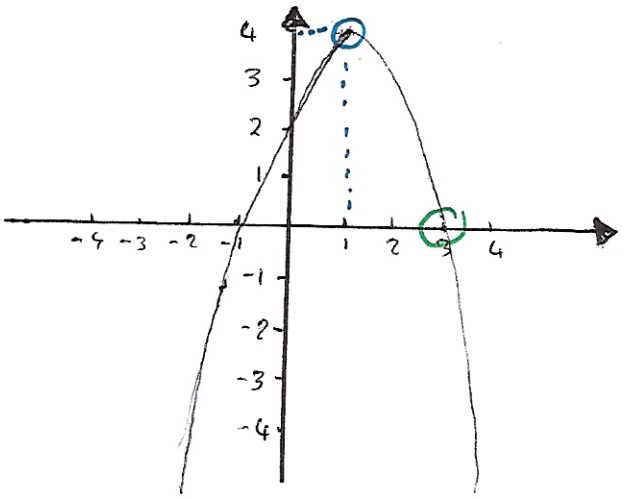
Transforming Functions

(13)



(a) A turning point is a maximum or minimum point on a curve.

So here (1, 4).

(b) "The value of $f(3)$" means what is the y co-ordinate of the point on the curve with an x-co-ordinate of 3.

Here when $x=3$, $y=0$.

(c) This is a transformation question.

(2) $f(x+3)$

The '2' is a stretch by a factor of 2 in the y direction. This doesn't affect the x-intercepts (-1 and 3).

The '+3' shifts the graph left by three (or -3 in the x-direction). This will affect the x-intercepts. It will shift the both by -3 to -4 and 0.

-4 and 0.

(14)(i) $f(x-2)$

Inside the bracket so change is in x-direction.

Inside the bracket so change "is the opposite".

"-2" shift the graph +2 in the x-direction.

(ii) $f(2x)$ Inside brackets ⇒ x-direction

⇒ opposite (so compress not stretch).

Shrinks or compresses the graph by scale factor of 2 in the x-direction.

(iii) $2f(x)$ outside brackets → y-direction

→ Does as expected (not opposite).

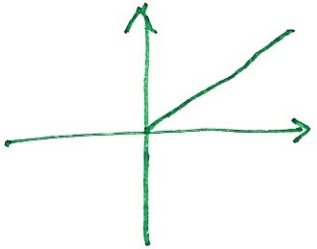
Stretch by a scale factor of 2 in the y-direction.

(iv) $-f(x)$ outside brackets ⇒ y-direction

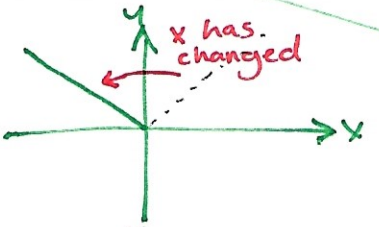
minus sign ⇒ reflection in an axis.

YOU HAVE TO BE CAREFUL WITH REFLECTIONS
IT IS THE Y-DIRECTION THAT CHANGES BUT
THE Y-CO-ORDINATES CHANGE WITH A REFLECTION
IN THE X-AXIS NOT WITH A REFLECTION IN THE

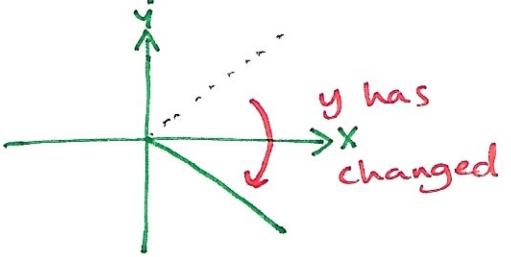
Y-AXIS.



Reflection in y-axis ⇒



Reflection in x-axis ⇒



So it's **a reflection in the x-axis**

because that changes y.

(v) $f(x) + 2$ ⇒ outside so y-direction
so as expected (not opposite)

Translated by +2 in y-direction

(vi) $f(-x)$ → inside so x-direction
→ minus so a reflection in an axis

A reflection in Y-AXIS changes x-co-ordinates.

A reflection in the y-axis