

Show all work for each question, full credit will be given only if all work is shown even when correct answer is circled. If answer is none of these, write correct answer in. Each question is worth 5 points. Good luck!

1. Solve the system of equations by substitution.

$$y = x^2 + 2$$

$$y = -x + 4$$

$$x^2 + 2 = -x + 4$$

$$x^2 + x - 2 = 0$$

$$(x+2)(x-1) = 0$$

$$x = -2 \quad x = 1$$

$$x = -2$$

$$y = -2 + 4$$

$$y = 2$$

$$(2, 2)$$

$$x = 1$$

$$y = -1 + 4$$

$$y = 3$$

$$(1, 3)$$

2. Solve the system of equations by elimination:

$$6x - 5y = -55$$

$$7x + 4y = -74$$

$$24x - 20y = -220$$

$$35x + 20y = -370$$

$$59x = -590$$

$$x = -10$$

$$-60 - 5y = -55$$

$$-5y = 5$$

$$y = -1$$

$$(-10, -1)$$

3. A total of \$11,000 is invested in two funds paying 7% and 8% simple interest. If the yearly interest for both funds total \$865, determine the amount invested at 8%.

a. \$9500

b. \$6500

c. \$1500

d. \$4500

e. None of these: \_\_\_\_\_

$$x = 7\% \text{ amt}$$

$$y = 8\% \text{ amt}$$

$$x + y = 11000$$

$$.07x + .08y = 865$$

$$7x + 8y = 86500$$

$$-7x - 7y = -77000$$

$$y = 9500$$

4. Solve the system of equations by hand. Show all work.

$$3y = 9$$

$$x + 2y + 4z = 21$$

$$y - 3z = -9$$

$$\rightarrow y = 3$$

$$\rightarrow 3 - 3z = -9$$

$$-3z = -12$$

$$z = 4$$

$$(-1, 3, 4)$$

$$x + 2(3) + 4(4) = 21$$

$$x + 6 + 16 = 21$$

$$x + 22 = 21$$

$$x = -1$$

5. Solve the system of linear equations. Show all work.

$$2x + 3y + 3z = 6$$

$$-x + y + z = 2$$

$$\begin{array}{r} 2x + 3y + 3z = 6 \\ -2x + 2y + 2z = 4 \\ \hline 5y + 5z = 10 \\ y + z = 2 \end{array}$$

$$\begin{array}{l} y + a = 2 \\ y = 2 - a \end{array}$$

$$\begin{array}{l} 2x + 3(2-a) + 3a = 6 \\ 2x + 6 - 3a + 3a = 6 \end{array}$$

$$\begin{array}{l} 2x = 0 \\ x = 0 \end{array}$$

- a.  $(2a - 4, 2 - a, a)$
- b.  $(0, 2 - a, a)$
- c.  $(2a, 2 + a, a)$
- d. No solution
- e. None of these: \_\_\_\_\_

$$(0, 2 - a, a)$$

$$\text{let } z = a$$

6. Find the equation of a parabola in the form  $y = ax^2 + bx + c$  that passes through the points  $(0, -5)$ ,  $(1, 0)$ , and  $(2, 9)$

$$\begin{array}{l} -5 = c \\ 0 = a + b + c \\ 9 = 4a + 2b + c \end{array}$$

$$\begin{array}{r} a + b = 5 \\ 4a + 2b = 14 \\ -4a - 4b = -20 \end{array}$$

$$\begin{array}{l} a + b + c = 0 \\ a + 3 - 5 = 0 \end{array}$$

$$a - 2 = 0$$

$$a = 2$$

$$-2b = -6$$

$$b = 3$$

$$y = 2x^2 + 3x - 5$$

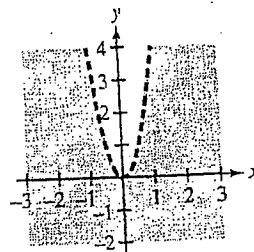
7. Match the graph with the correct inequality:

a.  $4x^2 - y \leq 0$

b.  $4x^2 - y < 0$

c.  $4x^2 - y \geq 0$

d.  $4x^2 - y > 0$

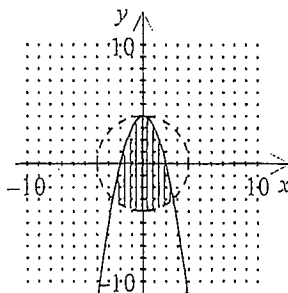


8. Identify the graph of the system of inequalities:

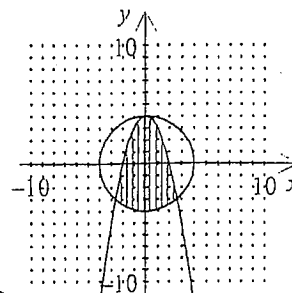
$$y \geq 4 - x^2$$

$$x^2 + y^2 \leq 16$$

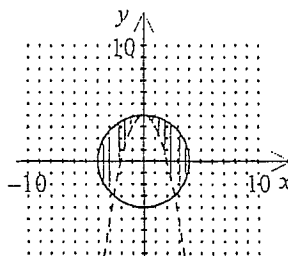
(A)



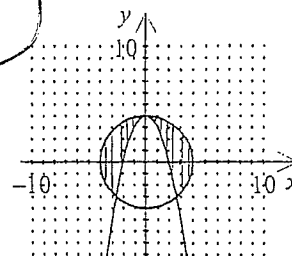
(B)



(C)



(D)



(E) None of these

9. Identify the graph of the system of constraints.

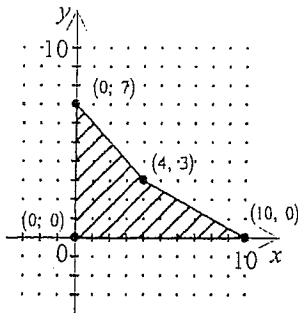
$$x \geq 0$$

$$y \geq 0$$

$$x + y \leq 9$$

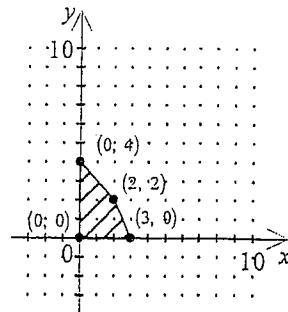
$$\frac{4}{5}x + y \leq 8$$

(A)



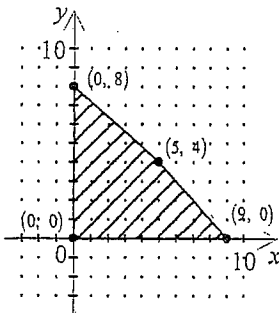
~~Maximum at (0, 7); 350~~

(B)



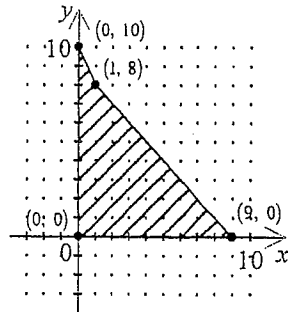
~~Maximum at (0, 4); 200~~

(C)



~~Maximum at (0, 8); 400~~

(D)



~~Maximum at (0, 10); 500~~

(E) None of these

10. Use the objective function  $P = 45x + 50y$  to find the maximum value of the function subject to the constraints in the problem above.

a. maximum value = 350 at (0, 7)

b. maximum value = 425 at (5, 4)

c. maximum value = 445 at (1, 8)

d. maximum value = 400 at (0, 8)

e. None of these: \_\_\_\_\_

$$\text{Test } (0, 8) \Rightarrow 400$$

$$(5, 4) \Rightarrow 425$$

$$(9, 0) \Rightarrow 405$$

$$(0, 0) \Rightarrow 0$$

11. Find the value of the variables, show all work.

$$\begin{bmatrix} 1 & 5t-1 \\ -8 & -8 \end{bmatrix} = \begin{bmatrix} 1 & 3t-8 \\ -8 & 4y+8 \end{bmatrix}$$

a.  $t = -\frac{7}{2}; y = -4$

b.  $t = 1; y = -\frac{7}{4}$

c.  $t = -\frac{7}{2}; y = -\frac{7}{4}$

d.  $t = 1; y = -4$

e. None of these: \_\_\_\_\_

$$5t - 1 = 3t - 8$$

$$2t = -7$$

$$t = -7/2$$

$$-8 = 4y + 8$$

$$-16 = 4y$$

$$y = -4$$

12. Solve the system of equations using a matrix in row reduced echelon form using your calculator. Show the original matrix and the row reduced matrix and state the solution.

$$2x + 3z = -13$$

$$x + 5y + z = -24$$

$$-3x - 4y - z = 18$$

$$\begin{bmatrix} 2 & 0 & 3 & -13 \\ 1 & 5 & 1 & -24 \\ -3 & -4 & -1 & 18 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & -4 \\ 0 & 0 & 1 & -5 \end{bmatrix}$$

$$(1, -4, -5)$$

13. Solve the matrix equation  $7X - 4A = -2B$  for the matrix X if

$$A = \begin{bmatrix} 2 & -5 & 3 \\ 9 & 0 & -8 \end{bmatrix} \text{ and } B = \begin{bmatrix} 7 & 8 & -6 \\ 5 & 2 & 4 \end{bmatrix}$$

$$7X = -2B + 4A$$

$$X = \frac{1}{7}[-2B + 4A]$$

a.  $\begin{bmatrix} -\frac{22}{7} & \frac{4}{7} & 0 \\ \frac{46}{7} & -\frac{4}{7} & \frac{24}{7} \\ -\frac{6}{7} & -\frac{36}{7} & \frac{24}{7} \end{bmatrix}$

b.  $\begin{bmatrix} -\frac{22}{7} & -\frac{36}{7} & 0 \\ \frac{26}{7} & \frac{4}{7} & -\frac{40}{7} \\ -\frac{6}{7} & -\frac{36}{7} & \frac{24}{7} \end{bmatrix}$

c.  $\begin{bmatrix} -\frac{6}{7} & 4 & \frac{24}{7} \\ \frac{26}{7} & 2 & -\frac{40}{7} \\ \frac{26}{7} & 2 & -\frac{40}{7} \end{bmatrix}$

d.  $\begin{bmatrix} -\frac{6}{7} & -\frac{36}{7} & \frac{24}{7} \\ \frac{26}{7} & \frac{4}{7} & -\frac{40}{7} \\ \frac{26}{7} & \frac{4}{7} & -\frac{40}{7} \end{bmatrix}$

e. None of these: \_\_\_\_\_

$$\frac{1}{7} \begin{bmatrix} -6 & -36 & 24 \\ 26 & 4 & -40 \end{bmatrix}$$

14. Find product BA by hand. Show all work.

$$A = \begin{bmatrix} -1 & 4 & -3 \\ -5 & 2 & -5 \\ -3 & -4 & -1 \end{bmatrix}$$

$$B = \begin{bmatrix} 2 & 3 & -4 \\ -1 & 2 & 2 \\ 4 & -5 & -3 \end{bmatrix}$$

$$\begin{bmatrix} -1 & 4 & -3 \\ -5 & 2 & -5 \\ -3 & -4 & -1 \end{bmatrix} =$$

a.  $\begin{bmatrix} -5 & 30 & -17 \\ -15 & -8 & -9 \\ 30 & 18 & 16 \end{bmatrix}$

d.  $\begin{bmatrix} -2 & -15 & 12 \\ -4 & 4 & -8 \\ -12 & 25 & 3 \end{bmatrix}$

b.  $\begin{bmatrix} -18 & 20 & 21 \\ -32 & 14 & 39 \\ -6 & -12 & 7 \end{bmatrix}$

e.  $\begin{bmatrix} -2 & 12 & 12 \\ 5 & 4 & -10 \\ -12 & 20 & 3 \end{bmatrix}$

$$\begin{bmatrix} -2 & -15 & +12 & 8 & +6 & +16 & -6 & -5 & +4 \\ 1 & -10 & -6 & -4 & +4 & -8 & 3 & -10 & -2 \\ -4 & +25 & +9 & 16 & -10 & +12 & -12 & +25 & +3 \end{bmatrix}$$

**AB**

c. None of these: \_\_\_\_\_

15. Find the inverse of the matrix by hand. Show all work.

$$\begin{bmatrix} -5 & -4 \\ -2 & 1 \end{bmatrix}$$

$$\frac{1}{-5-8} \begin{bmatrix} 1 & 4 \\ 2 & -5 \end{bmatrix} = -\frac{1}{13} \begin{bmatrix} 1 & 4 \\ 2 & -5 \end{bmatrix}$$

a.  $\begin{bmatrix} \frac{1}{13} & \frac{4}{13} \\ \frac{2}{13} & -\frac{5}{13} \end{bmatrix}$

b.  $\begin{bmatrix} -\frac{5}{13} & \frac{2}{13} \\ \frac{4}{13} & \frac{1}{13} \end{bmatrix}$

$$= \begin{bmatrix} -\frac{1}{13} & -\frac{4}{13} \\ -\frac{2}{13} & +\frac{5}{13} \end{bmatrix}$$

c. Does not exist

d. None of these: \_\_\_\_\_

16. Find the inverse matrix if it exists. Use a calculator if desired.

$$\begin{bmatrix} 1 & -2 & -2 \\ 0 & -1 & -1 \\ -4 & 7 & 8 \end{bmatrix}$$

a.  $\begin{bmatrix} 1 & -2 & 0 \\ -4 & 0 & -1 \\ 4 & -1 & 1 \end{bmatrix}$

b.  $\begin{bmatrix} 1 & -1 & 0 \\ -1 & 0 & -2 \\ 4 & -4 & 1 \end{bmatrix}$

c.  $\begin{bmatrix} -1 & 4 & -4 \\ 2 & 0 & 1 \\ 0 & 1 & -1 \end{bmatrix}$

d. Does not exist

e. None of these: \_\_\_\_\_

17. Find the determinant of the matrix by hand. Show all work.

$$\begin{vmatrix} -9 & -8 \\ -1 & -10 \end{vmatrix}$$

$$90 - 8 = 82$$

a. 98    b. 4    c. -82

d. -10

e. None of these:

82

18. Find the determinant of the matrix by hand. Show all work.

$$\begin{vmatrix} 4 & -1 & -4 \\ 3 & 5 & 3 \\ -3 & -2 & 1 \end{vmatrix}$$

$$= 20 + 9 + 24 - 60 - (-24) - (-3) = 20$$

a. -20

b. 34

c. -34

d. 20

e. none of these:

19. The encoding matrix E is shown below. Find the decoding matrix D using your calculator.

$$E = \begin{bmatrix} -3 & 1 \\ -4 & 1 \end{bmatrix}$$

$$D = \begin{bmatrix} 1 & -1 \\ 4 & -3 \end{bmatrix}$$

20. Using the decoding matrix D you found above, decode the message below using your calculator. Use the same chart shown below that we used in class (with 27 used as an extra space) for decoding the message.

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13

N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Φ
14	15	16	17	18	19	20	21	22	23	24	25	26	27

$$\begin{bmatrix} 20 & 19 & 9 & 14 & 21 \\ 11 & 10 & 18 & 7 & 1 \end{bmatrix}$$

Message: IT IS RIGHT