Gr 11 Mathematics

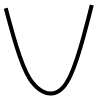
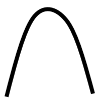
Function Summary 14 July 2020

Go through the following summary of functions

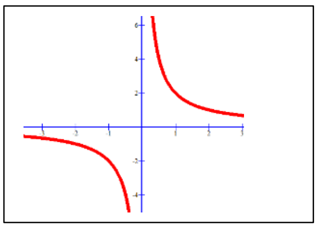
Linear functions of the form *y* = *mx* + *c.*

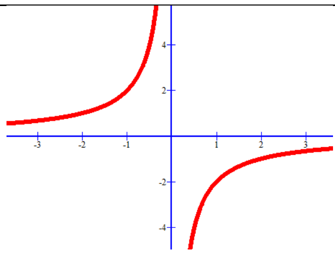
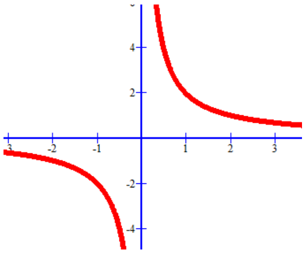
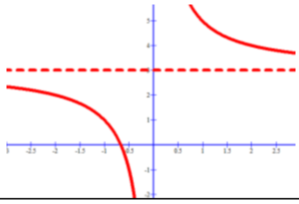
Domain	X E R
Range	Y E R
m changes (Gradient Changes)	The Slope changes.
c changes (y-intercept Changes)	The graph cuts the y axis at q. The graph can shift up or down then in comparison with original graph. Example f (x) = x-2 g(x) = x -5 The graph of g(x) cuts the y-axis at -5. Therefore g(x) has moved down 3 units from f(x) graph.

Quadratic functions of the form *y* = ax^2 + *q*.

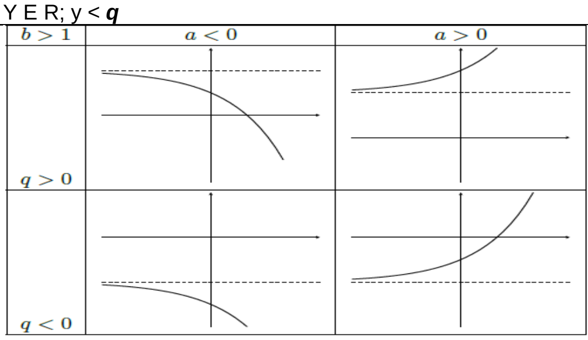
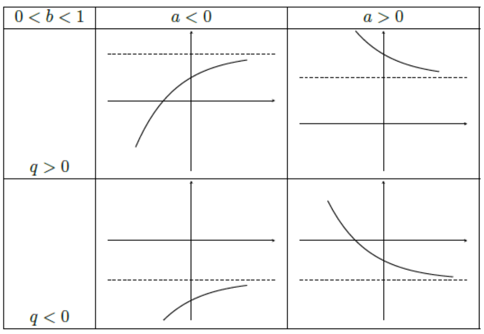
Domain	X E R
Range	***If a is positive*** Y ≥q ***If a is negative*** Y≤q
a change	If a ≥ 0  The greater a value the narrower the "smile" If a ≤0 The greater a value the narrower the "sad face" 
q changes	The graph cuts the y axis at q. The graph can shift up or down then in comparison with original graph.

Hyperbolic functions of the form *y* = $\frac{a}{x}$+ *q*.

Domain	X E R; x≠0
Range	Y E R; y≠q
a change	The value of y at x=1 will be a The value of y at x = -1 will be a ALSO REMEMBER If a >0  If a< 0

	
q changes	q indicates the y- asymptote. If q = 0 then the asymptote is y = 0 (x-axis)  If q = 3 then the asymptote is y = 3, shifting up the graph by 3 units. 

Exponential functions of the form $y = ab^x + q$.

Domain	X E R
Range	If a > 0 Y E R; y <***q*** If a<0 Y E R; y < ***q***
a and ***b*** and ***q*** changes	  The q is the Asymptote of the graph. As q changes the graph will move up or down depending on the value of q.

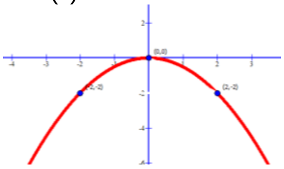
SUMMARY FOR ALL GRAPH SHIFTS

Function change	Shift
f(x) + c	Shift the graph of f(x) up c units
f(x) - c	Shift the graph of f(x) down c units
f(x + c)	Shift the graph of f(x) left c units
f(x - c)	Shift the graph of f(x) right c units
-f (x)	Reflect the graph of f(x) about the x-axis
f (-x)	Reflect the graph of f(x) about the y-axis
f(c.x)	Compress the graph of f(x) horizontally by a factor of c.
c.f(x)	Stretch the graph of f(x) vertically by a factor of c.

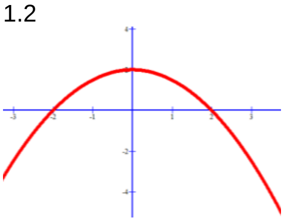
Textbook Exercises

Page 84 Exercise 1 number 1 (I put them on separate axes each time so you can see the graphs)

1.1 $f(x) = -\frac{1}{2} x^2$

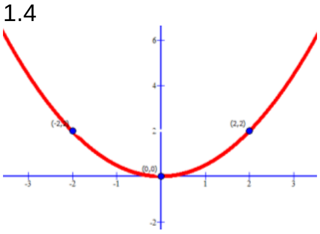


1.2



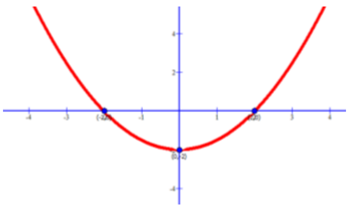
1.3 $g(x) = -\frac{1}{2} x^2+2$

1.4



1.5 $h(x) = \frac{1}{2} x^2$

1.6



1.7 $k(x) = \frac{1}{2} x^2 -2$

VERTICAL SHIFTS

Page 84 Exercise 1 number 2 (Try yourself)

Page 85 Exercise 2

Example for Number 1

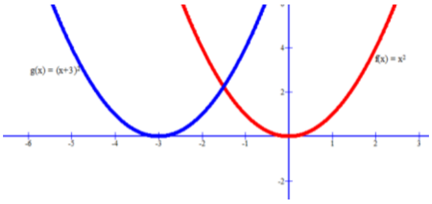
1. $y=x^2+6x+9$

REMEMBER FACTORISING INVOLVES EITHER
1. NORMAL FACTORISING
2. COMPLETING THE SQUARE
3. THE FORMULA

FACTORISE
$y = (x+3)^2$

Therefore, the shift from the origin is 3 units left.

ILLUSTRATED AS GRAPHS

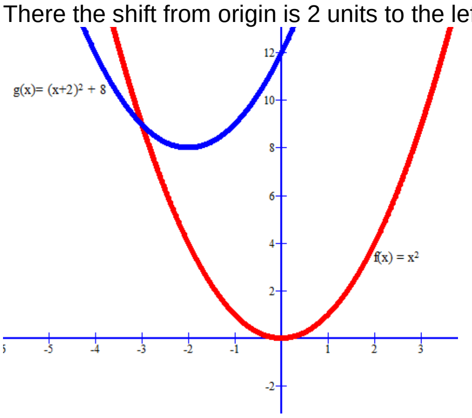


HORIZONTAL AND VERTICAL SHIFTS

Standard Form to make it easier is $y = (x+p)^2+q$
Where p is the horizontal shift
Where q is the vertical shift
How would you change $y = x^2+4x+12$ into $y = (x+p)^2+q$ form
COMPLETE THE SQUARE METHOD – you just not solving for x
$y = (x^2+4x+4)+12-4$
$y = (x+2)^2 + 8$

$$\left(\frac{Coefficient\ of\ b}{2}\right)^2$$
$$\left(\frac{4}{2}\right)^2 = 2^2$$
ADD and SUBTRACT TO NOT CHANGE THE EXPRESSION

There the shift from origin is 2 units to the left and 8 units up.



Page 86 Exercise 3 (ALREADY IN THE STANDARD FORM OF $y = (x+p)^2+q$

1. **X-INTERCEPT FORM**
   $y = (x-4)^2-9$
   $y = (x-4)(x-4) -9$
   $y = x^2-8x+16-9$
   $y = x^2-8x+7$ **STANDARD FORM**
   $y= (x-7)(x-1)$

   SHIFT
   $y = (x-4)^2-9$
   Shift 4 units to the right and 9 units down

Page 86 Exercise 2 (Try yourself)

2 to 4

Function change	Shift
f(x) + c	Shift the graph of f(x) up c units
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