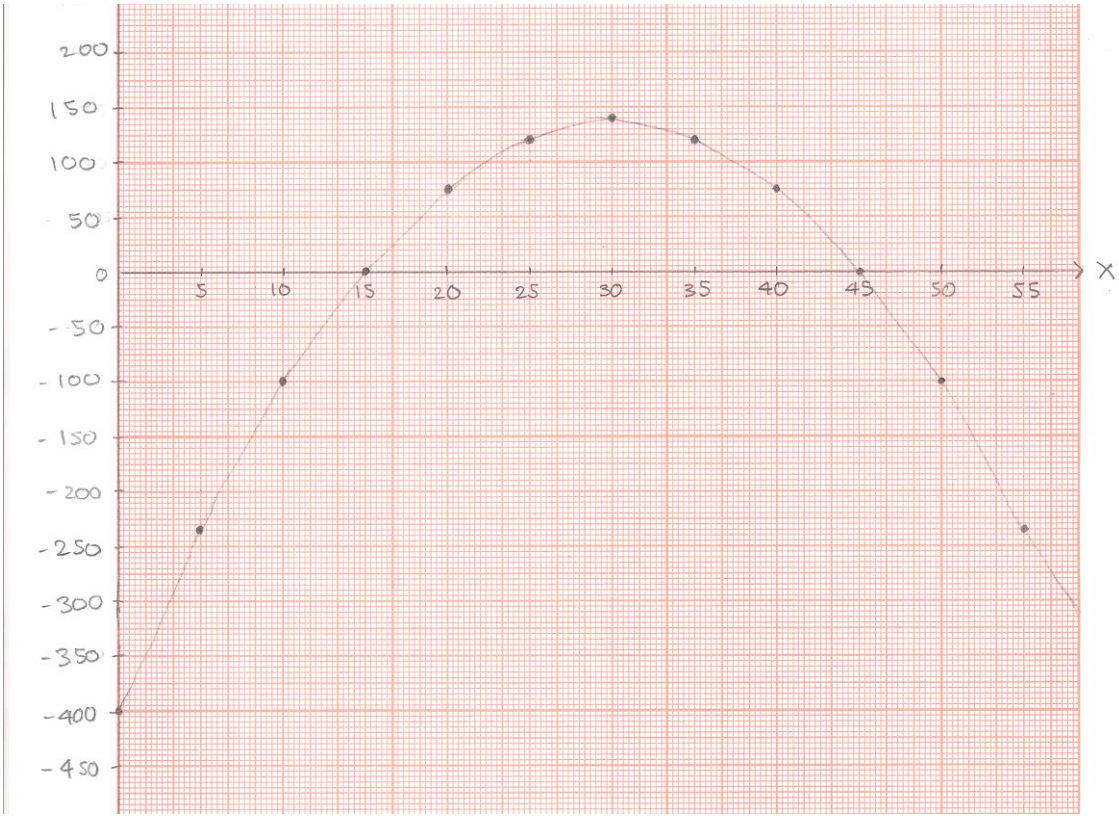
Report on Profits of Mr. Math's Magical Mathematical Mystery Tours

Mr. Math's Magical Mathematical Mystery Tours, otherwise known as 5M, is a tourism agency that offers groups of students 5-day tours of Ottawa. The company used the quadratic relation $P = -0.6n^2 + 36n - 405$ to determine the profit per student. Using this equation, the company was able to produce a table, showing the relationship between the number of students and the profit of the company, as shown below:

Number of students	0	5	10	15	20	25	30	35
Profit per student	-405	-240	-105	0	75	120	135	120

Using the same quadratic relation, the company also found several pieces of information linked to the correlation between the number of students and the profit of the company. One of the things the company was able to find was that, in order for the company to make a profit, the number of students attending the tour should be more than 15, but less than 45 (a). Another piece of information that the company found is that taking 30 students on the tour will give the company maximum profit (b). Another important finding is that the maximum profit per student is $135 (c). These findings are shown in the data table and can also be solved algebraically, using the quadratic relation $P = -0.6n^2 + 36n - 405$. This equation is not only used for finding the profit, but for finding the ideal number of students as well. If the company wanted to earn a profit of $96.60 for instance, at least 22 students must attend, or, at most, 38 students (d). Using all of this collected information, the company was able to sketch a graph of the correlation between the number of students and the profit the 5M will make.

Hand-Drawn Quadratic System: Relationship Between Number of Students and Profit



Using all of the information collected, the company will be able to organize tour trips efficiently and maximize their resources and money to produce the as much profit as they can.

Calculations for (a), (b), (c), and (d):

(a): calculation are the same as the ones done in (iii)

(b): A.O.S = axis of symmetry

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

$$A.O.S = \frac{-36}{2(-0.6)}$$

$$A.O.S = \frac{-36}{-1.2}$$

$$A.O.S = 30$$

∴ The number of students that will get the maximum profit is 30.

(c):

$$n = 30$$

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

$$P = 135$$

∴ The maximum profit per student is $135.

(d):

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

$$0 = -0.6n^2 + 36 - 501.60$$

$$(2ax + b)^2 = b^2 - 4ac$$

$$(2(-0.6n) + 36)^2 = 36^2 - 4(-0.6)(-501.60)$$

$$(-1.2n + 36)^2 = 1296 - 1203.84$$

$$\sqrt{(-1.2n + 36)^2} = \sqrt{92.16}$$

$$-1.2n + 36 = \pm 9.6$$

$$n = \frac{-36 \pm 9.6}{-1.2}$$

$$n = 22, 38$$

∴ The least number of students is 22 and the most number of students is 38.

Calculations for Factoring Work (ii):

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

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

$$P = -0.6(n^2 - 15n - 45n + 675)$$

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

$n - 15 = 0$ or $n - 45 = 0$

$n = 15$ $n = 45$

$n = 15, 45$

Calculations for work with the quadratic formula (iii):

$(2ax + b)^2 = b^2 - 4ac$

$0 = -0.6n^2 + 36n - 405$

$(2(-0.6n) + 36)^2 = 36^2 - 4(-0.6)(-405)$

$(-1.2n + 36)^2 = 1296 - 972$

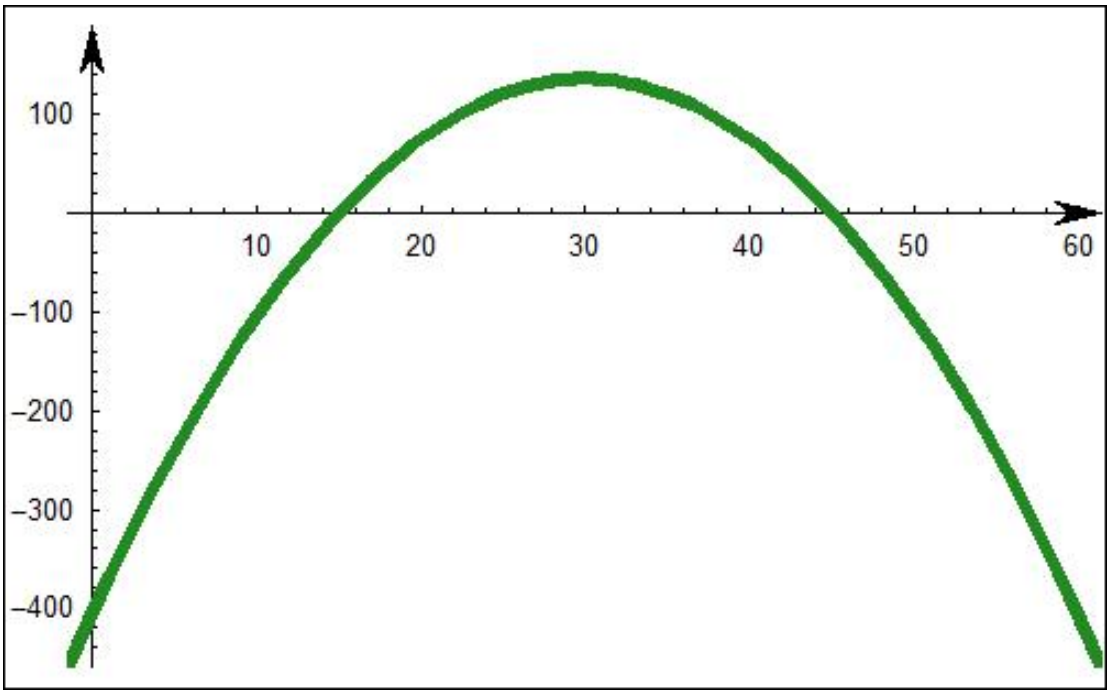
$\sqrt{(-1.2n + 36)^2} = \sqrt{324}$

$-1.2 + 36 = \pm 18$

$n = \frac{-36 \pm 18}{-1.2}$

$n = 15, 45$

Technology-Generated Graph: Relationship Between Number of Students and Profit



Legend: v = vertex x = zeroes/x-intercepts y = y-intercept

Graphing Program used to create technology-generated graph:

"Online Graphing Calculator: 1-Click Delivers Complete Graphs." *Online Graphing Calculators: WebGraphing.com*. Web. 12 Nov. 2011. <http://webgraphing.com/graphing_basic.jsp>.