Havergal College – Grade 10 Mathematics

Assignment – Quadratic Equations and Parabolas

By Alex Pintilie

You are to work on this assignment in groups of 4, and discuss these problems. Use this also as a check to see how much you know about this topic. This is about the level of difficulty expected from you in this course. Show your work to your neighbour and convince her that you are right. Please write up your solutions and hand in one set per group. Bonne chance!

1) Solve each quadratic equation, leaving answers as exact radicals where appropriate:

a) $6x^2 + x - 12 = 0$

b) $x^2 + x - 1 = 0$

c) $\dfrac{x+1}{36} + \dfrac{1}{9} = \dfrac{1}{x}$

2) A ball is thrown from a balcony and the path of the ball is given by the equation

$h = -2t^2 + 12t + 10$, where h is the height of the ball above the ground in metres and t

is time, measured in seconds. Determine:

a) the height of the balcony

b) the time taken for the ball to reach its maximum height

c) the maximum height

d) the time taken for the ball to hit the ground

e) the time taken for the ball to reach the height of the balcony, on its way down.

3) Solve the equation $x^4 - 13x^2 + 36 = 0$ by recognizing it as a disguised quadratic equation. (Either now think of the variable as $"x^2"$ or simply let $"a = x^2"$).

4) Make a sketch of each of these parabolas using the "intercept method". Also state the coordinates of the vertex for each.

a) $y = 2x^2 - 12x + 16$　　　　b) $y = -3x^2 + 48$　　　　c) $y = 4x^2 + 8x - 60$

*(**Note**: the intercept approach is easier then the expression factors).*

5) Make a sketch of each of these parabolas by "completing the square". State the coordinates of the vertex.

a) $y = x^2 + 6x - 5$　　　　b) $y = 3x^2 - 24x + 1$　　　　c) $y = -2x^2 + 20x - 3$

*(**Note**: completing the square is easier when the expression does not factor).*

6) The back yard of a home is a rectangle 15m by 20m. A garden of uniform width is to be built around the edge leaving a grass area inside. The area of the grass is to be the same as the area of the garden. What is the width of the garden?

7) Jane bought a number of watermelons at Pusateri's for $150. If each watermelon had been $5 more, 5 fewer could have been purchased. Find the price of each watermelon. (*Hint*: let x be the number of watermelons and y be the cost of each).
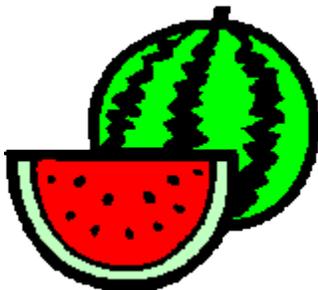
8) Farmer Brown, distant mathematical cousin of Mr. Brown, wants to enclose a grazing area along a river bank and build an opera hall. He has 500m of fencing available and none can be used along the riverbank. What are the dimensions that give the largest possible area?

9) The TTC has 1 000 000 customers daily, each paying a fare of $2.25. It is estimated that for each $0.25 increase in fare, 10 000 passengers will be lost. What should the TTC charge to maximize its profits?

10)

Merlin is at the casino. He has a metre stick and breaks it randomly into two pieces. He then uses these pieces to form the legs of a right triangle and computes the area of the triangle. If the area is more than 0.15 m^2, you win $50. If the area is less, you pay him $5. Would you play this game? (If the area is negative, he sizzles you to death with a lightning bolt).