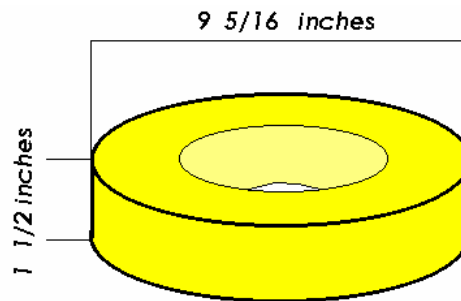


1. A population consists of the 3920 employees at Rex Hospital. A random sample of 2.5% of the employees was asked if they would take a statistics course if one were offered on site. Eight of the employees sampled said “yes.” About how many of the 3920 employees would likely take a statistics course, based on the sample data?

- a. 8
- b. 12
- c. 32
- d. 98
- e. 320

2. A hole must be cut in the center of a metal disk (see picture) so that the radius of the hole is one-half the radius of the disk. After the hole is cut, what is the width of the remaining disk on either side of the hole?

- a.  $\frac{149}{16}$  inches
- b.  $\frac{149}{32}$  inches
- c.  $\frac{149}{64}$  inches
- d.  $\frac{149}{128}$  inches
- e.  $\frac{3}{2}$  inches



3. A business runs an advertisement regularly in the local paper. The dimensions of the advertisement are 1.75 inches by 3.25 inches. In order to promote a special event, the business decides to increase the area of the advertisement by 20%. However, because of other limitations, the maximum width of the advertisement is 1.825 inches. If the larger advertisement is the maximum width, what is the smallest the other side can be in order to increase the size of the advertisement by at least 20%? (The dimensions of any advertisement are measured to the nearest 1/32 inch.)

- a. 118/32 inch
- b. 119/32 inch
- c. 120/32 inch
- d. 121/32 inch
- e. none of the above

4. In order to provide water downstream, an operator will open the release valve on a dam. The open valve will release about 500 cubic feet of water per minute. The goal is to release about 1.2 million cubic feet of water. If the release valve is opened at 9:54 am on Monday 15 July, at which of the given times will the dam operator need to close the dam valve?

- a. 2 pm, 15 July
- b. 2 am, 16 July
- c. 6 pm, 16 July
- d. 2 am, 17 July
- e. 6 am, 17 July

5. Last year, a realtor sold 47 homes. The highest priced home was \$426,000 and the lowest priced home was \$74,000. The realtor's total commissions last year was \$235,000. If the commission was 5% of each sale, what was the average selling price for the 47 homes?

- a. \$250,000
- b. \$247,368
- c. \$117,500
- d. \$106,383
- e. \$100,000

6. Consider the equation  $ax^2 + bx + c = 0$  for some non-zero  $a$ ,  $b$ , and  $c$ . If the solutions to the equation  $x^2 + bx + ac = 0$  are  $x = m$  and  $x = n$ , then the solutions to the equation  $ax^2 + bx + c = 0$  are

- a.  $x = m$  and  $x = n$
- b.  $x = am$  and  $x = an$
- c.  $x = m/a$  and  $x = n/a$
- d.  $x = cm/a$  and  $x = cn/a$
- e.  $x = am/c$  and  $x = an/c$

7. Which of the following is equal to  $\frac{2+3i}{1-3i}$

- a.  $\frac{18-14i}{20i}$
- b.  $\frac{18+14i}{20i}$
- c.  $\frac{-7-9i}{10}$
- d.  $\frac{-7+9i}{10}$
- e.  $\frac{8+i}{5+5i}$

8. Consider the equation  $4x(x-1) = 15$ . The product of all the solutions is

- a.  $-\frac{15}{4}$
- b.  $\frac{15}{4}$
- c. 1
- d. 0
- e.  $-\frac{15}{2}$

9. Let  $k$  be the least positive integer that is divisible by each of the first six natural numbers. Find

$$\sqrt{\frac{k+3k}{15}}$$

- a.  $8\sqrt{3}$
- b.  $4\sqrt{2}$
- c. 4
- d.  $6\sqrt{2}$
- e.  $\frac{4\sqrt{15}}{15}$

10. If  $2^{5xy} = 32^{4y}$ , and  $y \neq 0$ , then  $x$  is

- a. 2
- b. 4
- c. 1
- d. 0
- e. The value of  $x$  can not be determined from the information given.

11. Which of the following quadratic equations is the best model for the data below?

$t$	-1	0	8
$h(t)$	12.6	2.1	26.1

- a.  $y = -1.5x^2 - 9x - 2.1$
- b.  $y = -1.5x^2 - 9x + 2.1$
- c.  $y = 1.5x^2 - 9x - 2.1$
- d.  $y = 1.5x^2 - 9x + 2.1$
- e.  $y = 1.5x^2 + 9x + 2.1$

12.  $\log(8x^3) - 2\log x - \log 8 =$

- a.  $\log(x^2)$
- b.  $-2\log(x^2)$
- c.  $-\log(x)$
- d.  $\log x$
- e.  $\log(x^2)/2$

13. Consider the equation  $x^3 - 6 = 5x - 2x^2$ . If  $x = -1$  is a solution of the equation, then the sum of the other two solutions is

- a. -1
- b. 1
- c. 5
- d. -5
- e. -6

14. Consider the equation  $\sqrt{b(ax+b)} = ax+b$ ,  $a$  and  $b$  are non-zero numbers. The sum of all the solutions of this equation is

- a. 0
- b.  $a+b$
- c.  $b/a$
- d.  $-a/b$
- e.  $-b/a$

15. Consider the system of equations

$$\begin{cases} 3x + 2y = -2 \\ 5x - 3y = 22 \end{cases}$$

If  $(x, y)$  is the solution to the system, then the product  $xy$  is

- a. -2
- b. 14
- c.  $50/19$
- d. -6
- e. -8

16. If  $k = 2^{2003}$ , then  $2^{2005} - 2^{2004} - 2^{2003} =$

- a.  $7k$
- b. 0
- c.  $k$
- d.  $2k$
- e.  $5k$

17.  $\frac{\frac{1}{x} - x}{1 + \frac{1}{x}} =$

- a.  $1-x$
- b.  $x-1$
- c.  $\frac{1+x}{x-1}$
- d.  $\frac{1-x}{x+1}$
- e. -1

18. Consider the expression  $\frac{(a-1)!b!}{a!} + \frac{(b-1)!a!}{a \cdot b!}$

Which statement is true?

- i) The expression is equal to  $\frac{(b+1)!}{ab}$
  - ii) The expression is equal to  $\frac{(b-1)!(b+1)}{a}$
- a. only i is true
  - b. only ii is true
  - c. both i and ii are true
  - d. neither i nor ii are true

19. Consider the equation  $y = \frac{ax-b}{x+c}$  ( $a, b, c \neq 0$ ).

Which statement is true?

- i) The function has a vertical asymptote at  $x = c$
  - ii) As  $x$  gets large, the curve approaches the horizontal line  $y = a$
- a. only i is true
  - b. only ii is true
  - c. both i and ii are true
  - d. neither i nor ii are true

20. Consider the equation  $y = 4ax^2 + a$  ( $a > 0$ ).

Which statement is true?

- i) There is exactly one  $y$ -intercept
  - ii) There are exactly two  $x$ -intercepts
  - iii) There is exactly one  $x$ -intercept
- a. only i is true
  - b. only ii is true
  - c. only iii is true
  - d. both i and ii are true
  - e. none of the statements are true

21. The period,  $T$ , in seconds, of a pendulum of length  $l$ , in meters, is given by the formula

$T = \sqrt{\frac{l}{g}}$ , where  $g = 9.8m/sec^2$ . What is the length of the pendulum that has a period of

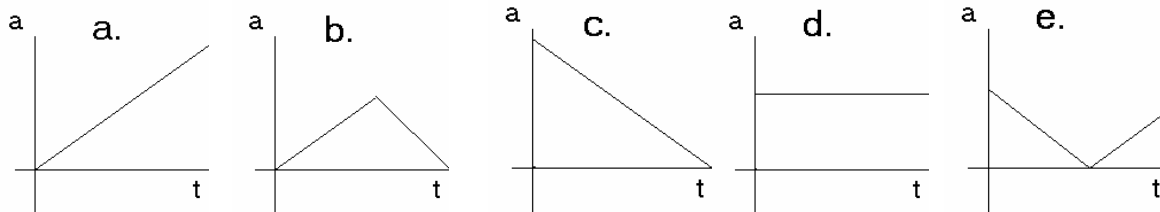
2.25 seconds?

- a. 49.6125 m
- b. 22.05 m
- c. 216.09 m
- d. 0.51658 m
- e. 0.22959 m

22. Spatial Solutions has determined that the equation  $C(x) = 35x + 105$  represents the cost, in dollars, of producing  $x$  storage units. The company decides to sell each unit for \$50 so the company's revenue can be found using  $R(x) = 50x$ . A company's profit,  $P(x)$ , can be modeled by subtracting its cost function from its revenue function. Spatial Solutions profit function is

- a.  $P(x) = 15x + 105$
- b.  $P(x) = 15x - 105$
- c.  $P(x) = 85x + 105$
- d.  $P(x) = 85x - 105$
- e.  $P(x) = 25x - 105$

23. A car accelerates uniformly from 0 to 60 miles per hour in 15 seconds. Which sketch best represents the graph of acceleration verses time for the motion of the car?



24. George invests a certain amount of money in the stock market. After his investment increases by 10%, he takes out \$150 and sets it aside. His remaining investment then decreases by 10%. If George's assets (his investment plus the \$150 set aside) shows a net increase of 4%, by how much have his assets increased?

- a. \$6
- b. \$10
- c. \$12
- d. \$16
- e. \$20

25. The height of a projectile is governed by the equation  $h(t) = d + vt - at^2$ , where  $t$  is time (seconds),  $d$  is the initial height (ft),  $v$  is the initial velocity (ft/sec), and  $a$  is the acceleration due to gravity (ft/sec<sup>2</sup>). If a projectile is fired from an initial height of 2 yards with an initial velocity of 170 ft/sec, how many seconds after it is fired will it hit the ground? (use 32 ft/sec<sup>2</sup> as the acceleration due to gravity.)

- a. less than 4 seconds after it is fired
- b. between 4 and 4.5 seconds after it is fired
- c. between 4.5 and 5 seconds after it is fired
- d. between 5 and 5.5 seconds after it is fired
- e. more than 5.5 seconds after it is fired

26. Consider the following equation:  $h(x) = \frac{3x^2 - 2}{x^2 - 8x - 20}$

Which statement is true?

- i)  $h(x)$  is a continuous function
  - ii)  $h(x)$  has three asymptotes
  - iii)  $h(x)$  has a local maximum at  $x = 0$
- a. All are true
  - b. Only i is true
  - c. Only ii is true
  - d. Only iii is true
  - e. Only ii and iii are true

27. The number of years  $n$  for a piece of machinery to depreciate to a known salvage value can be found using the formula

$$n = \frac{\log_5 s - \log_5 i}{\log_5 (1 - d)}$$

where  $s$  is the salvage value of the machinery,  $i$  is its initial value, and  $d$  is the annual rate of depreciation. Use this formula to determine the salvage value of a piece of machinery after five years given an initial value of \$90,000, and an annual rate of depreciation of 0.20 (20%).

- a. \$27,465.82
- b. \$43.91
- c. \$0.00
- d. \$33.59
- e. \$29,491.20

28. If  $2a - 4b = 128b^3 - 16a^3$  and  $a \neq 2b$ , find  $a^2 + 2ab + 4b^2$

- a.  $-1/8$
- b.  $-1/2$
- c.  $1/2$
- d.  $1/8$
- e. 2

29. Consider the following functions  $f(x) = \sqrt{x}$        $g(x) = 2x - 7.5$   
 $h(x) = x^2$        $k(x) = 0.5x + 3.75$

Which statement is true?

- i)  $f(h(g(x))) = g(x)$
  - ii)  $g(k(x)) = k(g(x))$
  - iii)  $f(x)$  and  $h(x)$  are inverse functions
- a. Only i and ii are true.
  - b. Only ii and iii are true
  - c. Only i and iii are true
  - d. Only i is true.
  - e. Only ii is true.

30. If  $a$ ,  $b$ ,  $c$ , and  $d$  are nonzero numbers such that  $c$  and  $d$  are solutions of  $x^2 + ax + b = 0$  and  $a$  and  $b$  are solutions of  $x^2 + cx + d = 0$ , find  $a + b + c + d$ .

- a. -2
- b. -1
- c. 0
- d. 1
- e. 2

---

## SHORT ANSWER

Place the answer in the appropriate space.

66. Consider the system of equations

$$\begin{cases} 5m + 7n = 506 \\ 8m + 12n = 836 \end{cases}$$

If  $(m, n)$  is the solution to the system, then what is the value of  $m + n$  ?

67. If one car is one mile behind another car traveling at a constant rate of 65 miles per hour on an interstate highway with plenty of open road ahead. What is the minimum speed necessary for the first car to travel in order to overtake the second car in ten minutes?

68. The mean of three numbers is ten more than the least of the three and fifteen less than the greatest of the three. If the median of the three numbers is 5, find their sum.

69. Consider the geometric series with the terms  $a_1 = 5$  and  $a_3 = 25.3125$ . Determine which term in the series is equal to 183,842,343,585.

70. The solution of the equation  $3^{x-5} = 5^{3-x}$  can be expressed in the form  $\log_a b$ . What then is the sum of  $a$  and  $b$ ?

71. Determine the sum of the coefficients and constant term of the quadratic function that best models the following data.

$x$	-2	1	2	4
$f(x)$	-45	9	19	27