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A LEVEL MATHS

(12) Solving Modulus Equations and Inequalities

WORKING AT D/E

(1) $f(x) = |x|, x \in R$
(a) Sketch the graph of $y = f(x)$
(b) Write down the range of $f(x)$
Using your answers to parts (a) and (b),
(c) Sketch the graph of $y = |x| + 3$
(d) State the range of $y = |x| + 3$
Give than $g(x) = -|x| + 3,\ x \in R$
(e) Find the range of $g(x)$
(f) Solve the equation $g(x) = -5$

(2) (a) Solve the equation $|2x + 6| = x + 4$
(b) Hence, solve $|2x + 6| \leq x + 4$

(3) By drawing two different graphs, show that there are no solutions to the equation $1 - |x| = 6$

WORKING AT B/C

(1) (a) Solve $|3x + 7| = |x - 3|$
(b) Hence, solve $|3x + 7| < |x - 3|$

(2) $f(x) = |3x| - 5$
(a) Sketch the graph of $y = f(x)$ showing where the graph crosses the coordinate axes.
(b) Solve the inequality $f(x) > 6$ giving your answers as exact fractions.
(c) Explain why $f^{-1}(x)$ doesn't exist.
(d) With the help of a sketch, show that there are no solutions to the equation $f(x) = x - 6$

(3) Sketch the graph of $y = 5 - |x + 1|$ show where the graph crosses the coordinate axes.

WORKING AT A*/A

(1) $f(x) = |ax - 2|, x \in R$ where a is a positive constant, $a > 1$.
(a) Sketch the graph of $y = f(x)$ showing where the graph meets or crosses the coordinate axes. Give the coordinates in terms of a
(b) Solve $|ax - 2| \geq a$ giving your answers in terms of a
Given that there is one solution to the equation $|ax - 2| = b - x$ where b is a constant
(c) Find b in terms of a.

(2) $f(x) = |x + a| + b,\ x \in R$ where a and b are constants.
The graph of $y = |x + a| + b$ has a minimum point with coordinates $(-1,4)$ and y intercept $(0,5)$.
(a) Find the values of a and b
(b) Hence solve $|x + a| + b < 3 - 0.5x$
(c) The equation $f(x) + c = 7$ where c is a constant has one solution. Find the value of c.

(3) There are no solutions to the equation $3|\cos(x)| + 1 = a, 0 < x < 360$, where a is a constant. Find the possible set of values of a.