

Revision of Grade 11 Functions

Key Concepts

In this session we will focus on summarising what you need to know about:

- Sketching the graphs of a straight line, parabola, hyperbola and exponential functions.
- Finding the equations of various functions.
- Answering interpretive questions.
- Transformations.

Terminology & Definitions

Asymptotes: The graph or expression is not defined at that value.

Guidelines

To sketch a straight line we can use one of three methods

- *Table method*
- *Gradient intercept method*
- *Dual intercept method*

To sketch a parabola we need

- *Shape*
- *Axis of symmetry*
- *Turning point*
- *Y intercept*
- *X intercept*

To sketch a hyperbola we need

- *Asymptotes*
- *X and y intercepts*
- *Table method*

To sketch an exponential we need

- *Asymptotes*
- *Table method*

X-planation

- When finding the equation of a parabola where we know the x intercepts and one other point, we use $y = a(x - x_1)(x - x_2)$
- Once we have the equation of the parabola and we are asked for the turning

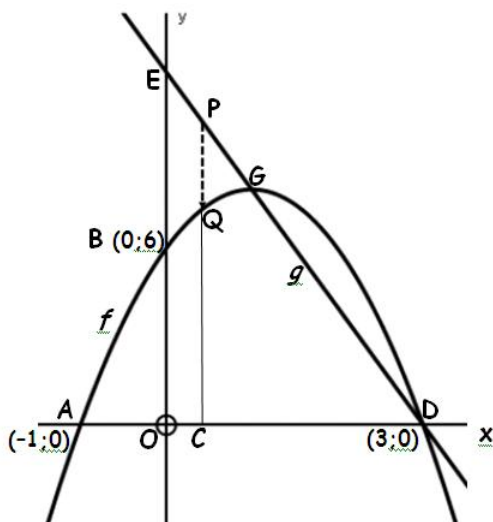
point, it is easier to use the equation $x = \frac{-b}{2a}$ to find the x value of the

turning point and then to substitute it into the equation for the corresponding y value. The other alternative is to complete the square which can be very difficult.

- Remember horizontal lengths are x values and vertical lengths are y values.
- If asked to find the equation of a parabola and we are given the turning point, we use $y = a(x - p)^2 + q$
- If asked about $f(x) < 0$ we are talking about the x values where the graph is below the x axis.
- If asked about $f(x) > 0$ we are talking about the x values where the graph is above the x axis.
- If asked about $f(x).g(x) < 0$ we are talking about the x values where one graph is below the x axis and the other is above the x axis.
- If asked about $f(x).g(x) > 0$ we are talking about the x values where both graphs are below the x axis, or both are above the x axis.

X-ample Question 1

In the diagram, the graph of $f(x) = ax^2 + bx + c$ passes through the points A (-1 ; 0), B (0 ; 6) and D (3 ; 0) with G the turning point of f . The graph of $g(x) = mx + k$ passes through the points D (3 ; 0) and G. E is the y-intercept of g .



- Show that $f(x) = -2x^2 + 4x + 6$
- Determine the coordinates of G, the turning point of f .
- Determine the values of m and k .
- If $OC = \frac{1}{2}$ unit, find distance PQ.

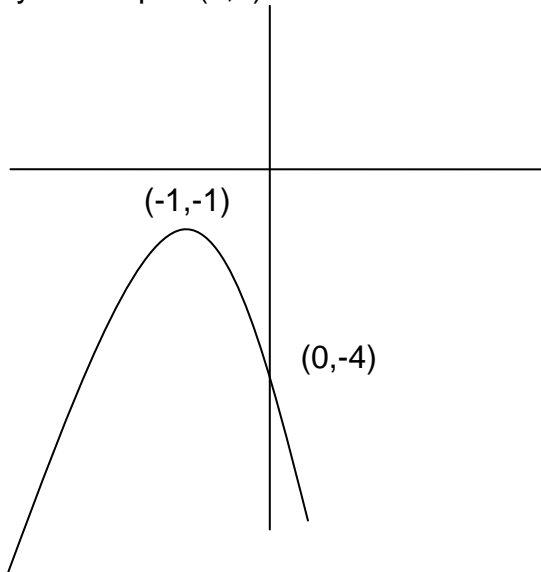
X-ample Question 2

$$y = \frac{-2}{x-2} + 1$$

- Sketch the graph.
- Write down the equations of the asymptotes to this graph.

X-ample Question 3

The graph of $y = ax^2 + bx + c$ is drawn below. The turning point is $(-1, -1)$ and the y-intercept is $(0, 4)$



X-ample Question 4

If $f(x) = x^2$ sketch the graphs indicated below:

Options:

- $f(x) + 2$
- $f(x) - 2$
- $f(x)$
- $f(x + 3)$
- $-f(x)$
- $-f(x) - 2$

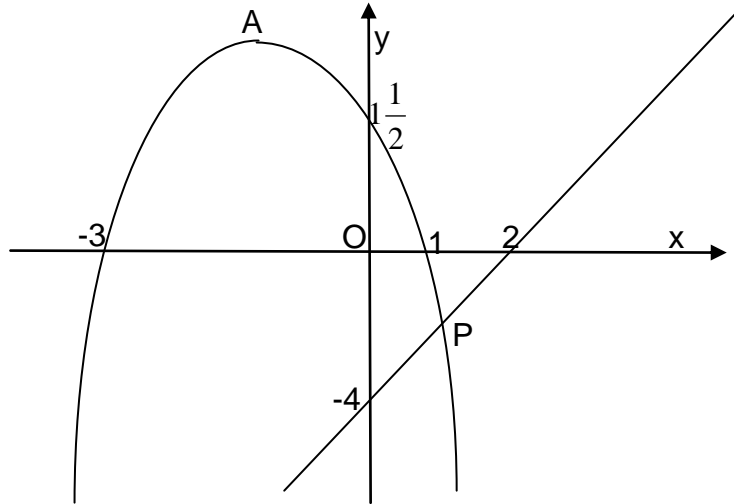
X-ample Question 5

On the same set of axes sketch the graphs of $f(x) = 2\sin x$ and $g(x) = \cos 2x$ if $x \in [-180^\circ; 90^\circ]$. Use your graphs to answer the following questions:

- For which value(s) of x is $f(x) > 0$
- For which value(s) of x is $f(x).g(x) > 0$
- If the curve of g is moved one unit downward, give the equation of the graph which is now represented by g .
- If the curve of f is shifted 45° to the left give the equation of the graph which is now represented by f .

X-ercise 1

The sketch shows the graphs of $y = ax^2 + bx + c$ and $y = mx + n$

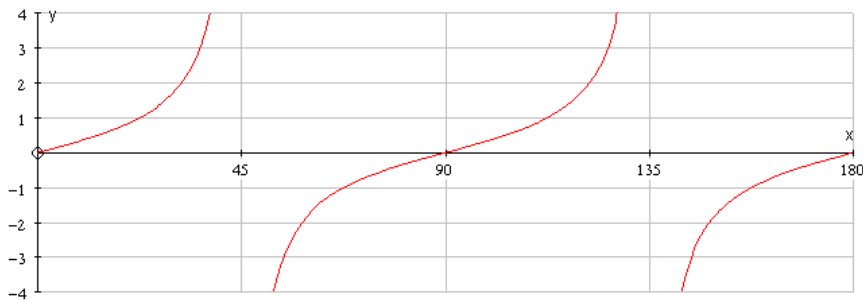


(a) Find the values of a , b , c , m and n
(7)

(b) Find the coordinates of A

(7)

X-ercise 2

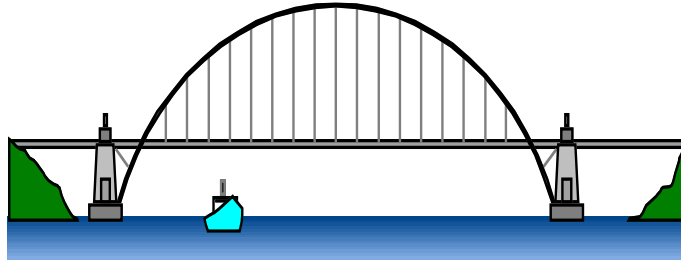


Refer to the figure

$h \rightarrow x : \tan ax, x \in [0^0; 180^0]$

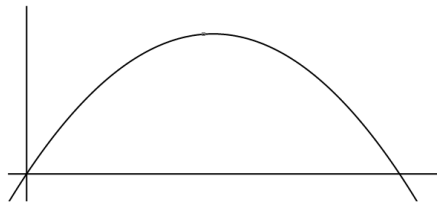
- What is the value of a ?
- For what value of x is the function not defined?
- If $2 + \tan ax = 1$, show clearly on the graph above using capital letters P , Q , etc. where you would read the solution(s) for x

X-exercise 3



The diagram shows the arch of a bridge in the shape of a parabola which spans a road over the river .

The accompanying figure shows the graph of $f(x) = ax^2 + bx + c$, the graph which passes through the origin has a maximum value of 20 units when $x = 10$.



- Determine the values of a , b and c
- If the equation represents the arch of the bridge shown in the diagram, and OB on the x -axis represents the length of the road underneath the bridge, determine the actual length of the road spanned by the bridge.
Scale 1 unit on the graph represents 1 meter
- What is the length of the road underneath if b and c have the values you found in question a), but the value of a is doubled

X-exercise Answers

X-exercise 1

a) $a = \frac{-1}{2}$, $b = -1$, $c = \frac{3}{2}$; $m = 2$; $n = -4$

b) $A(-1 ; 2)$

X-exercise 2

a) $a = 2$

b) $x = 45^\circ$ or $x = 135^\circ$

c) $x = 67.5^\circ$ or $x = 157.5^\circ$

X-exercise 3

a) $a = -\frac{1}{5}$, $b = 4$, $c = 0$

b) 20 m

c) 10 m