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:
- $y = f(x) = a(x + p) + q$
- $y = f(x) = a(x + p)^2 + q$
- $y = f(x) = a(x + p)^2 + q$
- $y = f(x) = \frac{a}{x + p} + q$

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

VERTICAL SHIFTS

Page 84 Exercise 1 (Try yourself)

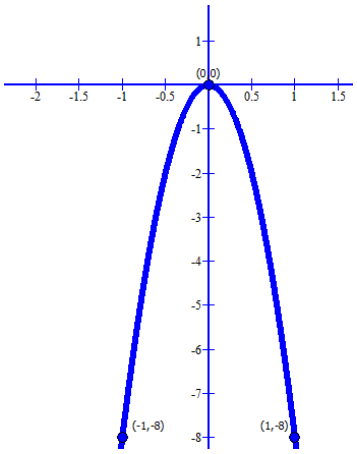
2

REMEMBER FACTORISING INVOLVES EITHER

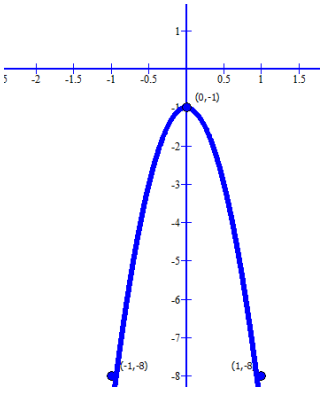
1. **NORMAL FACTORISING**
2. **COMPLETING THE SQUARE**
3. **THE FORMULA**

ANSWER

2.1

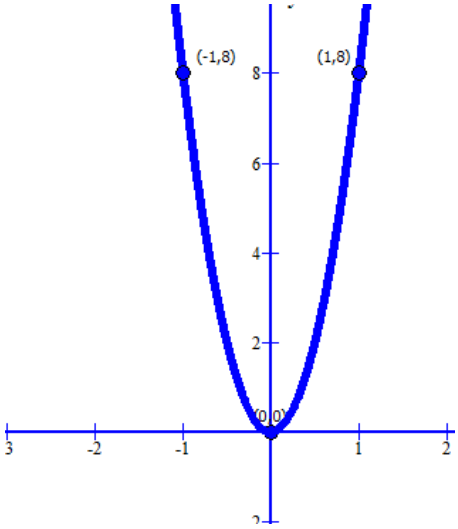


2.2



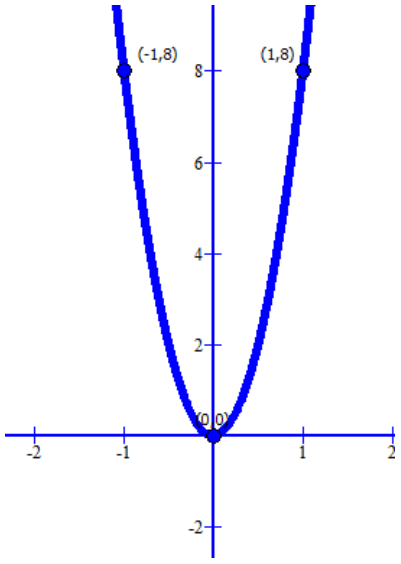
2.3 $g(x)= -8x^2 – 1$

2.4



2.5 $h(x) = 8x^2$

2.6



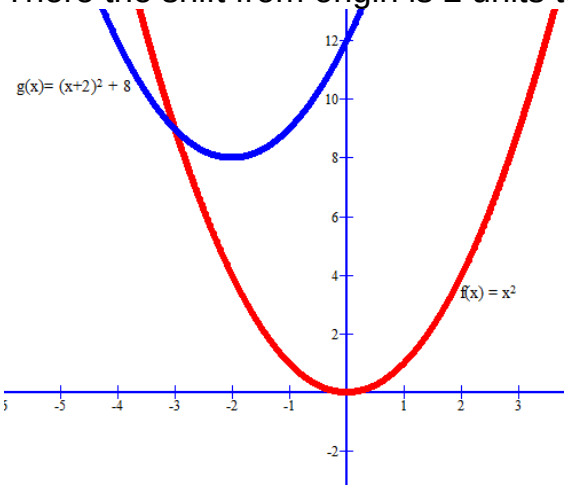
2.7 $k(x) = 8x^2 +1$

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 85 Exercise 2 (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 85 Exercise 2 (Try yourself)

2 to 4

ANSWER

2. $y = 4(x+2)^2-1$
   $y = 4x^2+16x+15$
   $y = (2x+3)(2x+5)$

   SHIFT FROM ORIGIN
   $y = 4(x+2)^2-1$
   2 units left and 1 unit down

TURNING POINT

(-2;-1)

3. $y = -(x+5)^2+16$
$y = -x^2-10x-9$
$y = -(x^2+10x+9)$
$y = -(x+9)(x+1)$

SHIFT FROM ORIGIN
$y = -(x+5)^2+16$
5 units left and 16 units up

TURNING POINT

(-5;16)

4. $y = -(x-3)^2 + 4$
$y = -x^2+6x-5$
$y= -(x^2-6x+5)$
$y = -(x-5)(x-1)$
SHIFT FROM ORIGIN
$y = -(x-3)^2 + 4$
3 units right and 4 units up

TURNING POINT

(3;4)