GRADE 11
Functions 2
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*

- $y = f(x) = \dfrac{a}{x + p} + q$

REMEMBER THE FOLLOWING

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.

Hyperbola
VERTICAL SHIFTS

$f(x) = \dfrac{a}{x+p} + q$

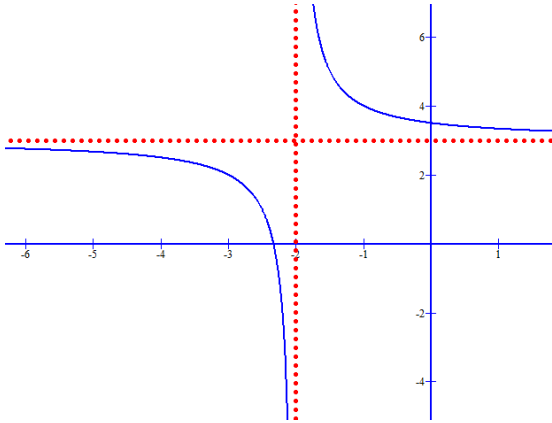$consider\ f(x) = \dfrac{1}{x}$
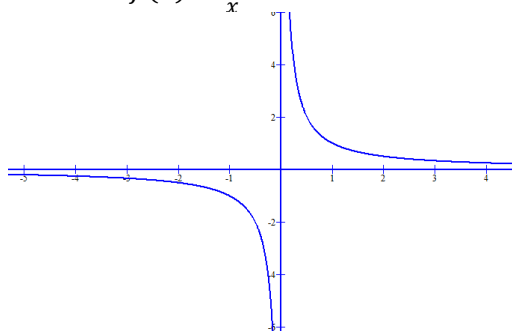
The Vertical asymptote is x = 0
The Horizontal asymptote y = 0

$f(x) = \dfrac{1}{x+2} + 3$

If p = 2 the hyperbola will shift 2 units to the left. The vertical asymptote is x = -2 now.
If q = 3 the hyperbola will shift 3 units up. The Horizontal Asymptote is y = 3 now.

Example 1 (Try yourself)

1. Consider $f(x) = \dfrac{4}{x-2} + 4$
   a. Describe the shift from the origin
   b. Write down the asymptotes of the function.
2. Consider $f(x) = -\dfrac{4}{x-3} - 1$
   a. Describe the shift from the origin
   b. Write down the asymptotes of the function.
3. Consider $f(x) = \dfrac{1}{x+2} - 3$
   a. Describe the shift from the origin
   b. Write down the asymptotes of the function.
4. Consider $f(x) = -\dfrac{3}{x-1} + 2$
   a. Describe the shift from the origin
   b. Write down the asymptotes of the function.
   c. Write down h(x) if h(x) is the reflection of f(x) about the x-axis
   d. Write down k(x) if k(x) is the reflection of f(x) about the y-axis