**Graphic Arts**
**Maximizing Profits Worksheet** **Name** Key

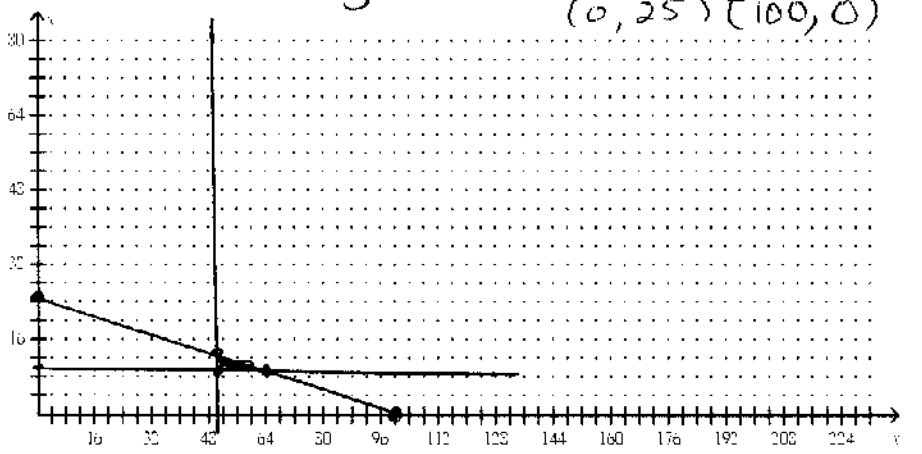
1. A screen printer has no more than $500 to spend on printing T-shirts and sweatshirts for a 5-K charity race. He must print at least 50 T-shirts and 10 sweatshirts. The supplies and labor cost $5 per T-shirt shirt and $20 per sweatshirt. The screen printer will make a profit of $10 per T-shirt and $35 per sweatshirt. How many of each should be printed to maximize the profit? What is the maximum profit?

$x$ = T-Shirt
$y$ = Sweatshirt

Profit function P = $10x + 35y$

Constraints $x \geq 50$ $y \geq 10$ $5x + 20y \leq 500$

$(0, 25)$ $(100, 0)$




| $(x, y)$ | $P = 10x + 35y$ |
|---|---|
| $(50, 10)$ | 850 |
| $(50, 12)$ ~~$(50, 12.5)$~~ | 920 |
| $(60, 10)$ | 950 |

Must be $\leq 500$, so do not round up

$10(50) + 35(10) = 850$

$10(50) + 35(12) = 920$

$10(60) + 35(10) = 950$

**Max profit** $950

60 T-shirts
10 Sweatshirts

2. A printer is hired to printer brochures and fliers for a travel agency to advertise special discounts and vacation destinations for spring break. Each brochure costs $.08 to print, and each flier costs $.04 to print. A brochure uses 2 pieces of paper, and a flier uses 1 piece of paper. The printer does not want to use more than 250 pieces of paper, and she needs at least 50 brochures and 75 fliers. How many of each should she print to minimize the cost? What is the minimum cost?

**a.** Write an objective function *C* and constraints for a linear program to model the problem.

**b.** Graph the constraint and find the coordinates of each vertex.

**c.** Evaluate *C* at each vertex to find the minimum cost.

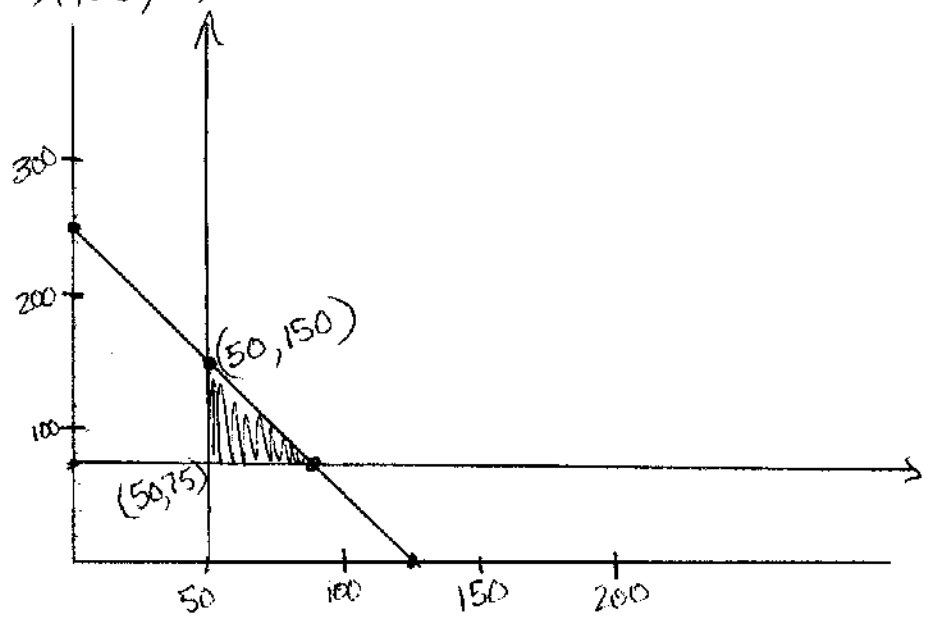
$x$ = brochure
$y$ = flier

**a.** $C = .08x + .04y$

**b. Constraints**

$2x + y \leq 250 \quad x \geq 50 \quad y \geq 75$

(0, 250) (125, 0)




| (x, y) | $C = .08x + .04y$ |
|---|---|
| (50, 75) | 7 |
| (50, 150) | 10 |
| (~~87.5~~ 87, 75) | 9.96 |

**c.** ~~**Max profit**~~ Min Cost $7 — 50 brochures, 75 fliers

3. Your computer supply store sells two types of inkjet printers. The first, type A, costs $137 and you make a $50 profit on each one. The second, type B, costs $100 and you make a $40 profit on each one. You can order no more than 100 printers this month, and you need to make at least $4400 profit on them. If you must order at least one of each type of printer, how many of each type of printer should you order if you want to minimize your cost?

$x$ = type A
$y$ = type B

Cost function C = $137x + 100y$

Constraints

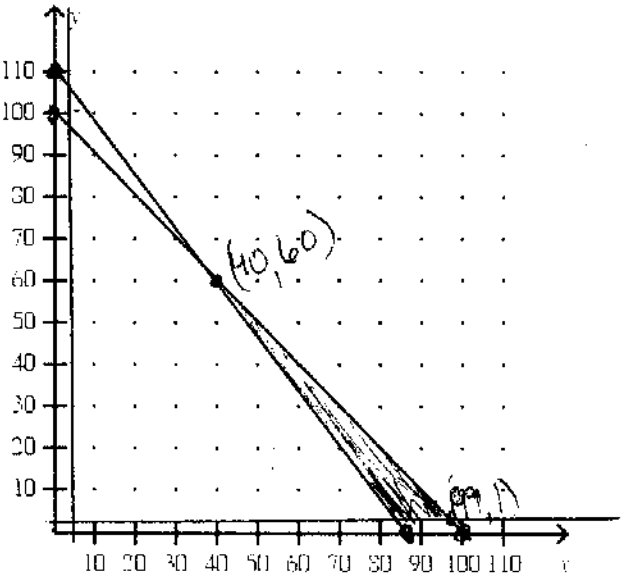
Printers $x + y \leq 100$

Profit $50x + 40y \geq 4400$

$x \geq 1$ $y \geq 1$

$x + y = 100$
(0, 100)
(100, 0)

$50x + 40y = 4400$
(0, 110)
(88, 0)




| (x, y) | C = 137x + 100y |
|---|---|
| ~~(1, 108.7)~~ | ~~11012~~ ← This won't work b/c more than 100 printers |
| (40, 60) | 11480 |
| (87.2, 1) | 12046.4 |
| (99, 1) | 13663 |

$-40(x + y = 100)$
$50x + 40y = 4400$

$50x + 40y = 4400$
$-40x - 40y = -4000$
$10x = 400$
$\frac{10x}{10} = \frac{400}{10}$
$x = 40$

$40 + y = 100$
$y = 60$
(40, 60)

**Min Cost** $11,480

Type A 40 Type B 60

4. Given the system of constraints, name all vertices. Then find the maximum value of the given objective function. Maximum for $C = 4x - 3y$

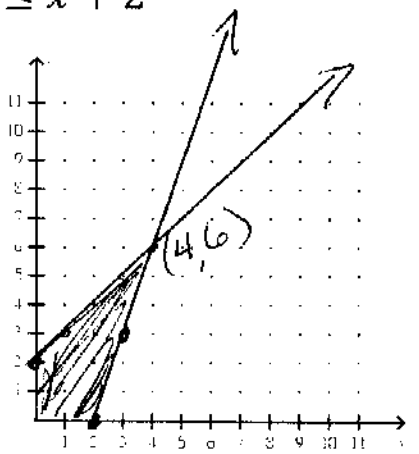
$x \geq 0, y \geq 0$

$6x - 2y \leq 12$ (0, -6)(2 0)

$y \leq x + 2$

$\frac{-2y}{-2} \leq \frac{-6x+12}{-2}$

$y \geq 3x - 6$




| (x,y) | C = 4x - 3y |
|---|---|
| (0,2) | -6 |
| (2 0) | 8 |
| (4,6) | -2 |

a. (0, 2), (2, 0), (4, 6); maximum value of –6
b. (0, 2), (2, 0), (6, 4); maximum value of 12
c. (0, 2), (2, 0), (4, 2); maximum value of 10
d. (0, 2), (2, 0), (4, 6); maximum value of 8

5. Graph the system of constraints. Then find the values of *x* and *y* that maximize.

P = 40x +20y

$x \geq 0$

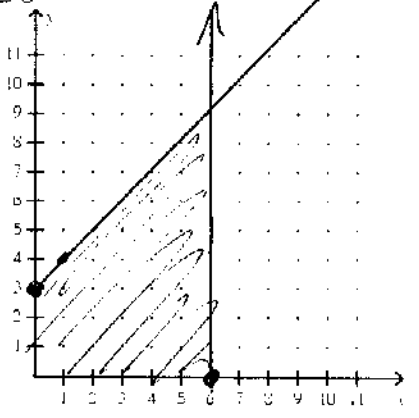
$y \geq 0$

$-2x + 2y \leq 6$ (0 3)(-3 0)

$x \leq 6$

$2y \leq 2x + 6$

$y \leq x + 3$



| (x,y) | P = 40x + 20y |
|---|---|
| (0 0) | 0 |
| (0,3) | 60 |
| (6 0) | 240 |
| (6,9) | 420 |

Max of 420 at (6,9)

6. Graph the system of constraints. Then find the values of *x* and *y* that maximize.

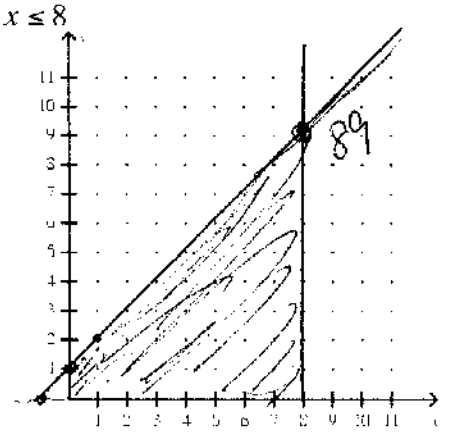
P = 50x +40y

$x \geq 0$

$y \geq 0$

$-x + y \leq 1$ (0, 1) (−1, 0) $y \leq x + 1$

$x \leq 8$




| (x,y) | P = 50x + 40y |
|---|---|
| (0,0) | 0 |
| (0,1) | 40 |
| (8,0) | 400 |
| (8,9) | 760 |

Max of 760 at (8,9)

7. Graph the system of constraints. Then find the values of *x* and *y* that maximize.

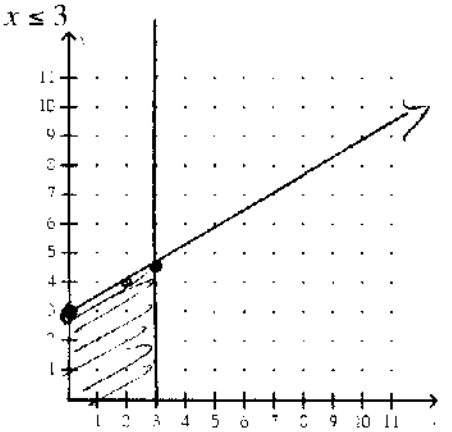
P = 30x +40y

$x \geq 0$

$y \geq 0$

$-x + 2y \leq 6$ $y \leq \frac{1}{2}x + 3$

$x \leq 3$



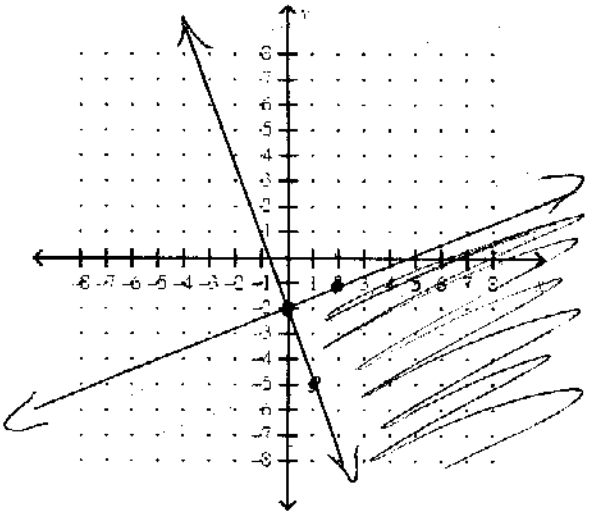
| (x,y) | P = 30x + 40y |
|---|---|
| (0,0) | 0 |
| (0,3) | 120 |
| (3,0) | 90 |
| (3,4.5) | 270 |

Max of 270 at (3,4.5)

8. Graph the inequalities. test (0,0)

$y \geq -3x - 2$ $0 \geq -2$ T

$y \leq \frac{1}{2}x - 2$ $0 \leq -2$ F

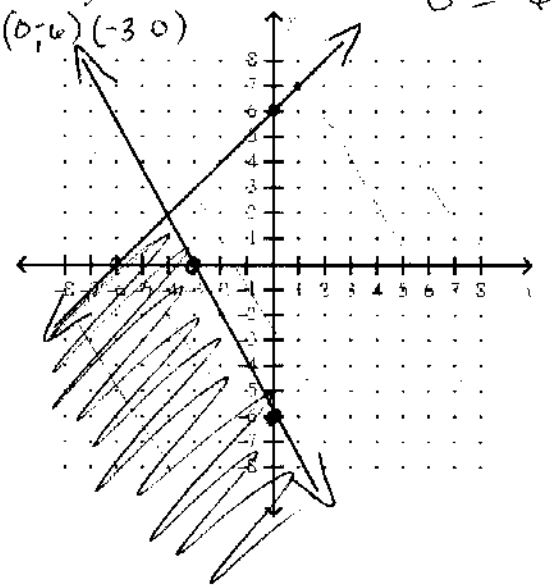


9. Graph the inequalities. test (0,0)

$y \leq x + 6$ $0 \leq 6$ T

$2x + y \leq -6$ $0 \leq -6$ F

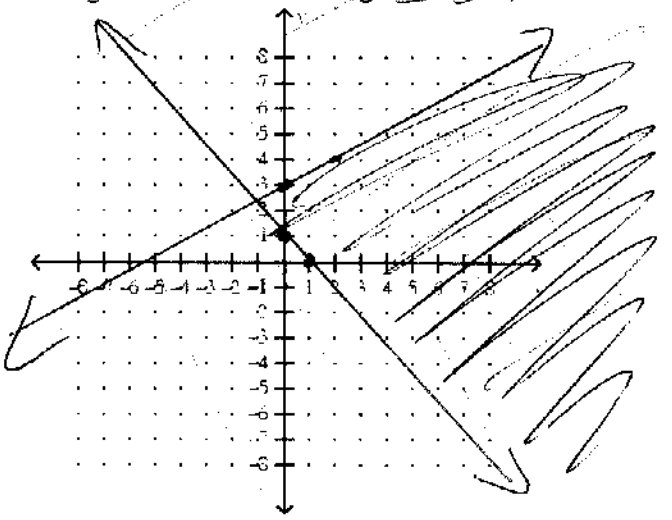
(0,-6) (-3 0)



10. Graph the inequalities test (0 0)

$y \geq -x + 1$ $0 \geq 1$ F

$y \leq \frac{1}{2}x + 3$ $0 \leq 3$ T



11. Graph the inequalities

$x \geq -3$

$y \leq 5$