

MATH 2003

Test B

This part of the exam is to be done without a calculator

1. The slope of the line tangent to the curve $3x^2 - 2xy + y^2 = 11$ at the point $(1, -2)$ is

- a) $-\frac{1}{6}$ b) 0 c) 1 d) $\frac{5}{3}$ e) 10

2. $\lim_{x \rightarrow 5} \frac{x^2 - 25}{x^2 - 15x + 50} =$

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

3. The side of a cube is expanding at a constant rate of 2 centimeters per second. What is the instantaneous rate of change of the surface area of the cube, in cm^2 per second, when its side is 3 centimeters?

- a) 6 b) 24 c) 36 d) 54 e) 72

4. Which of the functions below are not continuous at $x = 2$?

I. $\frac{2}{x-2}$

II. $\frac{(x-2)^2}{x-2}$

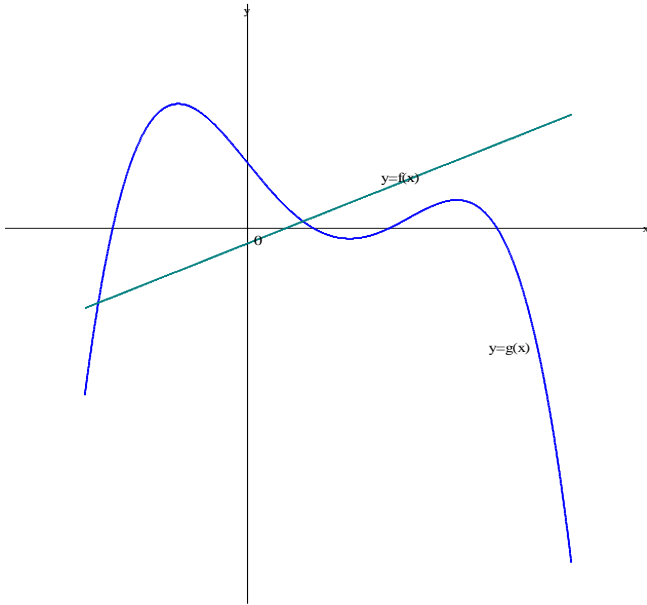
III. $x-2$

- a) I only b) II only c) III only d) I and II e) II and III

5. $\lim_{x \rightarrow \infty} \frac{5x}{x^2 - 4x + 3} =$

- a) 0 b) 1 c) 2 d) 3 e) 5

6.



The figure above shows the complete graph of the functions f and g . Based on the graphs, the equation $f(x) - g(x) = 0$ has how many solutions?

- a) One b) Two c) Four d) Five e) Seven

7. In the xy plane, the graph of $y = x^2 + bx + c$ is symmetric about the line $x = 3$ and passes through the point $(5, 2)$. What is the value of c ?

- a) -6 b) 0 c) 5 d) 6 e) 7

8. What is the domain of $h(x) = \frac{2}{x+3}$?

- a) $(-\infty, \infty)$ b) $(0, \infty)$ c) $(-\infty, -3) \cup (-3, \infty)$ d) $[-3, \infty)$ e) $(-3, \infty)$

9. Given $f(x) = 4x - x^2$ and $g(x) = 2x + 3$, find $f(g(2))$

- a) 11 b) -41 c) 10 d) -21 e) 24

10. If $y = (x^3 + 1)^2$, then $\frac{dy}{dx} =$

- a) $(3x^2)^2$ b) $2(x^3 + 1)$ c) $2(3x^2 + 1)$ d) $3x^2(x^3 + 1)$
 e) $6x^2(x^3 + 1)$

11. For $x \geq 0$, the horizontal line $y = 2$ is an asymptote for the graph of the function f . Which of the following statements must be true?

a) $f(0) = 2$

b) $f(x) \neq 2$ for all $x \geq 0$

c) $f(2)$ is defined

d) $\lim_{x \rightarrow 2} f(x) = \infty$

e) $\lim_{x \rightarrow \infty} f(x) = 2$

12. A company charges \$12 for a particular item that it costs the company \$4 per unit to produce with a daily overhead of \$3000. How many items must the company produce each day in order to break even?

a) 3000

b) 750

c) 375

d) 250

e) 188

13. Which of the following is the equation of the line that is tangent to the graph of $y = 2x^2 + 3x + 1$ at $x = -2$?

a) $y = -5x - 7$

b) $y = -5x + 1$

c) $y = -\frac{1}{5}x + \frac{13}{5}$

d) $y = -8x - 21$

e) $y = -5x - 2$

14. The zeros (x -intercepts) of $f(x) = \frac{x^2 - 7x + 12}{x - 3}$ are

a) $x = 3$ only

b) $x = 0$

c) $x = 3$ and $x = 4$

d) $x = 4$ only

e) $f(x)$ has no zeros

15. Given the line $8y - 3x = 24$, find the slope and coordinates of the x - and y -intercepts

a) slope $\frac{3}{8}$ x -intercept $\frac{1}{3}$ y -intercept $\frac{1}{8}$

b) slope $\frac{8}{3}$ x -intercept -8 y -intercept 3

c) slope $-\frac{3}{8}$ x -intercept -3 y -intercept -8

d) slope $\frac{3}{8}$ x -intercept -8 y -intercept 3

e) slope $-\frac{8}{3}$ x -intercept $\frac{1}{3}$ y -intercept $\frac{1}{8}$

16. Find the instantaneous rate of change at $x = 3$ of the function f given by

$$f(x) = \frac{x^2 - 2}{x + 1}.$$

- a) $-\frac{17}{16}$ b) $-\frac{1}{8}$ c) $\frac{1}{8}$ d) $\frac{13}{16}$ e) $\frac{17}{16}$

17. Find all values of t for which the instantaneous rate of change of $x(t) = t^2 - 7t + 12$ is zero.

- a) 2.5 b) 3 c) 3.5 d) 4 e) 4.5

18. An average of 400 iPods are sold every month at a certain store when the price of each iPod is \$150. For each \$10 increase in price, the average monthly sales fall by 20 units. Find the demand function.

- a) $p = -\frac{1}{2}x + 400$ b) $p = -\frac{3}{8}x + 350$ c) $p = -2x + 950$
d) $p = -\frac{1}{2}x + 350$ e) $p = 10x + 150$

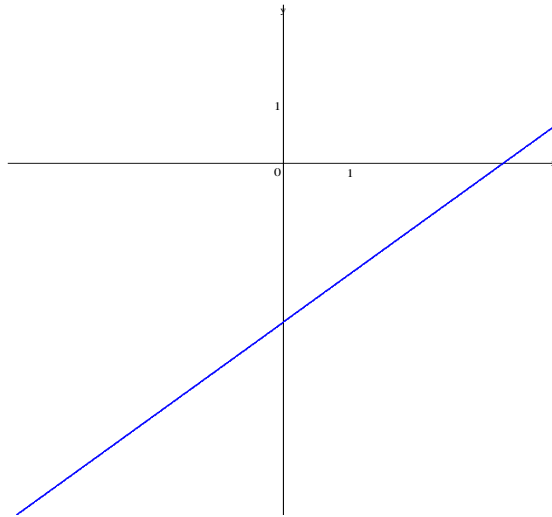
19. If $A = \begin{pmatrix} 3 & -2 \\ 1 & 4 \end{pmatrix}$, find A^2

- a) $A = \begin{pmatrix} 9 & 4 \\ 1 & 16 \end{pmatrix}$ b) $A = \begin{pmatrix} 10 & -2 \\ -2 & 20 \end{pmatrix}$ c) $A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$
d) $A = \begin{pmatrix} 7 & -14 \\ 7 & 14 \end{pmatrix}$ e) Not possible to find

20. Find the center and radius of the circle given by the equation $x^2 + 12x + y^2 - 8y = -43$

- a) Center $(6, -4)$ Radius 3
b) Center $(-6, 4)$ Radius 9
c) Center $(-\sqrt{6}, 2)$ Radius 3
d) Center $(-\sqrt{6}, 2)$ Radius 9
e) Center $(-6, 4)$ Radius 3

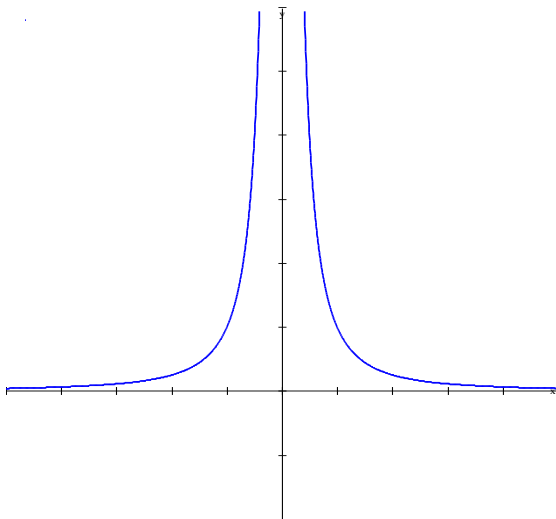
21. The equation of the line shown in the graph below is $y = ax + b$. Which of the following is always true of this line?



- a) $ab < 0$ b) $ab > 0$ c) $ab = 0$ d) $a = b$ e) $a = -b$

22. $f(x) = \begin{cases} x-9, & x \leq 3 \\ x^2, & x > 3 \end{cases}$ Find $f(2)$

- a) 4 b) -7 c) 9 d) 3 e) 1



23.

The equation whose graph is given above is

- a) $y = \sqrt{x}$ b) $y = \sqrt[3]{x}$ c) $y = \frac{1}{x^2}$ d) $y = \frac{1}{x^3}$ e) $y = \frac{1}{x}$

24. Given $y = \frac{2-x}{3x+1}$. Find $\frac{dy}{dx}$
- a) $-\frac{7}{(3x+1)^2}$ b) $\frac{6x-5}{(3x+1)^2}$ c) $-\frac{9}{(3x+1)^2}$ d) $\frac{7}{(3x+1)^2}$
- e) $\frac{7-6x}{(3x+1)^2}$

25. The reduced row echelon for that results from Gauss-Jordan row reduction of a

system of linear equations is:
$$\begin{bmatrix} 1 & 3 & 0 & 7 \\ 0 & 0 & 1 & 8 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Find ALL solutions to the system of equations

- a) $(3, 7, 8)$ b) $(7-3y, y, 8)$ c) $(x, 7-3y, 8)$
- d) $(7-3y, 7, 8)$ e) No solution exists

MATH 2003

Test B

Some of the questions on this part of the exam require a calculator

26. If s is a function of t such that $s(t) = \frac{t^3}{8}$, find the average rate of change of s over the interval $[1, 1.8]$.
- a) 0.375
 - b) 0.654
 - c) 0.765
 - d) 0.755
 - e) 1.215

27. Let f be the function defined by $f(x) = x^3$. Then $\frac{f(x+h) - f(x-h)}{2h} =$
- a) $3x^2 + h^2$
 - b) $3x^2$
 - c) $3x^2 + 3h$
 - d) $x^3 + h$
 - e) $x^3 + 3h^2$

28. The following represents the system of equations $AX = B$.

$$\begin{pmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 5 & -4 & 2 \end{pmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 7 \\ 4 \end{bmatrix}$$

The solution to the above system is:

- a) (1, 1, 1)
- b) (3, 9, -15)
- c) (6, 5, -3)
- d) (18, 15, -9)
- e) no solution

29. Find the linear regression equation for the data given below (round coefficients to three decimal places).

x	-2	1	3	7
y	8	5	1	-4

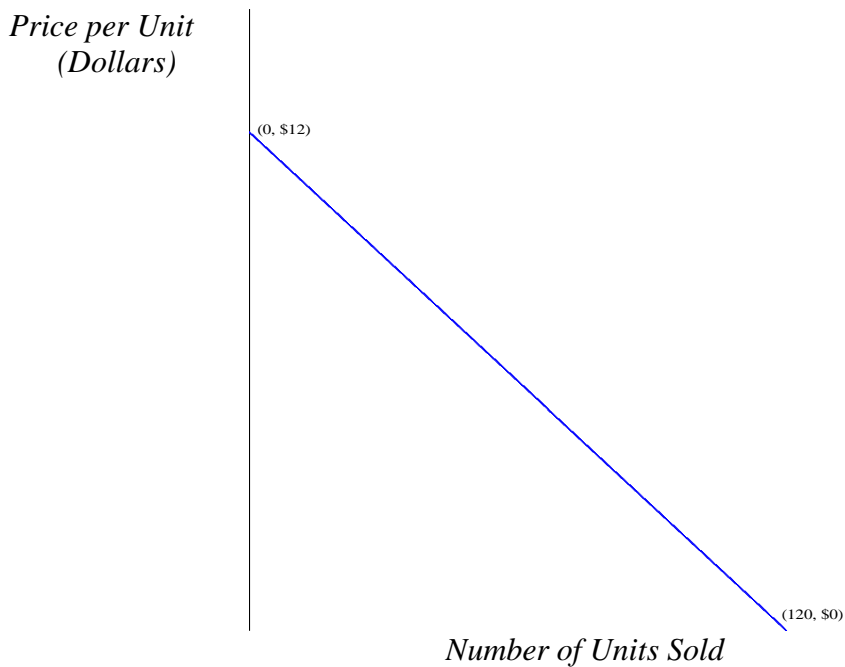
- a) $y = -1.368x + 5.579$
- b) $y = -1.468x + 5.679$
- c) $y = -1.568x + 5.779$
- d) $y = -1.668x + 5.879$
- e) $y = -1.768x + 5.979$

30. If $a \neq 0$, then $\lim_{x \rightarrow a} \frac{x^3 - a^3}{a^6 - x^6}$ is

- a) nonexistent b) 0 c) $-\frac{1}{2a^3}$ d) $-\frac{1}{a^3}$ e) $\frac{1}{2a^3}$

31. Based on past sales, a convenience store has observed a linear relationship between the number of sales of Product X that will be sold to customers each week and the price per unit. The figure below models this linear relationship. Based on the model, how many dollars would the convenience store expect to earn from its sales of product X in a week when the price per unit is \$5?

WEEKLY SALES OF PRODUCT X

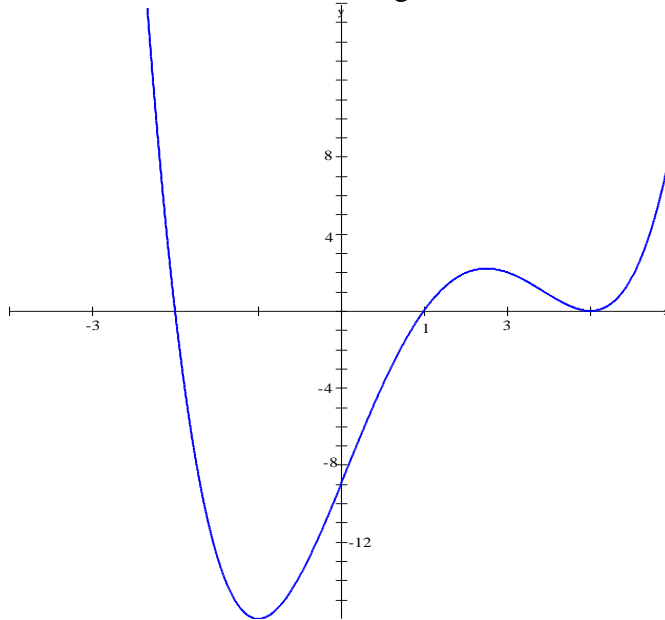


- a) \$125 b) \$250 c) \$350 d) \$600 e) 720

32. Which of the following is an equation of the line tangent to the graph of $f(x) = x^6 - x^4$ at the point where $f'(x) = -1$?

- a) $y = -x - 1.031$
b) $y = -x - 0.836$
c) $y = -x + 0.836$
d) $y = -x + 0.934$
e) $y = -x + 1.031$

33. The graph of $y = 0.5x^4 - 2.5x^3 + 0.5x^2 + 10.5x + k$, where k is a constant, is shown below. Which of the following could be a value of k ?



- a) -18 b) -16 c) -9 d) 9 e) 16

34. The cost C of producing x items is given by $C(x) = 20,000 + 5(x - 60)^2$. The revenue R obtained by selling x items is given by $R(x) = 15,000 + 130x$. The revenue will exceed the cost for all x such that

- a) $0 < x < 46$ b) $x > 46$ c) $x < 100$ d) $46 < x < 100$
 e) $x > 100$

35. Evaluate $\lim_{\Delta x \rightarrow 0} \frac{\sqrt[3]{(x + \Delta x)^2 - 32} - \sqrt[3]{x^2 - 32}}{\Delta x}$

- a) $\frac{(x^2 - 32)^{\frac{1}{3}} + 2 \cdot 2^{\frac{2}{3}}}{x}$ b) $\frac{2x}{3(x^2 - 32)^{\frac{2}{3}}}$ c) $\frac{2x}{3}$
 d) $\frac{x}{\sqrt{x^2 - 32}}$ e) there is no limit (undefined)

Answers to Test B

- | | | | | |
|-------|-------|-------|-------|-------|
| 1) d | 2) a | 3) e | 4) d | 5) a |
| 6) b | 7) e | 8) c | 9) d | 10) e |
| 11) e | 12) c | 13) a | 14) d | 15) d |
| 16) e | 17) c | 18) d | 19) d | 20) e |
| 21) a | 22) b | 23) c | 24) a | 25) b |
| 26) d | 27) a | 28) c | 29) a | 30) c |
| 31) c | 32) a | 33) c | 34) d | 35) b |