

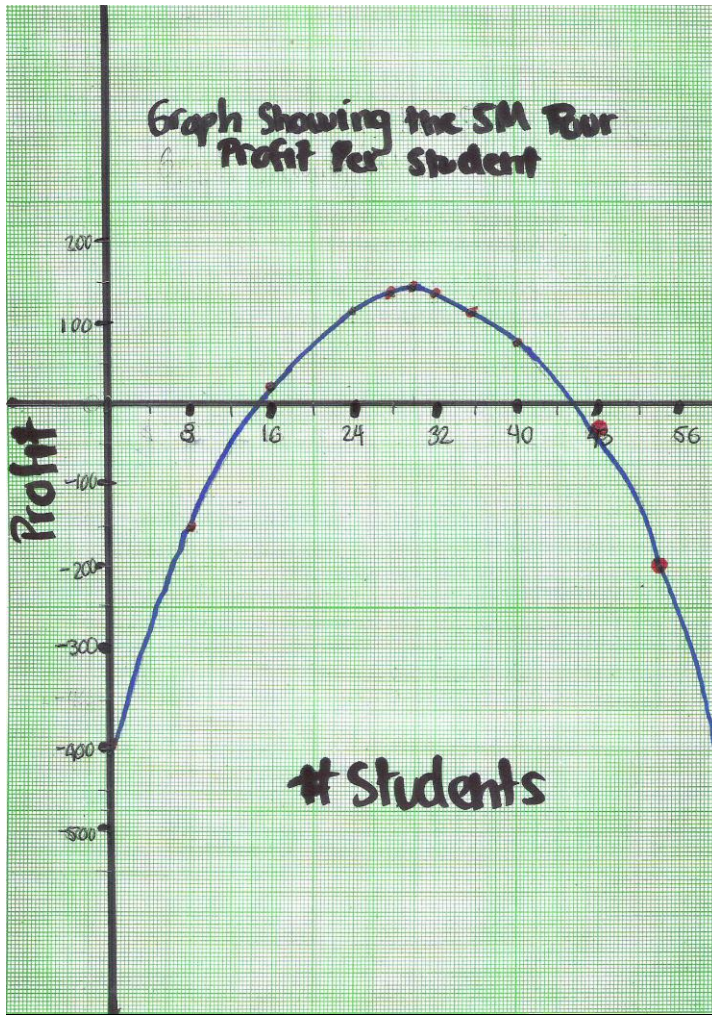
### Quadratic Functions Take- Home Assignment

In this assesment we will investigated the profit of a company selling tours to students. Their profit is sumarized by the equation  $P = -0.6n^2 + 36n - 405$  (where  $P$ = profit and  $n$ = # of students). The aim of this investigation is, to figure the number of students that the company needs to take on the tour in order for the company to maximize its profit as best as they can.

Table Showing the Number of Students and the Profit Per Student in Canadian Dollars

| # of Students      | 0    | 4      | 8      | 12    | 16   | 20 | 24    | 28    | 32    | 36    | 40 | 44   | 48    | 52     | 56     | 60   |
|--------------------|------|--------|--------|-------|------|----|-------|-------|-------|-------|----|------|-------|--------|--------|------|
| Profit Per Student | -405 | -270.6 | -155.4 | -59.4 | 17.4 | 75 | 113.4 | 132.6 | 132.6 | 113.4 | 75 | 17.4 | -59.4 | -155.4 | -270.6 | -405 |

#### Hand Drawn Graph



- a) The least and greatest number of students that should be accepted in order for the company to make profit is 16 and 44 because as you can see in the Data Table above from 16 to 44 the company is gaining a profit, rather than breaking even or losing money.
- b) In order to figure out the number of student that will maximize your profit, you need to use the equation:

$$\left(\frac{S+T}{2}\right)$$

Where  $S$  and  $T$  represent the two zeroes of the equation. For this particular equation the two zeroes are equal to 15 and 45. Therefore you make the substitution:

$$\left(\frac{15+45}{2}\right) = 30 \text{ Students}$$

The number of students that will maximize your profit is 30 students.

- c) In order to figure out the maximum profit per student you substitute  $n$  with the number of students that will maximize your profit which in this case equals to 30, into the following equation and then you find the solution:

$$P = -0.6n^2 + 36n - 405$$

$$P = -0.6(30)^2 + 36(30) - 405$$

$$P = 135$$

The maximum profit per student equals \$135.

- d) In order to figure out the least and greatest number of students that will give you a profit of 96.60 you must substitute  $P=96.60$  into the equation and solve:

$$P = -0.6n^2 + 36n - 405$$

$$96.60 = -0.6n^2 + 36n - 405$$

$$0 = -0.6n^2 + 36n - 501.6$$

Since it is impossible to factor the equation above you will need to use the quadratic formula to answer the question.

Quadratic Formula:

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Where  $a = -0.6$ ,  $b = 36$  and  $c = -501.6$

$$\frac{-36 \pm \sqrt{36^2 - 4(-0.6)(-501.6)}}{2(-0.6)}$$

$$\frac{-36 \pm \sqrt{92.16}}{-1.2}$$

$$\frac{36+9.6}{1.2} = 38 \quad \frac{36-9.6}{1.2} = 22$$

The least and greatest number of students that will give you a profit of 96.60 are 22 and 38.

(ii) Solving the quadratic equation by factoring:

$$P = -0.6n^2 + 36n - 405$$

$$P = -0.6(n^2 - 60n - 675)$$

$$P = -0.6(n - 45)(n - 15)$$

$$n = 45 \text{ and } 15$$

(iii) Solve using the quadratic formula:

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Where  $a = -0.6$ ,  $b = 36$  and  $c = -405$

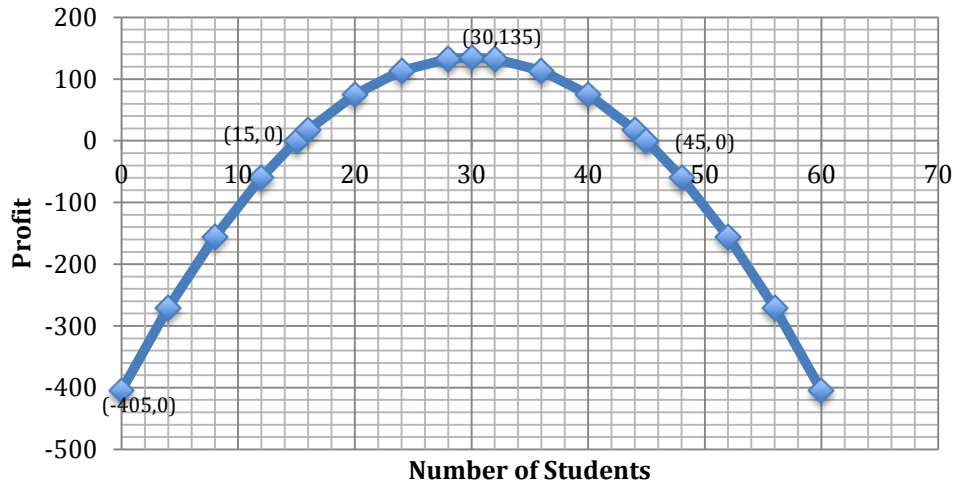
$$\frac{-36 \pm \sqrt{36^2 - 4(-0.6)(-405)}}{2(-0.6)}$$

$$\frac{-36 \pm \sqrt{324}}{-1.2}$$

$$\frac{36+18}{1.2} = 45 \quad \frac{36-18}{1.2} = 15$$

$$n = 45 \text{ and } 15$$

Graph Showing the 5M Tours Profit Per Student



Created using excel

It would be ideal for the company to have a total of 30 students in every tour for them to maximize their profit. The reason for having 30 is because, when you have 30 students your profit is of \$135 and this is the maximum profit that you the company can make. However, if it is not possible they should at least try to keep the number of students attending the tour above 15 and below 45, so at least they are not losing money but they are earning money. Fifteen and Forty-five are the two breaking points, a breaking point is when a company is not losing or earning any money, this being the reason for keeping the numbers between 15 and 45. In order for the company to improve their profit they should look for hotels/vans/busses/meals that offer the same quality but for a cheaper price this way their initial \$-405 that is accountable for the actual cost of the tour can be decreased.