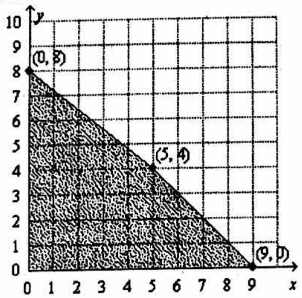
NC Math 3 Hon[...]
Unit 2- Systems of Equations REVIEW

Name: Key

Fill in the blank:

1. In a linear programming problem:
   a. The shaded region is called the feasible region.
   b. The function that is to be maximized or minimized is the objective function.
   c. If there is a maximum or minimum, it will occur at the vertices or corner points of the shaded region.
   d. The set of inequalities that represents the limitations on the resources is the set of constraints.

2. Find the values of $x$ and $y$ that maximize the objective function $P = 3x + 2y$ for the graph. What is the maximum value?




(0,8) 3(0)+2(8)=16
(5,4) 3(5)+2(4)=23
(9,0) 3(9)+2(0)=27
(0,0) 0

max = 27
occurs @ (9,0)

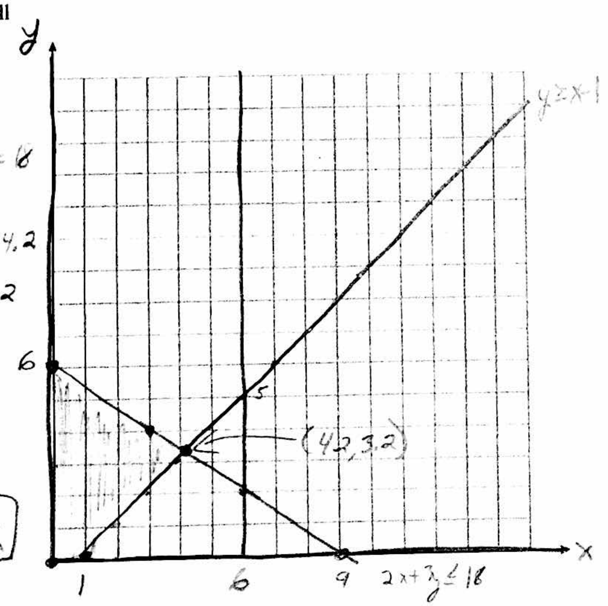
3. Given the system of constraints, name all vertices. Then find the maximum value of the given objective function.

$0 \le x \le 6$
$y \ge 0$
$2x + 3y \le 18$
$y \ge x - 1$

Maximum for
$C = 4x - 3y$

$2x+3(x-1)=18$
$5x = 21$
$x = \frac{21}{5} = 4.2$
$y = 4.2 - 1 = 3.2$

(0,0) 4(0)-3(0)=0
(0,6) 4(0)-3(6)=-18
(1,0) 4(1)-3(0)=4
(4.2,3.2) 4(4.2)-3(3.2)=
16.8-9.6 = 7.2 max




**Use the information below to answer questions 4-8.** x=first y=follow up

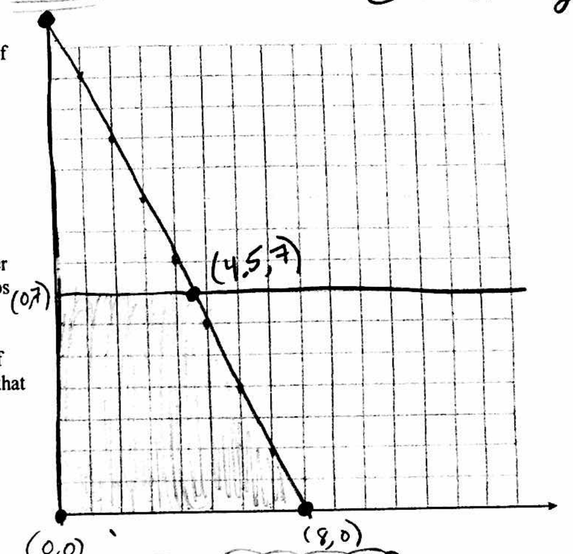
As a receptionist for a hospital, one of Elizabeth's tasks is to schedule appointments. She a[...] 60 minutes for the first visit and 30 minutes for a follow-up. The doctor cannot perform more than seven follow-ups per day. The hospital has eight hours available for appointments. The first visit costs $120 and the follow-up costs $70. Let x be the number of first visit and y be the number of follow-ups.

$C = 120x + 70y$

4. Write a system of inequalities to represent the number of first visits and the number of follow-ups that can be performed.

$x \ge 0$ $y \le 7$
$60x + 30y \le 480$
$6x + 3y \le 48$
$2x + y \le 16$

5. Graph the system of inequalities showing the feasible region to represent the number of first visits and the number of follow-ups that can be performed.




6. List the coordinates of the vertices of the feasible region to represent the number of first visits and the number of follow-ups that can be performed.

(0,0) (0,7) (8,0) (4.5,7)

7. Determine the number of first visits and follow-ups to be scheduled to make the maximum income.

(0,0) P=0
(0,7) P=120(0)+70(7)=490
(8,0) P=120(8)+70(0)=960
(4.5,7) P=120(4.5)+70(7)=1030

Ans: 4.5 first, 7 follow

Reality: 4 first 7 follow up

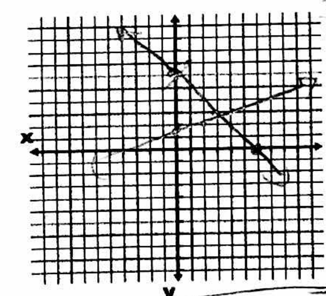
8. What is the maximum income that the doctor receives per day?

$1030

9. Solve the system by graphing.

$x + y = 6$ $y = -x + 6$
$y = \frac{1}{2}x + 2$

$\frac{1}{2}x + 2 = -x + 6$
$\frac{3}{2}x = 4$
$x = \frac{8}{3}$
$y = \frac{8}{6} + \frac{12}{6}$
$= \frac{20}{6} = \frac{10}{3}$




Ans: $\left(\frac{8}{3}, \frac{10}{3}\right)$

can use calc to help!

Solve the system by substitution:

$y = 5x + 3$
$4x - y = 7$

$4x-(5x+3)=7$
$-x-3=7$ $x=-10$
$y = 5(-10)+3$
$y = -47$
(-10,-47)

10. Solve the system by elimination:

$(4x - y = 11)5$
$x + 5y = 8$

$20x - 5y = 55$
$x + 5y = 8$
$21x = 63$
$x = 3$
$5y = 5$ $y = 1$

Ans: (3,1)

11. Create a system of equations with no solution.

Anything w/ same slope but diff y-ints. Ex: $y = x+2$, $y = x-2$

12. Create a system of equations with infinitely many solutions.

Anything w/ same slope and y-int. Ex: $2x+y=4$, $6x+3y=12$

13. On a feasible region whose vertices are (1,13), (3,13), (5,6) (6,2), what is the minimum of the objective function $R = 8x - 2y$, and where does it occur?

(1,13) $R = 8(1) - 2(13) = -18$
(3,13) $R = 8(3) - 2(13) = -2$
(5,6) $R = 8(5) - 2(6) = 28$
(6,2) $R = 8(6) - 2(2) = 44$

Minimum = −18 @ (1,13)

Using the matrices below to perform the operations.

$A = \begin{bmatrix} 0 & 11 \\ -1 & -5 \end{bmatrix}$ $B = \begin{bmatrix} 5 & 0 \\ 1 & 1 \end{bmatrix}$ $C = \begin{bmatrix} 4 & -13 \\ 7 & 0 \end{bmatrix}$

14. $A + B + C$

$\begin{bmatrix} 9 & -2 \\ 7 & -4 \end{bmatrix}$

15. $2B - 3C$

$\begin{bmatrix} 10 & 0 \\ 2 & 2 \end{bmatrix} - \begin{bmatrix} 12 & -39 \\ 21 & 0 \end{bmatrix} = \begin{bmatrix} -2 & 39 \\ -19 & 2 \end{bmatrix}$

16. $A \cdot B$

$\begin{bmatrix} 11 & 11 \\ -10 & -5 \end{bmatrix}$

17. $B \cdot A$

$\begin{bmatrix} 0 & 55 \\ -1 & 6 \end{bmatrix}$

18. Create two matrices that cannot be multiplied together and explain why this is not possible.

Anything where # columns in 1st ≠ # rows in 2nd

ex: $\underbrace{\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}}_{3\times 1} \cdot \underbrace{\begin{bmatrix} 4 & 5 \\ 6 & 7 \end{bmatrix}}_{3\times 2}$ no!

19. The sum of three numbers is 16. The largest number is equal to the sum of the other two, and three times the smallest number is 1 more than the largest. Find the three numbers.

x = 1st
y = 2nd
z = 3rd

$x + y + z = 16$
$x = y + z$
$3z = 1 + x$

rewrite into

$x+y+z=16$
$x-y-z=0$
$-x+0y+3z=1$

use calc matrices
$X = A^{-1}B$

x = 8
y = 5
z = 3

20. A parking lot has spaces reserved for motorcycles, cars, and vans. There are five more spaces reserved for vans than for motorcycles. There are three times as many car spaces as van and motorcycle spaces combined. If the parking lot has 180 total reserved spaces, how many of each type are there?

m = motorcycles
c = cars
v = vans

$m = v + 5$
$3c = v + m$
$m + c + v = 180$

rewrite into

$0c + m - v = 5$
$3c - m - v = 0$
$c + m + v = 180$

calc: c = 45, m = 70, v = 65

so 45 cars, 70 motorcycles, 65 vans

21. Every time a plumber makes a house call he gets paid a flat fee of $50 plus $40 per hour. Every hour he works he uses approximately $80 worth of materials. Let "x" represent the number of hours worked, S(x) represent total sales, and C(x) represent total cost.

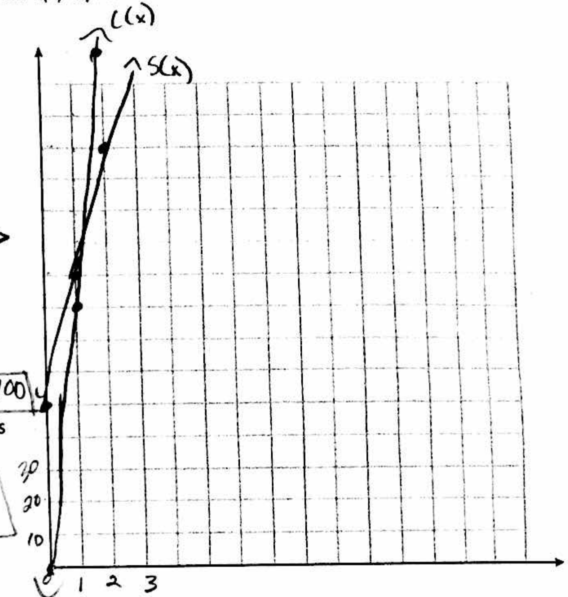
a. Write a sales equation.

$S(x) = 50 + 40x$

b. Write a cost equation.

$C(x) = 80x$

c. Graph the system of equations.




d. Solve the system to determine the break-even point.

$50 + 40x = 80x$
$50 = 40x$
$x = 5/4$ $y = 100$

e. What is the meaning of this solution point?

When he works 1.25 hrs, his cost = sales = $100.

22. Kareem spent $131 on shirts. Dry fit shirts cost $28 and plain cotton shirts cost $15. If he bought a total of 7 shirts, then how many of each kind did he buy?

D = dry fit
p = plain cotton

$28d + 15p = 131$
$d + p = 7$

d = 2 dry
p = 5 plain

23. At Elisa's Printing Company there are two kinds of printing presses. Model A can print 70 books per day and Model B can print 55 books per day. The company owns 14 total printing presses and this allows them to print 905 books per day. How many of each type of press do they have?

A = Model A
B = Model B

$A + B = 14$
$70A + 55B = 905$

A = 9
B = 5