The Modulus Function Exam Questions (From OCR 4723)

Q1 (Jun 2007, Q2)

Solve the inequality $|4x - 3| < |2x + 1|$. [5]

Q2 (Jun 2008, Q1)

Find the exact solutions of the equation $|4x - 5| = |3x - 5|$. [4]

Q3 (Jun 2010, Q5)

(i) Solve the inequality $|2x + 1| \leqslant |x - 3|$. **[5]**

(ii) Given that x satisfies the inequality $|2x + 1| \leqslant |x - 3|$, find the greatest possible value of $|x + 2|$. **[2]**

Q4 (Jun 2010, Q1)

Solve the equation $|3x + 4a| = 5a$, where a is a positive constant. **[3]**

Q5 (Jun 2011, Q7)

The functions f, g and h are defined for all real values of x by

$$f(x) = |x|, \qquad g(x) = 3x + 5 \qquad \text{and} \qquad h(x) = gg(x).$$

(i) Solve the equation $g(x + 2) = f(-12)$. **[3]**

(ii) Find $h^{-1}(x)$. **[3]**

(iii) Determine the values of x for which

$$x + f(x) = 0.$$ **[2]**

Q6 (Jun 2015, Q4)

It is given that $|x + 3a| = 5a$, where a is a positive constant. Find, in terms of a, the possible values of

$$|x + 7a| - |x - 7a|.$$ **[6]**

Q7 (Jun 2016, Q8)

The functions f and g are defined for all real values of x by

$$f(x) = |2x + a| + 3a \quad \text{and} \quad g(x) = 5x - 4a,$$

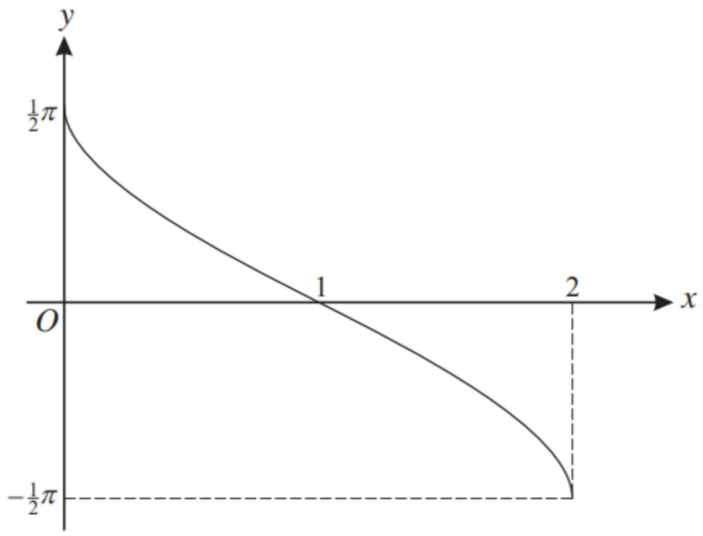
where a is a positive constant.

(i) State the range of f and the range of g. **[2]**

(ii) State why f has no inverse, and find an expression for $g^{-1}(x)$. **[3]**

(iii) Solve for x the equation $gf(x) = 31a$. **[5]**

Q8 (Jan 2008, Q6)



The diagram shows the graph of $y = -\sin^{-1}(x-1)$.

(i) Give details of the pair of geometrical transformations which transforms the graph of $y = -\sin^{-1}(x-1)$ to the graph of $y = \sin^{-1} x$. [3]

(ii) Sketch the graph of $y = |-\sin^{-1}(x-1)|$. [2]

(iii) Find the exact solutions of the equation $|-\sin^{-1}(x-1)| = \frac{1}{3}\pi$. [3]

Q9 (Jun 2009, Q5)

The functions f and g are defined for all real values of x by

$$\mathrm{f}(x) = 3x - 2 \quad \text{and} \quad \mathrm{g}(x) = 3x + 7.$$

Find the exact coordinates of the point at which

(i) the graph of $y = \mathrm{fg}(x)$ meets the x-axis, **[3]**

(ii) the graph of $y = \mathrm{g}(x)$ meets the graph of $y = \mathrm{g}^{-1}(x)$, **[3]**

(iii) the graph of $y = |\mathrm{f}(x)|$ meets the graph of $y = |\mathrm{g}(x)|$. **[4]**
