Exercise 2A

1 Write down the values of

a $\left|\frac{3}{|4|}\right|$ **b** $|-0.28|$ **c** $|3-11|$ **d** $\left|\frac{5}{7}-\frac{3}{8}\right|$ **e** $|20-6\times4|$ **f** $|4^2\times2-3\times7|$

2 $f(x) = |7-5x| + 3$. Write down the values of:

a $f(1)$ **b** $f(10)$ **c** $f(-6)$

3 $g(x) = |x^2 - 8x|$. Write down the values of:

a $g(4)$ **b** $g(-5)$ **c** $g(8)$

4 Sketch the graph of each of the following. In each case, write down the coordinates of any points at which the graph meets the coordinate axes.

a $y = |x-1|$ **b** $y = |2x+3|$ **c** $y = |4x-7|$ **d** $y = \left|\frac{1}{2}x - 5\right|$

e $y = |7-x|$ **f** $y = |6-4x|$

g $y = -|x|$ **h** $y = -|3x-1|$

Hint $y = -|x|$ is a reflection of $y = |x|$ in the x-axis. ← **Year 1, Chapter 4**

5 $g(x) = \left|4 - \frac{3}{2}x\right|$ and $h(x) = 5$

a On the same axes, sketch the graphs of $y = g(x)$ and $y = h(x)$.

b Hence solve the equation $\left|4 - \frac{3}{2}x\right| = 5$.

6 Solve:

a $|3x-1| = 5$ **b** $\left|\frac{x-5}{2}\right| = 1$ **c** $|4x+3| = -2$

d $|7x-3| = 4$ **e** $\left|\frac{4-5x}{3}\right| = 2$ **f** $\left|\frac{x}{6} - 1\right| = 3$

7 **a** On the same diagram, sketch the graphs $y = -2x$ and $y = \left|\frac{1}{2}x - 2\right|$.

b Solve the equation $-2x = \left|\frac{1}{2}x - 2\right|$.

E **8** Solve $|3x-5| = 11 - x$. **(4 marks)**

9 **a** On the same set of axes, sketch $y = |6-x|$ and $y = \frac{1}{2}x - 5$.

b State with a reason whether there are any solutions to the equation $|6-x| = \frac{1}{2}x - 5$.

(P) **10** A student attempts to solve the equation $|3x + 4| = x$. The student writes the following working:

$3x + 4 = x$		$-(3x + 4) = x$
$4 = -2x$	or	$-3x - 4 = x$
$x = -2$		$-4 = 4x$
		$x = -1$

Solutions are $x = -2$ and $x = -1$.

Explain the error made by the student.

11 **a** On the same diagram, sketch the graphs of $y = -|3x + 4|$ and $y = 2x - 9$.

b Solve the inequality $-|3x + 4| < 2x - 9$.

(E) **12** Solve the inequality $|2x + 9| < 14 - x$. **(4 marks)**

(E/P) **13** The equation $|6 - x| = \frac{1}{2}x + k$ has exactly one solution.

a Find the value of k. **(2 marks)**

b State the solution to the equation. **(2 marks)**

Problem-solving

The solution must be at the vertex of the graph of the modulus function.

Challenge

$f(x) = |x^2 + 9x + 8|$ and $g(x) = 1 - x$

a On the same axes, sketch graphs of $y = f(x)$ and $y = g(x)$.

b Use your sketch to find all the solutions to $|x^2 + 9x + 8| = 1 - x$.

1. Solve the following equations.

a) $|2x - 1| = 3$

b) $|2x + 4| = -4$

c) $|x^2 - 2x - 12| = 12$

d) $\left|\frac{x + 5}{2 - x}\right| = 6$

2. Solve the following inequalities.

a) $|x + 6| < 3$

b) $|3x - 1| \geq 5$

c) $|x - 11| \geq -10$

d) $\frac{1}{|x - 1|} < 2$

e) $|3x| < |2x - 5|$

f) $4 < |x - 2| < 9$

3a) Sketch the graph of $y = |2x - 1|$.

b) Determine the set of values of x for which

$$|2x - 1| > \frac{1}{x}.$$

4a) If p is real the value of $|p|$ is p if $p \geq 0$ and is $-p$ if $p < 0$.

By considering the ranges $x < 0$, $0 \leq x < 1$, $1 \leq x < 4$ and $x \geq 4$, show that the graph of

$$y = |x| + |x - 1| + |x - 4|$$

consists of four line segments and give the equation of each segment. Sketch the graph.

Calculate the roots of the equations

b) Calculate the roots of the equations

(i) $|x| + |x - 1| + |x - 4| = 6 - \frac{1}{3}x$,

(ii) $|x| + |x - 1| + |x - 4| = \frac{1}{x}$.