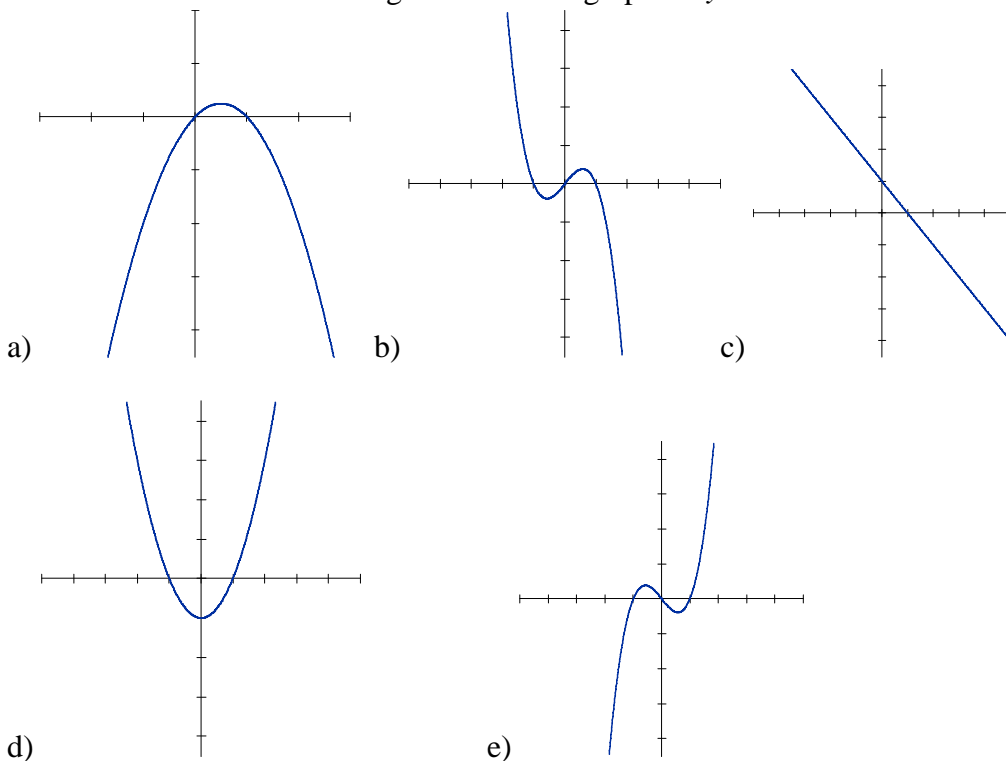


Math 2003

Test D

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

1. Which of the following is the correct graph of  $y = x - x^3$ ?



2. Find all the intercepts of  $y = 25x - x^3$

- |                              |                           |
|------------------------------|---------------------------|
| a) $x$ -intercept: 0         | $y$ -intercepts: 0, -5, 5 |
| b) $x$ -intercepts: -5, 5    | $y$ -intercept: 0         |
| c) $x$ -intercepts: -5, 5    | no $y$ -intercept         |
| d) $x$ -intercepts: 0, -5, 5 | $y$ -intercept: 0         |
| e) $x$ -intercepts: -5, 5    | no $y$ -intercept         |

3. If  $f(x) = \frac{x}{1-x}$ , then  $f'(x) =$

- |       |                     |                                |                           |                        |
|-------|---------------------|--------------------------------|---------------------------|------------------------|
| a) -1 | b) $\frac{-1}{1-x}$ | c) $f(x) = \frac{-1}{(1-x)^2}$ | d) $f(x) = \frac{1}{1-x}$ | e) $\frac{1}{(1-x)^2}$ |
|-------|---------------------|--------------------------------|---------------------------|------------------------|

4. The slope of the line tangent to the curve  $2x^3 - x^2y^2 + 4y^3 = 16$  at the point (2, 1) is

- |       |       |       |      |      |
|-------|-------|-------|------|------|
| a) -7 | b) -5 | c) -1 | d) 5 | e) 7 |
|-------|-------|-------|------|------|

5. Evaluate  $\lim_{x \rightarrow 12} \frac{x^2 - 12x}{(x^2 + 144)(x - 12)}$

- a) -24      b)  $-\frac{1}{24}$       c) 24      d)  $\frac{1}{24}$       e) 12

6. Find the limit:  $\lim_{x \rightarrow 0^+} \left( x^4 - \frac{1}{x} \right)$

- a) 0      b)  $-\infty$       c) 1      d) -1      e)  $\infty$

7. Determine the values of  $x$ , if any, at which the tangent to the graph of  $y(x) = x^4 - 32x + 3$  has a horizontal tangent.

- a)  $x = 0$       b)  $x = 0$  and  $x = 2$       c)  $x = 0$  and  $x = -2$       d)  $x = 2$   
 e) There are no values of  $x$  for which the graph of  $y$  has a horizontal tangent.

8. Find an equation of the tangent line to  $f(x) = (x - 5)(x^2 - 4)$  at  $(3, -10)$ .

- a)  $y = 7x + 11$       b)  $y = 31x - 7$       c)  $y = -7x - 31$       d)  $y = -7x + 11$   
 e)  $y = -7 + 11x$

9. The radius,  $r$ , of a circle is decreasing at a rate of 4 centimeters per minute. Find the rate of change of the area,  $A$ , in  $\frac{cm^2}{min}$  when the radius is 5 cm.

- a)  $-20\pi$       b)  $-200\pi$       c)  $200\pi$       d)  $-40\pi$       e)  $40\pi$

10. Find  $f'(x)$  if  $f(x) = (2 + 3x)^{\frac{6}{5}}$ .

- a)  $f'(x) = \frac{2}{5}(2 + 3x)^{\frac{1}{5}}$       b)  $f'(x) = \frac{18}{5}(2 + 3x)^{\frac{1}{6}}$       c)  $f'(x) = \frac{18}{5}(2 + 3x)^{\frac{1}{5}}$   
 d)  $f'(x) = \frac{3}{5}(2 + 3x)^{\frac{1}{5}}$       e)  $f'(x) = 3(2 + 3x)^{\frac{1}{5}}$

11. For a production level of  $x$  units of a commodity, the cost function in dollars is  $C(x) = 200x + 4100$ . The demand equation is  $p = 300 - 0.05x$ . What price  $p$  will maximize the profit?

- a) \$100      b) \$250      c) \$900      d) 1500      e) \$6000

12. Find the  $x$ -coordinate of the center of the circle  $x^2 + 10x + y^2 - 6y = 50$ .

- a) 5      b) -5      c) 3      d) -3      e) 4

13. For the function  $f(x) = 16x^3$ , find  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$

- a) 0                      b) 1                      c) 48                      d)  $48x$                       e)  $48x^2$

14. If  $A = \begin{pmatrix} 1 & -1 \\ 4 & 5 \end{pmatrix}$ , find the inverse,  $A^{-1}$ .

- a)  $A^{-1} = \begin{pmatrix} \frac{5}{9} & \frac{-1}{9} \\ \frac{4}{9} & \frac{1}{9} \end{pmatrix}$                       b)  $A^{-1} = \begin{pmatrix} \frac{5}{9} & \frac{4}{9} \\ \frac{-1}{9} & \frac{1}{9} \end{pmatrix}$                       c)  $A^{-1} = \begin{pmatrix} \frac{5}{9} & \frac{1}{9} \\ \frac{-4}{9} & \frac{1}{9} \end{pmatrix}$
- d)  $A^{-1} = \begin{pmatrix} \frac{-1}{9} & \frac{1}{9} \\ \frac{-4}{9} & \frac{-5}{9} \end{pmatrix}$                       e) The inverse does not exist.

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

- a)  $A = \begin{pmatrix} -3 & 4 \\ 1 & 2 \end{pmatrix}$                       b)  $A = \begin{pmatrix} 9 & -4 \\ -8 & 17 \end{pmatrix}$                       c)  $A = \begin{pmatrix} 1 & 4 \\ 16 & 9 \end{pmatrix}$
- d)  $A = \begin{pmatrix} 2 & 4 \\ 8 & -16 \end{pmatrix}$                       e)  $A = \begin{pmatrix} 1 & 16 \\ 4 & 9 \end{pmatrix}$

16. Find the average rate of change of the function  $f(x) = -x^3 + 7x + 1$  on the closed interval  $1 \leq x \leq 4$ .

- a) -14                      b) 7                      c) -6                      d) -42                      e) 4

17. The graph of  $f(x) = \frac{x^2 - 11x + 18}{x - 9}$  consists of a line and a hole. Find the equation of the line and the coordinates of the hole.

- a) line:  $y = x - 2$                       hole:  $(2, -7)$
- b) line:  $y = x - 2$                       hole:  $(2, 0)$
- c) line:  $y = x - 2$                       hole:  $(9, 0)$
- d) line:  $y = x - 2$                       hole:  $(9, 7)$
- e) line:  $y = x - 9$                       hole:  $(2, -7)$

18. The table below shows some values for the function  $f$ . If  $f$  is a linear function, what is the value of  $a + b$ ?

$x$	$f(x)$
5	$a$
10	32
15	$b$

- a) 32                  b) 42                  c) 48                  d) 64  
 e) It cannot be determined from the information given.

19. Write an equation of the line parallel to the line  $2x - 3y = -5$  through the point  $(-2, -6)$ .

- a)  $y = \frac{2}{3}x + \frac{14}{3}$                   b)  $y = \frac{2}{3}x - \frac{14}{3}$                   c)  $y = \frac{2}{3}x + 2$                   d)  $y = \frac{2}{3}x - \frac{16}{3}$   
 e)  $y = -\frac{2}{3}x - \frac{14}{3}$

20. Find the  $x$  values (if any) for which the function  $f(x) = \frac{x-5}{x^2-6x+5}$  is not continuous. Which of the discontinuities are removable?

- a) No points of discontinuity  
 b) Discontinuity at  $x = 5$  (removable); Discontinuity at  $x = 1$  (non-removable)  
 c) Discontinuity at  $x = 5$  (non-removable); Discontinuity at  $x = 1$  (non-removable)  
 d) Discontinuity at  $x = 5$  (removable); Discontinuity at  $x = 1$  (removable)  
 e) Discontinuous only at  $x = 1$  (non-removable)

21. For the demand function defined by  $p + x = 100$  for  $x \geq 0$  and the supply function  $p - 3x = 4$  for  $x \geq 0$ , the market equilibrium price is:

- a) 76                  b) 70                  c) 72                  d) 28                  e) 24

22. The function whose equation is  $f(x) = x^2 - 4x + 5$  has a graph which is a parabola whose vertex is:

- a) (2, 5)                  b) (-2, 5)                  c) (2, 9)                  d) (-2, -9)                  e) (2, 1)

23. Which of the following define functions that are odd?

I.  $y = x^3 + 1$

II.  $y = x^3$

III.  $y = \frac{x^2 + 1}{x}$

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

24. The demand function and cost function for  $x$  units of a product are defined by

$p = \frac{60}{\sqrt{x}}$  and  $C(x) = 0.65x + 400$ . Find the marginal profit when  $x = 100$ .

- a) \$2.35 per unit      b) \$4.58 per unit      c) \$193.50 per unit      d) \$187.35 per unit  
e) \$3.65 per unit

25. For the rational function  $f(x) = \frac{4x^2}{x^2 - 4}$ , the horizontal asymptote is:

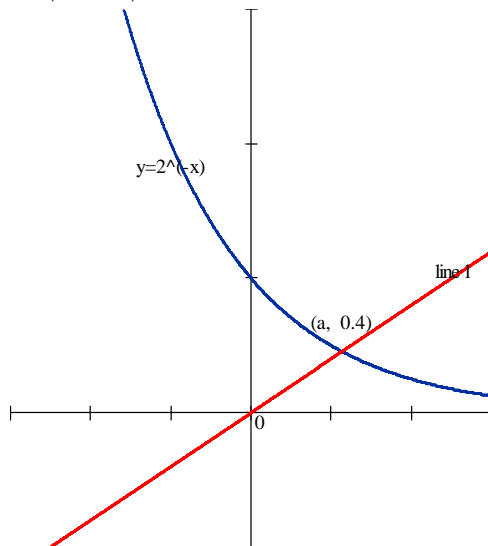
- a)  $x = 2$  and  $x = -2$       b)  $y = 2$  and  $y = -2$       c)  $y = 4$       d)  $y = -4$   
e) There is no horizontal asymptote

Math 2003

Test D

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

26. In the figure below, line  $l$  passes through the origin and intersects the graph of  $y = 2^{-x}$  at the point  $(a, 0.4)$ . What is the slope of line  $l$ ?



- a) 0.200
- b) 0.303
- c) 0.528
- d) 0.322
- e) 3.305

27. Evaluate the following limit if the limit exists:

$$\lim_{h \rightarrow 0} \frac{(16+h)^{0.25} - 16^{0.25}}{h}$$

- a)  $-\frac{1}{128}$
- b) 0
- c)  $\frac{1}{32}$
- d)  $\frac{3}{8}$
- e) 1

28. At a price of \$3.10 per gallon, the weekly demand by consumers for gas is 42 gallons. If the price rises to \$3.25 per gallon, the weekly demand drops to 39 gallons. Find a formula for  $Q$ , the weekly quantity of gas demanded in terms of  $p$ , the price per gallon, assuming that the demand is linear.

- a)  $Q = 20p - 836.90$
- b)  $Q = -20p + 836.90$
- c)  $Q = -20p + 104$
- d)  $Q = 20p - 104$
- e)  $Q = -\frac{1}{20}p - 104$

29. Let  $f$  be the function defined by  $f(x) = x^3 + 2x^2 + x$ . Find the value of  $x$  for which the average rate of change of  $f$  on the interval  $x = -1$  to  $x = 2$  is equal to the instantaneous rate of change on the interval from  $x = -1$  to  $x = 2$ .

- a)  $x = 0.786$       b)  $x = -1$       c)  $x = 2$       d)  $x = 6$   
 e)  $x = 1.485$

30. Let  $f(x) = 5x^2$  and  $g(x) = \frac{x^3}{5}$ . For what values of  $x$  is  $g(x) > f(x)$ ?

- a)  $f(x) > g(x)$  for all values of  $x$ .  
 b)  $g(x) > f(x)$  for all values of  $x$ .  
 c)  $x > 0$   
 d)  $x > 25$   
 e)  $x > 125$

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

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

In order to solve the system it is necessary to evaluate:

a)  $\begin{pmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 5 & -4 & 2 \end{pmatrix} \begin{bmatrix} 1 \\ 7 \\ 4 \end{bmatrix}$       b)  $\frac{1}{3} \begin{pmatrix} -3 & 0 & 3 \\ 5 & 2 & -4 \\ 7 & 1 & -5 \end{pmatrix} \begin{pmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 5 & -4 & 2 \end{pmatrix}$

c)  $\frac{1}{3} \begin{pmatrix} 0 & 2 & 1 \\ 1 & 2 & 0 \\ 2 & -1 & -1 \end{pmatrix} \begin{bmatrix} 1 \\ 7 \\ 4 \end{bmatrix}$       d)  $\begin{pmatrix} 0 & 2 & 1 \\ 1 & 2 & 0 \\ 2 & -1 & -1 \end{pmatrix} \begin{bmatrix} 1 \\ 7 \\ 4 \end{bmatrix}$

e)  $\frac{\begin{bmatrix} 1 \\ 7 \\ 4 \end{bmatrix}}{\begin{pmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 5 & -4 & 2 \end{pmatrix}}$

32. Given  $A = \begin{pmatrix} 2 & -1 & 2 \\ 1 & 2 & -1 \\ 3 & -1 & 2 \end{pmatrix}$ ,  $B = \begin{pmatrix} 0 & 1 & -2 \\ 3 & -1 & 0 \\ 1 & 0 & -1 \end{pmatrix}$  and  $C = \begin{pmatrix} 11 & -5 & \frac{1}{5} \\ 3 & 4 & -8 \\ \frac{71}{5} & -\frac{9}{2} & 3 \end{pmatrix}$ ,

find  $(AB)^{-1} + C$

a)  $\begin{pmatrix} 11 & -5 & -\frac{4}{5} \\ \frac{16}{3} & \frac{17}{3} & -\frac{34}{3} \\ \frac{238}{15} & -\frac{19}{6} & \frac{4}{3} \end{pmatrix}$       b)  $\begin{bmatrix} 7 & -5 & \frac{16}{5} \\ -\frac{32}{3} & \frac{10}{3} & \frac{7}{3} \\ \frac{118}{15} & -\frac{29}{6} & \frac{23}{3} \end{bmatrix}$       c)  $\begin{pmatrix} 12 & -3 & -\frac{19}{5} \\ 9 & 8 & -19 \\ \frac{81}{5} & -\frac{3}{2} & -3 \end{pmatrix}$

d)  $\begin{pmatrix} 12 & -6 & \frac{6}{5} \\ \frac{11}{3} & 5 & -10 \\ \frac{23}{15} & -\frac{5}{2} & 0 \end{pmatrix}$       e)  $\begin{pmatrix} 10 & -\frac{14}{3} & \frac{1}{30} \\ \frac{16}{5} & 3 & -9 \\ \frac{66}{5} & -\frac{17}{4} & \frac{23}{8} \end{pmatrix}$

33. The function  $f(x) = \frac{-x^2 - 2}{x^5 - 8x^4 + 25x^3 - 38x^2 + 28x - 8}$  has vertical asymptotes at:

- a) Nowhere      b)  $x = 1$  only      c)  $x = -3$  only      d)  $x = 1$  and  $x = 2$   
 e)  $x = 2$  and  $x = -3$

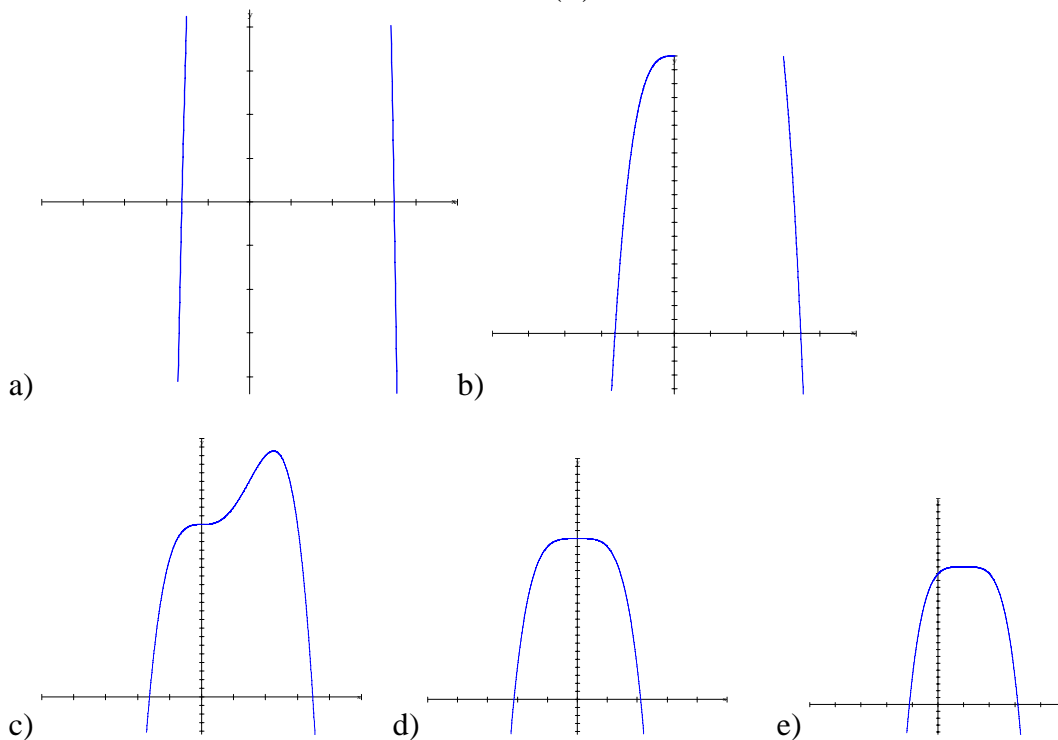
34. The table below shows the IQ of ten students and the number of hours of TV each watch per week. Find the correlation coefficient for the data.

<i>IQ</i>	110	105	120	140	100	125	130	105	115	110
<i>TV</i>	10	12	8	2	12	10	5	6	13	3

- a) -0.0234      b) -0.5389      c) -0.9989      d) 0.5389      e) 0.9989



35. A complete graph of  $f(x) = -x^4 + 3x^3 + 20$  is:



Answers to Test D

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