

Student Name:
solutions

							Total
Criteria 1	0	8	16	24	32	40	
Criteria 2	0	8	16	24	32	40	
Criteria 3 & 4	0	4	8	12	16	20	

Mathematics Secondary 5 CST
Situational Problem – Bicycle Business

Part 1

Wheeler Dealer produces mountain bikes (x) and road bikes (y).

- For now, due to a shortage of employees, the company can manufacture no more than 80 bikes per week. $x + y \leq 80$
- Their main customer is the retail outlet *Trekkers*. *Wheeler Dealer* has promised to ship them at least 45 mountain bikes and at least 10 road bikes per week. $x \geq 45$
 $y \geq 10$
- Consumer demand has shown that they need no fewer than 3 times as many mountain bikes as road bikes. $x \geq 3y$

Each mountain bike costs *Wheeler Dealer* \$145 to make; each road bike costs them \$105 to produce.

What they charge *Trekkers*

$$320 - 145 = 175$$

$$355 - 105 = 250$$

Wheeler Dealer charges them \$320 for a mountain bike and \$355 for a road bike.

What is the maximum profit they can have in a week given these constraints?

$$P = 175x + 250y$$

- *Wheeler Dealer* is thinking about changing their policy and producing **no more than 3** times as many mountain bikes as road bikes. Is that a change they should make? Justify your answer.

Show all work.

Name:

Your solution:

$$x + y \leq 80$$

x	y
0	80
80	0

$$x \geq 45 \quad y \geq 10$$

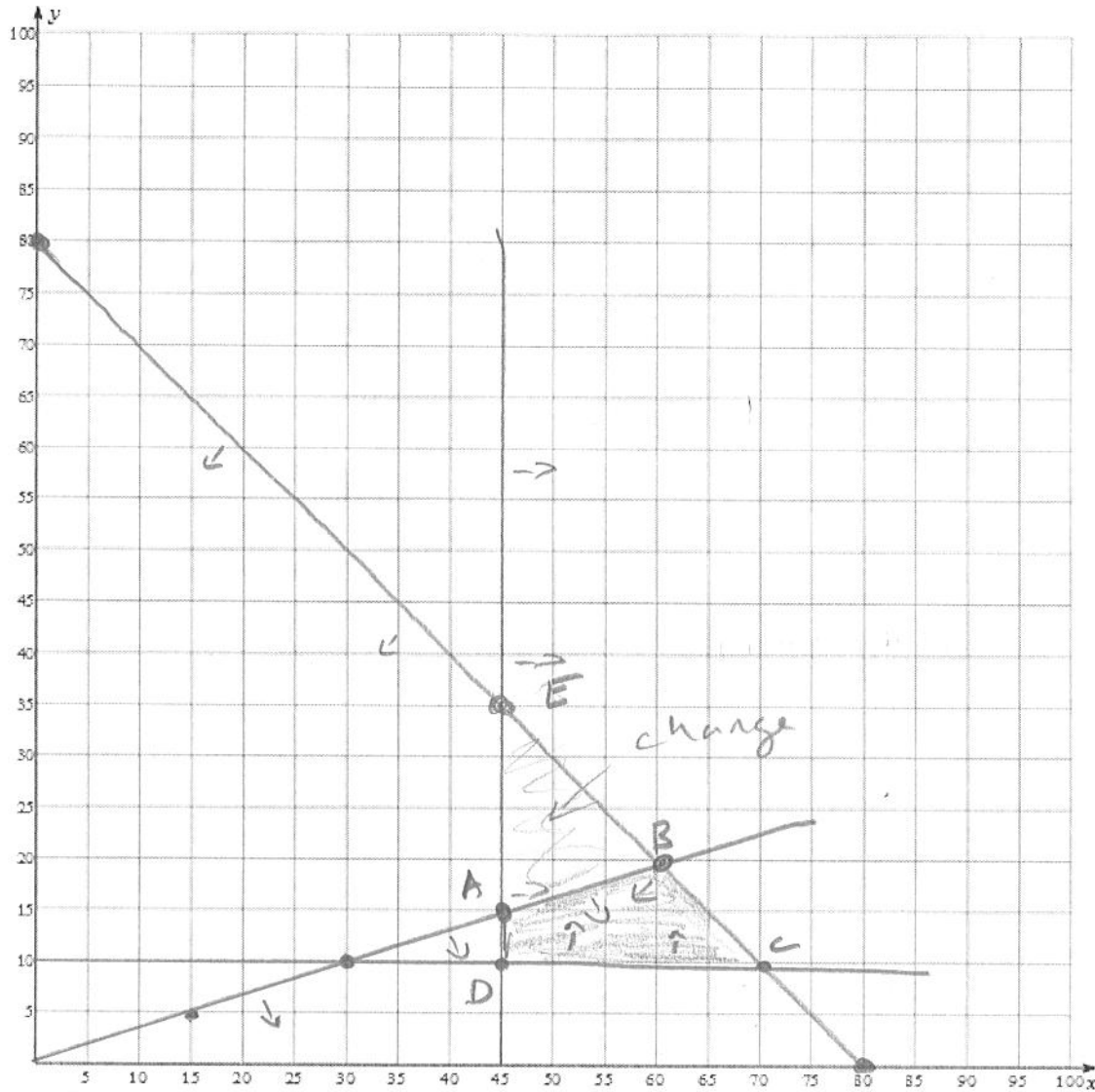
$$x \geq 3y$$

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

x	y
30	10
15	5

Wheeler Dealer weekly bike production for Trekkers

Road bikes



Mountain bikes

$$A : 45, 15 \quad \rightarrow \quad P = 175(45) + 250(15) = 11625$$

$$B : 60, 20 \quad \rightarrow \quad P = 175(60) + 250(20) = 15500$$

$$C : 70, 10 \quad \rightarrow \quad P = 175(70) + 250(10) = 14750$$

$$D : 45, 10 \quad \rightarrow \quad P = 175(45) + 250(10) = 10375$$

$$E : 45, 35 \quad \rightarrow \quad P = 175(45) + 250(35) = 16625$$

Wheeler Dealer should / should not change the ratio of mountain bikes to road bikes because the polygon of constraint changes. This would give them a

maximum weekly profit of \$ 16625.

Name: _____

Part 2

In a recent development, *Wheel Dealer* has been asked to supply bikes to one of *Trekkers* competitors, *Downboy*.

- *Downboy* needs a guarantee that the manufacturer can deliver up to 100 bikes. $x + y \leq 100$
- All the other constraints will still apply.
 - They need to have at least 45 mountain bikes and more than 10 road bikes per week. $x \geq 45$
 $y \geq 10$
 - Consumer demand has shown that they need no fewer than 3 times as many mountain bikes as road bikes. $x \geq 3y$

As a result of this development, *Wheeler Dealer* would need to hire a student to work part-time assembling bikes. The company could then increase their output to 100 bikes per week. However, if they take on the student, their costs will rise to \$160 per mountain bike and \$110 per road bike. This will cover the additional salary and benefits to the student employee.

$$P = 240x + 190y$$

What they would charge *DownBoy*

Wheeler Dealer would charge them \$400 for a mountain bike and \$300 for a road bike.

Trekkers and *DownBoy* each insist that the manufacturer give them exclusive rights to their bikes. *Wheeler Dealer* must decide which retailer to sell their bikes to.

What should the company do to maximize their profits?

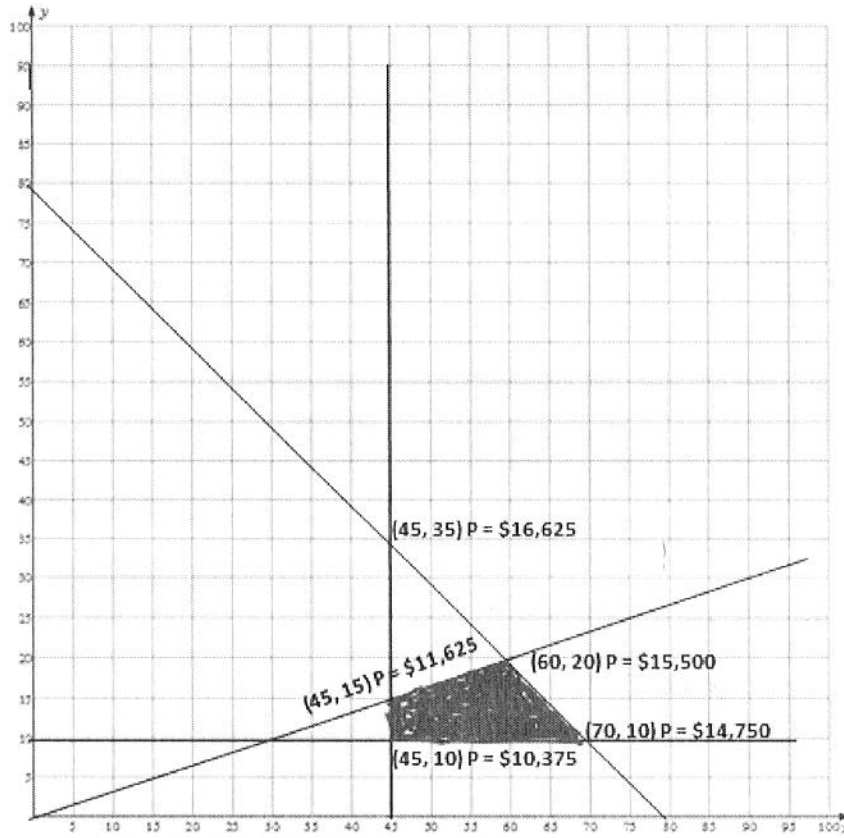
- Should they stay with their present customer, *Trekkers*, or should they sell their bikes exclusively to *DownBoy*?
- What mix of road and mountain bikes would give them the maximum profit?
- What would that profit be?

Your answer must be supported by the process of optimization. Please use the graphs provided. Your work must be organized and complete.

Your solution:

Info from Part 1:

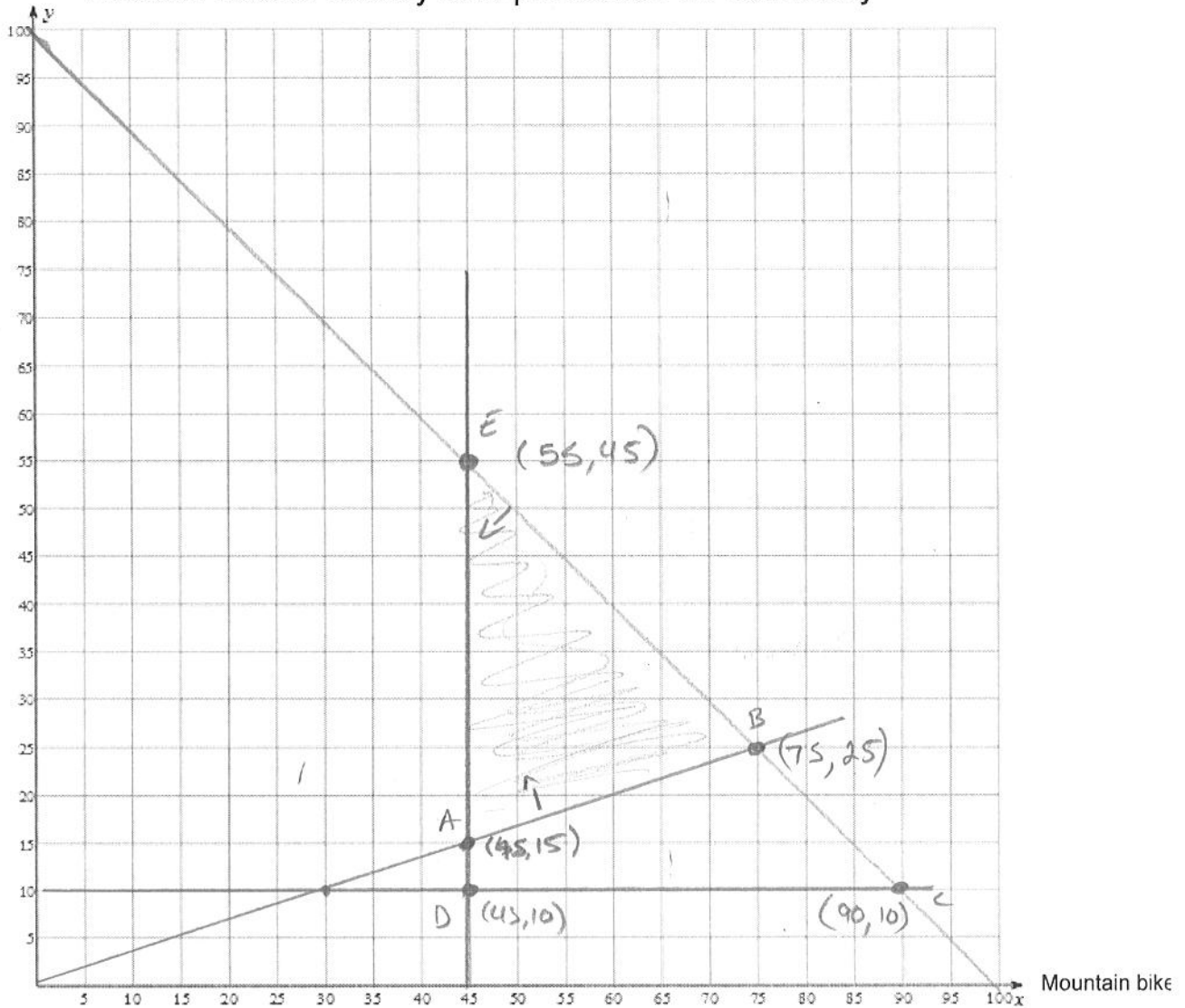
Wheeler Dealer weekly bike production for Trekkers



Your solution:

Road bikes

Wheeler Dealer weekly bike production for DownBoy



$$A: P = 240(45) + 190(15) = \$13650$$

$$B: P = 240(75) + 190(25) = \$22750$$

$$C: P = 240(90) + 190(10) = \$23500$$

$$D: P = 240(45) + 190(10) = \$12700$$

$$E: P = 240(55) + 190(45) = \$21750$$

Your solution:

Wheeler Dealer should go with Down boy. This would give them a maximum weekly profit of \$ 23500.