

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanation. In particular, solutions found from a graphic display calculator should be supported by suitable working, for example if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

Foundational: 12 points

ONE: Let $h(x) = \frac{40+10x}{2x-4}$

- Write down the y -intercept.
- Write down the x -intercept.
- Write down the equation of the vertical asymptote.
- Write down the equation of the horizontal asymptote.
- Write down the domain and range of $h(x)$;
- Hence, write down the domain and range of $y = h(x + 7) - 6$

Also be prepared to perform the same tasks with $h(x) = \frac{-5}{x+3}$

TWO: Let $j(x) = 2x^2 - x - 6$

- Find $j(-3)$.
- Find when $j(x) = 0$.
- Find the domain and range of $j(x)$.
- The graph of j is translated to the right 4 units and down 1 unit to give the graph of g . $g(x)$ can be expressed in the form $Ax^2 + Bx + C$. Find the values of A , B , and C .

Also be prepared to perform the same tasks with $j(x) = x - 3x^2$

Moderate: 8 pointsTHREE: Let $g(x) = \ln(x + 11) - \ln 4$

- Show that $g^{-1}(x) = 4e^x - 11$.
- Find a point where $g(x) = g^{-1}(x)$.
- Show that $(g^{-1} \circ g)(x) = x$.

Also be prepared to show
that $(g \circ g^{-1})(x) = x$

FOUR: Let $f(x) = -10 - 0.25\sqrt{0.5x + 30}$.

- State the domain and range of $f^{-1}(x)$.
- Describe all the horizontal and vertical transformations that map $y = \sqrt{x}$ to $f(x)$.
Be clear with the order of the transformations.
- The graph of f is vertically stretched by 4 and reflected over the y -axis to give the graph of $w(x)$.
Find $w(-10)$.

High Challenge: 2 pointsFIVE: Let the function $f(x) = a + \frac{b}{x+c}$. The graph of f has asymptotes at $x = 4$ and $y = 5$ and passes through $(2, 4)$.

- Write down the domain and range of f .
- Find the values of a , b , and c .
- Find $f^{-1}(x)$. State the domain and range of $f^{-1}(x)$.

Be prepared for a completely new HC problem of equal difficulty.