

Warm Up

$$\text{dom } f = \mathbb{R}$$

$$\text{ran } f = [6, +\infty[$$

What is the vertex and initial value of the parabola: $f(x) = 3x^2 - 12x + 18$

$$a = 3 \quad b = -12 \quad c = 18$$

$$h = \frac{-b}{2a} = \frac{-(-12)}{2(3)} = \frac{12}{6} = 2$$

$$k = \frac{4ac - b^2}{4a} = \frac{4(3)(18) - (-12)^2}{4(3)}$$

$$= \frac{216 - 144}{12} = \frac{72}{12} = 6$$

$$V = (2, 6)$$

$$|V| = 18$$

Lesson 18

Quadratic Functions Factored Form

Quadratic Function – Factored form

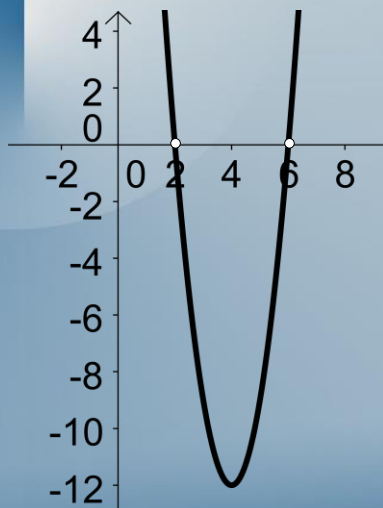
Ex. 1 Find the zeros of: $f(x) = 3x^2 - 24x + 36$

$$\begin{aligned} \Rightarrow 3(x^2 - 8x + 12) &= 0 & mn &= 12 \\ 3(x^2 - 2x) + 6(x + 12) &= 0 & m+n &= -8 \\ 3(x(x-2) - 6(x-2)) &= 0 \\ 3(x-2)(x-6) &= 0 \end{aligned}$$

\therefore the zeros are: 2 and 6

Quadratic Function – Factored form

Ex. 1 Find the zeros of: $f(x) = 3x^2 - 24x + 36$



$$\begin{aligned} 3(x-2)(x-6) &= 0 \\ f(x) &= 3(x-2)(x-6) \end{aligned}$$

Factored Form:

$$f(x) = a(x - x_1)(x - x_2)$$

Where x_1 and x_2 are the zeros of the function.

Finding the Rule of a Quadratic Function – Factored form

Given the ZEROS (x_1, x_2) and a POINT (x, y)

Step 1: Replace the ZEROS (x_1, x_2) into the Rule:

$$f(x) = a(x - x_1)(x - x_2)$$

Step 2: Replace the POINT (x, y) into the Rule

Step 3: Solve for "a"

Step 4: Write the RULE

Finding the Rule of a Quadratic Function – Factored form

Given the ZEROS (x_1, x_2) and a POINT (x, y)

Ex 2: Find the rule of a quadratic function with 1 and 3 as zeros and passing through the point P(4, -6).

Step 1: $f(x) = a(x - x_1)(x - x_2) \Rightarrow f(x) = a(x - 1)(x - 3)$

Step 2: $\Rightarrow -6 = a(4 - 1)(4 - 3)$

Step 3: $-6 = a(3)(1)$

$$-6 = 3a$$

$$-2 = a$$

Step 4:

$$\Rightarrow f(x) = -2(x - 1)(x - 3)$$

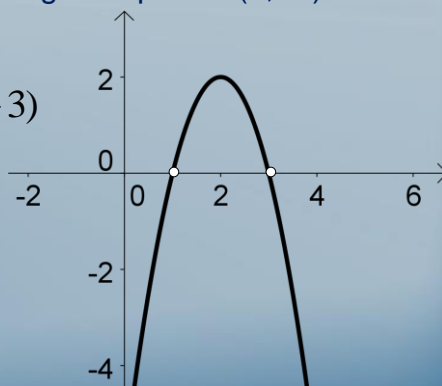
Finding the Rule of a Quadratic Function – Factored form

Given the ZEROS (x_1, x_2) and a POINT (x, y)

Ex 2: Find the rule of a quadratic function with 1 and 3 as zeros and passing through the point P(4, -6).

$$f(x) = -2(x-1)(x-3)$$

$$h = \frac{x_1 + x_2}{2} = \frac{1 + 3}{2} = 2$$



Quadratic Functions

Standard Form: $f(x) = a(x-h)^2 + k$

General Form: $f(x) = ax^2 + bx + c$

Factored Form: $f(x) = a(x-x_1)(x-x_2)$

NB: a is the same in all forms

Quadratic Functions

Factored Form to General Form:

$$f(x) = a(x - x_1)(x - x_2) \Rightarrow f(x) = ax^2 + bx + c$$

Ex 3: Write the following in general form:

$$f(x) = 2(x - 1)(x - 5)$$

Expand using FOIL: $f(x) = 2(x - 1)(x - 5)$

$$f(x) = 2(x^2 - x - 5x + 5)$$

$$f(x) = 2(x^2 - 6x + 5)$$

$$f(x) = 2x^2 - 12x + 10$$

Quadratic Functions

Standard Form to General Form:

$$f(x) = a(x - h)^2 + k \Rightarrow f(x) = ax^2 + bx + c$$

Ex 4: Write the following in general form:

$$f(x) = 2(x - 1)^2 - 8$$

Expand using FOIL: $f(x) = 2(x - 1)(x - 1) - 8$

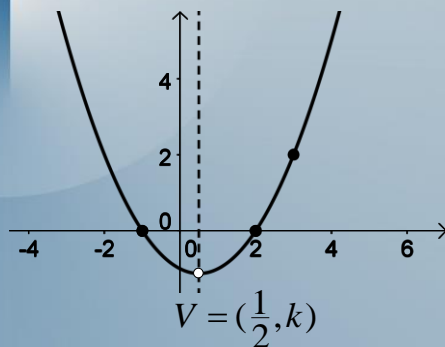
$$f(x) = 2(x^2 - x - x + 1) - 8$$

$$f(x) = 2(x^2 - 2x + 1) - 8$$

$$f(x) = 2x^2 - 4x - 6$$

Quadratic Functions

Ex 5: A parabola with zeros -1 & 2 passes through the point A(3, 2). What is the vertex of this parabola?



Step 1: Find h :

$$h = \frac{x_1 + x_2}{2}$$

$$h = \frac{-1 + 2}{2}$$

$$h = \frac{1}{2}$$

Quadratic Functions

Ex 5: A parabola with zeros -1 & 2 passes through the point A(3, 2). What is the vertex of this parabola?

Step 2: Find a : $f(x) = a(x - x_1)(x - x_2)$

$$\Rightarrow f(x) = a(x + 1)(x - 2)$$

$$\Rightarrow 2 = a(3 + 1)(3 - 2)$$

$$2 = a(4)(1)$$

$$2 = 4a$$

$$\frac{1}{2} = a$$

Quadratic Functions

Ex 5: A parabola with zeros -1 & 2 passes through the point A(3, 2). What is the vertex of this parabola?

Step 3: Find k: $f(x) = a(x - x_1)(x - x_2)$

$$\Rightarrow f(x) = \frac{1}{2}(x+1)(x-2)$$

$$h = \frac{1}{2} \quad \Rightarrow y = \frac{1}{2}\left(\frac{1}{2}+1\right)\left(\frac{1}{2}-2\right)$$

$$y = \frac{1}{2}\left(\frac{3}{2}\right)\left(-\frac{3}{2}\right)$$

$$y = -\frac{9}{8} \quad \therefore k = -\frac{9}{8} \quad \therefore V = \left(\frac{1}{2}, -\frac{9}{8}\right)$$

Homework

Workbook

P. 107 #3, 4, 5, 6, 9 & 11

P. 108 #13 & 16