

Exam

Name \_\_\_\_\_

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

1) Find the slope of the line with equation  $3y + 2 = 5x - 2y$ ?

A) 1

B) 5

C)  $\frac{5}{3}$

D)  $-\frac{1}{2}$

Answer: A

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

2) Find the slope of the line with the equation  $y = 4 - 5x$ .

Enter just an integer.

Answer: -5

3) Find the slope of the line with the equation  $2x + 4y = 5$ .

Enter just a fraction of form  $\frac{a}{b}$  in lowest terms.

Answer:  $-\frac{1}{2}$

4) Find the slope of the line with equation  $2x + 4 = 2(2y + 3)$ .

Enter just a fraction of form  $\frac{a}{b}$  in lowest terms.

Answer:  $\frac{1}{2}$

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

5) Consider 2 lines each having slope  $\frac{4}{3}$ , one passing through the point  $(-1, 2)$  and the other through  $(3, 5)$ . Which c

the following is/are true?

(I) They are parallel.

(II) They are the same line.

(III) They cross the x-axis at the same point.

(IV) They intersect at the point  $(0, 3)$ .

A) I

B) IV

C) II

D) III

E) none of these

Answer: A

6) Which of the following is/are true of the lines  $2x - 5y = -15$  and  $5x + 2y = 6$ ?

- (I) They are parallel.
- (II) They are perpendicular.
- (III) They cross the x-axis at the same point.
- (IV) They cross the y-axis at the same point.

- A) I
- B) II and III
- C) II
- D) II and IV
- E) none of these

Answer: D

Find the slope and the y-intercept of the line.

7)  $2x - 5y = 14$

- A)  $m = -\frac{5}{2}$ ,  $b = -5$
- B)  $m = \frac{2}{5}$ ,  $b = -\frac{14}{5}$
- C)  $m = \frac{5}{2}$ ,  $b = -\frac{14}{5}$
- D)  $m = -\frac{2}{5}$ ,  $b = 14$

Answer: B

8)  $x + 4y = 5$

- A)  $m = 4$ ,  $b = 20$
- B)  $m = -\frac{1}{4}$ ,  $b = \frac{5}{4}$
- C)  $m = -4$ ,  $b = 0$
- D)  $m = \frac{1}{4}$ ,  $b = 20$

Answer: B

9)  $x = 2y - 5$

- A)  $m = -\frac{1}{2}$ ,  $b = -\frac{5}{2}$
- B)  $m = \frac{1}{2}$ ,  $b = \frac{5}{2}$
- C)  $m = 2$ ,  $b = -5$
- D)  $m = -2$ ,  $b = 5$

Answer: B

10)  $y = 3x - 7$

- A)  $m = 3$ ,  $b = -7$
- B)  $m = 3$ ,  $b = 7$
- C)  $m = 7$ ,  $b = 3$
- D)  $m = -7$ ,  $b = 3$

Answer: A

11)  $y = -\frac{1}{2}x + 6$

- A)  $m = \frac{1}{2}$ ,  $b = -6$
- B)  $m = -\frac{1}{2}$ ,  $b = -6$
- C)  $m = \frac{1}{2}$ ,  $b = 6$
- D)  $m = -\frac{1}{2}$ ,  $b = 6$

Answer: D

12)  $x + y = 1$

- A)  $m = 1$ ,  $b = 1$
- B)  $m = -1$ ,  $b = -1$
- C)  $m = 1$ ,  $b = -1$
- D)  $m = -1$ ,  $b = 1$

Answer: D

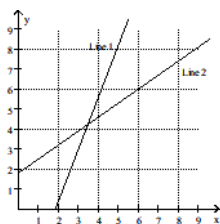
13)  $y = 6$

- A)  $m = \text{undefined}$ ,  $b = \text{none}$
- B)  $m = 0$ ,  $b = 6$
- C)  $m = 0$ ,  $b = \text{none}$
- D)  $m = \text{undefined}$ ,  $b = 6$

Answer: B

For the pair of lines in the following figure, determine the one with the greater slope.

14)



A) Line 1

B) Line 2

Answer: A

15) Find the equation of the following line: Parallel to  $y = -5x + 8$ ;  $(3, -4)$  on line.

A)  $y = -5x + 11$

B)  $y = -\frac{1}{5}x - \frac{11}{5}$

C)  $y = 5x - 11$

D)  $y = -5x - 11$

Answer: A

16) Find the equation of the following line: Perpendicular to  $y = \frac{1}{3}x + 3$ ;  $(2, 3)$  on line.

A)  $y = 3x - 9$

B)  $y = -3x - 9$

C)  $y = -3x + 9$

D)  $y = -\frac{1}{3}x - 3$

Answer: C

17) Find the equation of the following line: Parallel to  $y = -\frac{1}{2}x + 6$ ;  $(2, 4)$  on line.

A)  $y = \frac{1}{2}x - 5$

B)  $y = -\frac{1}{2}x + 5$

C)  $y = -2x - 10$

D)  $y = -\frac{1}{2}x - 5$

Answer: B

18) Find the equation of the following line: Parallel to  $5x + y - 3 = 0$ ;  $(3, 5)$  on line.

A)  $y = -5x - 20$

B)  $y = -\frac{1}{5}x - 4$

C)  $y = 5x - 20$

D)  $y = -5x + 20$

Answer: D

19) Find the equation of the following line: Perpendicular to  $-4x + y - 5 = 0$ ;  $(4, 2)$  on line.

A)  $y = \frac{1}{4}x - 3$

B)  $y = -\frac{1}{4}x - 3$

C)  $y = -4x - 12$

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

Answer: D

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

- 20) Find the equation of the following line: Slope is 3; y-intercept is 5.

Enter your answer in slope-intercept form.

Answer:  $y = 3x + 5$

- 21) Find the equation of the following line: (2, 3) and (4, 6) on line.

Enter your answer in slope-intercept form.

Include both the slope and the intercept in your equation.

Answer:  $y = \frac{3}{2}x$

- 22) Find the equation of the following line:  $\left(\frac{1}{2}, 1\right)$  and (2, 0) on line.

Enter your answer in point-slope form using  $\left(\frac{1}{2}, 1\right)$ .

Answer:  $y - 1 = -\frac{2}{3}\left(x - \frac{1}{2}\right)$

- 23) Find the equation of the following line: Parallel to  $5x - 3y = 7$ ; (-1, 3) on line.

Enter your answer in point-slope form with any fractions in the form of  $\frac{a}{b}$  in lowest terms.

Answer:  $y - 3 = \frac{5}{3}(x + 1)$

- 24) Find the equation of the following line: Perpendicular to  $5x = 7 - 8y$ ; y-intercept is -2.

Enter your answer in slope-intercept form with any fractions in the form  $\frac{a}{b}$  in lowest terms.

Answer:  $y = \frac{8}{5}x - 2$

- 25) Find the equation of the following line: Perpendicular to  $3y - \frac{5}{2}x = 1$ ; y-intercept is  $\frac{1}{3}$ .

Enter your answer in slope-intercept form.

Answer:  $y = -\frac{6}{5}x + \frac{1}{3}$

- 26) Find the equation of the following line: Slope is  $-\frac{5}{7}$ ;  $\left(-\frac{1}{2}, 1\right)$  on line.

Enter your answer in point-slope form.

Answer:  $y - 1 = -\frac{5}{7}\left(x + \frac{1}{2}\right)$

- 27) Find the equation of the following line:  $\left(\frac{3}{2}, -4\right)$  and  $\left(-\frac{3}{2}, -4\right)$  on the line (in the xy-plane).

Enter your equation in the simplest possible form.

Answer:  $y = -4$

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

Write an equation for the line described.

28) Through (2, -2) and (0, -5)

A)  $y = -\frac{4}{5}x - 5$

B)  $y = \frac{3}{2}x - 5$

C)  $y = \frac{4}{5}x - 5$

D)  $y = -\frac{3}{2}x - 5$

Answer: B

29) Through (-9, 0) and (-6, -4)

A)  $y = \frac{4}{3}x - 12$

B)  $y = \frac{9}{2}x + 23$

C)  $y = -\frac{9}{2}x + 23$

D)  $y = -\frac{4}{3}x - 12$

Answer: D

30) Through (2, -5) and (-5, -7)

A)  $y = -\frac{2}{7}x - \frac{39}{7}$

B)  $y = \frac{7}{2}x + \frac{21}{2}$

C)  $y = \frac{2}{7}x - \frac{39}{7}$

D)  $y = -\frac{7}{2}x + \frac{21}{2}$

Answer: C

31) Through (-10, 9) and (6, 9)

A)  $\frac{3}{5}x - 10y = 0$

B)  $\frac{5}{3}x + 6y = 0$

C)  $x = -10$

D)  $y = 9$

Answer: D

32) y-intercept -7, x-intercept -6

A)  $y = \frac{6}{7}x - 6$

B)  $y = -\frac{6}{7}x - 6$

C)  $y = -\frac{7}{6}x - 7$

D)  $y = \frac{7}{6}x - 7$

Answer: C

33) Passes through (5, 1) with slope 1

A)  $y = x + 6$

B)  $y = -x - 4$

C)  $y = x + 4$

D)  $y = x - 4$

Answer: D

34) Passes through (4, 3) with slope  $-\frac{3}{5}$

A)  $y = -\frac{3}{5}x + \frac{5}{27}$

B)  $y = -\frac{3}{5}x + \frac{27}{5}$

C)  $y = -\frac{3}{5}x - \frac{27}{5}$

D)  $y = -\frac{5}{3}x - \frac{5}{27}$

Answer: B

35) Passes through (7, 8) and has slope 0

A)  $y = 7$

B)  $y = 8$

C)  $x = 8$

D)  $x = 7$

Answer: B

36) Passes through (-8, -4) and has no slope

A)  $x = -4$

B)  $y = -8$

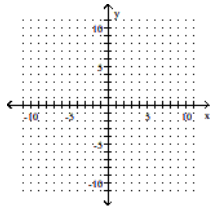
C)  $x = -8$

D)  $y = -4$

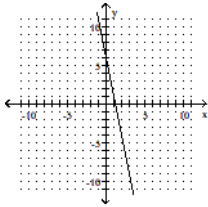
Answer: C

Sketch the graph of the line by using the given point and the slope of the line.

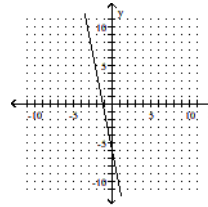
37) Through  $(0, 6)$ ,  $m = -5$



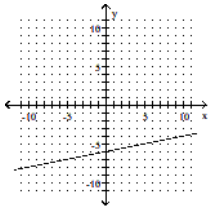
A)



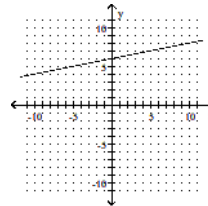
B)



C)

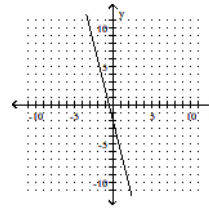
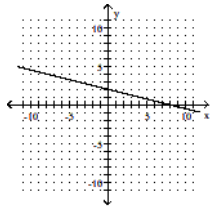
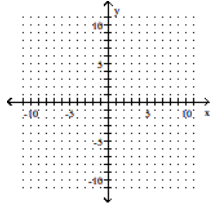


D)

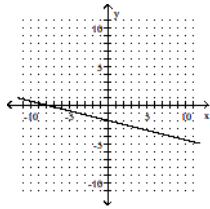


Answer: A

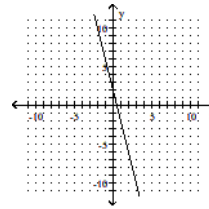
38) Through  $(8, 0)$ ,  $m = -\frac{1}{4}$



A)



B)

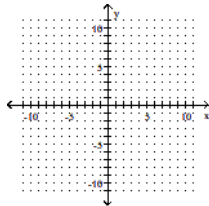


C)

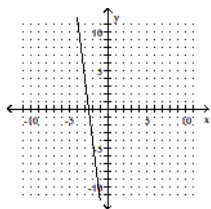
Answer: A

D)

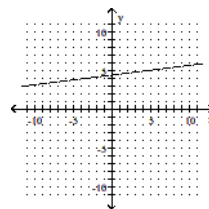
39) Through  $(-3, 4)$ ,  $m = -8$



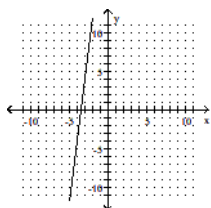
A)



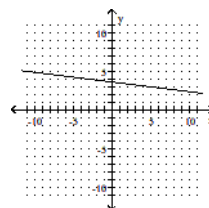
B)



C)

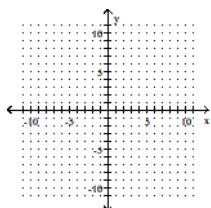


D)



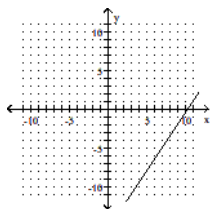
Answer: A

40) Through  $(-5, -8)$ ,  $m = \frac{3}{2}$

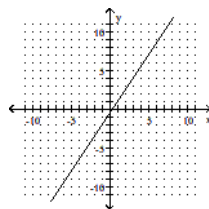




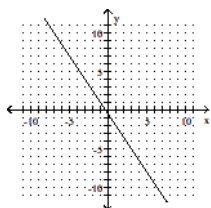
A)



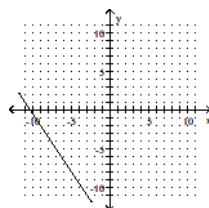
B)



C)

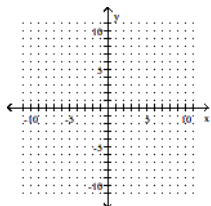


D)

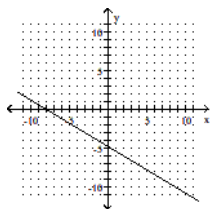


Answer: B

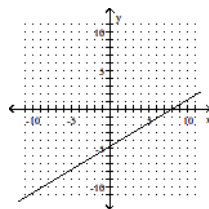
41) Through  $(-2, -6)$ ,  $m = -\frac{3}{5}$



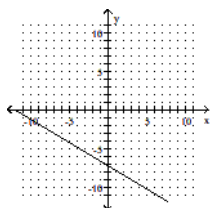
A)



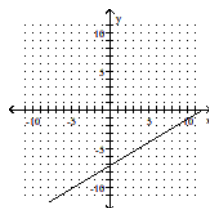
B)



C)

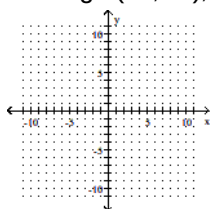


D)

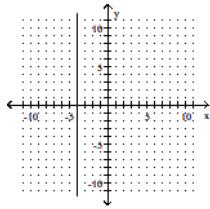


Answer: C

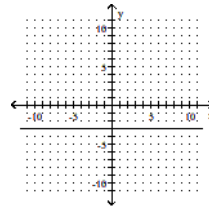
42) Through  $(-3, -5)$ ,  $m = 0$



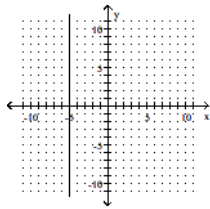
A)



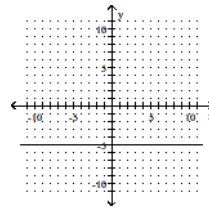
B)



C)



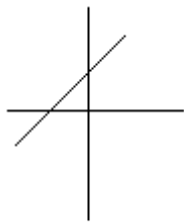
D)



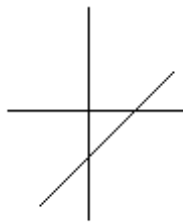
Answer: D

43) Each of the lines (I), (II), (III), and (IV) in the figure below is the graph of one of the equations (i), (ii), (iii), and (iv), each equation with its graph.

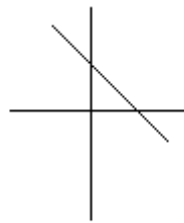
(a)  $x + y = 3$       (b)  $x - y = 3$       (c)  $x + y = -3$       (d)  $x - y = -3$



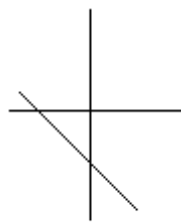
(I)



(II)



(III)



(IV)

A) (a) II  
(b) III  
(c) I  
(d) IV

B) (a) III  
(b) II  
(c) IV  
(d) I

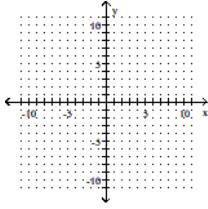
C) (a) I  
(b) II  
(c) III  
(d) IV

D) (a) IV  
(b) III  
(c) II  
(d) I

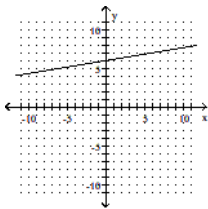
Answer: B

Find the equation and sketch the graph of the following line.

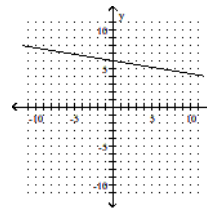
44) With slope  $\frac{1}{6}$  and y-intercept (0, 6)



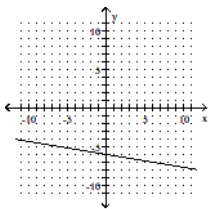
A)  $y = \frac{1}{6}x + 6$



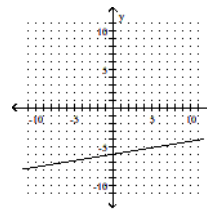
B)  $y = \frac{1}{6}x + 6$



C)  $y = \frac{1}{6}x - 6$



D)  $y = \frac{1}{6}x - 6$



Answer: A

Solve the problem.

- 45) Refer to a line of slope  $m$ . If you begin at a point on the line and move  $h$  units in the  $x$ -direction, how many units must you move in the  $y$ -direction to return to the line?

$$m = \frac{5}{4}, h = \frac{1}{6}$$

- A)  $\frac{5}{6}$                       B)  $\frac{5}{24}$                       C)  $\frac{1}{6}$                       D)  $\frac{24}{5}$

Answer: B

- 46) A line is specified by giving the slope and a point on the line. The first coordinate of another point is given. With deriving the equation of the line, find the second coordinate of the point.

Slope is  $-1$ ,  $(2, 3)$  is on line. Find  $(4, \underline{\hspace{1cm}})$ .

- A)  $(4, 3)$                       B)  $(4, -1)$                       C)  $(4, 1)$                       D)  $(4, 5)$

Answer: C

- 47) The average value of a certain type of automobile was \$15,300 in 1993 and depreciated to \$6660 in 1996. Let  $y$  be the average value of the automobile in the year  $x$ , where  $x = 0$  represents 1993. Write a linear equation in slope-intercept form that models the value of the automobile,  $y$ ,  $x$  years after 1993.

- A)  $y = -\frac{1}{2880}x - 6660$                       B)  $y = -2880x + 15,300$   
C)  $y = -2880x - 1980$                       D)  $y = -2880x + 6660$

Answer: B

Solve the problem.

- 48) In a certain city, the cost of a taxi ride is computed as follows: There is a fixed charge of \$2.80 as soon as you get in the taxi, to which a charge of \$2.10 per mile is added. Find a linear equation that can be used to determine the cost,  $C$ , of an  $x$ -mile taxi ride.

- A)  $C = 2.10x + 2.80$                       B)  $C = 4.90x$                       C)  $C = 2.80x + 2.10$                       D)  $C = 3.40x$

Answer: A

- 49) After two years on the job, an engineer's salary was \$45,000. After seven years on the job, her salary was \$57,500. Let  $y$  represent her salary after  $x$  years on the job. Assuming that the change in her salary over time can be approximated by a straight line, give an equation for this line in the form  $y = mx + b$ .

- A)  $y = 12,500x + 20,000$                       B)  $y = 2500x + 40,000$   
C)  $y = 12,500x + 45,000$                       D)  $y = 2500x + 45,000$

Answer: B

- 50) The cost of owning a home includes both fixed costs and variable utility costs. Assume that it costs \$4649 per month for mortgage and insurance payments and it costs an average of \$2.05 per unit for natural gas, electricity, and water usage. Determine a linear equation that computes the annual cost of owning this home if  $x$  utility units are used.

- A)  $y = -2.05x + 4649$                       B)  $y = -2.05x + 55,788$                       C)  $y = 2.05x + 55,788$                       D)  $y = 2.05x + 4649$

Answer: C

- 51) A shoe company will make a new type of shoe. The fixed cost for the production will be \$24,000. The variable cost will be \$37 per pair of shoes. The shoes will sell for \$105 for each pair. What is the profit if 600 pairs are sold?

- A) \$16,800                      B) \$61,200                      C) \$64,800                      D) \$40,800

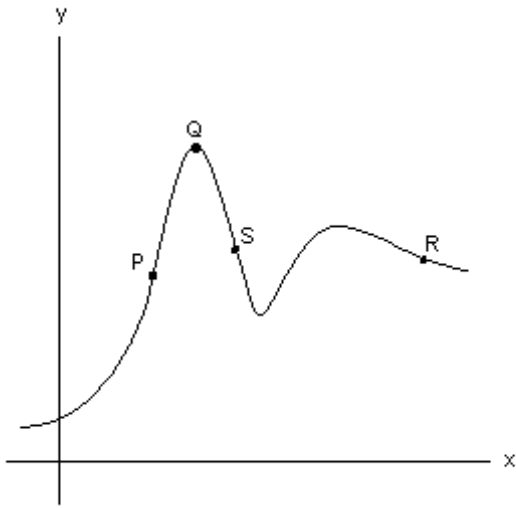
Answer: A

- 52) On a hot day, a child can sell 31 cups of lemonade if she charges \$1.00 per cup. If she raises the price to \$1.50 she will sell 24 cups. Let  $f(x)$  denote the number of cups of lemonade sold per day when the price is  $x$  dollars. Assume that  $f(x)$  is a linear function of  $x$ . How many cups will the child sell if she sets the price to \$1.75 per cup? (If necessary, round to the nearest whole cup.)

A) 19 cups                      B) 24 cups                      C) 21 cups                      D) 18 cups

Answer: C

Referring to the graph below, assign one of the following descriptors to the point: large positive slope, small positive slope, zero slope, small negative slope, large negative slope.



- 53) P

A) small positive slope                      B) small negative slope  
C) large negative slope                      D) large positive slope

Answer: D

- 54) Q

A) small positive slope                      B) small negative slope  
C) zero slope                      D) large negative slope

Answer: C

- 55) S

A) large negative slope                      B) small negative slope  
C) large positive slope                      D) zero slope

Answer: A

- 56) R

A) zero slope                      B) large negative slope  
C) small negative slope                      D) small positive slope

Answer: C

Solve the problem.

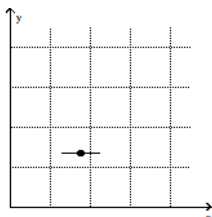
- 57) Find the slope of the curve  $y = x^6$  at  $x = -3$ .

A) slope = 1458                      B) slope = -4374                      C) slope = 4374                      D) slope = -1458

Answer: D

Estimate the slope of the curve at the designated point.

58)



A) 1

B) -1

C) undefined

D) 0

Answer: D

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

59) Find the slope of the tangent line to the graph of  $y = x^2$  at the point  $(0.9, 0.81)$  and write the equation of the tangent line.

Enter your answer exactly as just the equation in standard point-slope form.

Answer:  $y - .81 = 1.8(x - .9)$

60) Find the slope of the tangent line to the graph of  $y = x^2$  at the point  $\left(\frac{7}{6}, \frac{49}{36}\right)$  and write the equation of the tangent line.

Enter your answer exactly as just the equation in standard point-slope form. Use all fractions of form  $\frac{a}{b}$  in lowest terms.

Answer:  $y - \frac{49}{36} = \frac{7}{3}\left(x - \frac{7}{6}\right)$

61) Find the slope of the tangent line to the curve  $y = \sqrt[3]{x^2}$  at the point  $(8, 4)$ , and write the equation of this line.

Enter your answer as just the equation of the line in standard point-slope form using only fractions of form  $\frac{a}{b}$  in lowest terms or integers.

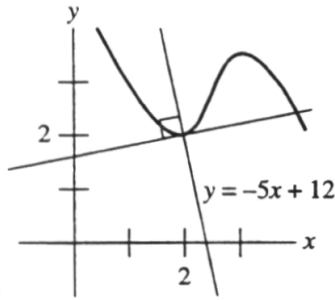
Answer:  $y - 4 = \frac{1}{3}(x - 8)$

62) Find all points at which the tangent line to the graph of  $y = x^3$  is parallel to the line  $y = 27x + 5$ .

Enter your answer in the form:  $(a, b), (c, d)$   
where  $a > c$

Answer:  $(3, 27), (-3, -27)$

63) Consider the curve  $f(x)$  in the accompanying sketch.



Find the slope of the tangent line at the point where  $x = 2$ .  
Enter your answer as just a fraction or an integer.

Answer:  $\frac{1}{5}$

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

64) Which of the following lines is/are parallel to the tangent line of the graph of  $y = -x^3$  at the point where  $x = 1$  and the slope of the tangent line is  $-3x^2$ .

- (I)  $y = -3x + 1$
- (II)  $y = 3x + 1$
- (III)  $y = -3x - 4$
- (IV)  $y = 3x + 1$
- A) (III) and (IV)
- B) (I) and (III)
- C) (I) and (II)
- D) (II) and (III)
- E) none of these

Answer: B

65) If  $(x, y)$  is a point on the parabola  $y = 3x^2$ , then the tangent line to  $y = 3x^2$  passing through  $(x, y)$  has slope  $6x$ .

Find the equation of the line tangent to  $y = 3x^2$  through the point  $(-2, 12)$ .

- A)  $y = -12x - 12$
- B)  $y = -2x + 12$
- C)  $y = 12x + 6$
- D)  $y = 6x + 12$

Answer: A

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

66) Find all points on the graph of  $y = x^3$  where the curve has slope 12. The slope of the tangent line to the graph is  $3x^2$ .

Enter your answer exactly in the form:  $(a, b), (c, d)$  where  $a > c$ .

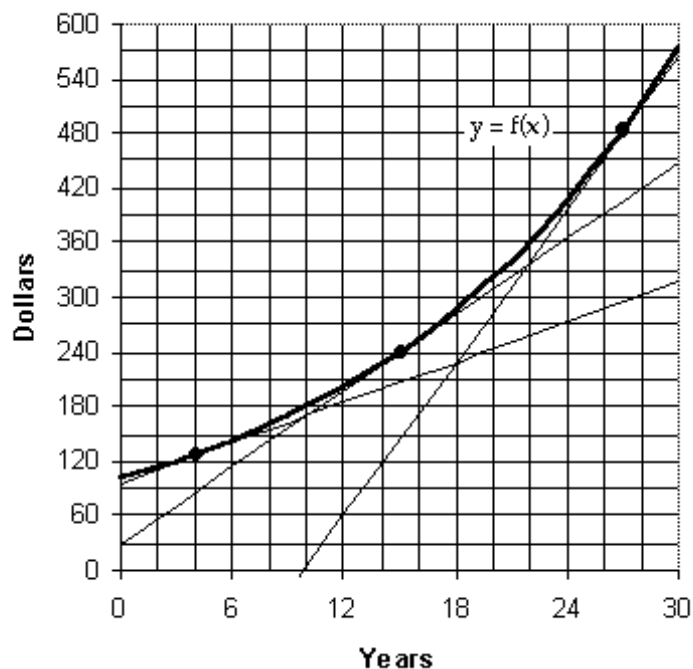
Answer:  $(2, 8), (-2, -8)$



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

Solve the problem.

- 67) One hundred dollars is deposited in a savings account at 6% interest compounded continuously. The function defined by  $f(x)$  shown in the figure gives the balance in the account after  $x$  years. At what rate (in dollars per year) is the balance growing after 27 years?



A)  $\approx \$28/\text{year}$

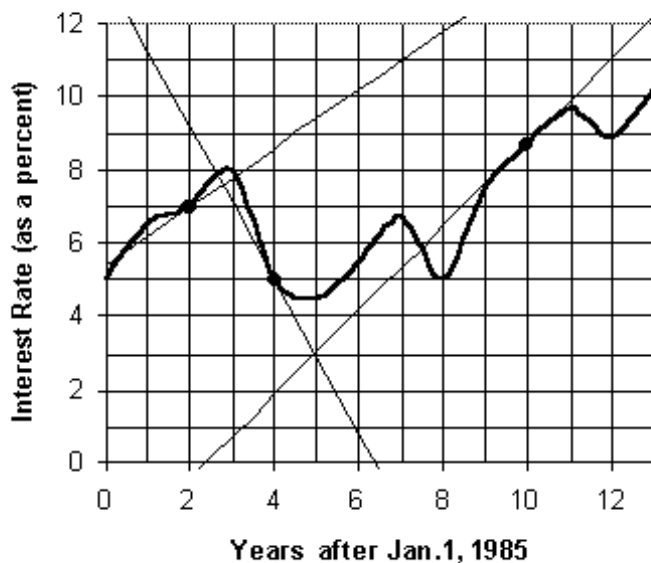
B)  $\approx \$14/\text{year}$

C)  $\approx \$8/\text{year}$

D)  $\approx \$7/\text{year}$

Answer: A

- 68) Refer to the figure, where  $f(t)$  is the interest rate (as a percent) on a 6-month certificate of deposit  $t$  years after January 1, 1985. The straight lines are tangent to the graph of  $y = f(t)$  at  $t = 2$ ,  $t = 4$ , and  $t = 10$ . How fast was the interest rate changing on January 1, 1987?



A)  $\approx 0\%/year$

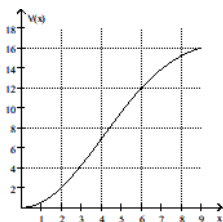
B)  $\approx 2\%/year$

C)  $\approx 1\%/year$

D)  $\approx -2\%/year$

Answer: C

- 69) The graph shows the amount of potential energy  $V(x)$  (in arbitrary energy units) stored in a large rubber band that is stretched a distance of  $x$  inches beyond its relaxed length.



The magnitude of the force required to hold the rubber band at the position  $x = a$  is equal to the rate of change of potential energy with respect to  $x$ , evaluated at the point  $x = a$ . Estimate the force required to hold the band at a stretched position  $x = 2$ . (Hint: the force in this problem has units of "energy units per inch".)

A) -0.3 energy units per inch

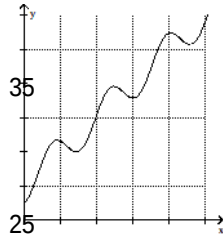
B) 1.9 energy units per inch

C) 3.0 energy units per inch

D) 3.7 energy units per inch

Answer: B

70) The graph below shows the sales (in thousands of dollars) at a certain company over the course of 4 years.



15

At the beginning of which year were the sales rising the most?

A) 1

B) 2

C) 3

D) 4

Answer: B

71) Find the derivative of  $f(x) = x^{5/2}$ .

A)  $5x^{3/2}$

B)  $\frac{5}{2}x^{3/2}$

C)  $\frac{5}{2}x^{-1/2}$

D)  $\frac{2}{5}x^{-1/2}$

Answer: B

72) Find the derivative of  $f(x) = \frac{1}{\sqrt[3]{x}}$ .

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

B)  $\frac{2}{3}x^{-4/3}$

C)  $-\frac{1}{3x^{4/3}}$

D) none of these

Answer: C

73) Find the derivative of  $f(x) = 7x - 19$  at  $x = 2$ .

A) 34

B) 7

C) 9

D) 14

Answer: B

74) Find the derivative of  $f(x) = 2\sqrt{x}$  at  $x = 4$ .

A)  $-\frac{1}{2}$

B) -1

C)  $\frac{1}{2}$

D) 2

Answer: C

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

75) Find the derivative of  $f(x) = \frac{1}{x^2}$ .

Enter your answer exactly in the form:  $ax^b$

Answer:  $-2x^{-3}$

76) Find the derivative of  $f(x) = \frac{1}{\sqrt{x}}$ .

Enter your answer exactly in the form:  $ax^b$ . Do not use parentheses.

Answer:  $-\frac{1}{2}x^{-3/2}$

77) Find the derivative of  $f(x) = \frac{5}{x^2}$ .

Enter your answer exactly in the form:  $ax^b$ , where a, b are integers. Do not use parentheses.

Answer:  $-10x^{-3}$

78) Find the derivative of  $f(x) = 4x^{5/4}$ .

Enter your answer in the form:  $ax^b$ , where a, b are either fractions in lowest terms or integers. No parentheses.

Answer:  $5x^{1/4}$

79) Find the derivative of  $f(x) = x^{6/5}$ .

Enter your answer in the form:  $ax^b$ , where a, b are either fractions of the form  $\frac{c}{d}$  or integers. No parentheses.

Answer:  $\frac{6}{5}x^{1/5}$

80) Find the derivative of  $f(x) = x^{4/5}$  at  $x = 32$ .

Enter just a reduced fraction or an integer.

Answer:  $\frac{2}{5}$

81) If  $g(x) = 2x^2 - x + 3$ , compute  $g(1)$  and  $g'(1)$ .

Enter your answer exactly in the form:  $g(1) = a$ ,  $g'(1) = b$  where a, b are integers.

Answer:  $g(1) = 4$ ,  $g'(1) = 3$

82) Determine:  $\frac{dy}{dx}$  if  $y = 4 - 6x$ .

Enter your answer as just an integer.

Answer:  $-6$

83) Determine:  $\frac{dy}{dx}$  if  $y = \frac{x-2}{5}$ .

Enter your answer as just an integer or a reduced fraction.

Answer:  $\frac{1}{5}$

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

Find the derivative.

84)  $y = x^6$

A)  $\frac{dy}{dx} = 6x^6$

B)  $\frac{dy}{dx} = 6x^5$

C)  $\frac{dy}{dx} = x^5$

D)  $\frac{dy}{dx} = x^6$

Answer: B

85)  $f(x) = 6x + 8$

A)  $f'(x) = 6$

B)  $f'(x) = 14$

C)  $f'(x) = 0$

D)  $f'(x) = 6x$

Answer: A

86)  $f(x) = \sqrt[4]{x}$

A)  $f'(x) = 3(3\sqrt{x})$

B)  $f'(x) = -\frac{5}{4}x^{-5/4}$

C)  $f'(x) = \frac{5}{4}x^{5/4}$

D)  $f'(x) = \frac{1}{4}x^{-3/4}$

Answer: D

Find the derivative of  $f(x)$  at the given value of  $x$ .

87)  $f(x) = x^3 + 3$ , at  $x = 8$

A) 195

B) 193

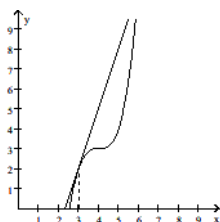
C) 192

D) -192

Answer: C

Use the graph of the curve  $y = f(x)$  to answer the question.

88) The curve  $y = f(x)$  is given below as well as the tangent line at  $x = 3$ . The equation of the tangent line at  $x = 3$  is  $y = 3x - 7$ . Find  $f(3)$  and  $f'(3)$ .



A)  $f(3) = 3$   
 $f'(3) = -3$

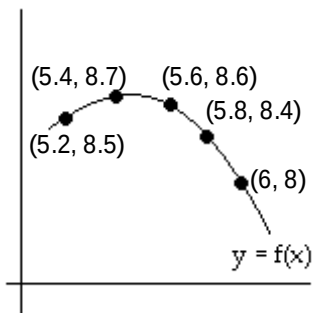
B)  $f(3) = 2$   
 $f'(3) = 3$

C)  $f(3) = 3$   
 $f'(3) = 3$

D)  $f(3) = 2$   
 $f'(3) = 17$

Answer: B

89) Estimate  $f'(6)$ .



A) -2

B) 0.5

C) -0.5

D) 2

Answer: A

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

90) What is the equation of the tangent line to the graph of  $y = x^2$  at the point where  $x = \frac{1}{3}$ ?

Enter your answer in standard point-slope form.

Answer:  $y - \frac{1}{9} = \frac{2}{3}\left(x - \frac{1}{3}\right)$

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

91) Which of the following is the equation of the line tangent to the curve  $y = \sqrt{x}$  at  $x = 9$ ?

(I)  $y = -x - \frac{1}{6}$

(II)  $y = \frac{1}{2}x + 3$

(III)  $y = \frac{1}{6}x + \frac{3}{2}$

(IV)  $y = \frac{1}{2}x^{-1/2} - \frac{1}{6}$

A) III

B) IV

C) I

D) II

E) none of these

Answer: A

Solve the problem.

92) The straight line  $y = \frac{1}{4}x + B$  is tangent to the graph of  $f(x) = 2\sqrt{x}$  at the point where  $x = A$ . Find A and B.

A)  $A = 16$

B)  $A = 16$

C)  $A = 4$

D)  $A = \frac{1}{16}$

$B = \frac{1}{4}$

$B = 4$

$B = 16$

$B = 4$

Answer: B

93) The line  $y = Ax + B$  is tangent to the graph of  $f(x) = x^2$  at the point  $P = (-4, 16)$ . Find A and B.

A)  $A = -8$

B)  $A = 32$

C)  $A = 8$

D)  $A = -8$

$B = -16$

$B = -16$

$B = 48$

$B = 48$

Answer: A

94) If  $f(x) = 2x^2 + 5x$ , find  $\frac{f(x+h) - f(x)}{h}$  and simplify.

- A)  $4x + 5 + 4h^2 + 5h$
- B)  $4x + 5 + 4h$
- C)  $4x + 5xh + h^2 + 5h$
- D)  $4x + 5h + 4h^2$
- E) none of these

Answer: E

95) If  $f(x) = -2x^2 - 3x + 2$ , find  $\frac{f(x+h) - f(x)}{h}$  where  $h \neq 0$ .

- A)  $-4x - 2h - 3$
- B)  $-4x - 1$
- C)  $\frac{-2x^2 - 2h^2 - 3h}{h}$
- D)  $\frac{-2h^2 - 3h + 2}{h}$
- E) none of these

Answer: A

96) If  $f(x) = -x^2 + 2x - 1$ , find  $\frac{f(x+h) - f(x)}{h}$ ,  $h \neq 0$ .

- A)  $\frac{h(-2x - h)}{h}$
- B)  $-2x + 2$
- C)  $-2xh - x^2 + 2h$
- D)  $-2x - h + 2$
- E)  $\frac{h(-h + 2)}{h}$

Answer: D

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

Solve the problem.

97) If  $f(t) = 5t - 4$ , find  $\frac{f(t+h) - f(t)}{h}$  where  $h \neq 0$  and simplify.

Enter your answer as just an integer.

Answer: 5

98) If  $g(t) = -3t^2 + 2t - 3$ , find  $\frac{g(a+h) - g(a)}{h}$  and simplify.

Enter your answer exactly as a polynomial in a in standard form.

Answer:  $-6a + 2 - 3h$

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

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

99)  $f(x) = x^2 - 6x$

A)  $2x + h + 1$

B)  $h - 6$

C)  $2x + h - 6$

D)  $2xh + h - 6x$

Answer: C

100)  $f(x) = 3x^2 + 9x - 14$

A)  $3x + 6 + 6h$

B)  $6x + 9$

C)  $6xh + 9h + 3h^2$

D)  $6x + 3h + 9$

Answer: D

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

Calculate the following limit(s) if they exist.

101)  $\lim_{x \rightarrow 1} (x^3 - 2x + 5).$

Enter just an integer or "does not exist".

Answer: 6

102)  $\lim_{x \rightarrow 0} \frac{(x+1)^{1/2} - 1}{x}$

Enter your answer as just a fraction or an integer, or the words "does not exist".

Answer:  $\frac{1}{2}$

103)  $\lim_{x \rightarrow 1} \frac{x^6 - 1}{x^3 - 1}$

Enter your answer as just an integer or a fraction in lowest terms, or the words "does not exist".

Answer: 2

104)  $\lim_{x \rightarrow 5} \frac{x^2 - 8x + 15}{x^2 - 7x + 10}$

Enter your answer as just a fraction in lowest terms or an integer, or the words "does not exist".

Answer:  $\frac{2}{3}$

105)  $\lim_{x \rightarrow 3} 4x^3$

Enter your answer as an integer.

Answer: 108

106)  $\lim_{x \rightarrow 2} (2x + 2)^2$

Enter your answer as an integer, or "does not exist".

Answer: 36



$$107) \lim_{x \rightarrow 1} [(x+1)^3 (x^2+1)\sqrt{2x+1}]$$

Enter your answer as an integer, or "does not exist".

Answer: 0

$$108) \lim_{x \rightarrow 1} \frac{x^2 - 4x - 5}{x + 1}$$

Enter your answer as a fraction, integer, or "does not exist".

Answer: -6

$$109) \lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x^3 + 1}$$

Enter either a fraction, integer, or "does not exist".

Answer: does not exist

$$110) \lim_{x \rightarrow 0} \frac{1}{x^3 - 1} + 1$$

Enter either a fraction in lowest terms, an integer, or "does not exist".

Answer: 0

$$111) \lim_{x \rightarrow 1} \frac{1}{x^3 - 1} + 1$$

Enter either a fraction, integer, or the words "does not exist"

Answer: does not exist

$$112) \lim_{x \rightarrow 2} \frac{x}{(x^3 + 8)^{-1}}$$

Enter either a fraction, integer, or the words "does not exist".

Answer: 0

$$113) \lim_{x \rightarrow 0} \frac{g(x)}{f(x)} \text{ where } \lim_{x \rightarrow 0} f(x) = -\frac{1}{3} \text{ and } \lim_{x \rightarrow 0} g(x) = \frac{2}{3}.$$

Enter your answer as an integer, fraction in lowest terms, or the words "does not exist".

Answer: -2

$$114) \lim_{x \rightarrow 0} \frac{7}{2f(x) + g(x)} \text{ where } \lim_{x \rightarrow 0} f(x) = -\frac{1}{3} \text{ and } \lim_{x \rightarrow 0} g(x) = \frac{2}{3}.$$

Enter your answer as a fraction, integer, or the words "does not exist".

Answer: does not exist

$$115) \lim_{x \rightarrow 0} \frac{3}{x^2 + 1}$$

Enter just an integer or a fraction.

Answer: 0

116)  $\lim_{x \rightarrow 1} \frac{x^3}{x^3 - 1}$

Enter just an integer or a fraction.

Answer: 1

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

117)  $\lim_{x \rightarrow \infty} \frac{2x^2 + 1}{x^2 + 1}$

A) 2

B)  $\infty$

C) 1

D) 0

Answer: A

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

118) Does  $\lim_{x \rightarrow a} \frac{x - a}{x^2 - a^2}$  (where  $a \neq 0$ ) exist?

Enter your answer as either "yes" or "no" or "does not exist".

Answer: no

119) Let  $f(x) = \frac{x^3 - 9x}{2x + 6}$ . Does  $\lim_{x \rightarrow 3} f(x)$  exist?

Enter your answer as either "yes" or "no" or "does not exist".

Answer: yes

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

120) Determine whether or not the following limit exists. If, so compute the limit.

$\lim_{x \rightarrow 1} \frac{x^2 - 1}{x + 1}$

A) 1

B) 0

C) does not exist

D) -2

E) none of these

Answer: D

121) Determine whether or not the following limit exists. If, so compute the limit.

$\lim_{x \rightarrow 8} \frac{\sqrt{x} - 4}{x^3 + 27}$

A) does not exist

B)  $\sqrt{3} - 4$

C)  $\frac{\sqrt{3} - 4}{54}$

D) 0

E) none of these

Answer: C

122) If  $f(t) = \frac{1}{x^{2/3}}$ , then  $\lim_{h \rightarrow 0} \frac{f(-8+h) - f(-8)}{h}$  equals

A)  $f'(8)$

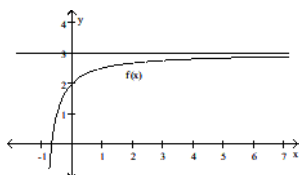
B)  $\frac{1}{48}$

C)  $f'(0)$

D) none of these

Answer: B

Using the graph below, find the given limit.



123)  $\lim_{x \rightarrow \infty} (2f(x) - 1)$

A) 6

B) 5

C) 0

D) 2

Answer: B

124)  $\lim_{x \rightarrow 0} [f(x)]^2$

A) 6

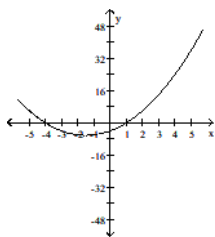
B) 0

C) 9

D) 4

Answer: D

125) For the following function  $g(x)$ , determine whether or not  $\lim_{x \rightarrow 3} g(x)$  exists. If so, give the limit.



A) 3

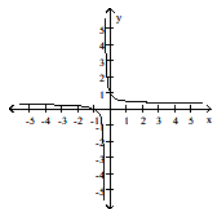
B) 0

C) 14

D) does not exist

Answer: C

126) For the following function  $f(x)$ , determine whether or not  $\lim_{x \rightarrow 0} f(x)$  exists. If so, give the limit.



A)  $\frac{1}{3}$

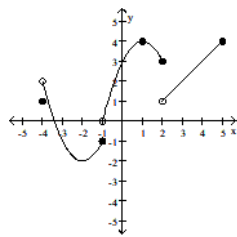
B) 1

C) 0

D) does not exist

Answer: B

127) For the following function  $g(x)$ , determine whether or not  $\lim_{x \rightarrow 2} g(x)$  exists. If so, give the limit.



A) -4

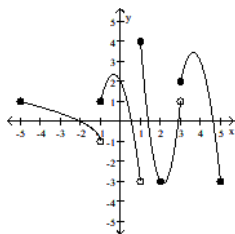
B) 0

C) 4

D) does not exist

Answer: D

128) For the following function  $g(x)$ , determine whether or not  $\lim_{x \rightarrow 1} g(x)$  exists. If so, give the limit.



A) 0

B) 1

C) -1

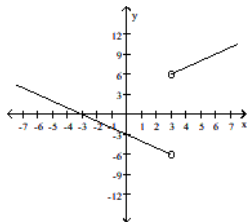
D) does not exist

Answer: D

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

129) For the following function  $f(x)$ , determine whether or not  $\lim_{x \rightarrow 2} f(x)$  exists. If so, give the limit.

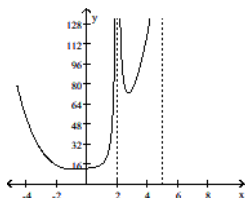
Enter either a real number or enter the words "does not exist".



Answer: does not exist

130) For the following function  $f(x)$ , determine whether or not  $\lim_{x \rightarrow 2} f(x)$  exists. If so, give the limit.

Enter either a real number or the words "does not exist".



Answer: does not exist

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

Give an appropriate answer.

131) Let  $\lim_{x \rightarrow 6} f(x) = -9$  and  $\lim_{x \rightarrow 6} g(x) = -6$ . Find  $\lim_{x \rightarrow 6} [f(x) - g(x)]$ .

- A) -9                                      B) -6                                      C) -3                                      D) -15

Answer: C

132) Let  $\lim_{x \rightarrow 6} f(x) = 8$  and  $\lim_{x \rightarrow 6} g(x) = -4$ . Find  $\lim_{x \rightarrow 6} [f(x) \cdot g(x)]$ .

- A) -32                                      B) 6                                      C) -4                                      D) 4

Answer: A

133) Let  $\lim_{x \rightarrow 1} f(x) = 8$  and  $\lim_{x \rightarrow 1} g(x) = 5$ . Find  $\lim_{x \rightarrow 1} \frac{f(x)}{g(x)}$ .

- A)  $\frac{5}{8}$                                       B) -1                                      C)  $\frac{8}{5}$                                       D) 3

Answer: C

Use the properties of limits to help decide whether the limit exists. If the limit exists, find its value.

134)  $\lim_{x \rightarrow 9} \frac{x^2 - 81}{x - 9}$

- A) 1                                      B) Does not exist                                      C) 18                                      D) 9

Answer: C

135)  $\lim_{x \rightarrow 9} \frac{x^2 + 18x + 81}{x + 9}$

- A) 324                                      B) 18                                      C) Does not exist                                      D) 0

Answer: D

$$136) \lim_{x \rightarrow 3} \frac{x^2 + 7x - 30}{x - 3}$$

A) 7

B) Does not exist

C) 0

D) 13

Answer: D

$$137) \lim_{x \rightarrow 4} \frac{x^2 - 16}{x + 4}$$

A) -4

B) -8

C) 0

D) Does not exist

Answer: B

$$138) \lim_{x \rightarrow 4} \frac{x^2 + 14x + 40}{x + 4}$$

A) 14

B) 6

C) Does not exist

D) 112

Answer: B

$$139) \lim_{x \rightarrow 64} \frac{\sqrt{x} - 8}{x - 64}$$

A)  $\frac{1}{16}$

B)  $\frac{1}{8}$

C) 8

D) 0

Answer: A

$$140) \lim_{x \rightarrow \infty} \frac{5x + 1}{8x - 7}$$

A) 0

B)  $\frac{5}{8}$

C)  $-\frac{1}{7}$

D)  $\infty$

Answer: B

$$141) \lim_{x \rightarrow \infty} \frac{5x + 1}{15x^2 - 7}$$

A)  $\frac{1}{3}$

B)  $\infty$

C) 0

D)  $-\frac{1}{7}$

Answer: C

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

$$142) \text{ Use limits to compute } f'(5) \text{ where } f(x) = \sqrt{3x+1}.$$

Enter just an integer or a fraction in lowest terms.

Answer:  $\frac{3}{8}$

$$143) \text{ Use limits to compute } f'(1) \text{ where } f(x) = \frac{1}{2 - 5x}.$$

Enter just a fraction in lowest terms or an integer.

Answer:  $\frac{5}{9}$

144) Let  $f(x) = \frac{1}{2x}$ . Compute  $f'(3)$  using limits.

Enter a reduced fraction or an integer.

Answer:  $-\frac{1}{18}$

145) Let  $f(x) = (2x + 1)^2$ . Compute  $f'(0)$  using limits.

Enter a reduced fraction or an integer.

Answer: 4

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

Find  $f'(x)$  at the given value of  $x$ .

146)  $f(x) = -12x^2 + 5x$ ; Find  $f'(4)$ .

- A) -48                      B) -91                      C) -83.5                      D) -76

Answer: B

147)  $f(x) = x^2 - 8x + 1$ ; Find  $f'(-2)$ .

- A) -11                      B) -4                      C) 21                      D) -12

Answer: D

148)  $f(x) = x^3 + 5$ ; Find  $f'(4)$ .

- A) 48                      B) 49                      C) -48                      D) 53

Answer: A

149)  $f(x) = -7x^2 + 6x + 6$ ; Find  $f'(5)$ .

- A) -58                      B) -40                      C) -64                      D) 76

Answer: C

Find  $f'(x)$  using limits.

150)  $f(x) = \frac{1}{13x^2}$

- A)  $f'(x) = -\frac{2}{13x}$                       B)  $f'(x) = \frac{2}{13x^3}$                       C)  $f'(x) = -\frac{2}{13x^3}$                       D)  $f'(x) = -\frac{1}{13x^3}$

Answer: C

151)  $f(x) = \frac{2}{x^3}$

- A)  $f'(x) = -\frac{6}{x^2}$                       B)  $f'(x) = \frac{6}{x^4}$                       C)  $f'(x) = \frac{2}{x^4}$                       D)  $f'(x) = -\frac{6}{x^4}$

Answer: D

152)  $f(x) = \sqrt{x+5}$

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

Answer: C



$$153) f(x) = \frac{x}{x-4}$$

$$A) f'(x) = \frac{-4}{x^2}$$

$$B) f'(x) = \frac{-4}{(x-4)^2}$$

$$C) f'(x) = \frac{-4}{x-4}$$

$$D) f'(x) = \frac{4}{(x-4)^2}$$

Answer: B

$$154) f(x) = \sqrt{3x}$$

$$A) f'(x) = \frac{3}{\sqrt{3x}}$$

$$B) f'(x) = \frac{1}{\sqrt{3x}}$$

$$C) f'(x) = 3\sqrt{3x}$$

$$D) f'(x) = \frac{3}{2\sqrt{3x}}$$

Answer: D

The given limit is a definition of  $f'(a)$ . Determine the function  $f(x)$  and the value of  $a$ .

$$155) \lim_{h \rightarrow 0} \frac{\frac{1}{(8+h)^2} - \frac{1}{64}}{h}$$

$$A) f(x) = \frac{1}{x}, a = 8$$

$$B) f(x) = \frac{1}{x^2}, a = 8$$

$$C) f(x) = \frac{1}{x^2}, a = 64$$

$$D) f(x) = \frac{1}{x^2 - x}, a = 64$$

Answer: B

Match the given limit with a derivative. Then find the limit by computing the derivative.

$$156) \lim_{h \rightarrow 0} \frac{\sqrt{16+h} - 4}{h}$$

$$A) \text{ Take } f(x) = \sqrt{x}; \text{ then, the given limit is } f'(4) = \frac{1}{4}.$$

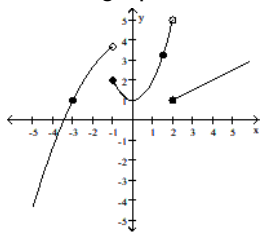
$$B) \text{ Take } f(x) = \sqrt{x}; \text{ then, the given limit is } f'(4) = \frac{1}{8}.$$

$$C) \text{ Take } f(x) = \sqrt{x}; \text{ then, the given limit is } f'(16) = \frac{1}{8}.$$

$$D) \text{ Take } f(x) = \frac{1}{\sqrt{x}}; \text{ then, the given limit is } f'(16) = \frac{1}{8}.$$

Answer: C

157) Use the graph of  $f$  to determine if  $f$  is continuous at  $x = 2$ .

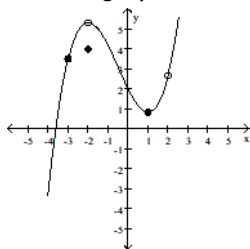


A) yes

B) no

Answer: B

158) Use the graph of  $f$  to determine if  $f$  is continuous at  $x = 2$ .



A) no

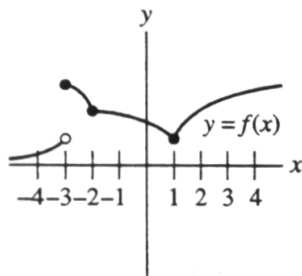
B) yes

Answer: A

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

159) In the graph of  $y = f(x)$ , for which values of  $x$  is  $f(x)$  not continuous?

Enter your answer exactly in the form:  $x = a$  where  $a$  is an integer. (If there is more than one value of  $x$  then enter  $x = a, b, c$ )



Answer:  $x = -3$

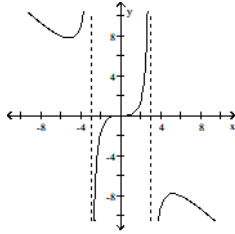
160) Let  $f(x) = \frac{x^3 - 9x}{2x + 6}$ . Is  $f(x)$  continuous at  $x = -3$ ?

Enter your answer as either "yes" or "no" or "does not exist".

Answer: no.

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

161) For the graphed function below, state the  $x$ -values for which the derivative does not exist.



A)  $x = 9, -9$

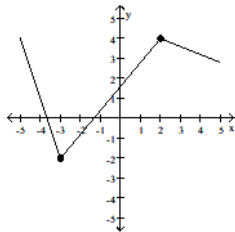
B)  $x = 0, 3, -3$

C)  $x = 3, -3$

D)  $x = 0, 9, -9$

Answer: C

162) For the graphed function below, state the  $x$ -values for which the derivative does not exist.



A)  $x = 2, 4, -3, -2$

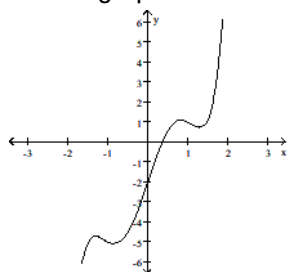
C)  $x = -3, -2$

B)  $x = 2, -3$

D)  $f$  is differentiable for all values of  $x$

Answer: B

163) For the graphed function below, state the x-values for which the derivative does not exist.



A)  $x = 1, -1$

C)  $x = 0$

B)  $x = 0, 1, -1$

D)  $f$  is differentiable for all values of  $x$

Answer: D

164) Which of the following properties are satisfied by the following function:  $f(x) = \begin{cases} x^2 + 1 & \text{for } x < 0 \\ 1 & \text{for } x = 0 \\ 5x + 1 & \text{for } x > 0 \end{cases}$

(I)  $f(x)$  is continuous

(II)  $f(x)$  is differentiable for all  $x$

(III)  $f(x)$  is differentiable at  $x = -2$

A) I and II only

B) I only

C) III only

D) I and III only

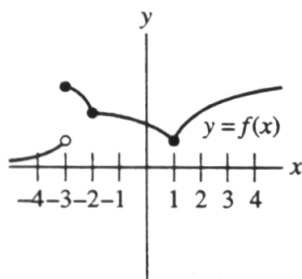
E) I, II, and III

Answer: D

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

165) In the graph of  $y = f(x)$ , for which values of  $x$  is  $f(x)$  not differentiable?

Enter your answer exactly in the form:  $x = a, b, c$  where  $a < b < c$ . (If there are fewer or more terms, separate the with commas in increasing order.)



Answer:  $x = -3, -2, 1$

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

Provide an appropriate response.

166) Is the function given by  $f(x) = 3x + 4$  continuous at  $x = 1$ ? Why or why not?

A) Yes,  $\lim_{x \rightarrow 1} f(x) = f(1)$

B) No,  $\lim_{x \rightarrow 1} f(x)$  does not exist

Answer: A

167) Is the function given by  $f(x) = \sqrt{x}$  continuous at  $x = -7$ ? Why or why not?

A) Yes,  $\lim_{x \rightarrow -7} f(x) = f(-7)$

B) No,  $f(-7)$  does not exist

Answer: B

168) Is the function given by  $f(x) = \begin{cases} x^2 - 3, & \text{for } x < 0 \\ -5, & \text{for } x \geq 0 \end{cases}$  continuous at  $x = -5$ ? Why or why not?

A) Yes,  $\lim_{x \rightarrow -5} f(x) = f(-5)$

B) No,  $\lim_{x \rightarrow -5} f(x) = f(-5)$  does not exist

Answer: A

169) Is the function given by  $f(x) = \begin{cases} -2x - 2, & \text{for } x < 1 \\ 1, & \text{for } x = 1 \\ 6x - 8, & \text{for } x > 1 \end{cases}$  continuous at  $x = 1$ ? Why or why not?

A) Yes,  $\lim_{x \rightarrow 1} f(x) = f(1)$

B) No,  $\lim_{x \rightarrow 1} f(x)$  does not exist

Answer: B

170) Is the function given by  $f(x) = \begin{cases} -4x - 3, & \text{for } x \leq 1 \\ -3x - 4, & \text{for } x > 1 \end{cases}$  continuous at  $x = 1$ ? Why or why not?

A) No,  $\lim_{x \rightarrow 1} f(x)$  does not exist

B) Yes,  $\lim_{x \rightarrow 1} f(x) = f(1)$

Answer: B

171) Is the function given by  $f(x) = \begin{cases} \frac{1}{x+2}, & \text{for } x > -2 \\ x^2 + 2x, & \text{for } x \leq -2 \end{cases}$  continuous at  $x = -2$ ? Why or why not?

A) No,  $\lim_{x \rightarrow -2} f(x)$  does not exist

B) Yes,  $\lim_{x \rightarrow -2} f(x) = f(-2)$

Answer: A

Determine whether the following function is continuous and/or differentiable at the given value of  $x$ .

172)  $f(x) = \begin{cases} x^2 & \text{for } 0 \leq x \leq 2 \\ 4 & \text{for } 2 < x \end{cases}; x = 2$

A) Continuous; differentiable

C) Continuous; not differentiable

B) Not continuous; not differentiable

D) Not continuous; differentiable

Answer: C

173)  $f(x) = \frac{1}{x^8}; x = -1$

A) Not continuous; not differentiable

C) Continuous; differentiable

B) Continuous; not differentiable

D) Not continuous; differentiable

Answer: C

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

- 174) The function  $i(x) = \frac{x^2 + 2x - 35}{x + 7}$  is continuous everywhere except at  $x = -7$ . If possible, define  $f(x)$  at  $x = -7$  in a way that makes  $f(x)$  continuous for all  $x$ .  
Enter your answer exactly as just:  $f(-7) = a$  where  $a$  is an integer or enter the words "not possible".  
Answer:  $f(-7) = -12$

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

The function is defined for all  $x$  except for one value of  $x$ . If possible, define  $f(x)$  at the exceptional point in a way that makes  $f(x)$  continuous for all  $x$ .

- 175)  $f(x) = \frac{x^2 + 9x + 8}{x + 1}; x \neq -1$   
A)  $f(-1) = -1$                       B)  $f(-1) = 7$                       C) Not possible                      D)  $f(-1) = 0$   
Answer: B

Determine the value of  $k$  that makes the function  $f(x)$  continuous at  $x = 0$ .

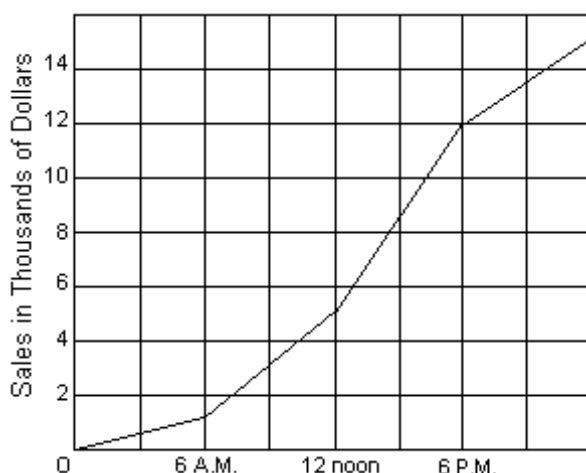
- 176)  $f(x) = \begin{cases} k(x^2 + 8) & \text{for } x \geq 0 \\ 3 + x & \text{for } x < 0 \end{cases}$   
A)  $k = -\frac{3}{8}$                       B)  $k = \frac{3}{8}$                       C)  $k = 11$                       D)  $k = \frac{8}{3}$   
Answer: B

- 177) A company is planning to manufacture a new blender. After conducting extensive market surveys, the research department estimates a weekly demand of 600 blenders at a price of \$50 per blender and a weekly demand of 800 blenders at a price of \$40 per blender. Assuming the demand equation is linear, use the research department's estimates to find the revenue equation in terms of the demand  $x$ .

- A)  $R(x) = 80x - 20x^2$                       B)  $R(x) = 80x - \frac{x^2}{20}$                       C)  $R(x) = 20x + \frac{x^2}{20}$                       D)  $R(x) = 80x - 20$

Answer: B

- 178) The graph below shows the total sales (in thousands of dollars) in a supermarket during a typical 24-hour period.



- (i) Estimate the rate of sales during the period from 6 A.M. to 12 noon.  
 (ii) Which 6-hour interval sees the highest rate of sales and what is this rate?
- A) (i) \$1167/hr  
 (ii) noon to 6pm  
 C) (i) \$667/hr  
 (ii) 12 noon to 6 pm \$1167/hr.
- B) (i) \$167/hr  
 (ii) 6pm to 12 noon  
 D) none of these

Answer: C

Differentiate.

179)  $f(x) = 4x^2 - 4x - 7$

A)  $f'(x) = 8x^2 - 4$

B)  $f'(x) = 8x - 4$

C)  $f'(x) = 4x^2 - 4$

D)  $f'(x) = 4x - 4$

Answer: B

180)  $f(x) = 3x^4 + 5x^3 + 1$

A)  $f'(x) = 12x^3 + 15x^2$

C)  $f'(x) = 4x^3 + 3x^2$

B)  $f'(x) = 4x^3 + 3x^2 - 7$

D)  $f'(x) = 12x^3 + 15x^2 - 7$

Answer: A

181)  $y = (4x^2 + 2x)^2$

A)  $\frac{dy}{dx} = 32x^3 + 24x^2 + 4x$

C)  $\frac{dy}{dx} = 32x^3 + 24x^2 + 8x$

B)  $\frac{dy}{dx} = 64x^3 + 48x^2 + 8x$

D)  $\frac{dy}{dx} = 64x^3 + 24x^2 + 8x$

Answer: B

182)  $y = (x^2 + 4)^3$

A)  $\frac{dy}{dx} = 6x^5 + 40x^3 + 96x$

C)  $\frac{dy}{dx} = 3x^5 + 48x^3 + 96x$

B)  $\frac{dy}{dx} = 6x^5 + 48x^3 + 96x$

D)  $\frac{dy}{dx} = 6x^5 + 24x^3 + 48x$

Answer: B

183)  $y = -6\sqrt{x}$

A)  $\frac{dy}{dx} = -\frac{3}{\sqrt{x}}$

B)  $\frac{dy}{dx} = 3\sqrt{x}$

C)  $\frac{dy}{dx} = \frac{3}{\sqrt{x}}$

D)  $\frac{dy}{dx} = -\frac{6}{\sqrt{x}}$

Answer: A

184)  $y = \sqrt[5]{x^4}$

A)  $\frac{dy}{dx} = \frac{4\sqrt[5]{x}}{5}$

B)  $\frac{dy}{dx} = \frac{4}{5\sqrt[5]{x}}$

C)  $\frac{dy}{dx} = \frac{5\sqrt[4]{x}}{4}$

D)  $\frac{dy}{dx} = \frac{1}{5\sqrt{x}}$

Answer: B

185)  $y = \frac{8}{x} - \frac{x}{2}$

A)  $\frac{dy}{dx} = -\frac{8}{x^2} - \frac{1}{2}$

B)  $\frac{dy}{dx} = -8x - \frac{1}{2}$

C)  $\frac{dy}{dx} = \frac{8}{x^2} - \frac{1}{2}$

D)  $\frac{dy}{dx} = -\frac{8}{x^2} + \frac{x}{2}$

Answer: A

186)  $y = \frac{3}{x^5} - \frac{2}{x}$

A)  $\frac{dy}{dx} = \frac{3}{x^6} + \frac{2}{x^2}$

B)  $\frac{dy}{dx} = -\frac{15}{x^4} - 2x$

C)  $\frac{dy}{dx} = -\frac{15}{x^6} + \frac{2}{x^2}$

D)  $\frac{dy}{dx} = -\frac{15}{x^6} - \frac{2}{x^2}$

Answer: C

187)  $y = -\frac{2}{3x^4}$

A)  $\frac{dy}{dx} = \frac{8}{(3x)^5}$

B)  $\frac{dy}{dx} = \frac{24}{x^5}$

C)  $\frac{dy}{dx} = -\frac{8}{3}x^5$

D)  $\frac{dy}{dx} = \frac{8}{3x^5}$

Answer: D

188)  $f(x) = \frac{2x - (x^2 + 1)^7}{3}$

A)  $f'(x) = 2 - 7(x^2 + 1)^6$

B)  $f'(x) = \frac{2}{3} - \frac{14}{3}x(x^2 + 1)^6$

C)  $f'(x) = \frac{2-x}{3(x^2 + 1)^6}$

D) none of these

Answer: B



$$189) h(x) = \frac{5}{x^3 - 4x^2 + 2}$$

$$A) h'(x) = \frac{-15x^2 + 40x}{(x^3 - 4x^2 + 2)^2}$$

$$C) h'(x) = \frac{3x^2 - 8x}{(x^3 - 4x^2 + 2)^2}$$

$$B) h'(x) = \frac{5}{(3x^2 - 8x)^2}$$

$$D) h'(x) = \frac{15x^2 - 40x}{x^3 - 4x^2 + 2}$$

Answer: A

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

$$190) y = x^{15/19}$$

Enter your answer exactly in the form:  $ax^b$  where a, b are either fractions or integers. No parentheses. No labels.

$$\text{Answer: } \frac{15}{19}x^{-4/19}$$

$$191) y = -\frac{1}{2x^2}$$

Enter your answer exactly in the form:  $ax^b$  where a, b are fractions or integers. No parentheses. If a power or coefficient is "1" then leave it off.

$$\text{Answer: } x^{-3}$$

$$192) y = \frac{5}{x^3}$$

Enter your answer in the form:  $ax^b$ . No parentheses.

$$\text{Answer: } -15x^{-4}$$

$$193) f(x) = \sqrt{x}$$

Enter your answer as just:  $ax^b$ . No parentheses.

$$\text{Answer: } \frac{1}{2}x^{-1/2}$$

$$194) f(x) = \frac{1}{x^2 + 5}$$

Enter your answer as just:  $\frac{P(x)}{(Q(x))^a}$  where P(x) and Q(x) are polynomials in standard form.

$$\text{Answer: } \frac{-2x}{(x^2 + 5)^2}$$

$$195) F(x) = \sqrt{3x + 1}$$

Enter your answer as just:  $aP(x)^b$  where P(x) is a polynomial in standard form.

$$\text{Answer: } \frac{3}{2}(3x + 1)^{-1/2}$$

$$196) y = \frac{1}{x^2 + 1}$$

Enter your answer exactly in the form:  $\frac{P(x)}{(Q(x))^a}$  where P(x) and Q(x) are polynomials in standard form.

$$\text{Answer: } \frac{-2x}{(x^2 + 1)^2}$$

$$197) y = \frac{3}{4x^2 + 1}$$

Enter your answer exactly as just:  $\frac{P(x)}{(Q(x))^a}$  where P(x) and Q(x) are polynomials in standard form.

$$\text{Answer: } \frac{-24x}{(4x^2 + 1)^2}$$

$$198) y = \frac{4}{4x + 1}$$

Enter your answer exactly as just:  $\frac{P(x)}{(Q(x))^a}$  where P(x) and Q(x) are polynomials in standard form.

$$\text{Answer: } -\frac{16}{(4x + 1)^2}$$

$$199) y = 3\sqrt{5x^2 + 2}$$

Enter your answer exactly as:  $\frac{dy}{dx} = \frac{P(x)}{\sqrt{Q(x)}}$  where P(x) and Q(x) are polynomials in standard form.

$$\text{Answer: } \frac{dy}{dx} = \frac{15x}{\sqrt{5x^2 + 2}}$$

$$200) y = \sqrt{x^4 + 1}$$

Enter your answer exactly as:  $\frac{dy}{dx} = \frac{P(x)}{\sqrt{Q(x)}}$  where P(x) and Q(x) are polynomials in standard form.

$$\text{Answer: } \frac{dy}{dx} = \frac{2x^3}{\sqrt{x^4 + 1}}$$

$$201) y = \sqrt{3x^2 + 4x}$$

Enter your answer exactly as:  $\frac{dy}{dx} = \frac{P(x)}{\sqrt{Q(x)}}$  where P(x) and Q(x) are polynomials in standard form.

$$\text{Answer: } \frac{dy}{dx} = \frac{3x + 2}{\sqrt{3x^2 + 4x}}$$

$$202) y = \frac{2}{\sqrt{2x+1}}$$

Enter your answer exactly as:  $\frac{dy}{dx} = a(P(x))^b$  where  $P(x)$  is a polynomial in standard form.  $a, b$  reduced fractions or integers. No parentheses on coefficients or powers.

Answer:  $\frac{dy}{dx} = -2(2x+1)^{-3/2}$

$$203) y = \frac{4}{3x^3 + x^2 + 4}$$

Enter your answer as just:  $\frac{P(x)}{(Q(x))^a}$  where  $P(x)$  and  $Q(x)$  are polynomials in standard form.

Answer:  $\frac{-36x^2 - 8x}{(3x^3 + x^2 + 4)^2}$

$$204) y = \frac{1}{\sqrt{2x+1}}$$

Enter your answer as just:  $\frac{P(x)}{(Q(x))^a}$  where  $P(x)$  and  $Q(x)$  are polynomials in standard form.

Answer:  $\frac{-1}{(2x+1)^{3/2}}$

205) Find the slope of the graph of  $y = (x^2 - 7)^3$  at  $x = 3$ .

Enter just an integer.

Answer: 72

206) Find the slope of the graph of  $f(x) = 1 + 3x - x^2$  at  $x = 5$ .

Enter just an integer.

Answer: -7

207) Find the slope of the graph of  $y = x^9 - 2x + (\sqrt{5-x})^3$  at  $(1, 7)$ .

Enter just an integer.

Answer: 4

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

208) Find the slope of the graph of  $y = \sqrt{2x^2 + 1}$  at the point  $(2, 3)$ .

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

B) 12

C)  $\frac{1}{4}$

D)  $\frac{3}{2}$

E) none of these

Answer: A

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

209) Let  $g(x) = 2x^3 - 5x^2 + 1$ ; find  $g'(3)$ .

Enter just an integer.

Answer: 24

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

210) Find the slope of the tangent line to the curve  $y = \frac{4}{3(x^3 - 2x^2 + 3x - 5)}$  at  $\left(2, \frac{4}{3}\right)$ .

A)  $-\frac{28}{3}$

B)  $\frac{8}{3}$

C)  $\frac{2}{3}$

D)  $-\frac{8}{3}$

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

Answer: A

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

211) Find the slope of the tangent line to the curve  $y = \frac{3}{(x+2)^2}$  at  $x = 3$ .

Enter a reduced fraction only.

Answer:  $-\frac{6}{125}$

212) Find the slope of the tangent line to the curve  $y = 2(x^3 + 4)^2$  at  $x = -1$ .

Enter just an integer.

Answer: 36

213) Find the slope of the tangent line to the curve  $y = 3x^4 + 2x^3$  at  $x = 1$ .

Enter just an integer.

Answer: 18

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

Provide an appropriate response.

214) If  $g(5) = 3$  and  $g'(5) = 7$ , find  $f(5)$  and  $f'(5)$  where  $f(x) = 6[g(x)]^{-2}$ .

A)  $f(5) = 2$ ;

B)  $f(5) = 54$ ;

C)  $f(5) = \frac{2}{3}$ ;

D)  $f(5) = \frac{2}{3}$ ;

$f'(5) = -\frac{28}{9}$

$f'(5) = -28$

$f'(5) = -\frac{28}{9}$

$f'(5) = -14$

Answer: C

215) The tangent line to the curve  $y = x^3 + 6x^2 - 33x + 2$  has slope 3 at two points on the curve. Find the two points.

A)  $(-6, 200)$ ;  $(2, -32)$

B)  $(6, 0)$ ;  $(-2, 0)$

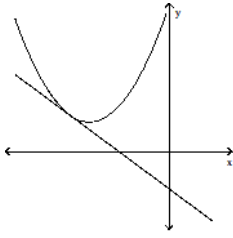
C)  $(6, 200)$ ;  $(-2, -32)$

D)  $(-6, 198)$ ;  $(2, -34)$

Answer: A

216) The straight line in the figure is tangent to the parabola  $y = \frac{1}{2}x^2 + 4x + 10$  at the point  $x = -5$ . Find the value of

b.



$(0, b)$

A)  $b = 2.5$

B)  $b = -2$

C)  $b = -6$

D)  $b = -2.5$

Answer: D

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

217) Find the equation of the tangent line to the curve  $y = \frac{1}{x+2}$  at  $\left(2, \frac{1}{4}\right)$ .

Enter your answer in standard slope-intercept form using reduced fractions. No parentheses.

Answer:  $y = -\frac{1}{16}x + \frac{3}{8}$

218) Find the equation of the tangent line to the curve  $y = \sqrt{x^2 + 5}$  at  $(2, 3)$ .

Enter your answer in standard point-slope form using reduced fractions and integers.

Answer:  $y - 3 = \frac{2}{3}(x - 2)$

219) Find the equation of the tangent line to the curve  $y = 1 + 3x - x^2$  at  $x = 5$ .

Enter your answer in standard slope-intercept form.

Answer:  $y = -7x + 26$

220) Find the equation of the tangent line to the curve  $y = x^3 + 4x^2 + 4$  at  $(1, 9)$ .

Enter your answer in standard slope-intercept form.

Answer:  $y = 11x - 2$

221) Find the equation of the tangent line to the curve  $y = x^3 + 3x - 8$  at  $x = 2$ .

Enter your answer in standard point-slope form.

Answer:  $y - 6 = 15(x - 2)$

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

222) Find the equation of the tangent line to the graph of  $y = -\frac{3}{5x+2}$  at  $x = 3$ .

A)  $y = \frac{15}{(5x-2)^2}$

B)  $y = \frac{15}{289}(x-3) - \frac{3}{17}$

C)  $y = \frac{15}{169}(x-3)$

D)  $y - 3 = 15(5x-2)^{-2}$

Answer: B

223) The tangent line to the curve  $y = \frac{1}{6}x^3 - \frac{1}{2}x^2 - x + 4$  is perpendicular to the line  $18x + 9y = -37$  at two points on the curve. Find the two points.

A)  $(-1, 0), (3, 0)$

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

C)  $(-3, -2), \left(1, -\frac{10}{3}\right)$

D)  $\left(-1, \frac{13}{3}\right), (3, 1)$

Answer: D

Solve the problem.

224) Find the points on the curve  $y = 6x^2 + 2x + 5$  where the tangent is parallel to the x-axis.

A)  $(0, -5)$

B)  $\left(\frac{1}{6}, \frac{25}{3}\right)$

C)  $(-14, 3001)$

D)  $\left(-\frac{1}{6}, \frac{29}{6}\right)$

Answer: D

225) Find an equation of the line perpendicular to the tangent to the curve  $y = x^3 + 9x - 7$  at the point  $(1, 2)$ .

A)  $y = 6x + 25$

B)  $y = 3x^2 + 9$

C)  $y = \frac{1}{12}x - \frac{25}{12}$

D)  $y = -\frac{1}{12}x + \frac{25}{12}$

Answer: D

226) Find the x- and y-intercepts of the line that is tangent to the curve  $y = x^3$  at the point  $(-1, -1)$ .

A) x-intercept = 0, y-intercept = 0

B) x-intercept = -2, y-intercept = -2

C) x-intercept =  $-\frac{2}{3}$ , y-intercept = 2

D) x-intercept =  $\frac{4}{3}$ , y-intercept = -4

Answer: C

227) Find the first derivative of  $w(t) = 7t^2 - 19\sqrt{t} + 23$

A)  $\frac{7}{2}t - \frac{19}{2}\sqrt{t}$

B)  $\frac{7}{2}t - \frac{19}{2\sqrt{t}}$

C)  $14t - \frac{19}{2}\sqrt{t}$

D)  $14t - \frac{19}{2\sqrt{t}}$

Answer: D

228) Find the first derivative of  $y = T^7 - 9T^5 + 2T^4 + 59$

A)  $T^6 - 9T^4 + 2T^3$

B)  $T^6 - 9T^4 + 2T^3 + 59$

C)  $7T^6 - 45T^4 + 8T^3 + 59$

D)  $7T^6 - 45T^4 + 8T^3$

Answer: D

229) Find  $\frac{d}{du}\sqrt{u^4 - 7}$ .

A)  $\frac{4u}{\sqrt{u^2 - 7}}$

B)  $\frac{2u}{\sqrt{u^4 - 7}}$

C)  $\frac{2u^3}{\sqrt{u^4 - 7}}$

D)  $\frac{2u}{\sqrt{u^2 - 7}}$

Answer: C

230) Find  $\frac{d}{ds}(p^2s^4 - q^4r^3s^2)$

A)  $8p^2s^3 - 24q^4r^3s$

B)  $2ps^4 - 4q^3r^3s^2$

C)  $8ps^3 - 24q^3r^2s$

D)  $4p^2s^3 - 2q^4r^3s$

Answer: D

231) Find the second derivative of  $y = \frac{1}{2x} + 3$ .

A)  $-6x^4$

B)  $-\frac{1}{6x^4}$

C)  $2x^0$

D)  $\frac{1}{6x^4}$

E) none of these

Answer: E

232) Find the second derivative of  $f(x) = 3x^2 + 9x - 5$

A)  $6x + 9$

B) 6

C) 0

D) 3

Answer: B

233) Find the second derivative of  $f(x) = 6x^4 - 7x^2 + 4$ .

A)  $24x^2 - 14x$

B)  $24x^2 - 14$

C)  $72x^2 - 14$

D)  $72x^2 - 14x$

Answer: C

234) Find the second derivative of  $f(x) = \frac{1}{3}x^{3/2} - \frac{4}{3}x^{1/4} + 5x - 2$

A)  $\frac{1}{4}x^{-1/2} + \frac{1}{4}x^{-7/4}$

B)  $\frac{1}{4}x^{-1/2} - \frac{1}{4}x^{-7/4}$

C)  $\frac{1}{2}x^{1/2} - \frac{1}{3}x^{-3/4} + 5$

D)  $x^{1/2} + \frac{4}{9}x^{-7/4}$

E)  $\frac{2}{9}x^{1/2} - \frac{16}{3}x^{-3/4} + 5$

Answer: A

235) Find the second derivative of  $f(x) = \frac{2x}{3x^2 + 4x}$  for  $x \neq 0$ .

A)  $12(3x + 4)^{-3}$

B)  $2(3x + 4)^{-1}$

C)  $(-2)3^{-2}$

D)  $-6(3x + 4)^{-2}$

E)  $36(3x + 4)^{-3}$

Answer: E

236) Find the second derivative of  $f(x) = \frac{3}{2x - 4}$  for  $x \neq 0$ .

A)  $3(2x - 4)^{-1}$

B)  $-6(2x - 4)^{-2}$

C)  $24(2x - 4)^{-3}$

D)  $12(2x - 4)^{-3}$

E) 0

Answer: C

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

237) Find the second derivative of  $f(x) = 3x^4 - 4x^3 + 5x + 1$ .

Enter just a polynomial in standard form, unlabeled.

Answer:  $36x^2 - 24x$

238) Find the second derivative of  $y = \pi + \sqrt{3}$ .

Do not label your answer.

Answer: 0

239) Compute the third derivative of  $f(x) = 3x^4 - 4x^3 + 5x + 1$ .

Enter your answer as an unlabeled polynomial in  $x$  in standard form.

Answer:  $72x - 24$

240) Compute the third derivative of the following function:  $f(z) = \frac{3}{2z - 2}$  at  $z = \frac{5}{2}$ .

Enter just a reduced fraction of form  $\frac{a}{b}$ .

Answer:  $-\frac{16}{9}$

241) Find the first derivative of  $y = (x^3 + 4x)^5$  at  $x = 1$ .

Enter just an integer.

Answer: 21,875

242) Find the first derivative of  $z = 4t + (3 - \sqrt{2t + 1})^3$  at  $t = \frac{3}{2}$ .

Enter just a fraction of form  $\frac{a}{b}$  in lowest terms.

Answer:  $\frac{5}{2}$



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

243) Let  $V = \frac{4}{3}\pi r^3$ . Compute  $\left. \frac{dV}{dr} \right|_{r=2}$ .

- A)  $\frac{32}{3}$
- B)  $16\pi$
- C)  $\frac{16\pi}{9}$
- D)  $8\pi$
- E) none of these

Answer: B

244) Let  $y = (-4 + 3\sqrt{x})^4$ . Compute  $\left. \frac{dy}{dx} \right|_{x=4}$ .

- A) 6
- B)  $\frac{27}{16}$
- C) 24
- D) -6
- E) none of these

Answer: C

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

245) Let  $y = \sqrt{5t^2 - 6}$ . Compute  $\left. \frac{dy}{dt} \right|_{t=2}$ .

Enter just a reduced fraction of form  $\frac{a}{b}$ .

Answer:  $\frac{10}{\sqrt{14}}$

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

246) Compute  $\left. \frac{d^2}{dt^2}(2\sqrt{2t}) \right|_{t=4}$ .

- A)  $\frac{1}{8}$
- B)  $-\frac{1}{2}$
- C)  $\frac{1}{16}$
- D)  $-\frac{1}{8}$
- E) none of these

Answer: E

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

247) Compute  $\frac{d^2y}{dy^2}\left(\frac{9t^{2/3}}{2}\right)\bigg|_{t=8}$ .

Enter just a reduced fraction of form  $\frac{a}{b}$ .

Answer:  $-\frac{1}{16}$

248) Let  $f(t) = t^3 - \frac{9}{t}$ . Compute  $\frac{d^2f}{dt^2}\bigg|_{t=3}$ .

Enter just a fraction  $\frac{a}{b}$  in lowest terms.

Answer:  $\frac{52}{3}$

249) Compute  $f''(2)$  when  $f(t) = \frac{3}{(3t-1)^2}$ .

Enter just a reduced fraction of form  $\frac{a}{b}$ .

Answer:  $\frac{162}{625}$

250) Compute  $\frac{d}{dt}\left(\frac{dv}{dt}\right)$ , where  $v = -5t^3 + \frac{2}{1-t}$  at  $t = -1$ .

Enter just a reduced fraction of form  $\frac{a}{b}$ .

Answer:  $\frac{61}{2}$

251) Find second derivative of  $y = x^{3/2} + x^2$  at  $x = 4$ .

Enter just a fraction of form  $\frac{a}{b}$  in lowest terms.

Answer:  $\frac{19}{8}$

252) Find second derivative of  $y = (2x - 4)^5$  at  $x = -1$ .

Enter just an integer.

Answer: -17,280

253) Find the second derivative of  $f(s) = \frac{4}{3}\pi s^3$  at  $s = \frac{1}{\pi}$ .

Enter just a real number.

Answer: 8

254) Find the second derivative of  $U = (3u - 7)^4 - u^3$  at  $u = \frac{5}{3}$ .

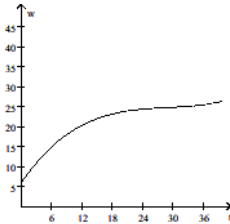
Enter just a real number.

Answer: 422

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

Solve the problem.

255) The median weight of a baby chimpanzee whose age is between 0 and 36 months can be approximated by the function  $w(t) = 6.21 + 1.79t - 0.0594t^2 + 0.000682t^3$ , where  $t$  is measured in months and  $w$  is measured in pounds.



Use this approximation to find the following for a baby chimpanzee with median weight:

- (i) The rate of change of weight with respect to time.
- (ii) The weight of the baby chimpanzee at age 30 months (rounded to the nearest pound).
- (iii) The rate of change of the baby's weight with respect to time at age 30 months (rounded to the nearest hundredth).

- |                                                                                                                                                                                                 |                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>A) (i) <math>w'(t) = 1.79 - 0.1188t + 0.002046t^2</math>;<br/>           (ii) <math>w(30)</math> is about 25 pounds;<br/>           (iii) <math>w'(30)</math> is about 0.07 pounds/month</p> | <p>B) (i) <math>w'(t) = 1.79 + 0.1188t - 0.002046t^2</math>;<br/>           (ii) <math>w(30)</math> is about 25 pounds;<br/>           (iii) <math>w'(30)</math> is about 3.51 pounds/month</p>  |
| <p>C) (i) <math>w'(t) = 1.79 - 0.0594t + 0.001364t^2</math>;<br/>           (ii) <math>w(30)</math> is about 25 pounds;<br/>           (iii) <math>w'(30)</math> is about 1.24 pounds/month</p> | <p>D) (i) <math>w'(t) = 1.79 - 0.1782t + 0.002728t^2</math>;<br/>           (ii) <math>w(30)</math> is about 25 pounds;<br/>           (iii) <math>w'(30)</math> is about -1.10 pounds/month</p> |

Answer: A

256) If the price (in dollars) of a product is given by  $P(x) = \frac{1024}{x} + 700$ , where  $x$  represents the demand for the product, find the rate of change of price when the demand is 8 units.

- |                |               |               |              |
|----------------|---------------|---------------|--------------|
| A) -\$128/unit | B) -\$16/unit | C) \$128/unit | D) \$16/unit |
|----------------|---------------|---------------|--------------|

Answer: B

257) The area  $A(r) = \pi r^2$  of a circular oil spill changes with the radius. At what rate does the area change with respect to the radius when  $r = 6$  ft?

- |                                |                                   |                                  |                                   |
|--------------------------------|-----------------------------------|----------------------------------|-----------------------------------|
| A) $12 \text{ ft}^2/\text{ft}$ | B) $12\pi \text{ ft}^2/\text{ft}$ | C) $6\pi \text{ ft}^2/\text{ft}$ | D) $36\pi \text{ ft}^2/\text{ft}$ |
|--------------------------------|-----------------------------------|----------------------------------|-----------------------------------|

Answer: B

- 258) The revenue from producing and selling  $x$  units of a product is given by  $R(x) = 16x - 0.04x^2$  dollars. (a) Find the marginal revenue at a production level of 12. (b) Find the production levels where the revenue is \$1200.
- A) (a) \$15.52                      B) (a) \$15.04                      C) (a) \$15.52                      D) (a) \$15.04  
 (b) 400 or 300                      (b) 400 or 300                      (b) 100 or 300                      (b) 100 or 300

Answer: D

- 259) Find the average rate of change for  $f(x) = -2x^2 + 5x - 2$  on  $[-1, 1]$
- A) 3                      B) 10                      C) 5                      D) 0                      E) undefined

Answer: C

- 260) Find the average rate of change for  $f(x) = -3x^2 - 2x + 5$  on  $[-2, 1]$
- A) 3                      B) 1                      C) 0                      D) - 7                      E) -3

Answer: B

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

- 261) An automobile's brakes are applied at time  $t = 0$  when the vehicle is traveling at 48 ft/sec. The brakes cause the automobile to decelerate so that after  $t$  sec the velocity is given by  $v(t) = 48 - 16t$ . At what rate is the vehicle decelerating after 1 sec?

Enter just an integer, no units.

Answer: 16

- 262) Suppose that  $t$  hours after being placed in a freezer, the temperature of a piece of meat is given by  $f(t) = 70 - 12t + \frac{4}{t+1}$ . How fast is the temperature of the meat falling 3 hours after being placed in the freezer?

Enter your answer as a reduced fraction of the form  $\frac{a}{b}$ , no units.

Answer:  $-\frac{49}{4}$

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

- 263) During the month of February, a flu epidemic hit the University. The number of people sick at time  $t$  (measured in days) is given by the function  $P(t)$ . The rate at which the epidemic is spreading on February 3 is 110 people per day. How is the information best represented mathematically?

- A)  $\left. \frac{dP}{dt} \right|_{t=110}$   
 B)  $P'(3) = 110$   
 C)  $\left. \frac{dP}{dt} \right|_{t=3} = P'(3)$   
 D)  $P(3) = 110$   
 E) none of these

Answer: B

264) Which of the following is the best description of  $f'(t)$ ?

- A) It is approximately equal to  $\frac{f(t+h) - f(t)}{h}$ , as  $h$  gets very small.
- B)  $f'(t) = \frac{f(t)}{t}$
- C)  $f'(a)$  measures the rate of change of  $f(t)$  per unit change in  $t$  at the point  $t = a$ .
- D) It is a function which gives the slope of the secant line through any two points.
- E) The derivative as a function is the best approximation of the tangent to line to  $f(x)$ .

Answer: C

265) At time  $t = 0$ , a seed is planted. After  $t$  weeks, the height of the plant is given by  $f(t) = 0.3t^2 + 0.6t + 0.5$  inches. At what rate is the plant growing after 8 weeks?

- A) 24.5 inches/week
- B) 5.4 inches/week
- C)  $0.6t + 0.6$  inches/week
- D) 10.1 inches/week
- E) none of these

Answer: B

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

266) A winter storm front moves through campus. At  $t$  hours after the onset of the storm, the temperature is given by  $T(t) = 35 - 2t^2 + t$ . At what rate is the temperature changing 3 hours after the storm begins?

Enter just an integer, no units.

Answer: -11

267) A winter storm front moves through campus. At  $t$  hours after the onset of the storm, the temperature is given by  $T(t) = 35 - 2t^2 + t$ . What is the average rate at which the temperature changes over the first 4 hours?

Enter just an integer, no units.

Answer: -9

268) A winter storm front moves through campus. At  $t$  hours after the onset of the storm, the temperature is given by  $T(t) = 35 - 2t^2 + t$ . At what instantaneous rate is the temperature changing when  $t = 4$ ?

Enter just an integer, no units.

Answer: 20

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

Find the average rate of change for the function over the given interval.

269)  $y = x^2 + 9x$  between  $x = 5$  and  $x = 7$

- A) 16                                      B) 6                                      C) 56                                      D) 21

Answer: D

270)  $y = 6x^3 - 6x^2 - 8$  between  $x = -4$  and  $x = 2$

- A)  $\frac{8}{3}$                                       B) 8                                      C) 252                                      D) 84

Answer: D

Find the instantaneous rate of change for the function at the given value.

271)  $F(x) = x^2 + 5x$  at  $x = 7$

A) 19

B) 14

C) 12

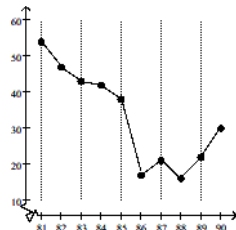
D) 84

Answer: A

Solve the problem.

272) The graph shows the average cost of a barrel of crude oil for the years 1981 to 1990 in constant 1996 dollars. Find the approximate average change in price from 1981 to 1984.

1996 \$/Barrel



Year

A) About -\$16/year

B) About -\$4/year

C) About -\$12/year

D) About -\$2/year

Answer: B

273) A particular strain of influenza is known to spread according to the function  $p(t) = \frac{1}{2}(t^2 + t)$ , where  $t$  is the number of days after the first appearance of the strain and  $p(t)$  is the percentage of the population that is infected. Find the instantaneous rate of change of  $p$  with respect to  $t$  at  $t = 4$ .

A)  $\frac{9}{2}$ % per day

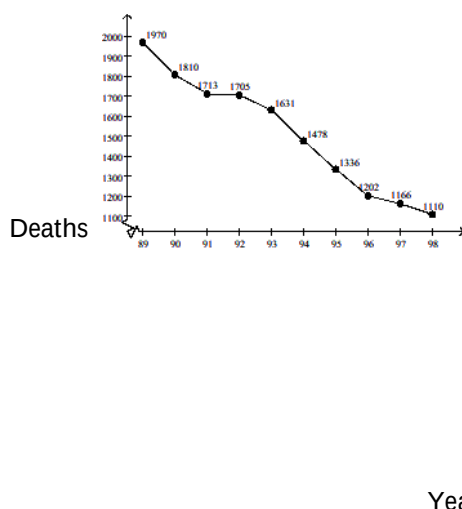
B) 5% per day

C) 10% per day

D) 4% per day

Answer: A

274) The graph below shows the number of tuberculosis deaths in the United States from 1989 to 1998.



Estimate the average rate of change in tuberculosis deaths from 1991 to 1997.

- A) About -60 deaths per year                      B) About -460 deaths per year  
C) About -120 deaths per year                      D) About -1 deaths per year

Answer: C

275) The size of a population of mice after  $t$  months is  $P = 100(1 + 0.2t + 0.02t^2)$ . Find the growth rate at  $t = 18$  months.

- A) 92 mice/month                      B) 184 mice/month                      C) 192 mice/month                      D) 46 mice/month

Answer: A

276) Find the (instantaneous) velocity at time  $t = 2$  seconds for a falling object where the height function is given by  $h(t) = -16t^2 + 60t + 30$  in feet.

- A) 28 feet/second  
B) -86 feet/second  
C) -4 feet/second  
D) 4 feet/second  
E) 86 feet/second

Answer: C

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

277) A ball is thrown straight up. Its height, in feet, at time  $t$ , in seconds, is represented by the equation  $h(t) = 30t - 16t^2 + 6$ . Determine the instantaneous velocity of the ball at  $t = 2$ .

Enter just an integer (no units)

Answer: -34

278) A point  $P$  is moving along the  $x$ -axis. At any time  $t$ , the location of  $P$  on the  $x$ -axis is described by  $x = t^3 - 4t^2 + 3t$ . Determine the point's instantaneous velocity when  $t = 5$ .

Enter just an integer.

Answer: 38

279) A point P is moving along the x-axis. At any time  $t$ , the location of P on the x-axis is described by  $x = t^3 - 4t^2 + 3t$ . Determine the instantaneous acceleration at time  $t = 5$  of the point P.  
Enter just an integer.  
Answer: 22

280) A rock is thrown off a cliff. Its distance from the ground below at  $t$  seconds is  $s(t) = -16t^2 + 16t + 96$  feet. What is the velocity after 1 second?  
Enter just an integer. No units.  
Answer: -16

281) A rock is thrown off a cliff. Its distance from the ground below at  $t$  seconds is  $s(t) = -16t^2 + 16t + 96$  feet. What is the velocity of the rock when it slams into the ground?  
Enter just an integer.  
Answer: 80

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

Suppose the position of an object moving in a straight line is given by the specified function. Find the instantaneous velocity at time  $t$ .

282)  $s(t) = t^2 + 3t + 5$ ,  $t = 4$   
A) 11                                      B) 13                                      C) 33                                      D) 20  
Answer: A

283)  $s(t) = t^2 + 5t + 3$ ,  $t = 1$   
A) 6                                      B) 10                                      C) 7                                      D) 9  
Answer: C

284)  $s(t) = 4t^2 - 7t - 2$ ,  $t = 4$   
A) 34                                      B) 25                                      C) 23                                      D) 9  
Answer: B

285)  $s(t) = t^3 + 5t + 4$ ,  $t = 2$   
A) 9                                      B) 11                                      C) 21                                      D) 17  
Answer: D

286)  $s(t) = t^3 + 4t + 5$ ,  $t = 1$   
A) 12                                      B) 7                                      C) 6                                      D) 10  
Answer: B

Solve the problem.

287) A ball is thrown vertically upward from the ground at a velocity of 124 feet per second. Its distance from the ground after  $t$  seconds is given by  $s(t) = -16t^2 + 124t$ . How fast is the ball moving 7 seconds after being thrown?  
A) 12 ft per sec                      B) 84 ft per sec                      C) -100 ft per sec                      D) -121 ft per sec  
Answer: C

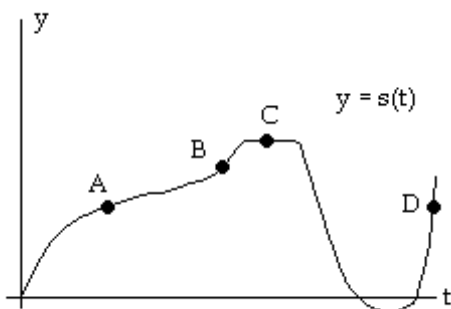


288) For a motorcycle traveling at speed  $v$  (in mph) when the brakes are applied, the distance  $d$  (in feet) required to stop the motorcycle may be approximated by the formula  $d = 0.05 v^2 + v$ . Find the instantaneous rate of change of distance with respect to velocity when the speed is 42 mph.

- A) 10.4 mph      B) 43 mph      C) 5.2 mph      D) 4.2 mph

Answer: C

289) In the following graph,  $s(t)$  represents the position of a particle moving in a straight line.



Is the particle moving faster at point D or A?

- A) A      B) D

Answer: B

290) If the cost function for producing a product is  $C(x) = x^3 - \frac{1}{2x^2} + 3x + 2$ , find the answer closest to the marginal cost at a production level of 10 units.

- A) 697      B) -697      C) 297      D) 293      E) .30

Answer: C

291) If the revenue function is  $R(x) = x^{2/3} + 2x^{1/2} + 6x + 2$  for producing a product, find the marginal revenue at a production level of 10 units.

- A)  $\frac{2}{3}(10)^{-1/3} + (10)^{-1/2} + 6$   
 B)  $(10)^{2/3} + 2(10)^{1/2} + 6(10) + 2$   
 C)  $\frac{2}{3}(10)^{1/3} + (10)^{1/2} + 6$   
 D)  $\frac{2}{3}(10)^{-1/3} + 4(10)^{-1/2} + 6$   
 E)  $\frac{2}{3}(10)^{-1/3} + (10)^{1/2} + 6$

Answer: A

292) If the profit function is  $P(x) = \frac{5x^2}{3} + \frac{2}{3x} + 2x - 10$  for producing a product, find the marginal profit at a production level of 10 units. Express the answer as a simplified fraction.

- A)  $\frac{252}{75}$       B) 60      C)  $\frac{2651}{150}$       D) 423      E)  $\frac{5299}{150}$

Answer: E

- 293) What is the difference between the actual increase in profit as production increases from 5 to 6 units, and the marginal profit at a production level of 5 units where the profit function is given by  $P(x) = 3x^2 - 5x + 2$ ?
- A) 25                      B) 3                      C) 0                      D) 6                      E) 27
- Answer: B

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

- 294) A ball is thrown straight up. Its height, in feet, at time  $t$ , in seconds, is represented by the equation  $h(t) = 20t - 16t^2 + 10$ . Determine the maximum height of the ball. (Hint: Consider the velocity of the ball at the moment the ball reaches its maximum height.)
- Enter just a reduced fraction of form  $\frac{a}{b}$ . No units.

Answer:  $\frac{65}{4}$

- 295) A rock is thrown off a cliff. Its distance from the ground below at  $t$  seconds is  $s(t) = -16t^2 + 16t + 96$  feet. When will it hit the ground?
- Enter your answer exactly as:  $t = a$ . No units.
- Answer:  $t = 3$

- 296) A rock is thrown off a cliff. Its distance from the ground below at  $t$  seconds is  $s(t) = -16t^2 + 16t + 96$  feet. How high was the cliff?
- Enter just an integer, no units.
- Answer: 96

- 297) A manufacturer's profit from producing  $x$  units of a product is given by  $P(x) = 0.002x^3 - 0.01x^2 + 0.5x$ . What is the marginal profit when the production level is at 50 units? Enter your answer as a real number to two decimal places, no units.
- Answer: 14.50

- 298) A manufacturer's profit from producing  $x$  units of a product is given by  $P(x) = 0.002x^3 - 0.01x^2 + 0.5x$ . At what production level(s) will the marginal profit be \$9.30 per unit?
- Enter just an integer, no units.
- Answer: 40

- 299) A winter storm front moves through campus. At  $t$  hours after the onset of the storm, the temperature is given by  $T(t) = 35 - 2t^2 + t$ . What is the temperature 3 hours after the storm begins?
- Enter just an integer, no units.
- Answer: 20

- 300) An automobile's brakes are applied at time  $t = 0$  when the vehicle is traveling at 48 ft/sec. The brakes cause the automobile to decelerate so that after  $t$  sec the velocity is given by  $v(t) = 48 - 16t$ . How long will it take for the vehicle to come to a complete stop?
- Enter just an integer, no units.
- Answer: 3

301) Suppose that  $t$  hours after being placed in a freezer, the temperature of a piece of meat is given by

$f(t) = 70 - 12t + \frac{4}{t+1}$ . What is the temperature of the meat after 3 hours?

Enter just an integer, no units.

Answer: 35

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

302) If  $f(35) = 1000$  and  $f'(35) = 16$ , estimate  $f(34.5)$ .

A)  $f(34.5) \approx 1008$

B)  $f(34.5) \approx 999.5$

C)  $f(34.5) \approx 1000.5$

D)  $f(34.5) \approx 992$

Answer: D