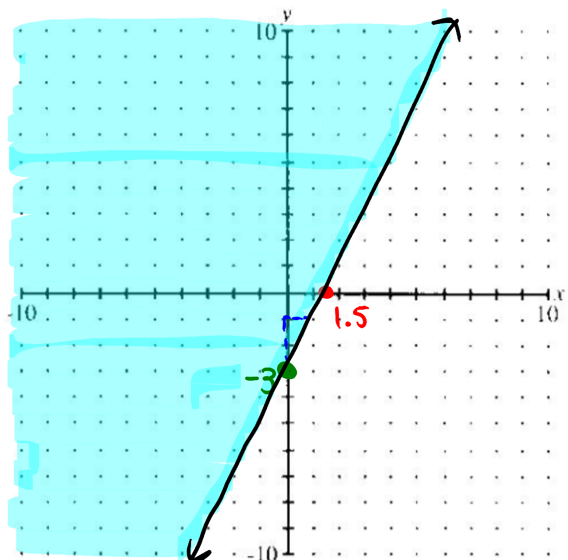
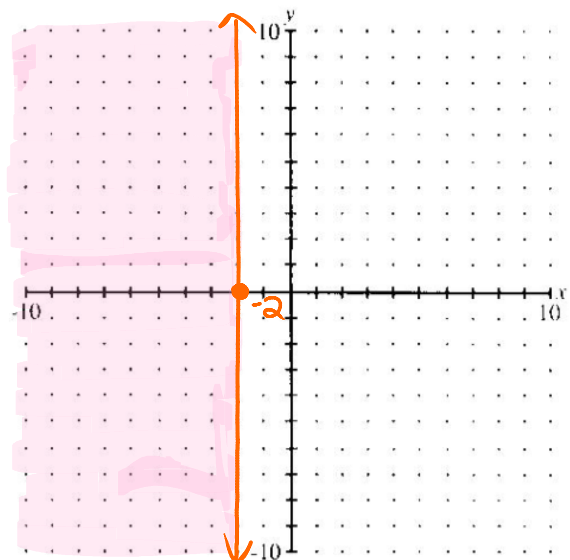
Chapter 6 Questions

1) Graph the solution set for each linear inequality.

a) $y \geq 2x - 3$

b) $4x \leq x - 6$





① Graph $y = 2x - 3$ (solid)

$x = 0 \Rightarrow y = 2(0) - 3$

$y = -3$

$y = 0 \Rightarrow 0 = 2x - \cancel{3}$

$+3 \qquad +3$

$\frac{3}{2} = \frac{\cancel{2}x}{\cancel{2}} \quad x = \frac{3}{2}$ or 1.5

② Find out which side to shade

Test (0,0) in original

$0 \geq 2(0) - 3$

$0 \geq 0 - 3$

$0 \geq -3$ ← True

(shade side containing (0,0))

① Graph $4x = x - 6$ (solid)

* only x variable, so isolate x (special case)

$4x = \cancel{x} - 6$

$-x \qquad -\cancel{x}$

$\frac{\cancel{3}x}{\cancel{3}} = \frac{-6}{3}$ $\boxed{x = -2}$ vertical thru

② Find out which side to shade

Test (0,0) in original

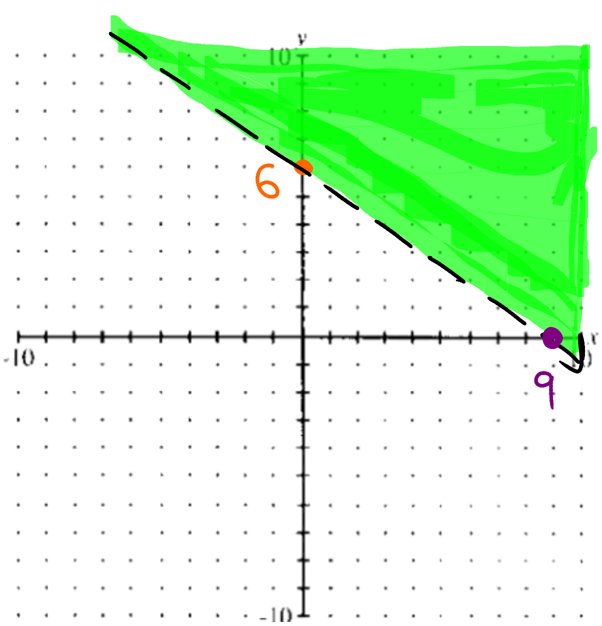
$4(0) \leq 0 - 6$

$0 \leq -6$ ← false

(shade side opposite (0,0))

2) Graph the solution set for the linear inequality.

$2x + 3y > 18$



① Graph $2x + 3y = 18$ (dashed)

$x = 0 \Rightarrow 2(0) + 3y = 18$

$\frac{3y}{3} = \frac{18}{3}$

$y = 6$

$y = 0 \Rightarrow 2x + 3(0) = 18$

$\frac{2x}{2} = \frac{18}{2}$

$x = 9$

② Find out which side to shade.

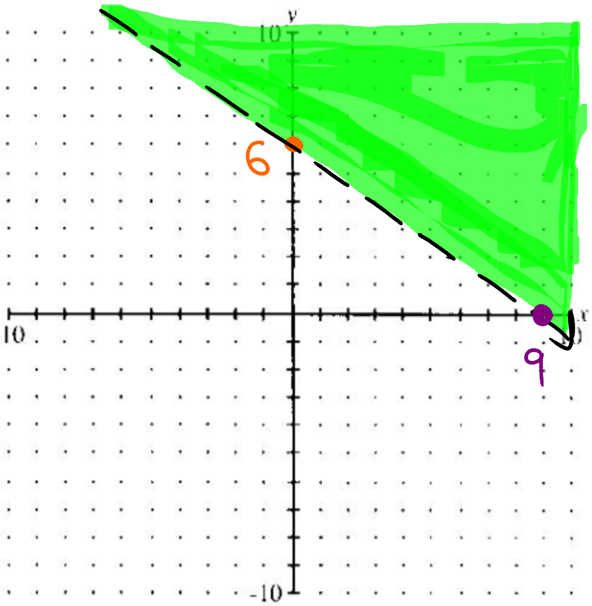
Test (0,0) in original

$2(0) + 3(0) > 18$

$0 + 0 > 18$

$0 > 18$ ← false

(shade side opposite (0,0))



$x=0 \Rightarrow 2(0)+3y=18$

$\frac{3y}{3}=\frac{18}{3}$

$y=6$

$y=0 \Rightarrow 2x+3(0)=18$

$\frac{2x}{2}=\frac{18}{2}$

$x=9$

② Find out which side to shade.

Test (0,0) in original

$2(0)+3(0)>18$

$0+0>18$

$0>18 \leftarrow$ false

(shade side opposite (0,0))

3) For the inequality $-2y < 3x+1$, determine whether each point is in its solution region

(3,0)

$-2(0)<3(3)+1$

$0<6+1$

$0<7 \leftarrow$ true

∴ it is in solution region

(-2,2)

$-2(2)<3(-2)+1$

$-4<-6+1$

$-4<-5 \leftarrow$ false (careful)

∴ it is not in the solution region.

(-1,1)

$-2(1)<3(-1)+1$

$-2<-3+1$

$-2<-2 \leftarrow$ false $(-2=-2)$

∴ it is not in the solution region.

4) Tyson loves candy. His two favourite types of candy are Caramilk Chocolate and Gobstoppers. Caramilk Chocolate is \$2 each and Gobstoppers are \$1 each. Tyson budgets himself no more than \$10 a week for candy. Tyson wants to know all of the possible combinations of Caramilk Chocolate and Gobstoppers he can buy in a week.

a) Define the variables (1 mark)

Let c = # of caramilks
Let g = # of gobstoppers

b) Write a linear inequality to represent the situation. (2 marks)

$2c + 1g \leq 10$

c) What are the restrictions on the variables? (1 mark)

must be positive integers

or $\begin{cases} c \in W \\ g \in W \end{cases}$

d) Graph the linear inequality. (2 marks)

① Graph $2c + 1g = 10$ (solid)

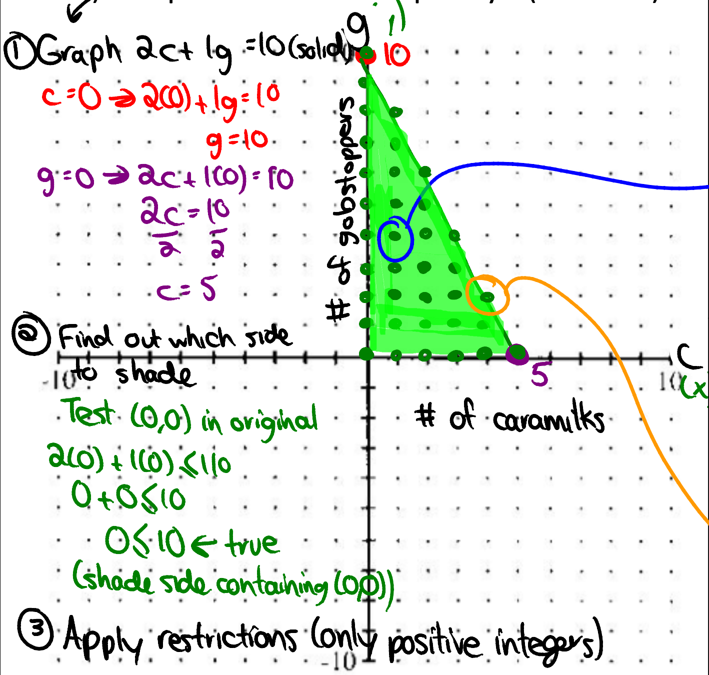
$c = 0 \Rightarrow 2(0) + 1g = 10$
$g = 10$

$g = 0 \Rightarrow 2c + 1(0) = 10$
$2c = 10$
$\frac{2c}{2} = \frac{10}{2}$
$c = 5$

② Find out which side to shade

Test (0,0) in original
$2(0) + 1(0) \leq 10$
$0 + 0 \leq 10$
$0 \leq 10 \leftarrow$ true
(shade side containing (0,0))

③ Apply restrictions (only positive integers)



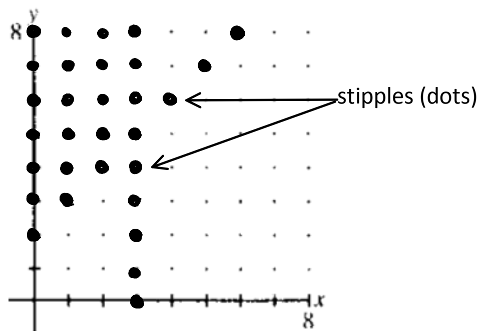
e) Use the graph to determine a combination of candy that Tyson can afford and still have money left over. (1 mark)

1 caramilk, 4 gobstoppers

f) Use the graph to determine a combination of candy that Tyson can afford with no money left over. (1 mark)

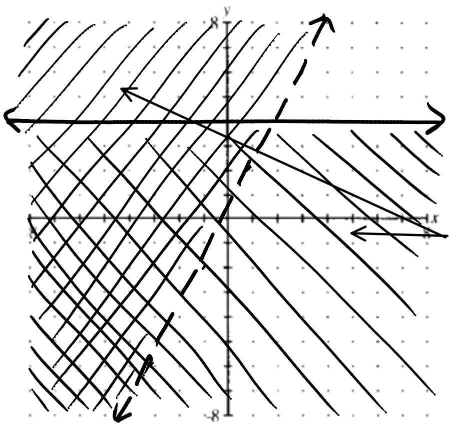
4 caramilks, 2 gobstoppers.

5) What can you infer about the restrictions on the variables for the system of linear inequalities below?



a) x ∈ I, y ∈ I
b) x ∈ R, y ∈ R
c) x ∈ W, y ∈ W
d) x ∈ y, y ∈ x

6) What can you infer about the restrictions on the variables for the system of linear inequalities below?



shaded regions

a) $x \in I, y \in I$
b) $x \in R, y \in R$
c) $x \in W, y \in W$
d) $x \in y, y \in x$

7) Stephanie is buying hamburger buns and hot dog buns. She buys less than 30 hamburger buns and more than 10 hot dog buns. If *m* represents the number of hamburger buns and *d* represents the number of hot dog buns, which inequalities represent these relationships?

a) $m < 30, d > 10$ c) $m \leq 30, d \geq 10$
b) $m > 30, d < 10$ d) $m \geq 30, d \leq 10$

8) Jared is a disc jockey and plays at least twice as many rap songs as country songs. If *r* represents the number of rap songs and *c* represents the number of country songs, which inequality represents this relationship?

a) $c \leq 2r$ c) $r \leq 2c$
b) $c \geq 2r$ d) $r \geq 2c$

9) Consider the system of linear inequalities.

$\{(x,y) \mid 3x-6y<18, x\in I, y\in I\}$
$\{(x,y) \mid x \geq -3, x\in I, y\in I\}$

Circle each point that is a solution to the system.
THERE MAY BE MORE THAN ONE ANSWER!

a) (-4, 3) d) (2, -2)
b) (0, 0) e) (3, -1)
c) (0.5, 1.5)

a) $3(-4)-6(3)<18$
$-12-18<18$
$-30<18$ ✓
$-4 \geq -3$ ×

b) $3(0)-6(0)<18$

d) $3(2)-6(-2)<18$
$6+12<18$
$18<18$ ×

e) $3(3)-6(-1)<18$
$9+6<18$

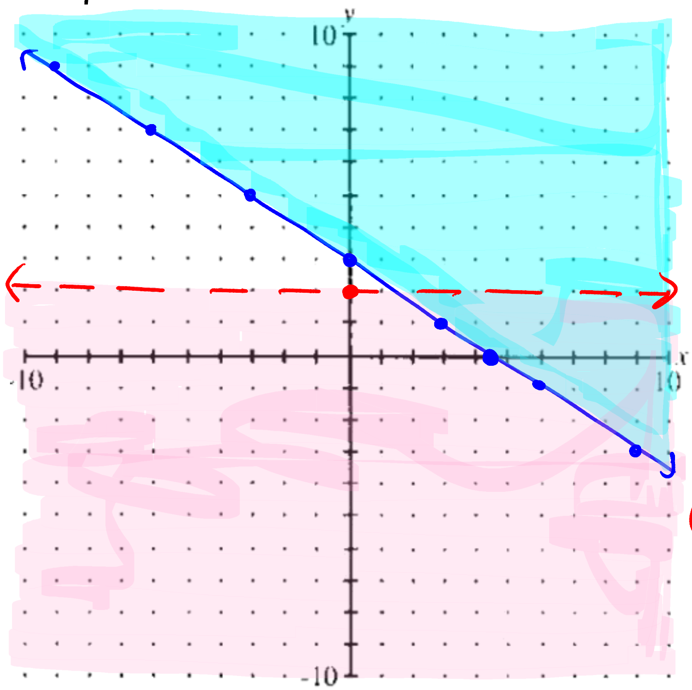
$0<18$ ✓
$0 \geq -3$ ✓

$15<18$ ✓
$3 \geq -3$ ✓

Ⓒ not integers ×

10) Graph the solution set for the following system of inequalities.

$2x+3y \geq 9$
$y<2$



① Graph
$2x+3y=9$ ← solid.

$x=0 \rightarrow 2(0)+3y=9$
$\frac{3y}{3}=\frac{9}{3}$
$y=3$

$y=0 \rightarrow 2x+3(0)=9$
$\frac{2x}{2}=\frac{9}{2}$
$x=4.5$

Test (0,0)
$2(0)+3(0) \geq 9$
$0 \geq 9$ ← false (shade opposite (0,0))

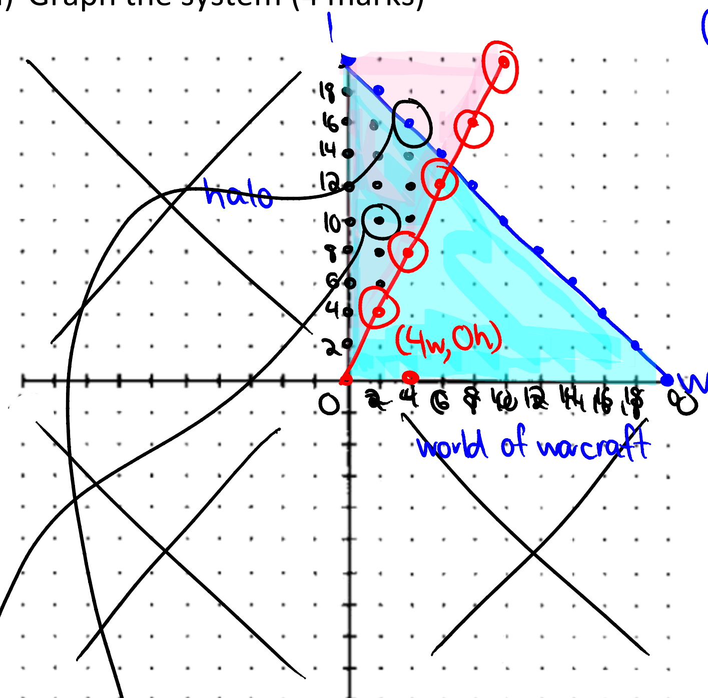
② Graph $y=2$ ← dotted
Test (0,0)
$0<2$ ← true
(shade side w/

11) Travis loves video games. His two favorite games are "World of Warcraft" and "Halo".

- Travis is allowed to play video games a maximum of 20 times per week.
- He plays "Halo" at least twice as many times as he plays "World of Warcraft".

a) Define the variables (1 mark)	b) What are the restrictions on the variables? (1 mark)	c) Write a system of inequalities that models this situation (2 marks)
h = halo w = world of warcraft	positive integers or $\begin{cases} h \in W \\ w \in W \end{cases}$	$h + w \leq 20$ $h \geq 2w$

d) Graph the system (4 marks)



① Graph $h + w = 20 \leftarrow$ solid

$h = 0 \rightarrow 0 + w = 20$

$w = 20$

$w = 0 \rightarrow h + 0 = 20$

$h = 20$

Test (0,0)

$0 + 0 \leq 20$

$0 \leq 20 \leftarrow$ true

② Graph $h = 2w \leftarrow$ solid

$h = 0 \rightarrow \frac{0}{2} = \frac{2w}{2}$

$w = 0$

$w = 0 \rightarrow h = 2(0)$

$h = 0$

$w = 2 \rightarrow h = 2(2)$

$h = 4$

Test (4w, 0h)

$0 \geq 2(4)$

$0 \geq 8 \leftarrow$ false

e) Use the graph to determine a combination of video games that Tyson can play in one week. (1 mark)

4 w.o.w., 16 halo

2 w.o.w., 10 halo

12) Which of the following is a possible solution to the inequality 2y - 9 > 3x?

a) (-1, 3) c) (-2, -2)

b) (0, 0) d) (3, 10)

ⓐ $2(3) - 9 > 3(-1)$ ⓑ $2(0) - 9 > 3(0)$ ⓒ $2(-2) - 9 > 3(-2)$ ⓓ $2(10) - 9 > 3(3)$

$6 - 9 > -3$ $-9 > 0$ ✗ $-4 - 9 > -6$ $11 > 9$ ✓

$-3 > -3$ ✗ $-13 > -6$ ✗

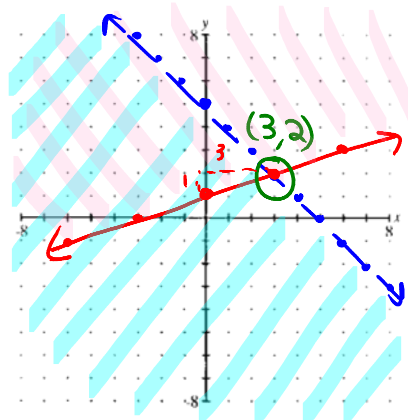
13) Identify the point of intersection for the following system of linear inequalities.

$x + y \leq 5$

$3y - x \geq 3$

a) (-6, -1) c) (3, 2)

b) (-3, 2) d) (6, -1)



Answer questions #14 and #15 from the following system and objective function.

Constraints:

$x \geq 0$ } means "X"

$y \geq 0$

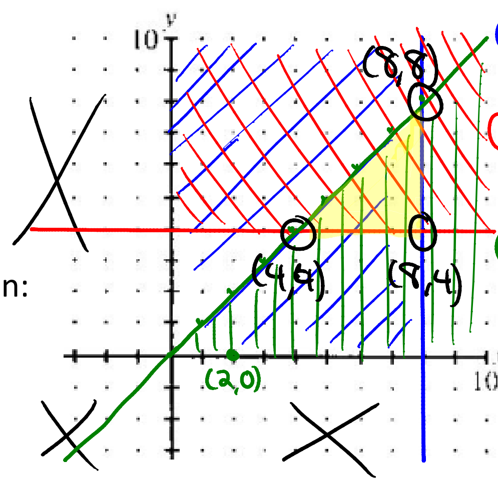
$x \leq 8$

$y \geq 4$

$x \geq y$

Objective function:

$G = 2x - y$



① $x = 8$ ← solid

Test (0,0) → $0 \leq 8$ true

② $y = 4$ ← solid

Test (0,0) → $0 \geq 4$ false

③ $x = y$ ← solid

$y = x$

$y = 1x + 0$ } y int = 0, slope = 1

Test (2,0) → $2 \geq 0$ ← true

14) Where is the maximum solution to the objective function?

a) (0, 0) d) (8, 4)

b) (8, 0) e) (8, 8)

c) (4, 4)

Substitute corners into objective function

(8,8) → $G = 2(8) - 8$

$G = 8$

(4,4) → $G = 2(4) - 4$

$G = 4$] MIN

(8,4) → $G = 2(8) - 4$

$G = 12$] MAX

15) Where is the minimum solution to the objective function?

a) (0, 0) d) (8, 4)

b) (8, 0) e) (8, 8)

c) (4, 4)

Answer questions #16-19 from the following information:

A student council is ordering signs for the winter dance. Signs can be made in letter or poster size.

- No more than 30 of each size are wanted. $L \leqslant 30$ and $P \leqslant 30$
- More poster size signs are wanted than letter-size signs. $P > L$
- Up to three times as many poster-size signs are wanted than letter-size signs.
- No more than 50 signs are needed altogether $P + L \leqslant 50$ $P \leqslant 3L$
- Letter-size signs cost \$5 each and poster-size signs cost \$12.

Let L represent the number of letter-size signs.
Let P represent the number of poster-size signs.

16) Which of the following is a constraint of the system?

a) $L + P \leqslant 30$
b) $L \leqslant 30$
c) $P \geqslant 30$
d) $L + P \geqslant 30$

17) Which of the following is a constraint of the system?

a) $P > L$
b) $P < L$
c) $P \geqslant L$
d) $P \leqslant L$

18) Which of the following is a constraint of the system?

a) $P \geqslant 3L$
b) $P \leqslant 3L$
c) $L \geqslant 3P$
d) $L \leqslant 3P$

19) How would you write the objective function for cost?

a) $5L + 12P \leqslant 50$
b) $L + P \leqslant 50$
c) $C = L + P$
d) $C = 5L + 12P$

Cost is \$5 times the # of letter size signs plus \$12 times the # of poster size signs

20) Joseph tutors Math and English and has made a plan for how much tutoring he can do in the next month.

- He wants to spend at least twice as much time tutoring Math than tutoring English.
- He can tutor, at most, for 45 hours altogether.
- He wants to tutor Math for at least 10 hours.

Joseph earns $20 per hour for tutoring Math and $25 per hour for tutoring English.

a) Define the variables

m = # of hours tutoring Math
e = # of hours tutoring English

b) Write the objective function for how much revenue Joseph can earn.

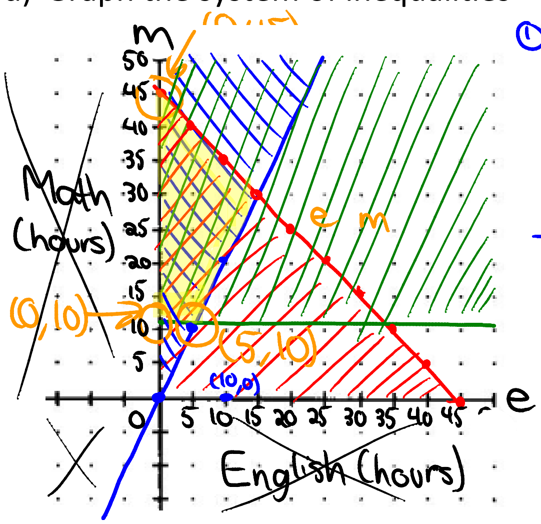
Revenue is $20 per hour of Math plus $25 per hour of English

$R = 20m + 25e$

c) Write a system of inequalities that models the constraints

$m \geq 2e$
$m + e \leq 45$
$m \geq 10$

d) Graph the system of inequalities



① $m = 2e$ ← solid
$y = 2x$
$\underbrace{y = 2x + 0}$
y-int = 0
slope = 2
Test $(\underset{e}{10}, \underset{m}{0})$
$0 \geq 2(10)$
$0 \geq 20$ ← false

② $m + e = 45$ ← solid
$y + \cancel{x} = 45$
$\;\;\; -\cancel{x} \;\; -x$
$\underbrace{y = -x + 45}$
y-int = 45
slope = -1
Test (0,0)
$0 + 0 \leq 45$ true

③ $m = 10$ ← solid
$y = 10$
Test (0,0)
$0 \geq 10$ ← false

e) What is the maximum revenue that Joseph can earn?

Test top corners!

(0,45)
$R = 20(45) + 25(0)$
$R = \$900$

$\boxed{\begin{array}{l}(15, 30) \\ R = 20(30) + 25(15) \\ R = \$975\end{array}}$

f) What is the minimum revenue that Joseph can earn?

Test bottom corners

(5,10)
$R = 20(10) + 25(5)$
$R = \$325$

$\boxed{\begin{array}{l}(0, 10) \\ R = 20(10) + 25(0) \\ R = \$200\end{array}}$