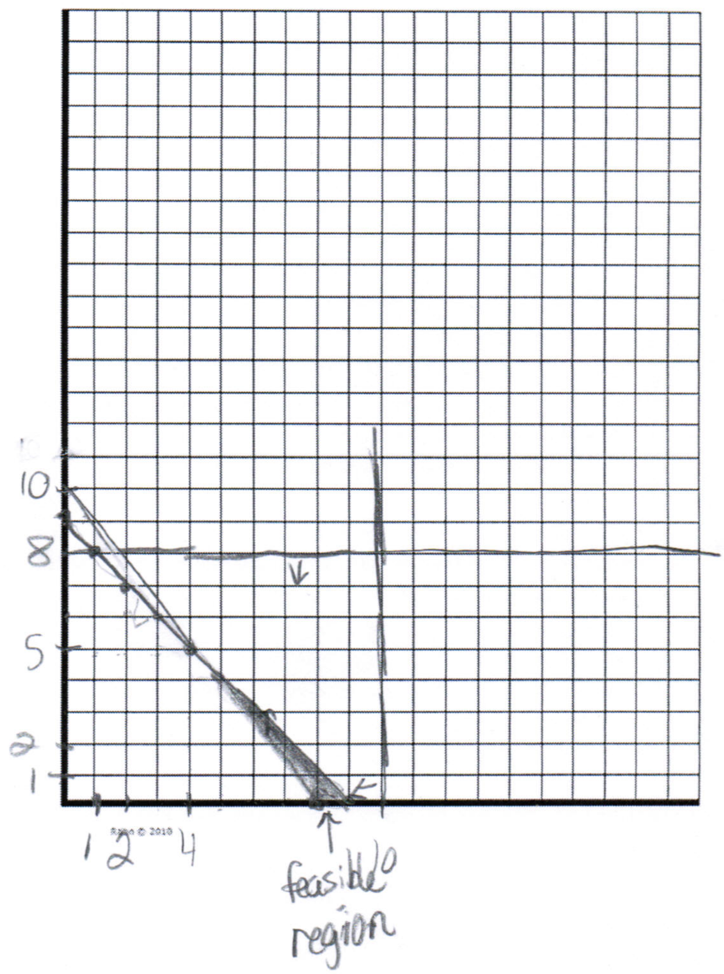
Algebra 1
Practice
Linear Programming

Name Solutions

Period_____

1. A school is preparing a trip for 400 students. The company who is providing the transportation has 10 buses of 50 seats each and 8 buses of 40 seats, but only has 9 drivers available. The rental cost for a large bus is $800 and $600 for the small bus. Calculate how many buses of each type should be used for the trip for the least possible cost.



1) Define variables

X = large buses

Y= small buses

2) State/ Write Objective Function

$800x + 600y$

3) Write the constraints

$x \leq 10$

$y \leq 8$

$50x + 40y \geq 400 \rightarrow 5x + 4y \geq 40$

$y \geq -\frac{5}{4} + 10$

$x + y \leq 9 \rightarrow y \leq -x + 9$

4) Draw Feasible region

5) Determine the vertices (corners)

$x + y = 9$
$5x + 4y = 40$

$\rightarrow$

$-4x - 4y = -36$
$+5x + 4y = 40$
$x = 4$
$y = 5$

(4,5)
(8,0)
(0,9)

6) Plug all vertices into objective function and state the optimal solution.

$(4,5) \rightarrow 800(4) + 600(5) = 6200$

$(8,0) \rightarrow 800(8) + 600(0) = 6400$

$(0,9) \rightarrow 800(0) + 600(9) = 5400 \leftarrow$ minimum

2. Stitches Inc. can make at most 30 jean jackets and 20 leather jackets in a week. It takes a worker 10 hours to make a jean jacket and 20 hours to make a leather jacket. The total number of hours by all of the employees can be no more than 500 hours per week. The profit on a jean jacket is $20, and the profit on a leather jacket is $50. How many of each type should be produced in order to maximize profit? What is the maximum profit?

1) Define variables

X = # of jean jackets

Y= # of leather jackets

2) State/ Write Objective Function

$20x + 50y$

3) Write the constraints

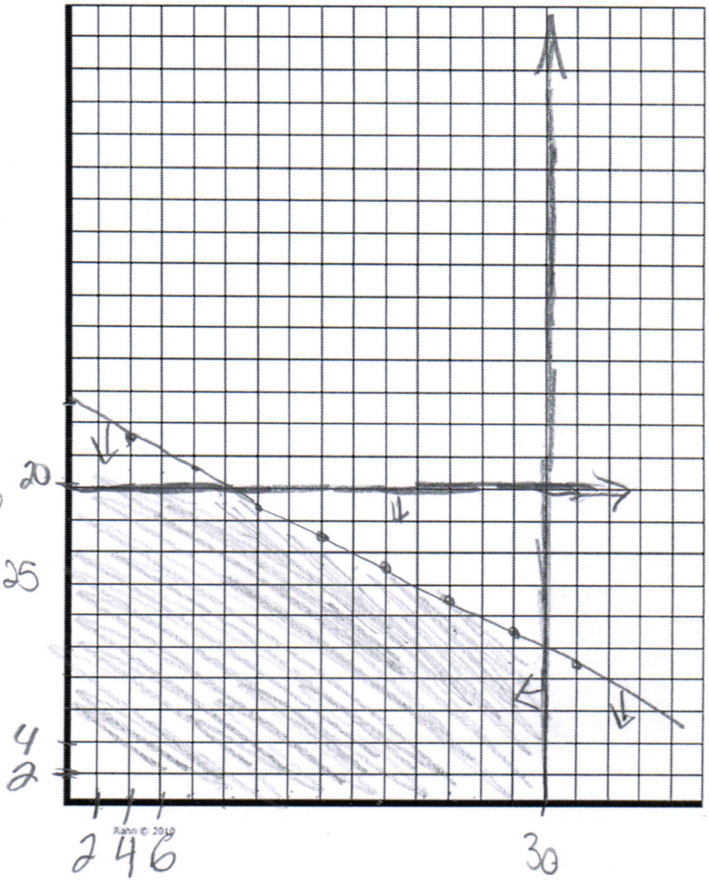
$10x + 20y \leq 500 \rightarrow x + 2y \leq 50$

$2y \leq -x + 50$

$y \leq -\frac{1}{2}x + 25$

$x \leq 30$

$y \leq 20$



4) Draw Feasible region

5) Determine the vertices (corners)

(0,20) (10, 20)
(30,0) (30, 10)

6) Plug all vertices into objective function and state the optimal solution.

$(0, 20) \longrightarrow 20(0) + 50(20) = 1000$

$(10, 20) \longrightarrow 20(10) + 50(20) = 1200 \leftarrow$ maximum

$(30, 0) \longrightarrow 20(30) + 50(0) = 600$

$(30, 10) \longrightarrow 20(30) + 50(10) = 1100$

3. A transport company has two types of trucks, Type A and Type B. Type A has a refrigerated capacity of 20 m^3 and a non-refrigerated capacity of 40 m^3 while Type B has the same overall volume with equal sections for refrigerated and non-refrigerated stock. A grocer needs to hire trucks for the transport of 3,000 m3 of refrigerated stock and 4 000 m3 of non-refrigerated stock. The cost per kilometer of a Type A is $30, and $40 for Type B. How many trucks of each type should the grocer rent to achieve the minimum total cost?

1) Define variables

X = # Type A

Y= # Type B

2) State/ Write Objective Function

$30x + 40y$

3) Write the constraints

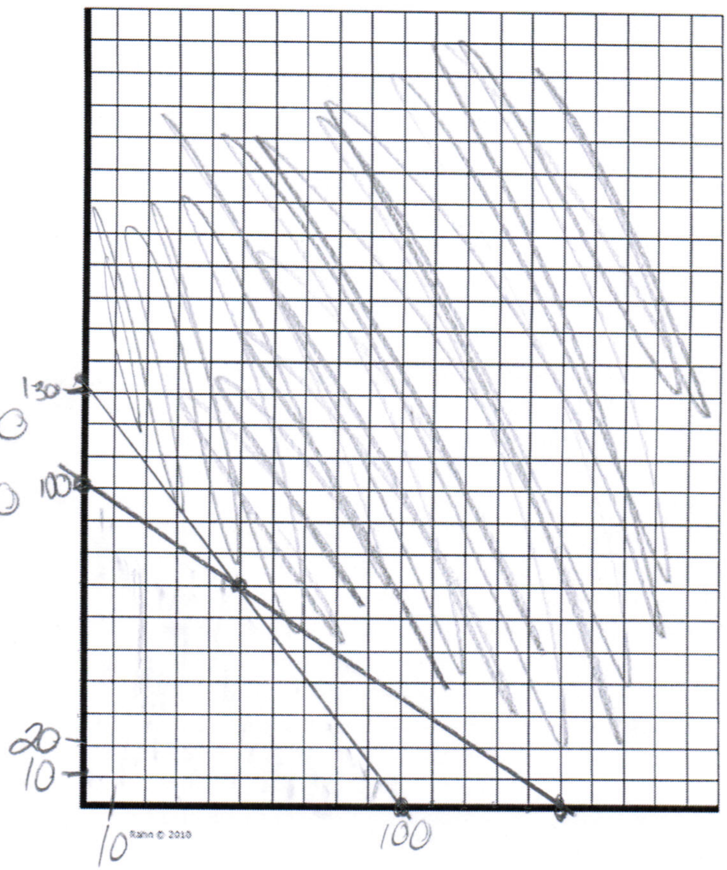
$20x + 30y \geq 3000 \rightarrow 2x + 3y \geq 300$

$40x + 30y \geq 4000 \rightarrow 4x + 3y \geq 400$

x	y
0	100
150	0

x	y
0	133.33
100	0

4) Draw Feasible region



5) Determine the vertices (corners)

(150, 0)

$(0, 133.\overline{33})$

(50, 67)

$$\begin{aligned} 2x+3y &= 300 \\ - \quad 4x+3y &= 400 \\ \hline -2x &= -100 \\ x &= 50 \end{aligned}$$

$y = 66.67 = 67$

6) Plug all vertices into objective function and state the optimal solution.

$(150, 0) \longrightarrow 30(150) + 40(0) = 4500$

$(0, 133.\overline{33}) \longrightarrow 30(0) + 40(100) = 5333.2$

$(50, 67) \rightarrow 30(50) + 40(67) = 4180$ minimum total cost