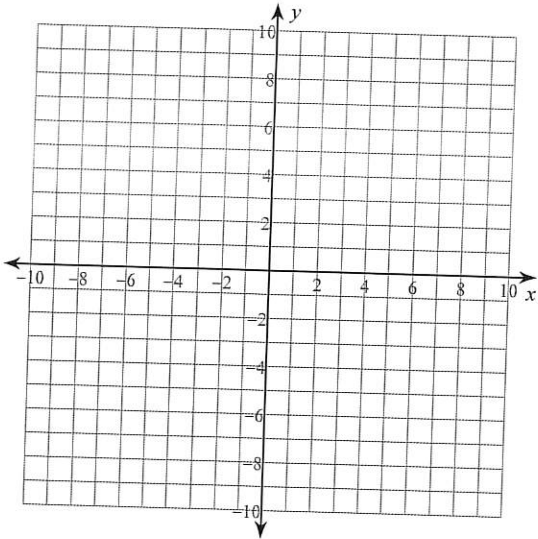Algebra 3 - 2020

# Semester 1 Exam Review

Name___*Key (odds)*___ ID: 1

Date_____ Hour____
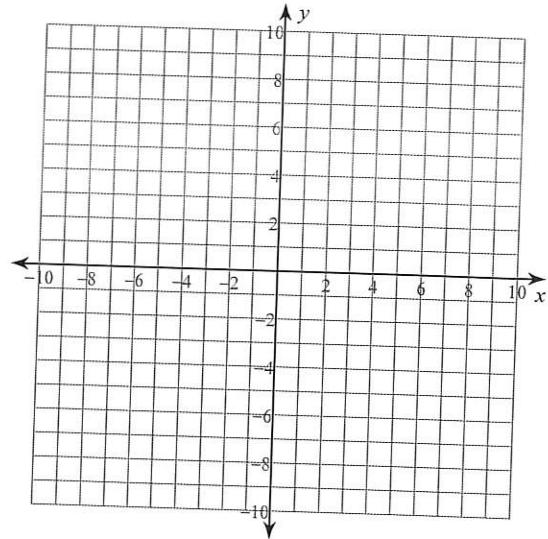
**Solve each system.**

1) $y = \dfrac{9}{8}x - 3$

$y = \dfrac{1}{8}x + 5$

*(8, 6)*



2) $y = \dfrac{1}{3}x - 5$

$y = -\dfrac{1}{3}x - 1$



3) $y = 5x - 4$
   $y = 4x - 3$

*(1, 1)*

4) $-5x - 2y = -6$
   $y = -2x + 1$

5) $-6x + 7y = 9$
   $x - 8y = -22$

*(2, 3)*

6) $-3x - 2y = 2$
   $5x - y = 1$

7) $-3x - y = 20$
   $-x + y = 8$

*(-7, 1)*

8) $-7x + 7y = -12$
   $-7x + 7y = -21$

9) $3x - 8y = 24$
   $-9x - 4y = 12$

*(0, -3)*

10) $-9x - 3y = 0$
    $4x - 5y = 19$

**Solve each system by elimination by hand showing all work.**

11) $3x - y + 5z = -28$
$\phantom{11)}\ 4x - y - 5z = -14$
$\phantom{11)}\ -3x + y + 5z = 8$

12) $2r + 3s + 5t = -6$
$\phantom{12)}\ -3s - 4t = 3$
$\phantom{12)}\ -4r - 3s - t = 24$

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

13) $-3x - 5y + z = -10$
$\phantom{13)}\ 3x - 3y + 3z = 18$
$\phantom{13)}\ -6x - 6y + 3z = -30$

14) $-3r + 5s + 4t = -1$
$\phantom{14)}\ -4r + 4s - 2t = -6$
$\phantom{14)}\ 6r - 2s - 4t = -2$

$$(6, -2, -2)$$

15) $-a - 3b - c = 5$
$\phantom{15)}\ 2a + b - c = 7$
$\phantom{15)}\ -a + 6b + 2c = -16$

16) $6a - 4b - 6c = 8$
$\phantom{16)}\ 2a - 4b - 2c = -8$
$\phantom{16)}\ a - 6b - 4c = -2$

$$(2, -1, -4)$$

**Sketch the graph of each linear inequality.**
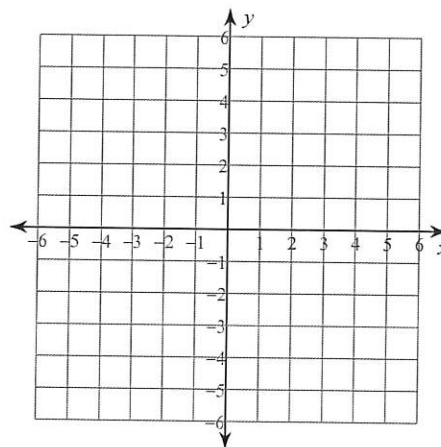
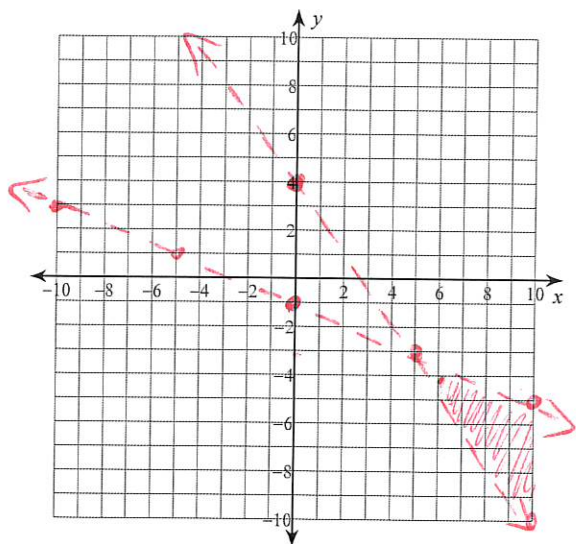17) $x \leq 4$
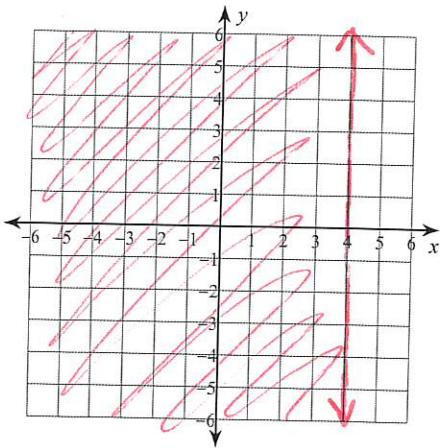


18) $y < -5x + 5$
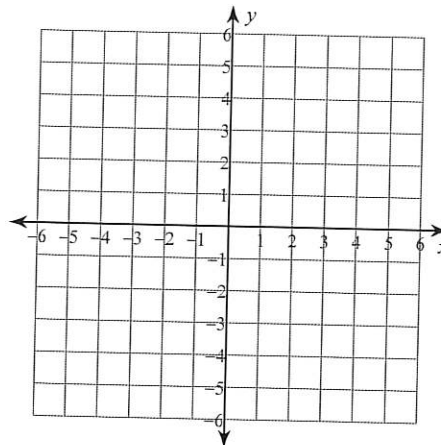
19) $3x + y > 0$
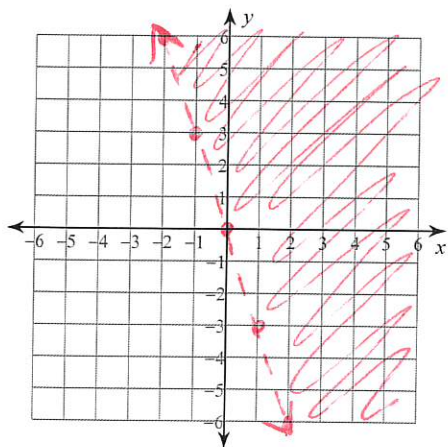


20) $3x + 2y \leq 0$



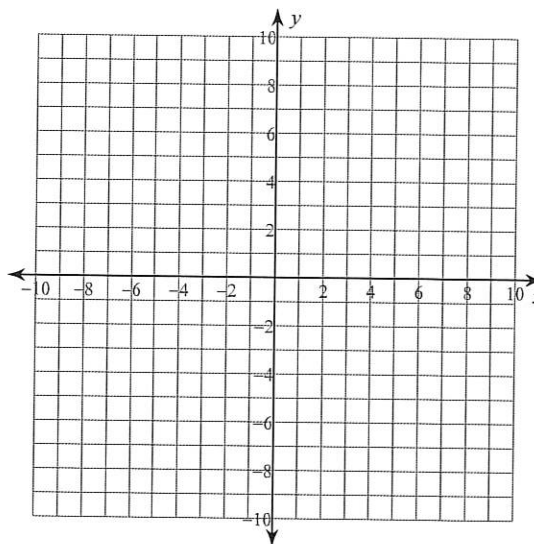**Sketch the solution to each system of inequalities.**
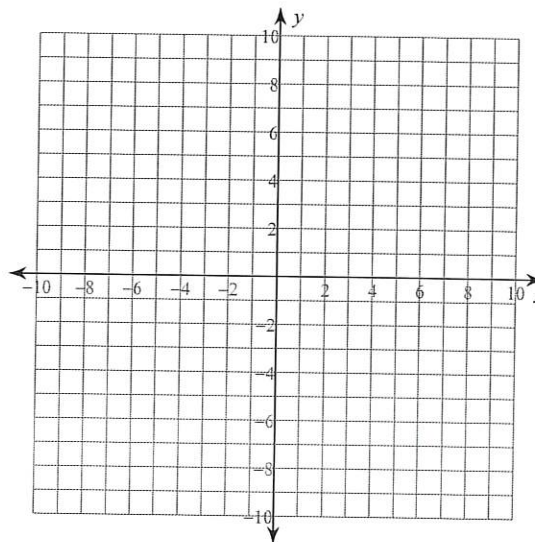
21) $y > -\dfrac{7}{5}x + 4$

$y < -\dfrac{2}{5}x - 1$



22) $y > -\dfrac{11}{6}x - 7$

$y > \dfrac{1}{2}x + 7$

23) $4x - y \le -6$
$3x + 2y \ge -10$



24) $x + 2y < 16$
$3x - 2y \ge -8$
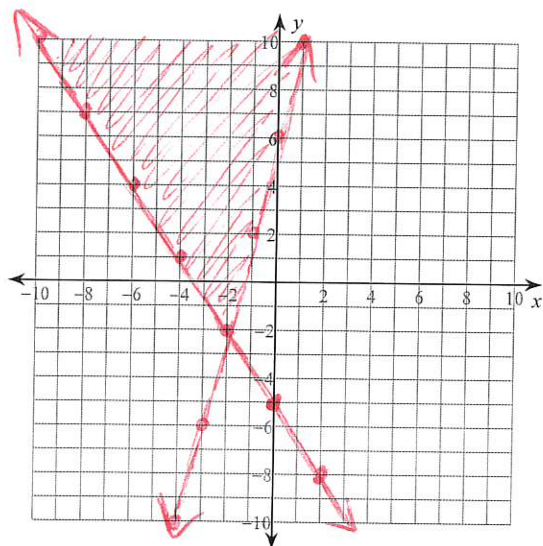


**Simplify. Write "undefined" for expressions that are undefined.**

25) $\begin{bmatrix} -2 & 2 & 0 \end{bmatrix} + \begin{bmatrix} -2 & 5 & -4 \end{bmatrix}$

$$\begin{bmatrix} -4 & 7 & -4 \end{bmatrix}$$

26) $\begin{bmatrix} -4 & 3 \\ -6 & -5 \\ 3 & 5 \end{bmatrix} - \begin{bmatrix} -6 & 6 & 2 \\ -6 & -2 & 5 \end{bmatrix}$

27) $\begin{bmatrix} 5 & 1 \\ 3 & -3 \end{bmatrix} - \begin{bmatrix} 5 & -4 \\ -2 & -1 \end{bmatrix} = \begin{bmatrix} 0 & 5 \\ 5 & -2 \end{bmatrix}$

28) $\begin{bmatrix} -1 & -5 & 5 & 0 \\ 3 & -2 & -2 & 4 \end{bmatrix} - \begin{bmatrix} 2 & -1 & -5 & 1 \\ -3 & 4 & -1 & -5 \end{bmatrix}$

29) $\begin{bmatrix} -2 & 5 & -6 \\ 0 & 4 & 1 \end{bmatrix} + \begin{bmatrix} -5 & -1 & 0 \\ -3 & -6 & 1 \end{bmatrix}$

$$\begin{bmatrix} -7 & 4 & -6 \\ -3 & -2 & 2 \end{bmatrix}$$

30) $\begin{bmatrix} 4 & -6 \\ 4 & 0 \\ -1 & 3 \end{bmatrix} + \begin{bmatrix} 1 & 5 \\ -4 & 0 \\ -1 & -3 \end{bmatrix}$

31) $\begin{bmatrix} -2 \\ -5 \\ -2 \end{bmatrix} - \begin{bmatrix} -2 \\ -3 \\ 1 \end{bmatrix}$

$$\begin{bmatrix} 0 \\ -2 \\ -3 \end{bmatrix}$$

32) $3\begin{bmatrix} -2 & 5 \\ 6 & 1 \\ 4 & -3 \\ 1 & 5 \end{bmatrix}$

-4-

33) $\begin{bmatrix} -1 & -4 & -2 & -5 \\ 5 & -1 & 2 & -4 \end{bmatrix} \cdot \begin{bmatrix} -1 & 0 \\ 4 & -2 \\ 5 & -5 \\ 3 & 2 \end{bmatrix} = \begin{bmatrix} -40 & 8 \\ -11 & -16 \end{bmatrix}$

34) $\begin{bmatrix} 5 & 2 & 0 & -4 \\ -4 & 4 & 4 & 5 \end{bmatrix} \cdot \begin{bmatrix} -5 & 2 \\ 2 & -4 \\ -4 & -2 \\ 3 & -5 \end{bmatrix}$

35) $\begin{bmatrix} -3 & 2 \\ 6 & 5 \end{bmatrix} \cdot \begin{bmatrix} 6 & 2 & -1 \\ 2 & 0 & -5 \end{bmatrix}$

$\begin{bmatrix} -14 & -6 & -7 \\ 46 & 12 & -31 \end{bmatrix}$

36) $\begin{bmatrix} -5 & -2 & 4 & -6 \\ 1 & -6 & 1 & 5 \end{bmatrix} \cdot \begin{bmatrix} 0 & -1 \\ -1 & -2 \\ 3 & 2 \end{bmatrix}$

**Solve each equation.**

37) $\begin{bmatrix} -32 & -4 & 8 \end{bmatrix} = -4X$

$X = \begin{bmatrix} 8 & 1 & -2 \end{bmatrix}$

38) $3A = \begin{bmatrix} -15 & 9 & 15 \\ -27 & -27 & 18 \end{bmatrix}$

39) $5Y = \begin{bmatrix} 35 \\ 30 \\ 10 \end{bmatrix}$  $Y = \begin{bmatrix} 7 \\ 6 \\ 2 \end{bmatrix}$

40) $4A = \begin{bmatrix} 4 & 4 & 4 & -32 \end{bmatrix}$

**Evaluate each determinant.**

41) $\begin{vmatrix} 1 & -2 \\ 6 & 6 \end{vmatrix} = 18$

42) $\begin{vmatrix} 2 & 0 \\ 2 & 1 \end{vmatrix}$

43) $\begin{vmatrix} -5 & -5 \\ 6 & 5 \end{vmatrix} = 5$

44) $\begin{vmatrix} -2 & 3 \\ 0 & 4 \end{vmatrix}$

**Find the inverse of each matrix.**

45) $\begin{bmatrix} -6 & 1 \\ -10 & 0 \end{bmatrix} = \begin{bmatrix} 0 & -\frac{1}{10} \\ 1 & -\frac{3}{5} \end{bmatrix}$

46) $\begin{bmatrix} 1 & 7 \\ 0 & 9 \end{bmatrix}$

-5-

47) $\begin{bmatrix} 7 & 7 \\ -7 & -7 \end{bmatrix}$   *no inverse exists*

48) $\begin{bmatrix} 0 & 1 \\ 6 & -7 \end{bmatrix}$

**Evaluate each determinant.**

49) $\begin{vmatrix} 2 & -3 & -2 \\ -3 & -5 & 5 \\ 1 & 4 & 4 \end{vmatrix} = -117$

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

51) $\begin{vmatrix} 2 & -1 & -4 \\ -4 & -3 & 3 \\ -2 & -4 & -2 \end{vmatrix} = 10$

52) $\begin{vmatrix} 0 & 5 & 4 \\ 0 & -4 & 0 \\ -4 & 1 & 0 \end{vmatrix}$

**Find the inverse of each matrix.**

53) $\begin{bmatrix} -2 & 3 & -3 \\ 1 & 0 & -1 \\ 6 & -3 & -3 \end{bmatrix}^{-1} = \begin{bmatrix} -\frac{1}{2} & 3 & -\frac{1}{2} \\ -\frac{1}{2} & 4 & -\frac{5}{6} \\ -\frac{1}{2} & 2 & -\frac{1}{2} \end{bmatrix}$

54) $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 1 \\ -5 & 5 & 0 \end{bmatrix}$

55) $\begin{bmatrix} 0 & -5 & -3 \\ -5 & -3 & 5 \\ -5 & -5 & 4 \end{bmatrix}^{-1} = \begin{bmatrix} -\frac{13}{5} & -7 & \frac{34}{5} \\ 1 & 3 & -3 \\ -2 & -5 & 5 \end{bmatrix}$

56) $\begin{bmatrix} 3 & 5 & 3 \\ 2 & 3 & 2 \\ 0 & 1 & -2 \end{bmatrix}$

**Solve each equation or state if there is no unique solution.**

57) $\begin{bmatrix} 2 & -1 & 5 \\ 6 & -8 & -5 \\ -5 & 6 & 2 \end{bmatrix} C = \begin{bmatrix} 35 & -5 & 27 \\ 20 & 15 & 21 \\ -26 & -10 & -23 \end{bmatrix}$

$C = \begin{bmatrix} 8 & 8 & -3 \\ 1 & 6 & -8 \\ 4 & -3 & 5 \end{bmatrix}$

58) $\begin{bmatrix} 5 & 8 & -8 \\ 1 & 1 & 4 \\ -4 & -6 & 4 \end{bmatrix} Y = \begin{bmatrix} -24 \\ 9 \\ 14 \end{bmatrix}$

59) $\begin{bmatrix} 36 & 2 \\ 31 & 6 \end{bmatrix} = \begin{bmatrix} 7 & 5 \\ 7 & 6 \end{bmatrix} X - \begin{bmatrix} 0 & 4 \\ 8 & 4 \end{bmatrix}$

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

60) $\begin{bmatrix} -2 & 1 & 7 \\ 4 & 3 & 4 \\ -1 & -2 & -5 \end{bmatrix} C - \begin{bmatrix} -8 & -1 & -1 \\ 4 & -8 & 2 \\ -8 & -5 & -3 \end{bmatrix} = \begin{bmatrix} 23 & -1 & 0 \\ -13 & 29 & 11 \\ 6 & -5 & -2 \end{bmatrix}$

$C = \begin{bmatrix} -2 & 1 & 5 \\ -3 & 7 & -5 \\ 2 & -1 & 2 \end{bmatrix}$

61) Identify a34.

$\begin{bmatrix} 1 & 4 & -1 & -6 \\ -5 & 6 & -5 & 1 \\ -5 & 2 & 3 & 3 \end{bmatrix}$

$a_{34} =$

62) How do you know when a matrix does NOT have an inverse?

63) In order to add or subtract matrices, what has to be true?

64) What has to be true in order to mulitply matrices?

65) How do you know what the dimensions of your matrix should be when you multiply 2 matrices?

66) How do you state the dimensions of a matrix?

**Solve each equation.**

67) $\begin{bmatrix} 8 & 5 & -1 \\ -2 & 0 & 5 \end{bmatrix} + \begin{bmatrix} 9 & 8 \\ 0 & 1 \end{bmatrix} X = \begin{bmatrix} -19 & -7 & 48 \\ -11 & 3 & 1 \end{bmatrix}$

$X = \begin{bmatrix} 5 & -4 & 9 \\ -9 & 3 & -4 \end{bmatrix}$

68) $\begin{bmatrix} 5 & 5 \\ 2 & 4 \end{bmatrix} Y - \begin{bmatrix} -6 & -5 & 4 \\ -5 & -4 & -6 \end{bmatrix} = \begin{bmatrix} -9 & 0 & 46 \\ -9 & -8 & 32 \end{bmatrix}$
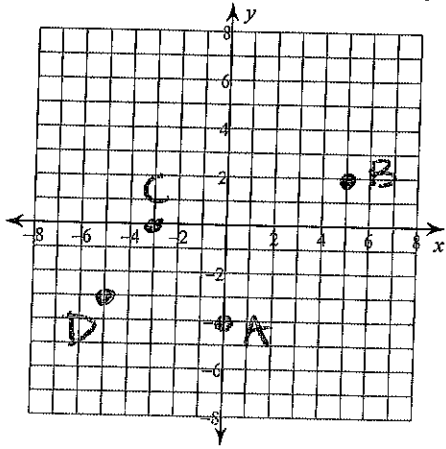
69) $\begin{bmatrix} 5 \\ 4 \end{bmatrix} + \begin{bmatrix} 2 & -4 \\ 6 & -7 \end{bmatrix} C = \begin{bmatrix} 23 \\ 48 \end{bmatrix}$

$C = \begin{bmatrix} 5 \\ -2 \end{bmatrix}$

70) Plot the following points in the coordinate plane.

(0,-4), (5,2), (-3, 0), (-5,-3)

A     B    C     D

**Find the distance between the two points.**

71) $(-4, -2)$, $(-5, -3)$   $d = \sqrt{2}$

72) $(6, 7)$, $(11, -8)$   $d = 5\sqrt{10}$

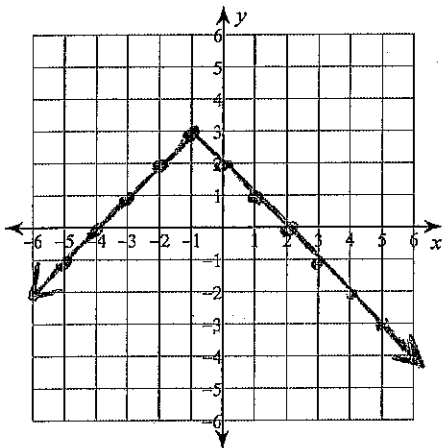**Find the midpoint of the line segment with the given endpoints.**

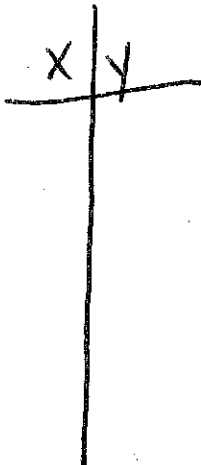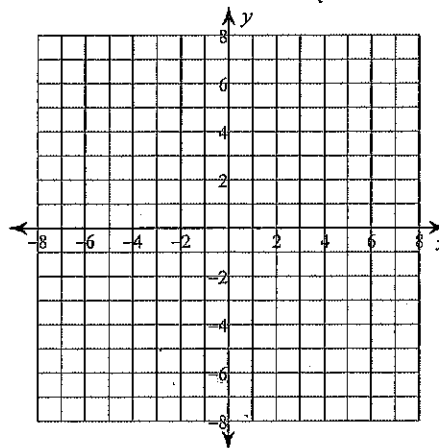73) $(2, 10)$, $(-2, -7)$

74) $(-14, 13)$, $(3, -9)$

$$m = \left(0, \frac{3}{2}\right)$$

**Graph each equation by creating a table of values and plotting the points.**

75) $y = -\left|x + 1\right| + 3$



76) $y = \sqrt{x + 5}$



| x | y |
|---|---|
|   |   |

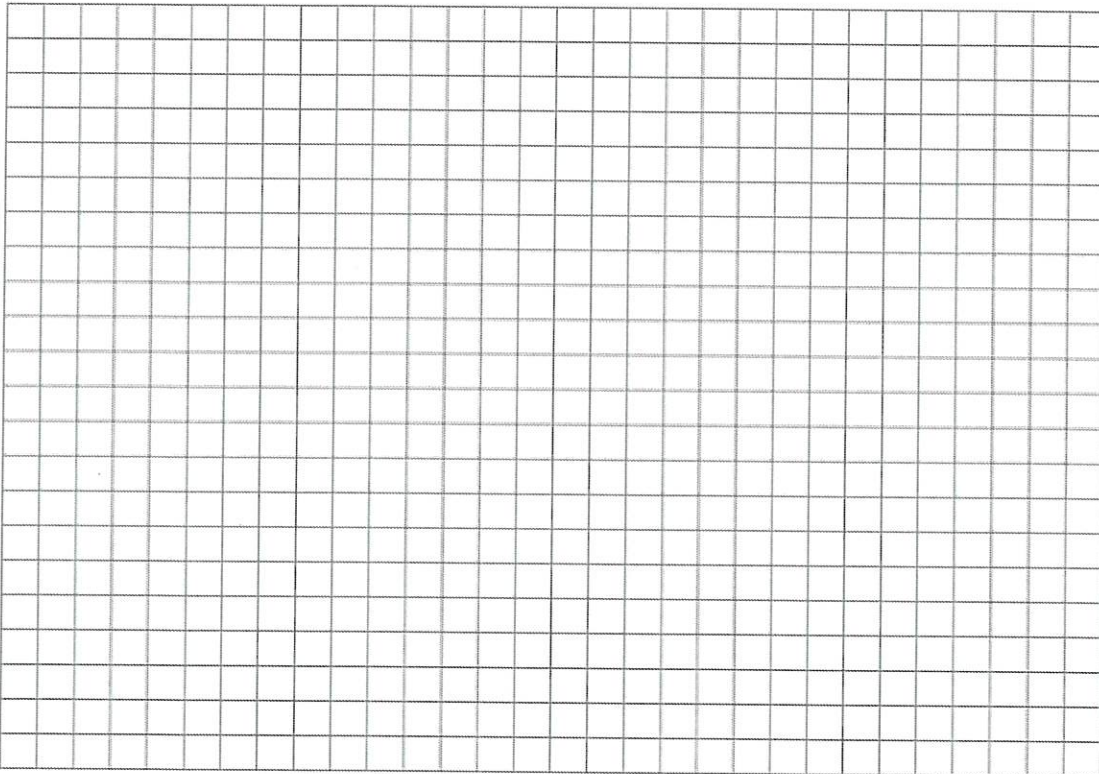**Directions: Solve each linear programming problem. Assume $x \geq 0$ and $y \geq 0$.**

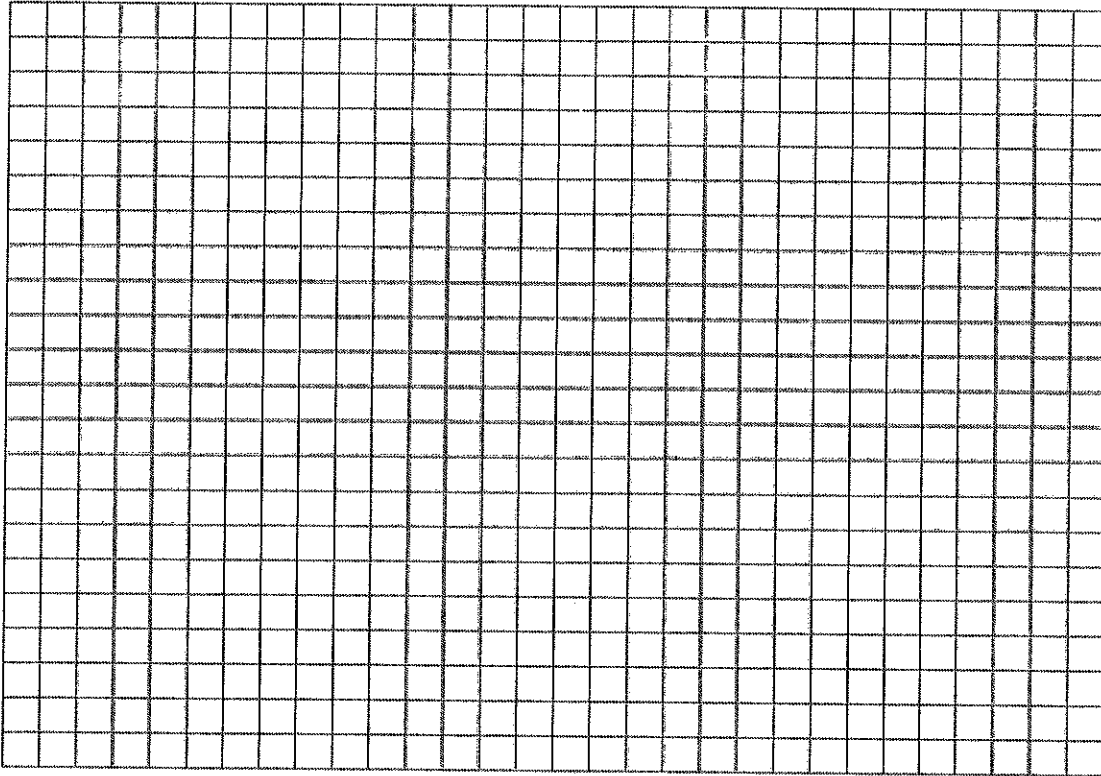1. Maximize $P = 2x + 2y$ with the constraints

$$\begin{cases} x + 2y \leq 14 \\ 5x + 2y \leq 30 \end{cases}$$

max of 18 @ (4,5)

2. Minimize $P = 6x + 3y$ with the constraints

$$\begin{cases} 5x + 2y \geq 20 \\ x + y \geq 7 \\ x + 2y \geq 10 \\ x \leq 15, y \leq 15 \end{cases}$$

3. Lisa has an online jewelry shop where she sells earrings and necklaces. She sells earrings for $30 and necklaces for $40. It takes 30 minutes to make a pair of earrings and 1 hour to make a necklace, and, since Lisa is a math tutor, she only has 10 hours a week to make jewelry. In addition, she only has enough materials to make 15 total jewelry items per week. She makes a profit of $15 on each pair of earrings and $20 on each necklace. **How many pairs of earrings and necklaces should Lisa make each week in order to maximize her profit, assuming she sells all her jewelry?**
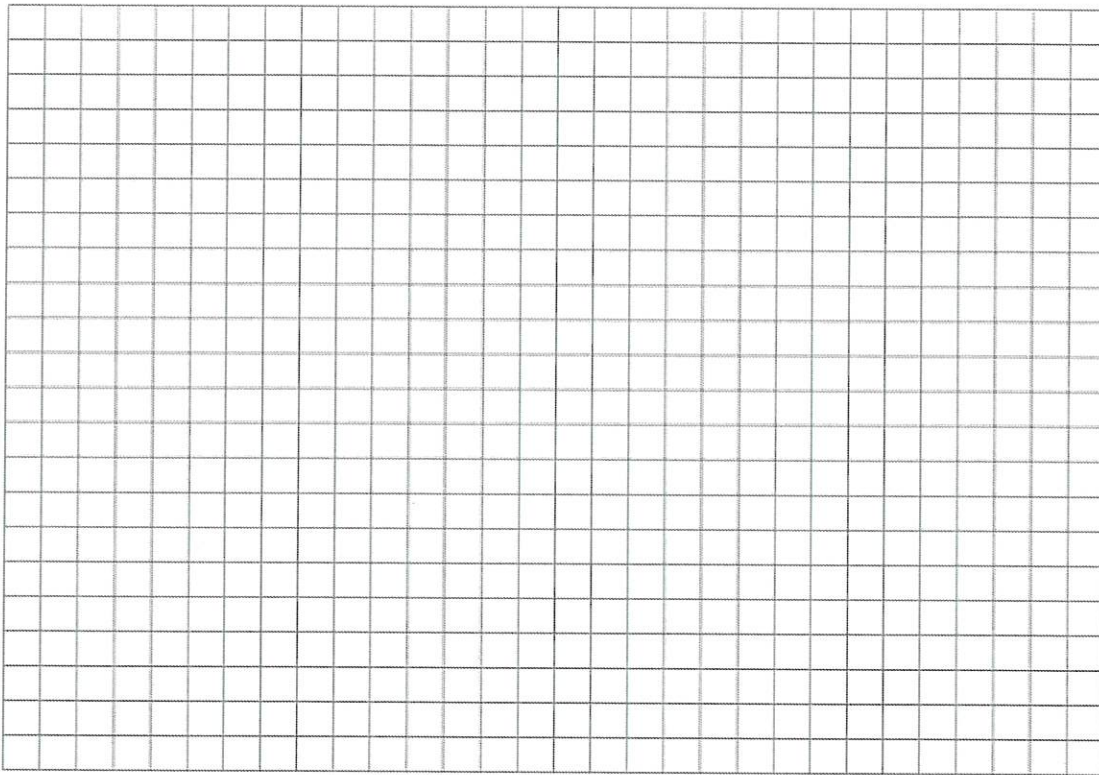
Lisa should make 10 pairs of earrings and 5 necklaces per week to maximize her profit.

4. A farmer has 10 acres to plant in wheat and rye. He has to plant at least 7 acres. However, he has only $1200 to spend and each acre of wheat costs $200 to plant and each acre of rye costs $100 to plant. Moreover, the farmer has to get the planting done in 12 hours and it takes an hour to plant an acre of wheat and 2 hours to plant an acre of rye. If the profit is $500 per acre of wheat and $300 per acre of rye how many acres of each should be planted to maximize profits?
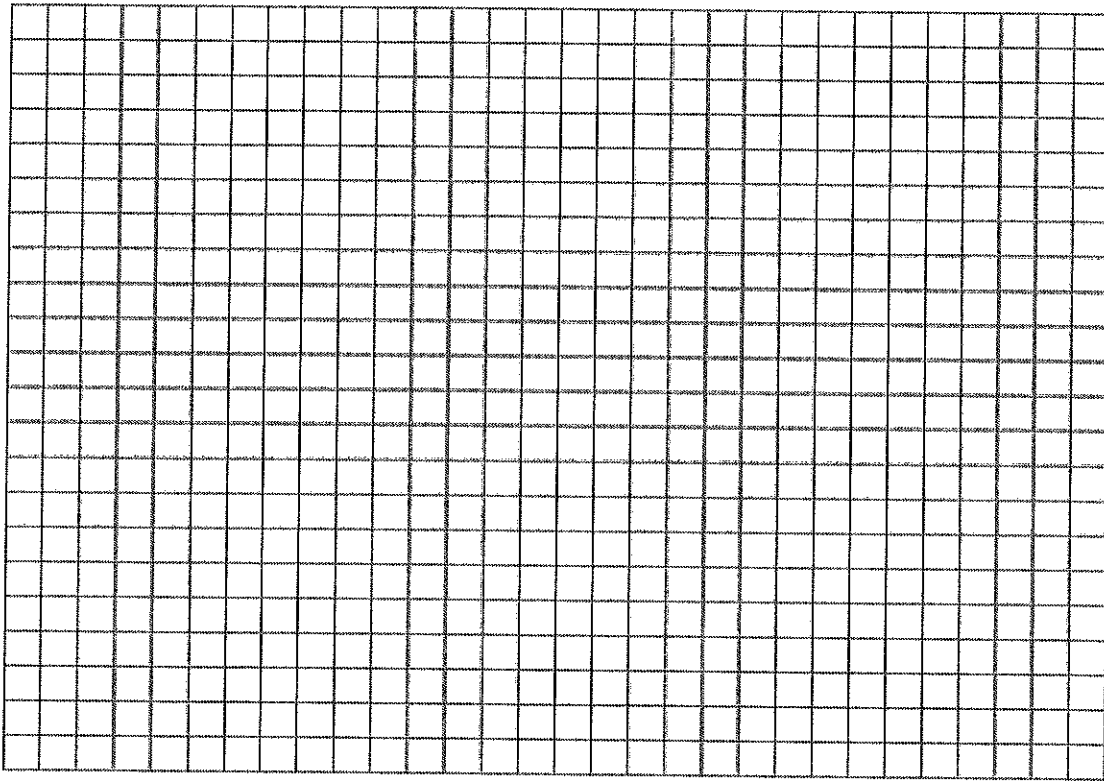
5. a. Write a matrix $H$ to represent the data in the table below.
   b. Find element $h_{23}$. What does this element represent?

**Technology in Public Schools (millions)**

| Type of School | Videodisc Players | Modems | Networks | CD-ROMs |
|---|---|---|---|---|
| Elementary | 25.9 | 35.1 | 26.4 | 37.9 |
| Junior High | 9.2 | 11.0 | 9.0 | 11.0 |
| Senior High | 10.7 | 14.5 | 12.9 | 14.0 |

SOURCE: Quality Education Data

(a)

$$\begin{bmatrix} 25.9 & 35.1 & 26.4 & 37.9 \\ 9.2 & 11.0 & 9.0 & 11.0 \\ 10.7 & 14.5 & 12.9 & 14.0 \end{bmatrix}$$

(b) $h_{23} = 9.0$

9.0 million networks in Junior High school

6. a. Using the data table above, create another matrix where the rows represent types of technology and columns represent type of school.

b. What are the dimensions of the new matrix?

c. Find the element $h_{23}$. What does this element represent?