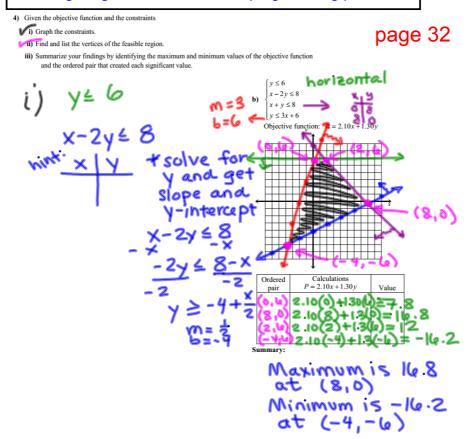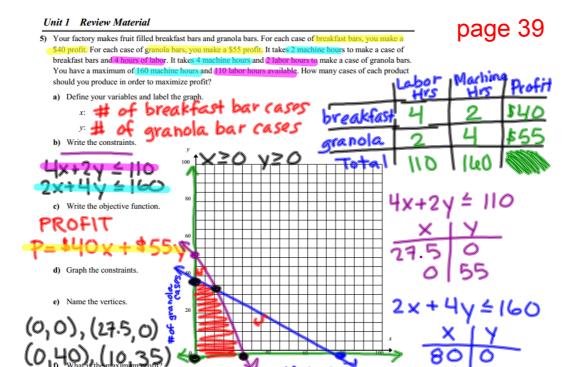## 1.3E Solving Linear Programming Problems

Section 1.3E

Linear programming sounds really difficult, but it is just a neat way to use math to find out the best way to do things – for example, how many things to make or buy. It usually involves a system of linear inequalities called constraints, but in the end, we want to either maximize something (like profit) or minimize something (like cost). Whatever we are maximizing or minimizing is called the objective function. In this section, we will further investigate the objective function and the means to identify the maximum or minimum value(s) for problems presented.

4) Given the objective function and the constraints

✓ **i)** Graph the constraints.

ii) Find and list the vertices of the feasible region.

iii) Summarize your findings by identifying the maximum and minimum values of the objective function and the ordered pair that created each significant value.

i) $y \le 6$

$x - 2y \le 8$

hint: $\dfrac{x \mid y}{}$

★ solve for y and get slope and y-intercept

$x - 2y \le 8$
$-x \quad\quad -x$
$\dfrac{-2y \le 8 - x}{-2}$

$y \ge -4 + \dfrac{x}{2}$

$m = \dfrac{1}{2}$
$b = -4$

b)
$\begin{cases} y \le 6 \\ x - 2y \le 8 \\ x + y \le 8 \\ y \le 3x + 6 \end{cases}$ ⟶ horizontal

$m = 3$
$b = 6$

Objective function: $P = 2.10x + 1.30y$

$(0,6)$ $(2,6)$ $(8,0)$ $(-4,-6)$

Ordered pair	Calculations $P = 2.10x + 1.30y$	Value
$(0,6)$	$2.10(0) + 1.30(6) = 7.8$	
$(8,0)$	$2.10(8) + 1.30(0) = 16.8$	
$(2,6)$	$2.10(2) + 1.30(6) = 12$	
$(-4,-6)$	$2.10(-4) + 1.30(-6) = -16.2$	

Summary:

Maximum is 16.8 at $(8,0)$

Minimum is -16.2 at $(-4,-6)$

5) Your factory makes fruit filled breakfast bars and granola bars. For each case of breakfast bars, you make a $40 profit. For each case of granola bars, you make a $55 profit. It takes 2 machine hours to make a case of breakfast bars and 4 hours of labor. It takes 4 machine hours and 2 labor hours to make a case of granola bars. You have a maximum of 160 machine hours and 110 labor hours available. How many cases of each product should you produce in order to maximize profit?

a) Define your variables and label the graph.

x: # of breakfast bar cases

y: # of granola bar cases

b) Write the constraints.

$4x + 2y \leq 110$
$2x + 4y \leq 160$

$x \geq 0 \quad y \geq 0$

	Labor Hrs	Machine Hrs	Profit
breakfast	4	2	$40
granola	2	4	$55
Total	110	160	

c) Write the objective function.

PROFIT
$P = \$40x + \$55y$

$4x + 2y \leq 110$

x	y
27.5	0
0	55

d) Graph the constraints.

e) Name the vertices.

$(0,0), (27.5, 0)$
$(0, 40), (10, 35)$

# of granola cases

# of breakfast cases

$2x + 4y \leq 160$

x	y
80	0
0	40

f) What is the maximum profit?

g) How many cases of each product should you produce to maximize profit?

HOMEWORK TONIGHT:

Date Covered	LT#	Learning Target (LT) (What you should know)	Practice Problems	Number of Test Questions/Points	Self-Evaluation (Do you know it?)
	1.2	I Can Demonstrate Understanding of Real-World Situations as a Linear Equation or Linear Inequalities	1.2 A 3-8 (P-19)	# of Questions = Points =	☹ ☺
	1.3	I Can Represent Real-World Situations as a Linear Programming Problem and Demonstrate an Understanding of How to Find Reasonable Solutions	1.3A 1,3,5,7 (P-21)	# of Questions = Points =	☹ ☺
			1.3B 1,2,10 (P-25)	# of Questions = Points =	☹ ☺
			1.3B 9,11,12 (P-26)	# of Questions = Points =	☹ ☺
			1.3C 1-5 (P-29)		
					☹ ☺
	1.3	I Can Represent Real-World Situations as a Linear Programming Problem and Demonstrate an Understanding of How to Find Reasonable Solutions	1.3C 6-7,9 (P-31)	# of Questions = Points =	☹ ☺
			1.3D 6-9 (P-36)		
			1.3D 17-21 (P-41)		
			1.3E 1.3 E Worksheet #1	# of Questions = Points =	☹ ☺
			1.3E 1.3 E Worksheet #2		
		Review	Unit 1 Part B Review		☹ ☺
		EXTRA CREDIT	1.3E 1 (page 30)		