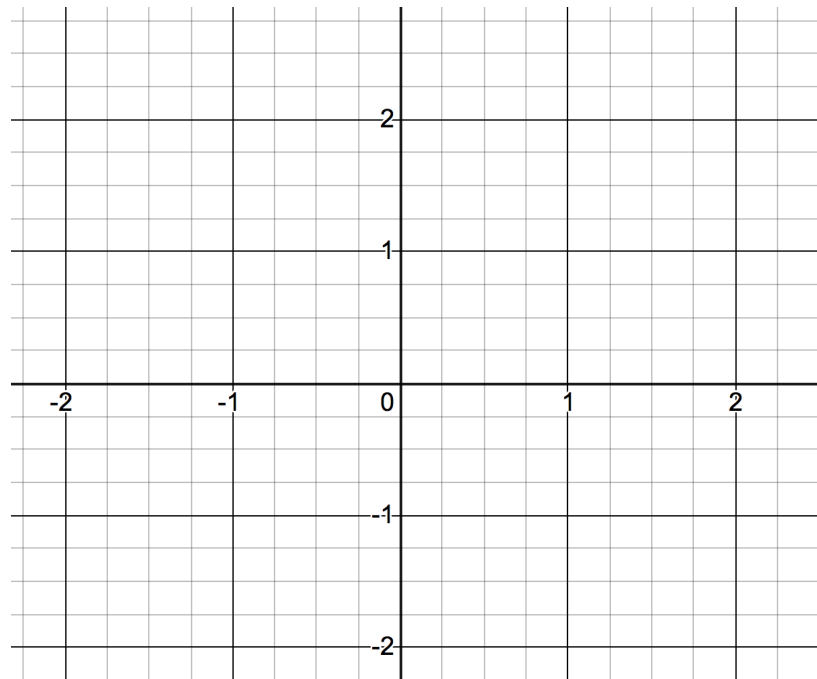**Functions 10: Mixed exam style questions [non GDC]**

(1)   The following functions are defined:

$$f(x) = x^2 \quad g(x) = -x + 2 \quad h(x) = x + 1$$

(a) Sketch $gf(x)$ below ($-2 \leq x \leq 2$). Describe the transformation that takes $f(x)$ to $gf(x)$.

(b) $f(x)$ is now restricted to the domain $0 \leq x \leq 2$. Sketch $f^{-1}(x)$.

(2)   The function $f(x) = \frac{ax+3}{2x-b}$ has asymptotes with equations $x = 3$ and $y = 4$.

(a)   Find a and b.
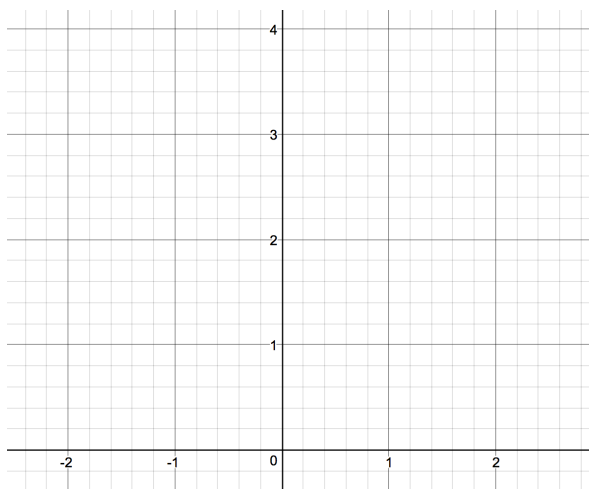
(b)   Find the inverse function $f^{-1}(x)$.

(c)   The function $g(x)$ is defined as: $g(x) = \frac{2(ax+3)}{2x-b} + 2$. Describe the set of transformations which take $f(x)$ to $g(x)$.

(3)   For what values of m does $f(x) = 2x^2 + mx + m$ have no real roots?

(4)   For $f(x) = x^2 + 2x + 1$ and $g(x) = 3x + c$, for what values of c do the graphs intersect in 2 points?

(5)   The function $f(x)$ is defined as: $f(x) = 2x^2 - 4x - 6$.

(a)   Rewrite the quadratic **both** in the form $y = r(x - p)^2 + q$ and $y = (ax + b)(cx + d)$.

(b)   Hence sketch the graph showing axes intercepts and coordinates of the vertex.

(c)   Find the coordinates of the vertex for the function $f(x + 1) + 2$

(6)   Some functions are defined below:

$$f(x) = 2x - 2, \qquad g(x) = x^2 - x \qquad h(x) = \frac{x + 2}{x - 1}, x \neq 1$$

(a)   Find $gf(x) = 12$

(b)   Find $h^{-1}(3)$

(c)   Find $ff(x) = f^{-1}(x)$

(7) Below is the graph of $f(x)$.
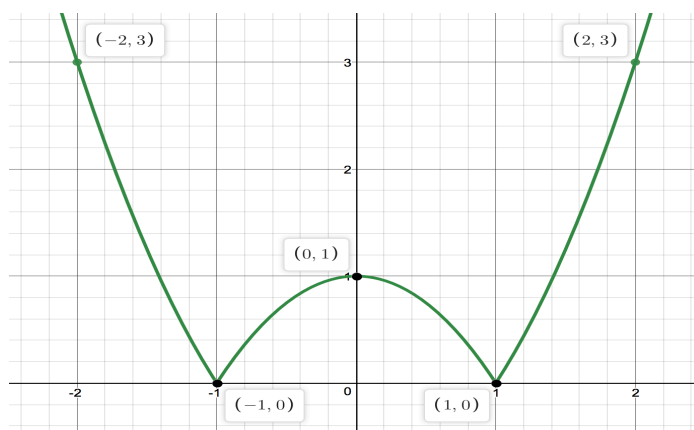
(a)   Sketch the graph of $f(2x)$ $(-1 \leq x \leq 1)$.

(b)   Sketch the graph of $f(x-1)+1$ $(-1 \leq x \leq 3)$.