

Math 2003 Test E  
A calculator is not permitted on this part

1. For the function  $f(x) = 4x^5$ , find  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$
- a) 0                      b) 1                      c)  $\frac{1}{2}$                       d)  $20x^4$                       e) 4
2. Which of the following gives the domain of  $f(x) = \frac{x}{\sqrt{9-x^2}}$ ?
- a)  $x \neq \pm 3$                       b)  $-3 < x < 3$                       c)  $-3 \leq x \leq 3$   
d)  $-\infty < x < -3 \cup 3 < x < \infty$                       e)  $3 < x < \infty$
3. If  $f(x) = 2x - 1$  and  $g(x) = x + 3$ , which of the following gives  $f(g(2))$ ?
- a) 2                      b) 6                      c) 7                      d) 9                      e) 10
4. Which of the following gives an equation for the line through  $(3, -1)$  and parallel to the line  $y = -2x + 1$ ?
- a)  $y = \frac{1}{2}x + \frac{7}{2}$                       b)  $y = \frac{1}{2}x - \frac{5}{2}$                       c)  $y = -2x + 5$                       d)  $y = -2x - 7$   
e)  $y = -2x + 1$
5. A \$15,000 robot depreciates linearly to zero in 10 years. How much is the robot worth three years after it is purchased/
- a) \$12,000  
b) \$11,500  
c) \$11,000  
d) \$10,500  
e) \$10,000

6. Let  $f$  be the function defined by  $f(x) = \begin{cases} 2-x, & x \leq 1 \\ \frac{x}{2}+1, & x > 1 \end{cases}$ . What is the value of

$$\lim_{x \rightarrow 1^-} f(x)?$$

- a)  $\frac{5}{2}$                       b)  $\frac{3}{2}$                       c) 1                      d) 0                      e) does not exist

7. Which of the following lines is a horizontal asymptote for  $f(x) = \frac{2x^3 - x^2 + x + 1}{x^3 - 1}$ ?

- a)  $y = 1$                       b)  $y = \frac{1}{2}$                       c)  $x = \frac{1}{2}$                       d)  $x = 2$                       e)  $y = 2$

8. On which of the following intervals is  $f(x) = \frac{1}{\sqrt{x}}$  not continuous?

- a)  $0 < x < \infty$                       b)  $0 \leq x < \infty$                       c)  $0 < x < 2$                       d)  $1 < x < 2$   
e)  $1 \leq x < \infty$

9. At what point on the curve  $y = 3x^2 + 2x + 1$  is its slope 8?

- a)  $\left(-\frac{5}{3}, 6\right)$                       b)  $\left(-\frac{5}{16}, -\frac{69}{16}\right)$                       c) (1, 6)                      d) (1, 9)  
e)  $\left(\frac{4}{3}, 9\right)$

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

a)  $(2x+1)\sqrt{x^2 + x + 1}$

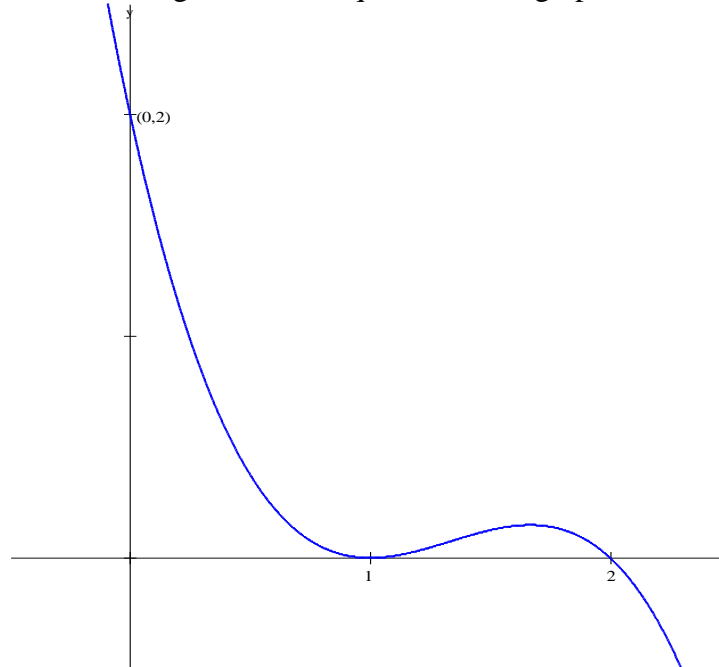
b)  $\frac{(2x+1)\sqrt{x^2 + x + 1}}{2}$

c)  $\frac{1}{2\sqrt{x^2 + x + 1}}$

d)  $\frac{2x+1}{2\sqrt{x^2 + x + 1}}$

e)  $\frac{2x+1}{\sqrt{x^2 + x + 1}}$

11. Which of the following can be the equation of the graph shown below?



a)  $y = (1-x)(x-2)$

b)  $y = (1-x)(2-x)$

c)  $y = (1-x)^2(2-x)$

d)  $y = (1-x)^2(x-2)$

e)  $y = (1-x)(2-x)^2$

12. The function  $f(x) = \frac{x^2 + x}{x}$  is defined and continuous for all  $x$  except  $x = 0$ .

What value of  $x$  must be assigned to  $f(x)$  for  $x = 0$  in order that the function be continuous at  $x = 0$ ?

- a) -1                  b) 0                  c) 1                  d) 2                  e)  $\infty$

13. What is the minimum value of the function  $f(x) = x^2 - 5x + 4$ ?

- a) 4                  b)  $\frac{91}{4}$                   c)  $-\frac{9}{4}$                   d) 0                  e)  $-\frac{5}{4}$

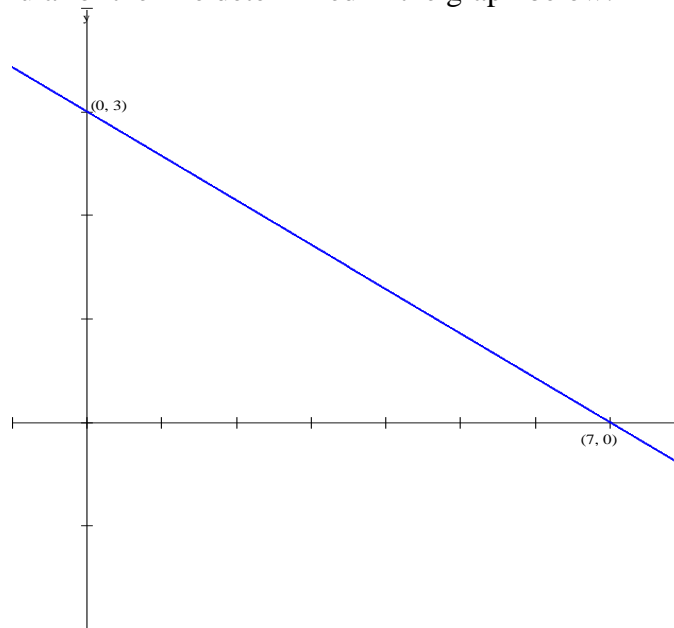
14. Evaluate  $\lim_{h \rightarrow 0} \frac{\sqrt{x+h} - \sqrt{x}}{h}$  when  $x = 2$ .

- a) 0                  b)  $\frac{1}{2\sqrt{2}}$                   c)  $\frac{1}{2}$                   d)  $\frac{2}{\sqrt{2}}$                   e)  $\infty$

15. A company producing jigsaw puzzles has fixed costs of \$6000 and variable costs of \$2 a puzzle. The company sells the puzzles for \$5 each. The formula for the profit function is:

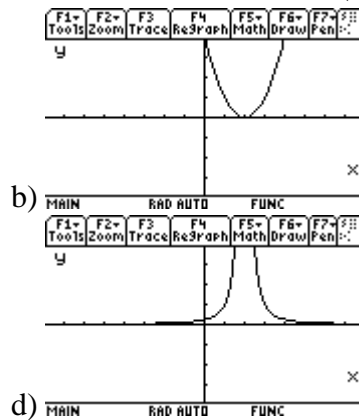
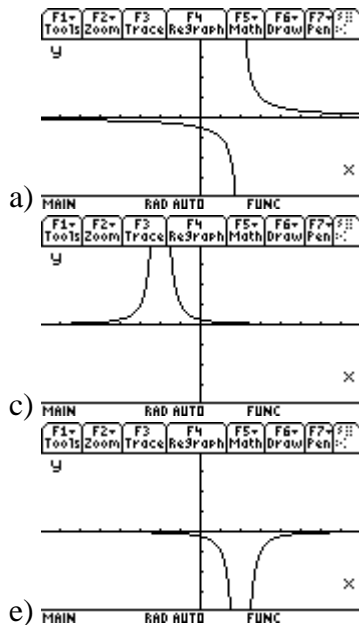
- a)  $P(x) = 5x$   
b)  $P(x) = 2x + 6000$   
c)  $P(x) = 3x + 6000$   
d)  $P(x) = 3x - 6000$   
e)  $P(x) = 5x - 6000$

16. Find a formula for the line determined in the graph below:



- a)  $7y - 3x = 21$
- b)  $7y + 3x = 49$
- c)  $7y + 3x = 21$
- d)  $7y - 3x = 0$
- e)  $7y - 3x = 49$

17. Which of the following is the correct sketch of  $f(x) = \frac{1}{(x-2)^2}$  ?



18. The graph of  $x^2 + y^2 - 24x + 12y + 100 = 0$  is a circle. Find the coordinates of the center of the circle and the radius of the circle.

- a) Center: (24, 12)                      Radius: 10  
 b) Center: (-24, 12)                    Radius: 10  
 c) Center: (-12, 6)                     Radius:  $\sqrt{80} = 4\sqrt{5}$   
 d) Center: (12, -6)                     Radius:  $\sqrt{80} = 4\sqrt{5}$   
 e) Center: (12, -6)                     Radius: 10

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

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

20. If  $\begin{pmatrix} 2 & -1 & 2 \\ 1 & 2 & -1 \\ 3 & -1 & 2 \end{pmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 7 \\ 4 \end{bmatrix}$  is represented by  $AX = B$  and  $A^{-1} = \begin{pmatrix} -1 & 0 & 1 \\ \frac{5}{3} & \frac{2}{3} & -\frac{4}{3} \\ \frac{7}{3} & \frac{1}{3} & -\frac{5}{3} \end{pmatrix}$ ,

find the solution  $X$

- a)  $\begin{bmatrix} 1 \\ 7 \\ 4 \end{bmatrix}$                       b)  $\begin{bmatrix} 3 \\ 11 \\ -15 \end{bmatrix}$                       c)  $\begin{bmatrix} \frac{1}{3} \\ 3 \\ \frac{7}{3} \\ 4 \\ \frac{4}{3} \end{bmatrix}$                       d)  $\begin{bmatrix} -1 \\ \frac{14}{3} \\ -20 \\ \frac{1}{3} \end{bmatrix}$                       e)  $\begin{bmatrix} 3 \\ 1 \\ -2 \end{bmatrix}$

21. The average cost of producing  $x$  items is given by  $a(x) = 0.01x^2 - 0.06x + 13$ , for  $x > 0$ . What is the total cost,  $C(x)$ , of producing  $x$  items?

a)  $C(x) = \frac{0.01x^2 - 0.06x + 13}{x}$

b)  $C(x) = 0.01x^2 - 0.06x + 13$

c)  $C(x) = 0.01x^3 - 0.06x^2 + 13x$

d)  $C(x) = 0.02x - 0.06$

e)  $C(x) = 0.01x^3 - 0.06x^2$

22. The demand curve for a product is given by  $q = 120,000 - 500p$ , where  $p$  is the price in dollars. The supply curve is given by  $q = 1000p$ . Find the equilibrium price and quantity.

a) Price = \$240      Quantity = 240,000

b) Price = \$80      Quantity = 80,000

c) Price = \$800      Quantity = 800,000

d) Price = \$8      Quantity = 8,000

e) Price = \$24      Quantity = 24,000

23. Which of the following equations has a graph that is symmetric with respect to the origin?

a)  $y = \frac{x-1}{x}$

b)  $y = \frac{x}{x^3+1}$

c)  $y = 2x^4 + 1$

d)  $y = x^3 + 2x$

e)  $y = x^3 + 2$

24. The function  $f(x) = \begin{cases} \frac{x^2}{x}, & \text{if } x \neq 0 \\ 0, & \text{if } x = 0 \end{cases}$

a) is continuous everywhere

b) is continuous except at  $x = 0$

c) has a removable discontinuity at  $x = 0$

d) has an infinite discontinuity at  $x = 0$

e) has  $x = 0$  as a vertical asymptote

25. If  $y = \frac{1+x^2}{1-x^2}$ , find  $\frac{dy}{dx}$

a)  $-\frac{4x}{(1-x^2)^2}$

b)  $\frac{4x}{(1-x^2)^2}$

c)  $-\frac{4x^3}{(1-x^2)^2}$

d)  $\frac{2x}{1-x^2}$

e)  $\frac{4x}{1-x^2}$



Test E

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

26.  $\lim_{x \rightarrow 0} \left( 1 + \frac{1}{x} \right)^x$

- a) 1                      b) 0                      c) 2.594                      d) There is no limit                      e) 2.718

27. The graphs of the functions  $f(x) = 5 + x^4$  and  $g(x) = 5 \cdot 3^{0.2x}$  intersect

- a) Never  
 b) Once  
 c) Twice  
 d) Three times  
 e) Four times

28.

$x$	$f(x)$
3.99800	1.15315
3.99900	1.15548
4.00000	1.15782
4.00100	1.16016
4.00200	1.16250

The table above gives values of a differentiable function  $f$ . What is the approximate value of  $f'(4)$ ?

- a) 0.00234  
 b) 0.289  
 c) 0.427  
 d) 2.34  
 e)  $f'(4)$  cannot be determined from the information given

29.  $\lim_{x \rightarrow -3} \frac{x^2 + 3x}{\sqrt{x^2 + 6x + 9}}$

- a) -3                      b) -1                      c) 1                      d) 3                      e) nonexistent

30. A company wants to understand the relationship between the amount spent on advertising,  $a$ , and total sales  $S$ . Suppose that the company collected data as shown in the table below:

$a$ (advertising in \$1000s)	3	4	5	6
$S$ (sales in \$1000s)	105	117	141	152

Calculate the regression line for the data and predict the sales if the expenditure for advertising is \$4,800.

- a) \$133.70
- b) \$120.50
- c) \$120,500
- d) \$133,700
- e) \$137,000

31. Solve the system of equations below:

$$x + 3y = 6$$

$$3x - y = 5$$

$$-x + 7y = 7$$

$$2x - 4y = -1$$

- a) There is no solution
- b)  $\left(\frac{11}{10}, -\frac{49}{30}\right)$
- c)  $\left(\frac{21}{10}, \frac{13}{10}\right)$
- d)  $\left(\frac{21}{10}, -\frac{13}{10}\right)$
- e)  $\left(-\frac{21}{10}, -\frac{13}{10}\right)$

32. If  $A = \begin{pmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & -4 \end{pmatrix}$ , find  $A^3 - 5A^2 + 8A - 4$

- a)  $\begin{pmatrix} 4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 4 \end{pmatrix}$
- b)  $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$
- c)  $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$
- d)  $\begin{pmatrix} -40 & 48 & 48 \\ 8 & -32 & -16 \\ -24 & 48 & 32 \end{pmatrix}$
- e) The expression cannot be evaluated

33. A company manufactures  $x$  calculators weekly that can be sold for  $75 - 0.01x$  dollars each, at a cost of  $1850 + 28x - x^2 + 0.001x^3$  dollars for manufacturing  $x$  calculators. The marginal profit obtained when 600 calculators are manufactured is:

- a) \$ 91.99
- b) \$155.00
- c) \$ 92.00
- d) \$ 29.00
- e) \$92.01

34. The cost in dollars of producing  $x$  units of a product is given by

$$C(x) = \frac{2x^2 - 2x + 9}{\sqrt{x}} \text{ for } x \geq 0. \text{ Determine the value of } x \text{ when the marginal cost is zero.}$$

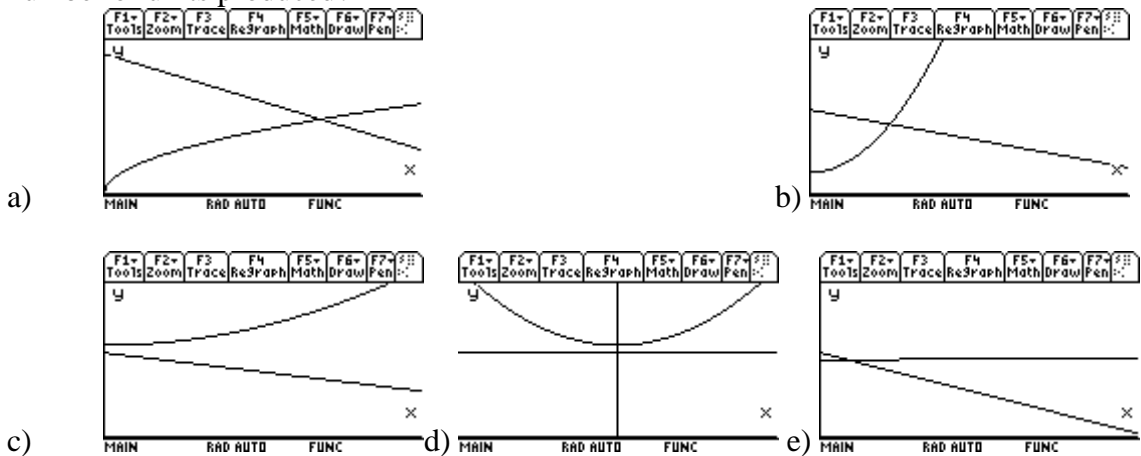
- a) 0.8
- b) 1.4
- c) 3.5
- d) 4.2
- e) 5.3

35. The following are a pair of supply and demand equations:

$$4p + 15x - 1100 = 0$$

$$p - x^2 = 70$$

Which of the following graphs BEST represents supply and demand as a function of the number of units produced?



Answers to Test E

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

