WEEK 10

Graphing Quadratic Functions and Analyzing the Effects on its Graph

I

After going through this module, you are expected to:

- Determines the equation of a quadratic function given: (a) a table of values; (b) graph; (c) zeros.
- Solves problems involving quadratic functions.

Complete the table using the function of x.

x	- 3	- 2	- 1	0	1	2	3
$f(x) = 3x^2 - 5$							

D

Equation of the Quadratic function can be determine through table.

Illustrative Example 1

x	1	2	3	4	5	6	7
y	5	11	19	29	41	55	71
1st Differences		6	8	12	14	16	18
2nd Differences			2	2	2	2	2

Solution: Let the quadratic function f be of the form $y = ax^2 + bx + c$ where a, b and c are to be determined. Let us consider any 3 ordered pairs (x, y) from the table.

Equation 1 → $5 = a(1)^2 + b(1) + c \rightarrow 5 = a + b + c$

Equation 2 → $19 = a(3)^2 + b(3) + c \rightarrow 19 = 9a + 3b + c$

Equation 3 → $29 = a(4)^2 + b(4) + c \rightarrow 29 = 16a + 4b + c$

We obtain a systems of linear equations in 3 unknowns a, b and c.

(1) $5 = a + b + c$

(2) $19 = 9a + 3b + c$

(3) $29 = 16a + 4b + c$

– (1) gives 8a + 2b = 14 or 4a + b = 7 (4)

– (2) gives 7a + b = 10 (5)

(5) - (4) gives 3a = 3 or **a = 1**

Substituting **a = 1** in (4) yields **b = 3**.

Substituting **a = 1** and **b = 3** in (1), we obtain **c = 1**.

Thus, the quadratic function determined by the table is **$y = x^2 + 3x + 1$.**

Equation of the Quadratic function can also be determine backwards:

Illustrative Example 2

Determine an equation that has the solutions x= - 4 and x= 3.

Work backward to find the equation:

x = - 4	x = 3	given
x + 4 = 0	x—3 = 0	set equal to 0
(x + 4) (x - 3) = 0		equation factor
$x^2 + x - 12 = 0$		product of factors

The equation is $x^2 + x - 12 = 0$

Illustrative Example 3

Find the solutions for the equation

$3x^2 + 3x - 36 = 0$

The equation can be solved by factoring

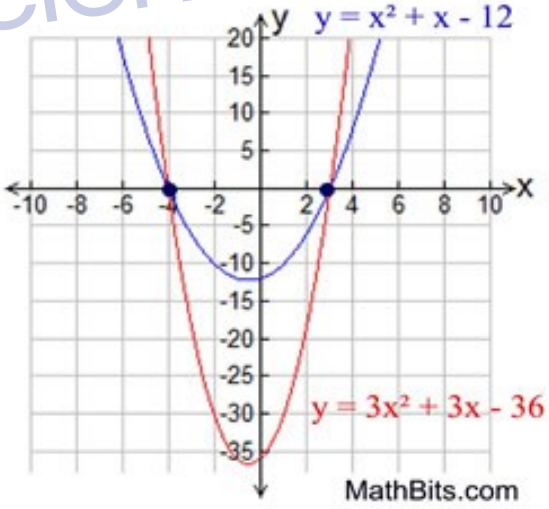
$3x^2 + 3x - 36 = 0$

$3(x^2 + x - 12) = 0$

$3(x + 4)(x - 3) = 0$

$3 \neq 0$; $x + 4 = 0$; $x - 3 = 0$

x = - 4 x = 3

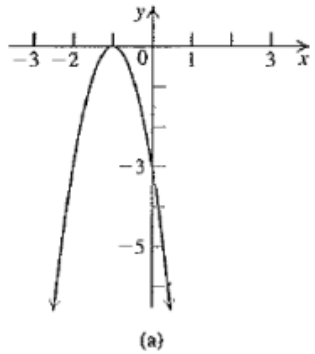


Note: Working backward will create an equation, but remember that there are other equations that will also have that same set of solutions.

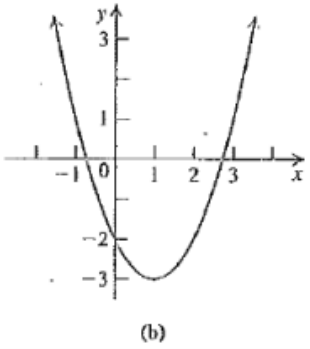
Illustrative Example 4

If the x-intercepts are (-3, 0) and (4, 0), we know that the roots (zeros) of the equation will be x = -3 and x = 4. Working background, we can create the factors (x + 3) and (x - 4) and get the equation y = (x + 3)(x - 4). Then the equation is $y = x^2 - x - 12$.

Find the equation of the parabolas below. Put your answer in standard form.



(a)



(b)

E

The sum of two numbers is 29. Find the maximum possible product of the two numbers.

Solution:

Let x be the first number

29 – x be the second number

y be the maximum possible product of the two numbers

$y = x(29 - x)$

$y = 29x - x^2$

The graph of $y = 29x - x^2$ opens downward and has a maximum value which is equal to **k** and it occurs at **h**.

Solving for the value of k,

$$k = \frac{4ac - b^2}{4a} = \frac{4(-1)(0) - 29^2}{4(-1)} = 210.25$$

The two numbers that will give its maximum possible product are equal to h.

$$h = -\frac{b}{2a} = -\frac{29}{2(-1)} = 14.5$$

Learning Task 2. Solve each problem using quadratic functions.

1. The sum of two positive integers is 35. What is the minimum sum of their squares?

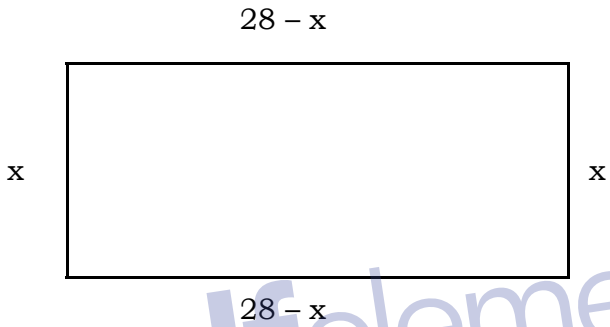
2. A rectangle has a perimeter of 100 cm. Find the greatest possible area for the rectangle.

Find the quadratic function determined by each table.

x	- 2	- 1	0	1	2	3
y	4	0	- 2	- 2	0	4

A

Learning Task 3. Find the largest area which the farmer can enclose with 56 m of fencing materials.



Reference

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Learner's Material for Mathematics Grade 9 (2013) Module 2: Quadratic Functions

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For inquiries or feedback, please write or call:

Department of Education Region 4A CALABARZON

Office Address: Gate 2 Karangalan Village, Cainta Rizal

Landline: 02-8682-5773 local 420/421

Email Address: lrmd.calabarzon@deped.gov.ph