



<b>SUBJECT and GRADE</b>	Mathematics Grade 11	
<b>TERM 2</b>	Week 5	
<b>TOPIC</b>	<b>Functions and Graphs: Finding the equation of functions</b>	
<b>AIMS OF LESSON</b>	<ul style="list-style-type: none"> <li>To find the equation of the Parabola, hyperbola and exponential functions if graph is given.</li> </ul>	
<b>RESOURCES</b>	<i>Paper based resources</i>	<i>Digital resources</i>
	Please go to the Functions and Graphs section in your Mathematics Textbook.	Parabola: <a href="https://www.youtube.com/watch?v=5yecNfFyvF8">https://www.youtube.com/watch?v=5yecNfFyvF8</a> Hyperbola: <a href="https://www.youtube.com/watch?v=Mx9-3WqFV6c">https://www.youtube.com/watch?v=Mx9-3WqFV6c</a> Exponential: <a href="https://www.youtube.com/watch?v=YYNYc6HP6sk">https://www.youtube.com/watch?v=YYNYc6HP6sk</a> <a href="https://www.youtube.com/watch?v=vmFiraM8qTw">https://www.youtube.com/watch?v=vmFiraM8qTw</a>
<b>INTRODUCTION</b>	<p>By now you should have dealt with the parabola, hyperbola and the exponential functions where you have sketched the functions and made deductions from the sketches. In this lesson we will determine the equations of the mentioned functions.</p> <p><b>Recall:</b> the general form for the,</p> <ul style="list-style-type: none"> <li>parabola: <math>y = ax^2 + bx + c</math> and the turning point form: <math>y = a(x + p)^2 + q</math>, where <math>(-p; q)</math> are the coordinates of the turning point. Note: when we determine the <math>x</math>-intercepts/ roots, we use: <math>y = a(x - x_1)(x - x_2)</math> where <math>x_1</math> and <math>x_2</math> are the roots of the parabola.</li> <li>hyperbola: <math>y = \frac{a}{x+p} + q</math> where <math>x = -p</math> and <math>y = q</math> are the equations of the asymptotes of the hyperbola.</li> <li>exponential function: <math>y = a \cdot b^x + q</math> where <math>y = q</math> is the equation of the asymptote of the exponential function.</li> </ul>	

**CONCEPTS AND SKILLS**

**LESSON 1: TO DETERMINE THE EQUATION OF A GIVEN PARABOLA**

**Example 1:** Determine the equation of the given parabola.

**Solution:**  
 $y = a(x - x_1)(x - x_2)$   
 Substitute  $x_1 = -2$  and  $x_2 = 3$   
 $\therefore y = a[x - (-2)][x - 3]$   
 $= a(x + 2)(x - 3) \dots \textcircled{1}$

Now determine the value of  $a$  by substituting the point  $(0; -6)$  into  $\textcircled{1}$ :  $y = a(x + 2)(x - 3)$   
 $\therefore -6 = a(0 + 2)(0 - 3)$   
 $\therefore -6 = a(-6) \Rightarrow a = 1$   
 $\therefore$  equation:  $y = 1(x + 2)(x - 3) = x^2 - x - 6$

**CAN YOU?**

1. Determine the equation of the parabola given below.

**Answer:**  $y = -2x^2 + 2$



**Example 2:** Determine the equation of the given parabola.

**Solution:**

$$y = a(x + p)^2 + q$$

Substitute  $-p = 1 \Rightarrow p = -1$  and  $q = 4$

$$\therefore y = a(x - 1)^2 + 4 \dots \textcircled{1}$$

Determine the value of  $a$  by substituting the point  $(2; -1)$

into  $\textcircled{1}$ :  $y = a(x - 1)^2 + 4$

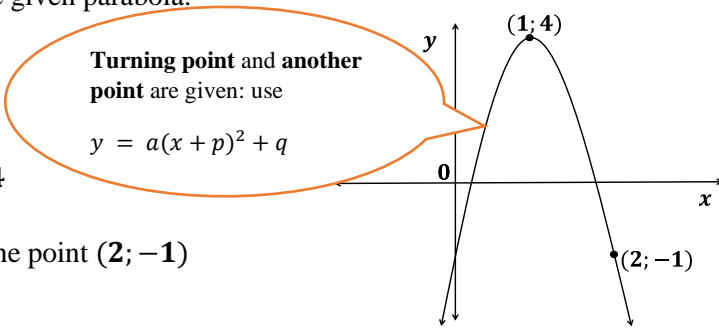
$$\therefore -1 = a[(2) - 1]^2 + 4$$

$$\therefore -1 = a[1]^2 + 4$$

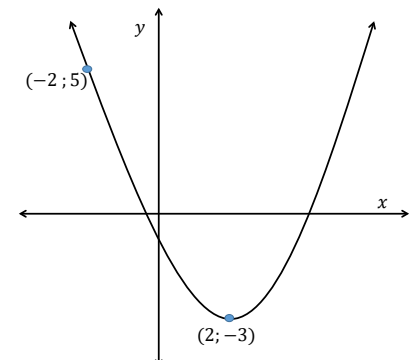
$$\therefore -1 - 4 = a = -5$$

$$\therefore \text{equation: } y = -5(x - 1)^2 + 4 \quad \text{OR} \quad y = -5x^2 + 10x - 1$$

**Take note of the different forms of the equivalent equation**



Determine the equation of the parabola given below in the form,  $y = a(x + p)^2 + q$ .



Answer:  $y = \frac{1}{2}(x - 2)^2 - 3$

**Do Exercises from your Textbook:** Finding equation of Parabola

**LESSON 2: TO DETERMINE THE EQUATION OF A GIVEN HYPERBOLA**

**Example 3:** Determine the equation of the hyperbola in the diagram:

**Solution:**

$$y = \frac{a}{x+p} + q$$

Substitute  $-p = 2 \Rightarrow p = -2$  and  $q = 1$

$$\therefore y = \frac{a}{x-2} + 1 \dots \textcircled{1}$$

Determine the value of  $a$  by substituting the point  $(4; 4)$

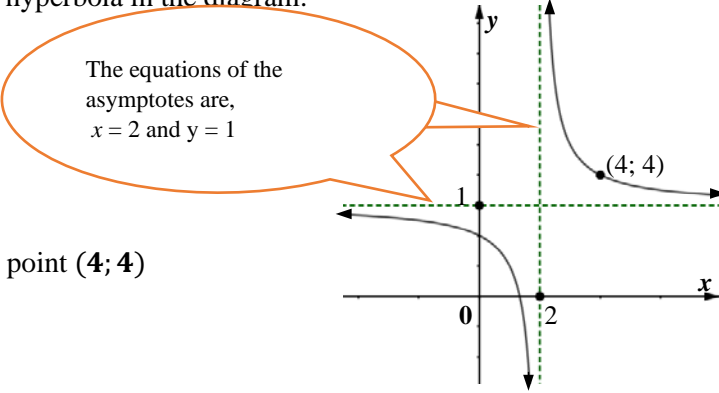
into  $\textcircled{1}$ :  $y = \frac{a}{x-2} + 1$

$$\therefore 4 = \frac{a}{4-2} + 1$$

$$\therefore 4 = \frac{a}{2} + 1$$

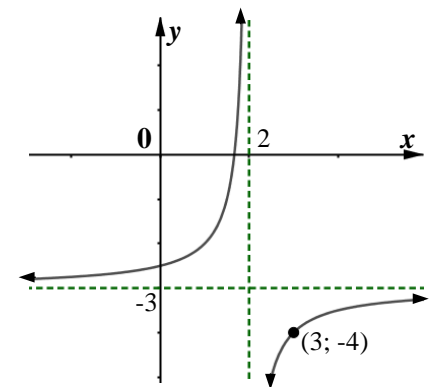
$$\therefore 3 = \frac{a}{2}$$

$$\therefore 6 = a \Rightarrow \text{Equation: } y = \frac{6}{x-2} + 1$$



**CAN YOU?**

Determine the equation of the hyperbola in the diagram:



Answer:  $y = \frac{-1}{x-2} - 3$

**Do Exercises from your Textbook:** Finding equation of hyperbola



**LESSON 3: TO DETERMINE THE EQUATION OF AN EXPONENTIAL FUNCTION**

**Example 4:** Determine the equation of the exponential function below:

**Solution:**

$$y = a \cdot b^x + q$$

We must find the values of  $a$ ,  $b$  and  $q$

Substitute  $q = 4$

$$\therefore y = a \cdot b^x + 4 \dots \textcircled{1}$$

Substitute the y-intercept (0; 2) into  $\textcircled{1}$  to determine  $a$

$$\therefore 2 = a \cdot b^0 + 4$$

$$\therefore 2 = a \cdot 1 + 4$$

$$\therefore -2 = a \Rightarrow y = -2 \cdot b^x + 4 \dots \textcircled{2}$$

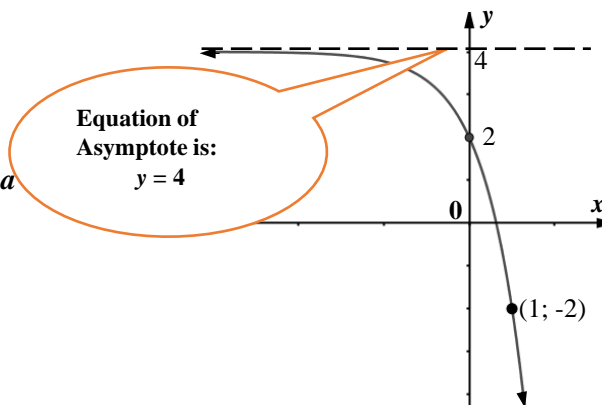
Substitute the point (1; -2) into  $\textcircled{2}$  to determine  $b$

$$\therefore -2 = -2 \cdot b^1 + 4$$

$$\therefore -6 = -2 \cdot b$$

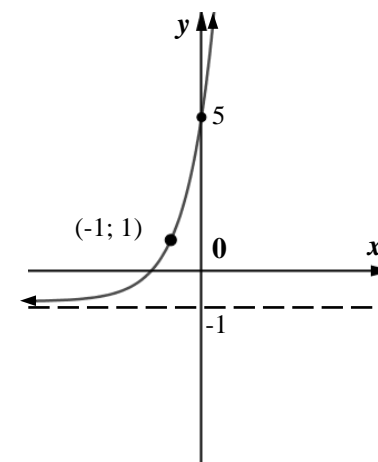
$$\therefore 3 = b$$

Equation:  $y = -2 \cdot 3^x + 4$



**CAN YOU?**

Determine the equation of the following exponential function



**Revise exponential laws**

Answer:  $y = 6 \cdot 3^x - 1$  OR  $y = 2 \cdot 3^{x+1} - 1$

ACTIVITIES/ASSESSMENT	Mind Action Series	Platinum	Classroom Mathematics	Everything Mathematics
	Ch 4 Pg: 63/64; 66/67; 71/73 and 78-80	Topic 5 Pg. 90-91; 98-99; 104-105; 106-109; 114-115	Ch 5 Pg: 109-112; 118-124; 125-131	Ch 5 Pg: 161-163; 181-183 and 191-196

CONSOLIDATION	<p><i>Parabola:</i></p> <ul style="list-style-type: none"> <li>If roots and a point are given; use <math>y = a(x - x_1)(x - x_2)</math> where <math>x_1</math> and <math>x_2</math> are the roots; substitute other point to determine <math>a</math>.</li> <li>If turning point and another point are given; use <math>y = a(x + p)^2 + q</math> where <math>(-p; q)</math> are the coordinates of the turning point; substitute other point to determine <math>a</math>.</li> </ul> <p><i>Hyperbola:</i></p> <ul style="list-style-type: none"> <li>Use <math>y = \frac{a}{x+p} + q</math> where <math>x = -p</math> and <math>y = q</math> are the equations of the asymptotes; substitute other point to determine <math>a</math>.</li> </ul> <p><i>Exponential function:</i></p> <ul style="list-style-type: none"> <li>Use <math>y = a \cdot b^x + q</math> where <math>y = q</math> is the equation of the asymptote; substitute y-intercept to determine <math>a</math> and another point to determine <math>b</math> (if not given).</li> </ul>
---------------	--



**Western Cape  
Government**

Education

Directorate: Curriculum FET