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.

PARABOLA
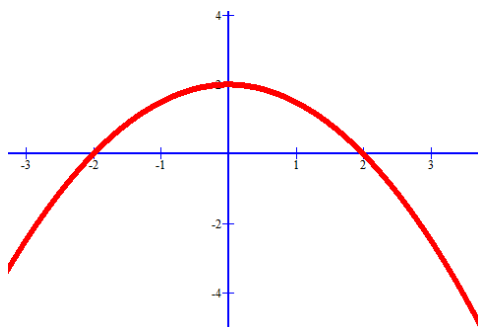**VERTICAL SHIFTS**
Textbook Exercises
Page 84 Exercise 1 number 1 (I put them on separate axes each time so you can see the graphs)
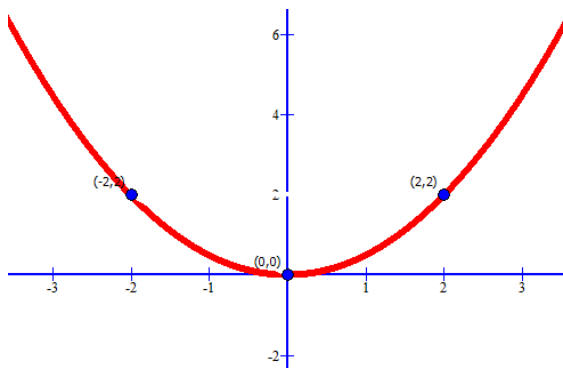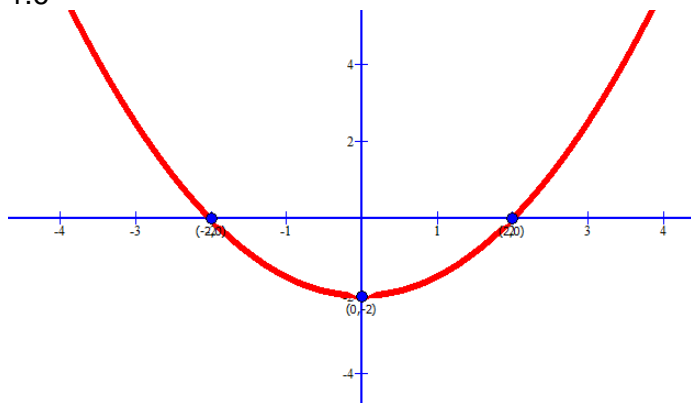$f(x) = -\frac{1}{2}x^2$
1.1
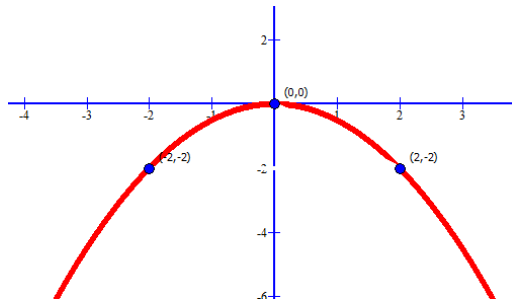
1.2

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 (Try yourself)
2

Page 85 Exercise 2
Number 1
    1. $y = x^2 + 6x + 9$
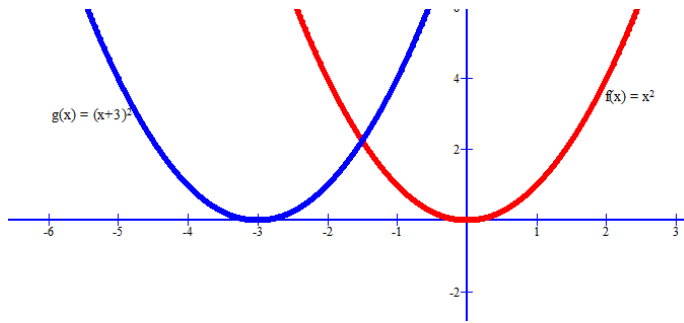   FACTORISE
        $y = (x+3)^2$

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

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
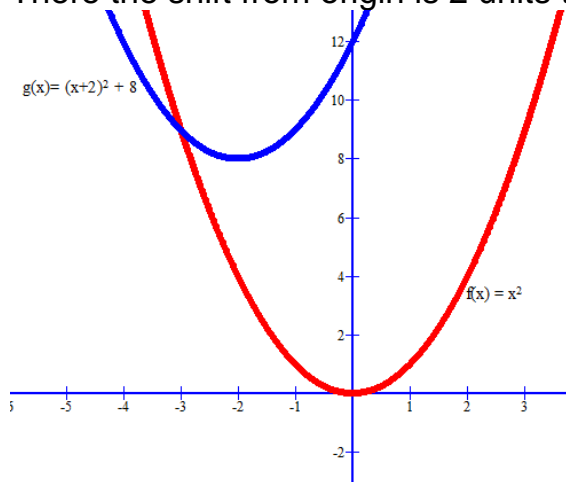
$y = (x^2+4x+4)+12-4$

$y = (x+2)^2 + 8$

$$(\frac{Coefficient\ of\ b}{2})^2$$
$$(\frac{4}{2})^2 = 2^2$$
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**

   $y = (x-4)^2-9$

   $y = (x-4)(x-4) -9$

   $y = x^2-8x+16-9$

   $y = x^2-8x+7$

   $y= (x-7)(x-1)$

   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