GRADE 11
Functions
WEBSITE NOTES

TOPIC:

- Revise the effect of *a* and *q* and investigate the effect of p on the graphs of the functions defined by:
- $y = f(x) = a(x + p) + q$
- $y = f(x) = a(x + p)^2 + q$
- $y = f(x) = a(x + p)^2 + q$
- $y = f(x) = \frac{a}{x + p} + q$

Functions

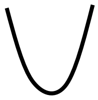
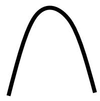
Characteristics of functions:
– The given *x*-value is known as the independent variable, because its value can be chosen freely. The calculated *y*-value is known as the dependent variable, because its value depends on the *x*-value.
– An asymptote is a straight line, which the graph of a function will approach, but never touch.

– Linear functions of the form $y = mx + q$.

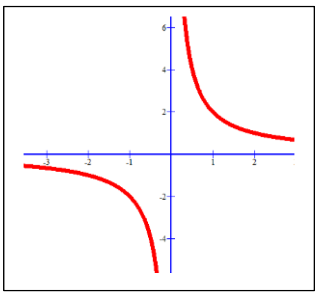
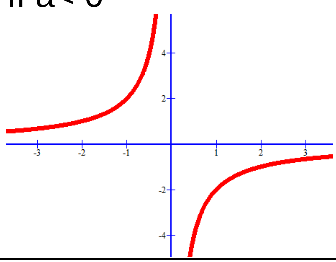
Sketch Graph	Use a table. ***Y=f(x) = x-2*** Substitute the values for x (which you chose) into the equation <table><tr><td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td></tr><tr><td>F(x) =y</td><td>**(-2)** -2 =-4</td><td>***(-1)*** – 2 =-3</td><td>-2</td><td>-1</td><td>0</td></tr></table>
Domain	X E R
Range	Y E R
m changes	The Slope changes.
q 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.

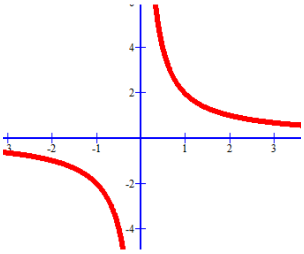
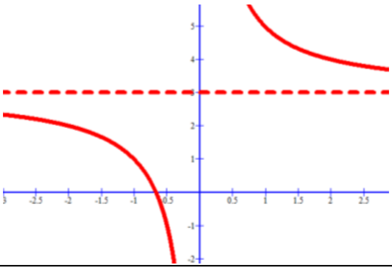
– Parabolic functions of the form $y = ax^2 + q$.

Sketch Graph	Use a table. Substitute the values for x (which you chose) into the equation
Domain	X E R

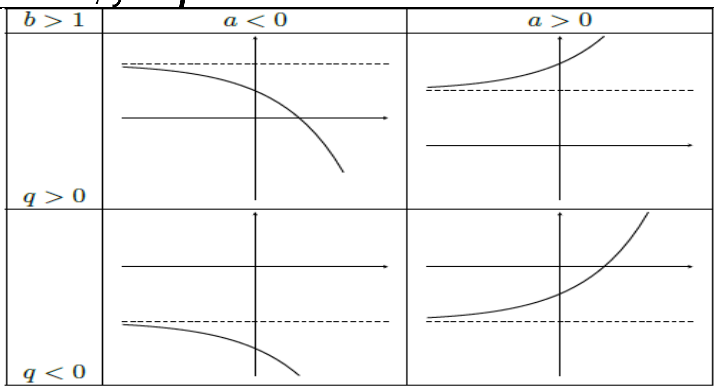
Range	***If a is positive*** Y ≥q ***If a is negative*** Y≤q
a changes	If a ≥ 0  The greater the a value the more narrow the “smile” If a ≤0  The greater the a value the more narrow the “sad face”
q changes	The graph cuts the y axis at q. The graph can shift up or down then in comparision with original graph.

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

Sketch Graph	Use a table. Substitute the values for x (which you chose) into the equation
Domain	X E R; x≠0
Range	Y E R; y≠q
a changes	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 $y = ab^x + q$.

Sketch Graph	Use a table
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	

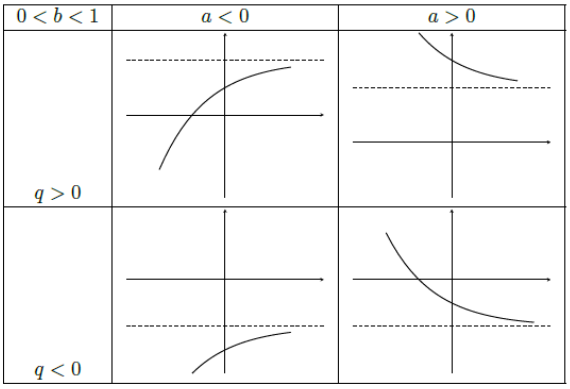


Table 6.5: The effect of a and q on an exponential graph when $0 < b < 1$.

The q is the Asymptote of the graph. As q changes the graph will move up or down depending on the value of q.

Shifts For c>0, *to obtain the graph of:*		
f(x)+c	*shift the graph of f(x)*	**upward** c units
f(x)-c	*shift the graph of f(x)*	**downward** 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

Reflections *To obtain the graph of:*		
-f(x)	*reflect the graph of f(x)*	**about the x-axis**
f(-x)	*reflect the graph of f(x)*	**about the y-axis**

Stretches and compressions For c>1, *to obtain the graph of:*		
cf(x)	***stretch*** *the graph of f(x)*	**vertically** by a factor of c
(1/c)f(x)	***compress*** *the graph of f(x)*	**vertically** by a factor of c
f(cx)	***compress*** *the graph of f(x)*	**horizontally** by a factor of c
f(x/c)	***stretch*** *the graph of f(x)*	**horizontally** by a factor of c