Optimization Assignment
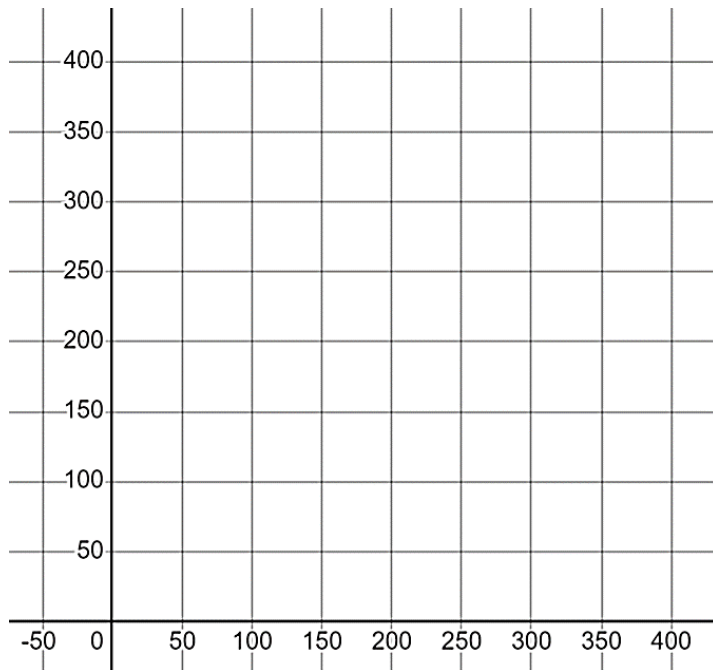
Show ALL work for every question.

1) Jessica is going apple picking. After picking the apples, Jessica is going to make apple sauce, apple pies, and apple crisp. Over years of picking apples and baking, Jessica has found that the best types of apples for her baking projects are Macintosh and Jonagold, so those are the only apples Jessica will pick.

| **10 pts** |

- Jessica needs at least 150 apples
- Jessica needs no more than 300 apples
- Jessica needs a maximum of twice as many Macintosh apples as Jonagold apples
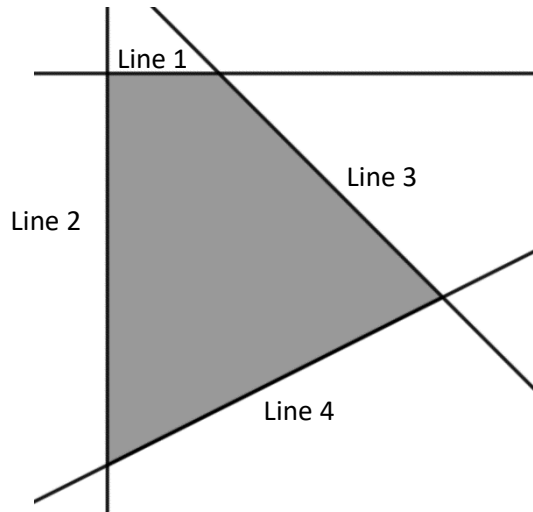- Jessica needs a minimum of 50 Macintosh apples

Each Macintosh apple costs $0.15 and each Jonagold apple costs $0.17

What is the minimum Jessica could spend to buy all the apples she needs?

2) The graph below represents the polygon of constraints for an optimization scenario. **4 pts**
Algebraically determine the coordinates of all vertices.

Line 1

Line 3

Line 2

Line 4

Line 1: $y \leq 100$

Line 2: $x \geq 25$
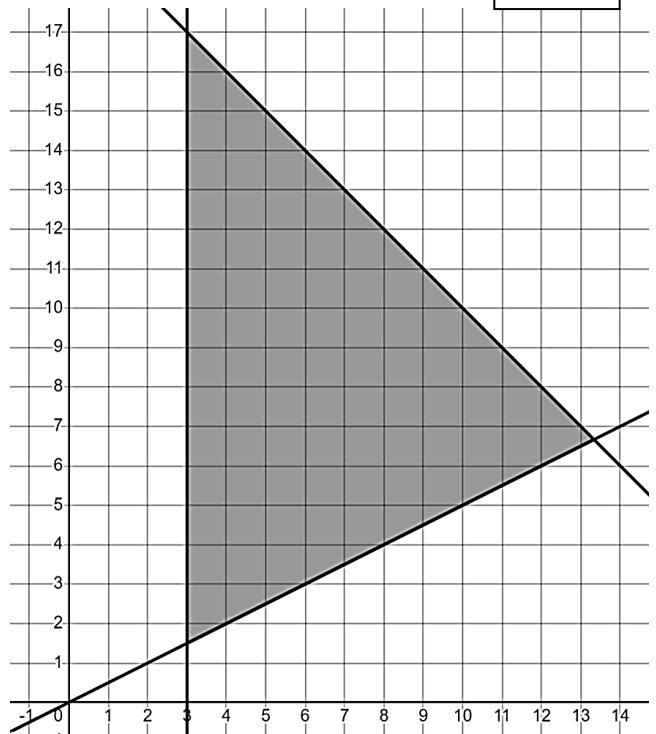
Line 3: $x + y \leq 150$

Line 4: $y \geq \frac{1}{2}x$

3) The Pawfectionist is a business offering dog grooming services. They offer the basic **4 pts**
package (which includes a nail trim and a bath) and
the exclusive package (which includes a nail trim, a
bath, a haircut, and a fancy bow). The number of
basic and exclusive packages they can sell each day
is limited, as shown in the polygon of constraints.

Each basic package (x) earns The Pawfectionist a
profit of $70 and each exclusive package (y) earns a
profit of $45.

**What is the maximum profit The Pawfectionist
can earn each day?**

4) Soapnificient is a company which makes and sells specialty bars of soaps. Every November, they are making and selling two scented bars of soap: pumpkin spice and apple cinnamon.

| 10 pts |

- Soapnificient will make at most 240 bars of soap
- Soapnificient makes at least half as many bars of apple cinnamon soap as pumpkin spice soap
- Soapnificient makes a maximum of 120 bars of apple cinnamon soap
- Soapnificient makes a minimum of 40 bars of pumpkin spice soap

Soapnificient makes a profit of $6.50 per bar of pumpkin spice soap and $7 per bar of apple cinnamon soap.

This November, however, staffing shortages means they cannot produce as much soap as planned.

- Soapnificient will only be able to make at most 180 bars of soap.

Hint: You will first need to find the old profit (before the staffing shortage), then add the new line and find the new maximum.

By how much will the maximum profit decrease due to this staffing shortage?