $\lim_{x \to +\infty} f(x) = -\infty$; $\lim_{x \to -\infty} f(x) = +\infty$

Answer: D

91) $f(x) = \frac{6 - 5x^3}{3x^3 - 8x - 5}$ 91) _______

A) $\lim_{x \to +\infty} f(x) = -\frac{5}{3}$; $\lim_{x \to -\infty} f(x) = \frac{5}{3}$
B) $\lim_{x \to +\infty} f(x) = -\infty$; $\lim_{x \to -\infty} f(x) = -\infty$
C) $\lim_{x \to +\infty} f(x) = -\frac{6}{5}$; $\lim_{x \to -\infty} f(x) = -\frac{6}{5}$
D) $\lim_{x \to +\infty} f(x) = -\frac{5}{3}$; $\lim_{x \to -\infty} f(x) = -\frac{5}{3}$

Answer: D

92) $f(x) = \dfrac{9 - 5x^3}{x - 5}$ 92) _______

A) $\lim\limits_{x \to +\infty} f(x) = \infty$; $\lim\limits_{x \to -\infty} f(x) = \infty$

B) $\lim\limits_{x \to +\infty} f(x) = -\infty$; $\lim\limits_{x \to -\infty} f(x) = -\infty$

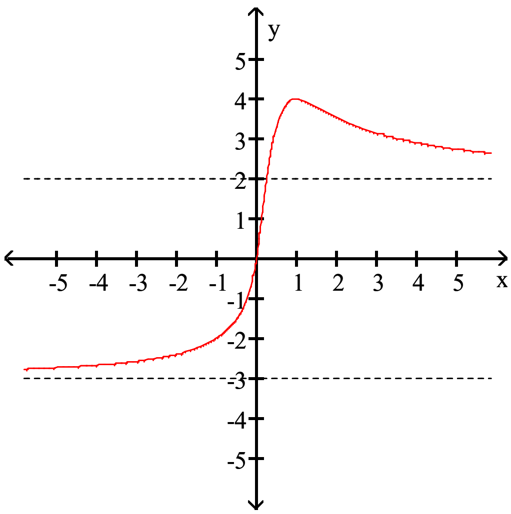
C) $\lim\limits_{x \to +\infty} f(x) = 5$; $\lim\limits_{x \to -\infty} f(x) = 5$

D) $\lim\limits_{x \to +\infty} f(x) = -5$; $\lim\limits_{x \to -\infty} f(x) = -5$

Answer: B

The graph of a function $f(x)$ is given. Use the graph to determine $\lim\limits_{x \to +\infty} f(x)$ and $\lim\limits_{x \to -\infty} f(x)$.

93) 93) _______



A) $\lim\limits_{x \to +\infty} f(x) = 4$; $\lim\limits_{x \to -\infty} f(x) = -3$

B) $\lim\limits_{x \to +\infty} f(x) = -3$; $\lim\limits_{x \to -\infty} f(x) = 4$

C) $\lim\limits_{x \to +\infty} f(x) = 2$; $\lim\limits_{x \to -\infty} f(x) = -3$

D) $\lim\limits_{x \to +\infty} f(x) = -3$; $\lim\limits_{x \to -\infty} f(x) = 2$

Answer: C

Complete the table by evaluating *f* (*x*) at the specified values of *x*. Then use the table to estimate the indicated limit or show it does not exist.

94) $f(x) = x - \frac{8}{x}$; $\lim_{x \to 0} f(x)$ 94) ______

x	-0.09	-0.009	0	0.0009	0.009	0.09
$f(x)$			X			

A)

x	-0.09	-0.009	0	0.0009	0.009	0.09
$f(x)$	88.7989	888.8799	X	-8888.888	-888.8799	-88.7989

$\lim_{x \to 0} f(x) = 89$

B)

x	-0.09	-0.009	0	0.0009	0.009	0.09
$f(x)$	88.7989	888.8799	X	-8888.888	-888.8799	-88.7989

$\lim_{x \to 0} f(x) = -8889$

C)

x	-0.09	-0.009	0	0.0009	0.009	0.09
$f(x)$	88.7989	888.8799	X	-8888.888	-888.8799	-88.7989

$\lim_{x \to 0} f(x)$ does not exist.

D)

x	-0.09	-0.009	0	0.0009	0.009	0.09
$f(x)$	88.7989	888.8799	X	-8888.888	-888.8799	-88.7989

$\lim_{x \to 0} f(x) = 889$

Answer: C

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Find the indicated limit or show that it does not exist using the following facts about limits involving the functions *f* (*x*) and *g*(*x*):

$\lim_{x \to c} f(x) = 5$ **and** $\lim_{x \to \infty} f(x) = -3$

$\lim_{x \to c} g(x) = -2$ **and** $\lim_{x \to \infty} f(x) = 4$

95) $\lim_{x \to c} [4f(x) + 3g(x)]$ 95) ______________

Answer: 14

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

Solve the problem.

96) A business manager determines that t months after production begins on a new product, the number of units produced will be P thousand, where 96) ______

$$P(t) = \frac{9t^2 + 8t}{(t+4)^2}$$

What happens to production in the long run (as $t \to \infty$)?

A) Production approaches 9000 units.
B) Production approaches 17,000 units.
C) Production increases without bound.
D) Production approaches 0 units.

Answer: A

97) A business manager determines that the total cost of producing x units of a particular commodity may be modeled by the function 97) ______

$$C(x) = 4.5x + 330{,}000$$

(dollars). The average cost is $A(x) = \dfrac{C(x)}{x}$. Find $\lim\limits_{x \to +\infty} A(x)$, and interpret your result.

A) \$4.50; As the number of units produced increases, the contribution of fixed costs to the average cost decreases to 0.
B) \$330,000; As the number of units produced increases, the average cost increases, approaching a minimum of \$330,000.
C) \$4.50; As the number of units produced increases, the average cost increases, approaching a minimum of \$4.50.
D) \$330,000; As the number of units produced increases, the contribution of variable costs to the average cost decreases to 0.

Answer: A

98) Alicia, the manager of a plant, determines that when x% of the plant's capacity is being used, the total cost of operation is C hundred dollars, where 98) ______

$$C(x) = \frac{16x^2 - 1272x - 640}{x^2 - 68x - 960}$$

The company has a policy of rotating maintenance in an attempt to ensure that approximately 80% of capacity is always in use. What cost should Alicia expect when the plant is operating at this ideal capacity?

A) \$1200
B) \$1400
C) \$1600
D) \$1800

Answer: B

99) When starting a new job at a production facility, employees can be expected to assemble n items per hour after t weeks of work experience, where 99) ______

$$n(t) = 85 - \frac{130}{t + 15.54}$$

Employees are paid 20 cents for each item they assemble.
a. Find an expression for the amount of money $A(t)$ earned per hour by an employee with t weeks of experience.
b. How much money per hour should an employee expect to earn in the long run (as $t \to \infty$)?

A) **a.** $A(t) = 0.20(85) - \dfrac{130}{85 + 15.54}$

b. \$15.54/hour.

B) **a.** $A(t) = 0.20(85) - \dfrac{130}{t + 15.54}$

b. \$17.00/hour.

C) **a.** $A(t) = 0.20\left(85 - \dfrac{130}{t + 15.54}\right)$

b. \$15.33/hour.

D) **a.** $A(t) = 0.20\left(85 - \dfrac{130}{t + 15.54}\right)$

b. \$17.00/hour.

Answer: D

100) Scott, an urban planner, models the population $P(t)$ (in thousands) of his community t years from now by the function 100) ______

$$P(t) = \frac{40t}{t^2 + 10} - \frac{60}{t + 4} + 70$$

By how much does the population change during the 3rd year? Is the population increasing or decreasing over this time period?

A) The population decreased by approximately 67,744 during the third year.
B) The population increased by approximately 67,744 during the third year.
C) The population decreased by approximately 2030 during the third year.
D) The population increased by approximately 2030 during the third year.

Answer: D

101) Scott, an urban planner, models the population $P(t)$ (in thousands) of his community t years from now by the function 101) ______

$$P(t) = \frac{20t}{t^2 + 10} - \frac{40}{t + 4} + 60$$

a. What is the current population of the community?
b. What population should Scott plan for in the long run (as $t \to \infty$)?

A) **a.** The current population is 70,000.
b. In the long run, the population approaches 60,000.

B) **a.** The current population is 70,000.
b. In the long run, the population approaches 50,000.

C) **a.** The current population is 50,000.
b. In the long run, the population approaches 70,000.

D) **a.** The current population is 50,000.
b. In the long run, the population approaches 60,000.

Answer: D

102) To study the rate at which animals learn, a psychology student performed an experiment in which a rat was sent repeatedly through a laboratory maze. Suppose the time required for the rat to traverse the maze on the nth trial was approximately 102) ______

$$T(n) = \frac{6n + 19}{n}$$

minutes. What happens to the time of traverse as the number of trials n increases indefinitely? Interpret your result.

A) The rat's traversal time will approach a maximum time of 19 minutes.
B) The rat's traversal time will approach a minimum time of 6 minutes.
C) The rat's traversal time will approach a maximum time of 25 minutes.
D) The rat's traversal time will approach a minimum time of 19 minutes.

Answer: B

103) Two species coexist in the same ecosystem. Species I has population $P(t)$ in t years, while Species II has population $Q(t)$, both in thousands, where P and Q are modeled by the functions 103) ______

$$P(t) = \frac{42}{6 + t} \quad \text{and} \quad Q(t) = \frac{45}{5 - t}$$

for all times for which the respective populations are nonnegative. What happens to $P(t)$ ε t increases? What happens to $Q(t)$?

A) As t increases, $P(t)$ approaches 6; as t increases to approach 5, $Q(t)$ approaches 0.
B) As t increases, $P(t)$ approaches 7; as t increases to approach 5, $Q(t)$ approaches 9.
C) As t increases, $P(t)$ approaches 7; as t increases to approach 5, $Q(t)$ approaches ∞.
D) As t increases, $P(t)$ approaches 0; as t increases to approach 5, $Q(t)$ approaches ∞.

Answer: D

104) In some animal species, the intake of food is affected by the amount of vigilance maintained by the animal while feeding. In essence, it is hard to eat heartily while watching for predators that may eat you. In one model, if the animal is foraging on plants that offer a bite of size S, the intake rate of food, $I(S)$, is given by a function of the form 104) ______

$$I(S) = \frac{19S}{S + 6}$$

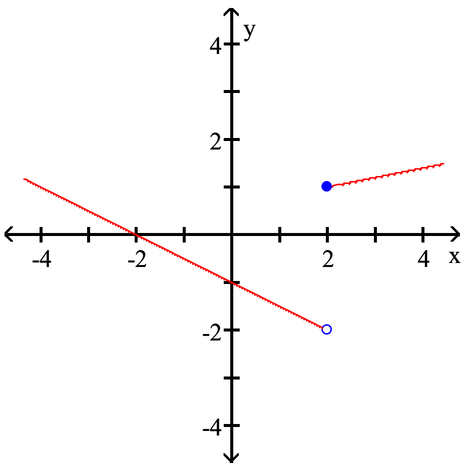
where a and c are positive constants. What happens to the intake $I(S)$ as bite size S increases indefinitely? Interpret your result.

A) $\lim\limits_{s \to +\infty} I(S) = \frac{19}{6}$. No matter how large the bite size, animal has a limit to the amount of food it can consume.
B) $\lim\limits_{s \to +\infty} I(S) = 19$. There is a maximum bite size that the animal can take.
C) $\lim\limits_{s \to +\infty} I(S) = \frac{19}{6}$. There is a maximum bite size that the animal can take.
D) $\lim\limits_{s \to +\infty} I(S) = 19$. No matter how large the bite size, animal has a limit to the amount of food it can consume.

Answer: D

Find the one-sided limits $\lim_{x \to 2^-} f(x)$ and $\lim_{x \to 2^+} f(x)$ from the given graph of f and determine whether $\lim_{x \to 2} f(x)$ exists.

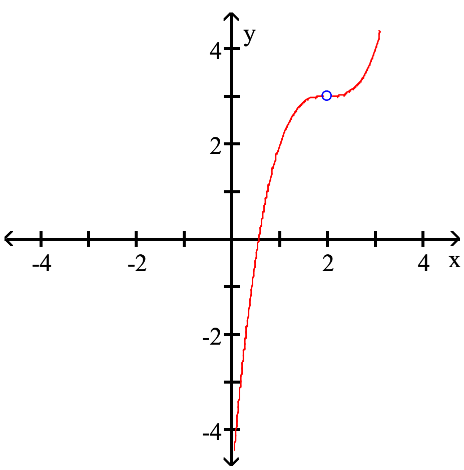
105) 105) ______



A) 1; -2; exists and equals -2
B) -2; 1; does not exist
C) -2; 1; exists and equals 1
D) 1; -2; does not exist

Answer: B

106) 106) ______



A) 2; 2; exists and equals 2
B) 2; 2; does not exist
C) 3; 3; exists and equals 3
D) 3; 3; does not exist

Answer: C

Find the indicated one-sided limit. If the limiting value is infinite, indicate whether it is $+\infty$ or $-\infty$.

107) $\lim_{x \to 5^+} (4x^2 - 8)$ 107) ______

A) $-\infty$
B) -8
C) $+\infty$
D) 92

Answer: D

108) $\lim_{x \to 6^-} \frac{x+9}{x+6}$ 108) ______

A) $\frac{5}{4}$ B) $\frac{3}{2}$ C) $-\infty$ D) $+\infty$

Answer: A

109) $\lim_{x \to 0^+} (9x - 8\sqrt{x})$ 109) ______

A) 0 B) 1 C) $-\infty$ D) $+\infty$

Answer: A

110) $\lim_{x \to -5^-} f(x)$ and $\lim_{x \to -5^+} f(x)$ where $f(x) = \begin{cases} \frac{1}{x - 5} & \text{if } x < -5 \\ x^2 + 2x & \text{if } x \geq -5 \end{cases}$ 110) ______

A) $\lim_{x \to -5^-} f(x) = 15$; $\lim_{x \to -5^+} f(x) = -\frac{1}{10}$ B) $\lim_{x \to -5^-} f(x) = -\frac{1}{10}$; $\lim_{x \to -5^+} f(x) = 15$

C) $\lim_{x \to -5^-} f(x) = 15$; $\lim_{x \to -5^+} f(x) = -\infty$ D) $\lim_{x \to -5^-} f(x) = -\infty$; $\lim_{x \to -5^+} f(x) = 15$

Answer: B

Decide if the given function is continuous at the specified value of x.

111) $f(x) = x^5 + 9x^2 + x + 4$ at $x = 0$ 111) ______

A) No; $\lim_{x \to 0} \neq f(0)$ B) Yes; $\lim_{x \to 0} \neq f(0)$

C) Yes; $\lim_{x \to 0} = f(0) = 4$ D) No; $\lim_{x \to 0} = f(0) = 4$

Answer: C

112) $f(x) = \frac{4x - 28}{6x - 7}$ at $x = 7$ 112) ______

A) No; $\lim_{x \to 7} = f(7) = 0$ B) No; $\lim_{x \to 7} \neq f(7)$

C) Yes; $\lim_{x \to 7} \neq f(7)$ D) Yes; $\lim_{x \to 7} = f(7) = 0$

Answer: D

113) $f(x) = \dfrac{x + 3}{x - 3}$ at $x = 3$ 113) ______

A) No; $\lim\limits_{x \to 3} = f(3) = 0$

B) Yes; $\lim\limits_{x \to 3} = f(3) = 0$

C) No; $\lim\limits_{x \to 3} \neq f(3)$

D) Yes; $\lim\limits_{x \to 3} \neq f(3)$

Answer: C

114) $f(x) = \dfrac{7x - 4}{4x - 12}$ at $x = 3$ 114) ______

A) Yes; $\lim\limits_{x \to 3} = f(3) = 17$

B) No; $\lim\limits_{x \to 3} \neq f(3)$

C) No; $\lim\limits_{x \to 3} = f(3) = 17$

D) Yes; $\lim\limits_{x \to 3} \neq f(3)$

Answer: B

115) $f(x) = \begin{cases} x + 4 & \text{if } x \le 1 \\ 1 & \text{if } x > 1 \end{cases}$ at $x = 1$ 115) ______

A) Yes; $\lim\limits_{x \to 1} = f(1) = 1$

B) No; $\lim\limits_{x \to 1} = f(1) = 1$

C) No; $\lim\limits_{x \to 1} \neq f(1)$

D) Yes; $\lim\limits_{x \to 1} \neq f(1)$

Answer: C

116) $f(x) = \begin{cases} x^2 + 1 & \text{if } x \le 2 \\ 4x - 3 & \text{if } x > 2 \end{cases}$ at $x = 2$ 116) ______

A) No; $\lim\limits_{x \to 2} = f(2) = 5$

B) Yes; $\lim\limits_{x \to 2} = f(2) = 5$

C) Yes; $\lim\limits_{x \to 2} \neq f(2)$

D) No; $\lim\limits_{x \to 2} \neq f(2)$

Answer: B

List all the values of *x* for which the given function is not continuous.

117) $f(x) = \dfrac{x - 3}{x + 4}$ 117) ______

A) $x = 3$ B) $x < -4$ C) $x < 3$ D) $x = -4$

Answer: D

118) $f(x) = \dfrac{3x}{x^2 - x}$ 118) ______

A) $x = 0$
B) $x = 0, x = 1$
C) $x = 1$
D) $x = -1, x = 0, x = 1$

Answer: B

119) $f(x) = \begin{cases} 5x + 4 & \text{if } x < 0 \\ x^2 + x & \text{if } x \geq 0 \end{cases}$ 119) ______

A) $f(x)$ is continuous for all x
B) $x > 0$
C) $x = 0$
D) $x < 0$

Answer: C

Solve the problem.

120) In certain situations, it is necessary to weigh the benefit of pursuing a certain goal against the cost of achieving that goal. For instance, suppose that to remove x% of the pollution from an oil spill, it costs C thousands of dollars, where 120) ______

$$C(x) = \frac{13x}{100 - x}$$

What happens as $x \to 100^-$? Is it possible remove all the pollution?

A) $\lim_{x \to 100^-} C(x) =$ \$1,300,000; it is not possible to remove all the pollution.

B) $\lim_{x \to 100^-} C(x) =$ \$1,300,000; it is possible to remove all the pollution.

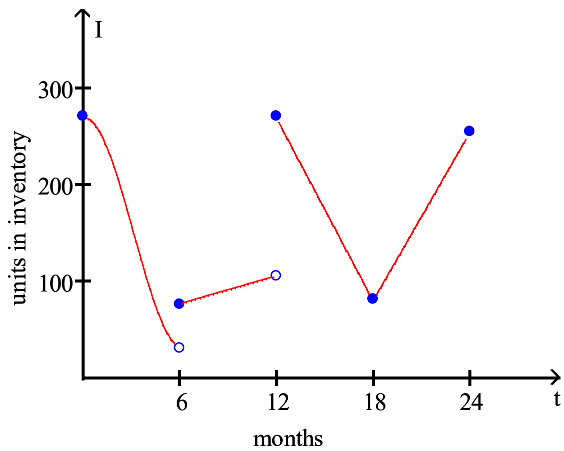
C) $\lim_{x \to 100^-} C(x) = \infty$; it is possible to remove all the pollution.

D) $\lim_{x \to 100^-} C(x) = \infty$; it is not possible to remove all the pollution.

Answer: D

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

121) The accompanying graph shows the number of units in inventory at a certain business over a 2-year period. When is the graph discontinuous? What do you think is happening at those times? 121) ___________



Answer: The graph is discontinuous at $x = 6$ and $x = 12$. What happened to cause these jumps is a writing exercise; answers will vary.

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

122) It is estimated that t years from now the population of a certain suburban community will be p thousand people, where 122) _____

$$p(t) = 19 - \frac{8}{t + 3}$$

An environmental study indicates that the average level of carbon monoxide in the air wil be c parts per million when the population is p thousand, where

$$c(p) = 0.4\sqrt{p^2 + p + 20}$$

What happens to the level of pollution c in the long run (as $t \to \infty$)?

A) $\lim\limits_{t \to \infty} p(t) = 16$ and $c(16) \approx 15.5$

B) $\lim\limits_{t \to \infty} p(t) = 19$ and $c(19) \approx 17.9$

C) $\lim\limits_{t \to \infty} p(t) = 16$ and $c(16) \approx 6.8$

D) $\lim\limits_{t \to \infty} p(t) = 19$ and $c(19) \approx 8.0$

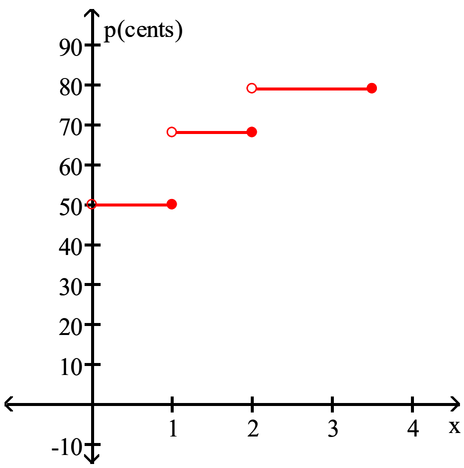
Answer: D

123) In 2010, in a particular country, the cost $p(x)$ in cents of mailing a letter weighing x ounces was 123) ______

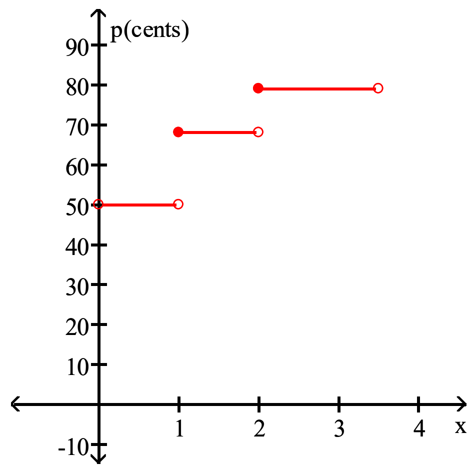
$$p(x) = \begin{cases} 50 & \text{if } 0 < x \le 1 \\ 68 & \text{if } 1 < x \le 2 \\ 79 & \text{if } 2 < x \le 3.5 \end{cases}$$

Sketch the graph of $p(x)$ for $0 < x \le 3.5$. For what values of x is $p(x)$ discontinuous for $0 < x \le 3.5$?

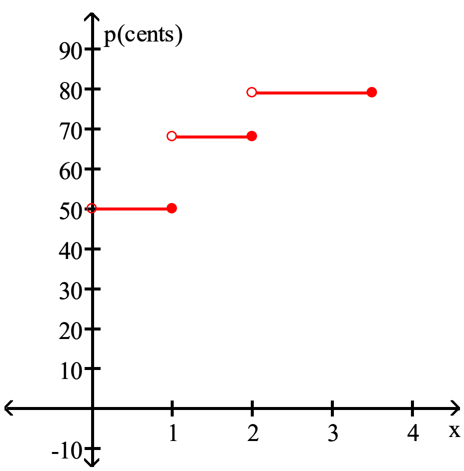
A) $p(x)$ is continuous for all x.



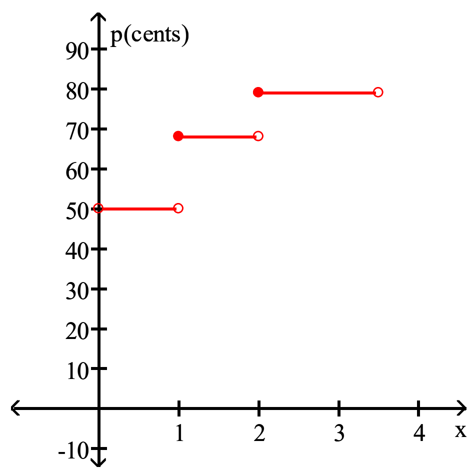
B) $p(x)$ is continuous for all x.



C) $p(x)$ is discontinuous at $x = 1$ and 2.



D) $p(x)$ is discontinuous at $x = 1$ and 2.



Answer: C