transformations of graphs - 1

4 questions – progressing from ‘accessible’ to ‘discriminating’

1. (a) Given that the function \( h \) is defined as \( h(x) = x^2 \). [no calculator]
   show that \( g(x) = h(x-2) + 1 = x^2 - 4x + 5 \).
   (b) Describe fully the transformations which map \( h(x) \) onto \( g(x) \).

2. The function \( f \) is defined as \( f(x) = \sqrt{4-x} \). Sketch the graph of each function
   given below – each on a separate pair of axes. [no calculator]
   (a) \( y = f(2x) \)  
   (b) \( y = f(-x) \)  
   (c) \( y = \frac{1}{2} f(x) + 2 \)

3. The graphs of functions \( f(x) \) and \( g(x) \) are shown below. [no calculator]

   (a) Describe fully the transformations which map the graph of \( f(x) \) onto the
   graph of \( g(x) \).
   (b) Express \( g(x) \) in terms of \( f(x) \).

4. Given \( k > 0 \), what value(s) of \( x \) satisfy the equation \( |x+k| = |x| + k \).
   [no calculator]
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Answers

1. (b) horizontal translation 2 units to the right, and vertical translation 1 unit up

2. (a) \[ y = f(2x) \]
(b) \[ y = f(-x) \]
(c) \[ y = \frac{1}{2} f(x) + 2 \]

3. (a) reflection about the x-axis, followed by a horizontal shrink of factor \( \frac{1}{4} \), followed by a vertical shrink of factor \( \frac{1}{4} \), followed by a vertical translation 1 unit down.
(b) \[ g(x) = -\frac{1}{4} f\left(\frac{x}{4}\right) - 1 \]

4. \( x \geq 0 \)