Unit 1: Equations and Polynomials

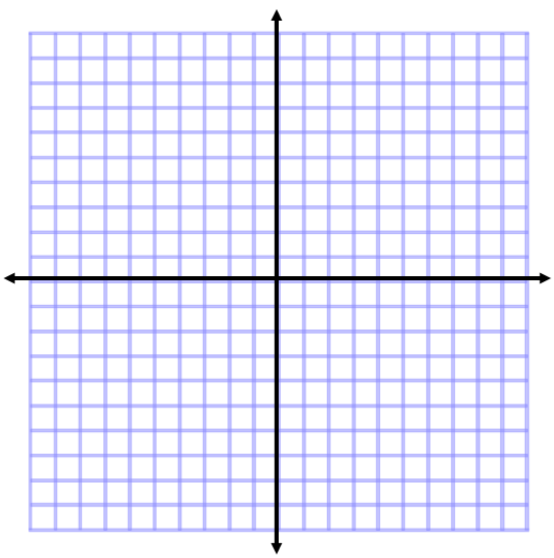
Lesson 6: Linear Programming

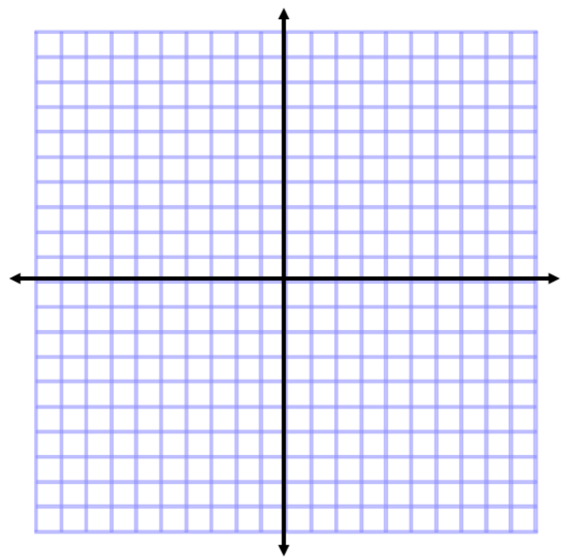
<u>Warm-Up</u>

Solve each system of inequalities by graphing

1. $\begin{cases} x \geq 5 \\ y > -3x + 6 \end{cases}$

2. $\begin{cases} x + 3y < -6 \\ 2x - 3y \leq 4 \end{cases}$





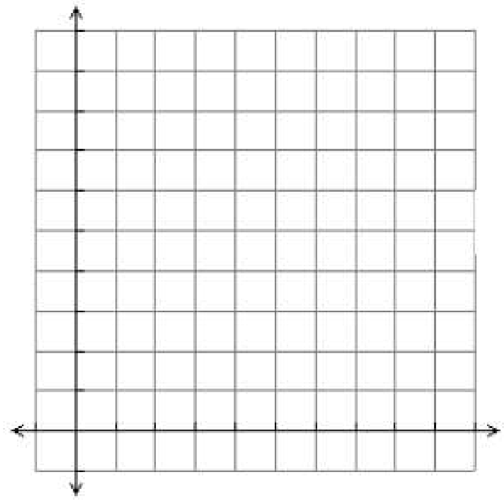
<u>LINEAR PROGRAMMING:</u>

<u>VERTEX PRINCIPAL OF LINEAR PROGRAMMING:</u>

Example # 1

Find the values of x and y that maximize and minimize P for the objective function $P = 3x + 2y$. What is the value of P at each vertex?

Constraints $\begin{cases} y \geq \frac{3}{2}x - 3 \\ y \leq -x + 7 \\ x \geq 0, y \geq 0 \end{cases}$

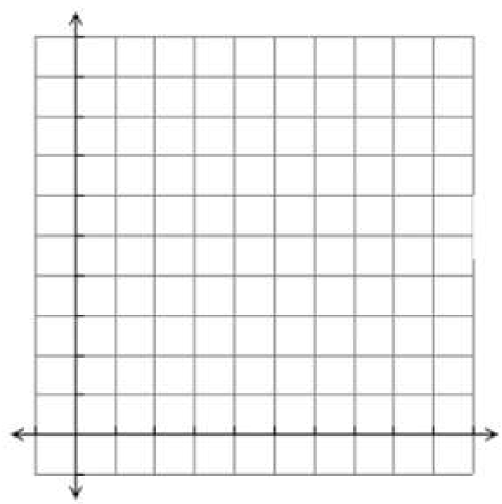


Example # 2

$\begin{cases} x + y \leq 8 \\ 2x + y \leq 10 \\ x \geq 0, y \geq 0 \end{cases}$

Maximum for

$N = 100x + 40y$

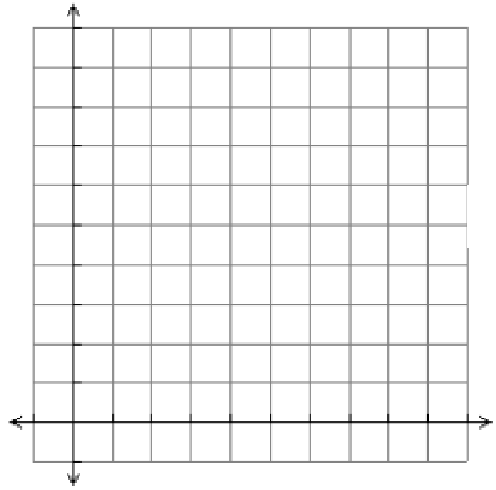


PRACTICE 1-6 LINEAR PROGRAMMING

1. $\left\{\begin{matrix} x+y\geq 8 \\ y\geq 5 \\ x\geq 7 \end{matrix}\right\}$

Minimum for

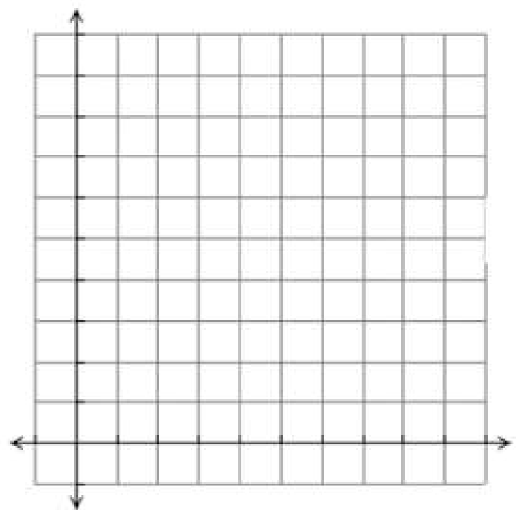
P = 3x + y



2. $\left\{\begin{matrix} x+y\geq 6 \\ y\leq 5 \\ x\leq 8 \end{matrix}\right\}$

Maximum for

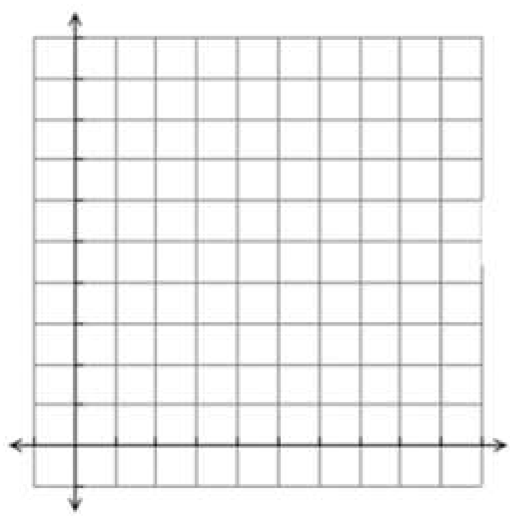
C = x + 3y



3. $\left\{\begin{matrix} x+2y\geq 8 \\ x\geq 2 \\ y\geq 0 \end{matrix}\right\}$

Maximum for

C = 2x + 3y



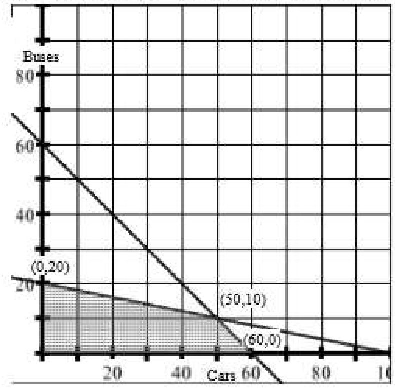
NAME ____ DATE ____________

Linear Programming Worksheet
Algebra 2

1. The area of a parking lot is 600 square meters. A car requires 6 square meters. A bus requires 30 square meters. The attendant can handle only 60 vehicles. If a car is charged \$2.50 and a bus \$7.50, how many of each should be accepted to maximize income?

Constraints:
$c \geq 0;\ b \geq 0$
$c + b \leq 60$
$6c + 30b \leq 600$
Profit:
$P(c,b) = 2.5c + 7.5b$

	Car (c)	Bus (b)	Combined
Area:	6	30	600
Quantity:			60
\$:	\$2.50	\$7.50	

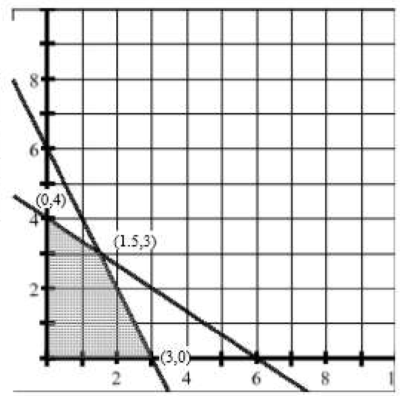


2. The B & W Leather Company wants to add handmade belts and wallets to its product line. Each belt nets the company \$18 in profit, and each wallet nets \$12. Both belts and wallets require cutting and sewing. Belts require 2 hours of cutting time and 6 hours of sewing time. Wallets require 3 hours of cutting time and 3 hours of sewing time. If the cutting machine is available 12 hours a week and the sewing machine is available 18 hours per week, what ratio of belts and wallets will produce the most profit within the constraints?

Constraints:
$b \geq 0;\ w \geq 0$
Cutting: $2b + 3w \leq 12$
Sewing: $6b + 3w \leq 18$

Profit:
$P(b,w) = 18b + 12w$

	Belts (b)	Wallets (w)	Combined
Cutting:	2	3	12
Sewing:	6	3	18
\$:	\$18	\$12	

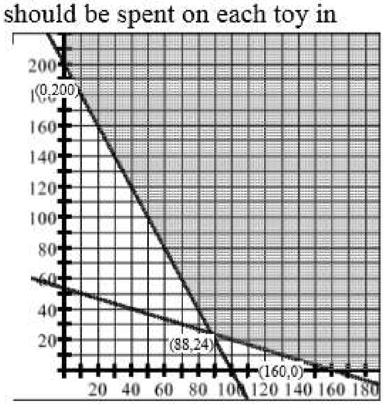


3. Toys-A-Go makes toys at Plant A and Plant B. Plant A needs to make a minimum of 1000 toy dump trucks and fire engines. Plant B needs to make a minimum of 800 toy dump trucks and fire engines. Plant A can make 10 toy dump trucks and 5 toy fire engines per hour. Plant B can produce 5 toy dump trucks and 15 toy fire engines per hour. It costs \$30 per hour to produce toy dump trucks and \$35 per hour to operate produce toy fire engines. How many hours should be spent on each toy in order to minimize cost? What is the minimum cost?

Constraints:
$d \geq 0; f \geq 0$
Plant A: $10d + 5f \geq 1000$
Plant B: $5d + 15f \geq 800$

Cost:
$C(x,y) = 30d + 35f$

	Dump hrs (d)	Fire hrs (f)	Combined
Plant A:	10	5	1000
Plant B:	5	15	800
\$:	\$30	\$35	



4. A diet is to include at least 140 milligrams of Vitamin A and at least 145 milligrams of Vitamin B. These requirements can be obtained from two types of food. Type X contains 10 milligrams of Vitamin A and 20 milligrams of Vitamin B per pound. Type Y contains 30 milligrams of Vitamin A and 15 milligrams of Vitamin B per pound. If type X food costs $12 per pound and type Y food costs $8 per pound how many pounds of each type of food should be purchased to satisfy the requirements at the minimum cost?

Constraints:

$x \geq 0;\ y \geq 0$

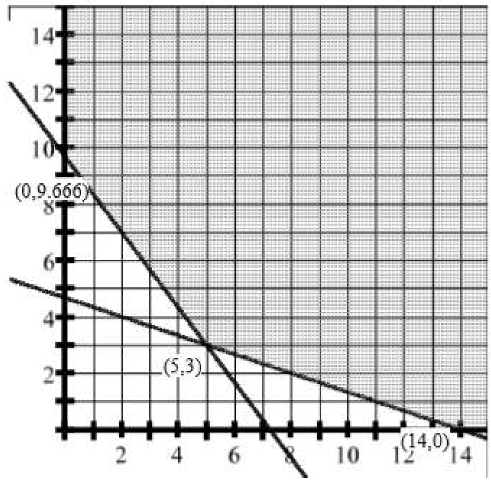
Vit A: $10x + 30y \geq 140$

Vit. B: $20x + 15y \geq 145$

Cost:

$C(x, y) = 12x + 8y$

	Food X	Food Y	Combined
Vit A:	10	30	140
Vit B:	20	15	145
$:	$12	$8	



5. The Cruiser Bicycle Company makes two styles of bicycles: the Traveler, which sells for $300, and the Tourister, which sells $600. Each bicycle has the same frame and tires, but the assembly and painting time required for the Traveler is only 1 hour, while it is 3 hours for the Tourister. There are 300 frames and 360 hours of labor available for production. How many bicycles of each model should be produced to maximize revenue?

Traveler $= x$

Tourister $= y$

	Traveler (x)	Tourister (y)	Combined
Frame:			300
Labor:	1	3	360
$:	$300	$600	

Constraints:

$x \geq 0;\ y \geq 0$

Frames: $x + y \leq 300$

Labor: $x + 3y \leq 360$

Revenue:

$R(x, y) = 300x + 600y$