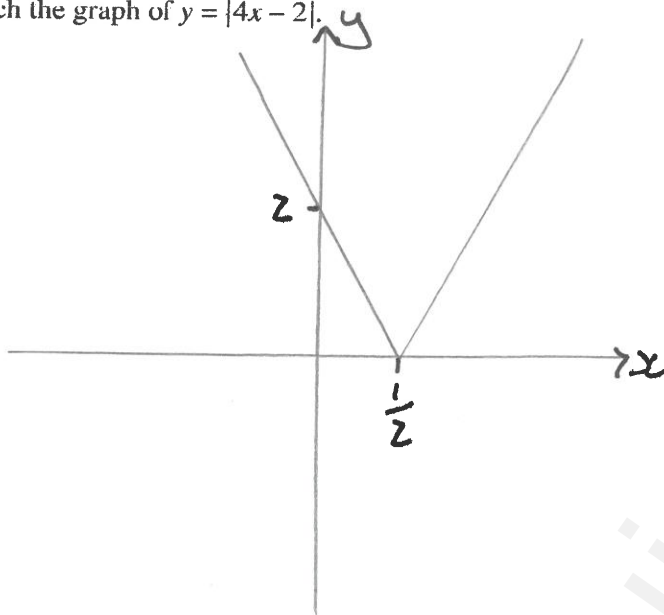


- 1 (a) Sketch the graph of
- $y = |4x - 2|$
- .

[1]



- (b) Solve the inequality
- $1 + 3x < |4x - 2|$
- .

[4]

+/- method: Critical values:

$$+ : \begin{aligned} 1 + 3x &= 4x - 2 \\ 1 &= x - 2 \\ x &= 3 \end{aligned}$$

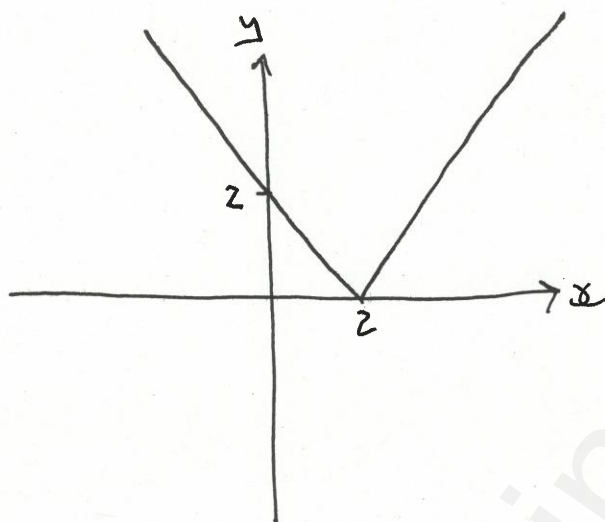
$$\begin{aligned} - : 1 + 3x &= -(4x - 2) \\ 1 + 3x &= -4x + 2 \\ 1 + 7x &= 2 \\ 7x &= 1 \\ x &= \frac{1}{7} \end{aligned}$$

$x < \frac{1}{7}$	$\frac{1}{7} < x < 3$	$x > 3$
e.g. $x = 0$	e.g. $x = 1$	e.g. $x = 4$
$1 + 3(0) < 4(0) - 2 $	$1 + 3(1) < 4(1) - 2 $	$1 + 3(4) < 4(4) - 2 $
$1 < -2 $	$4 < 2 $	$13 < 14 $
$1 < 2$	$4 < 2$	$13 < 14$
✓	✗	✓

so $x < \frac{1}{7}$ or $x > 3$

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

[1]



- (b) Solve the inequality
- $|x - 2| < 3x - 4$
- .

[3]

+/- method:

critical values: ① $x - 2 = 3x - 4$ ② $-(x - 2) = 3x - 4$

$$\begin{array}{l} -x \\ -2 \end{array} \quad \begin{array}{l} -x \\ -2 \end{array} \quad \begin{array}{l} -x + 2 \\ +x \end{array} \quad \begin{array}{l} -x + 2 \\ +x \end{array}$$

$$\begin{array}{l} -2 = 2x - 4 \\ +4 \quad +4 \end{array} \quad \begin{array}{l} 2 = 4x - 4 \\ +4 \end{array}$$

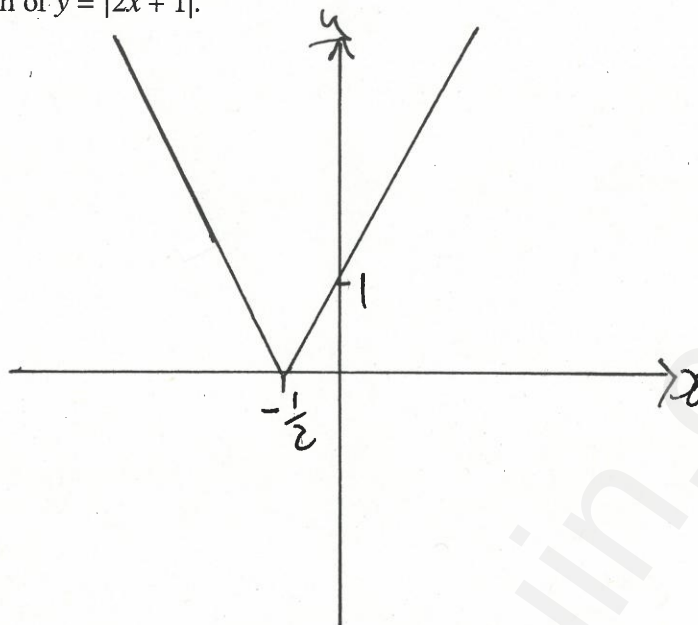
$$\begin{array}{l} 2 = 2x \\ 1 = x \end{array} \quad \begin{array}{l} 6 = 4x \\ \frac{3}{2} = x \end{array}$$

$x < 1$	$1 < x < \frac{3}{2}$	$x > \frac{3}{2}$
e.g. $x = 0$:	e.g. $x = 1.2$:	e.g. $x = 2$:
$ 0 - 2 < 3(0) - 4$	$ 1.2 - 2 < 3(1.2) - 4$	$ 2 - 2 < 3(2) - 4$
$ -2 < -4$	$ -0.8 < 3.6 - 4$	$0 < 2$
$2 < -4$	$0.8 < -0.4$	✓
✗	✗	

so $x > \frac{3}{2}$

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

[1]



- (b) Solve the inequality
- $3x + 5 < |2x + 1|$
- .

[3]

+/- method:

Critical values: ① $3x + 5 = 2x + 1$ ②: $3x + 5 = -(2x + 1)$

$$x + 5 = 1$$

$$x = -4$$

$$3x + 5 = -2x - 1$$

$$5x + 5 = -1$$

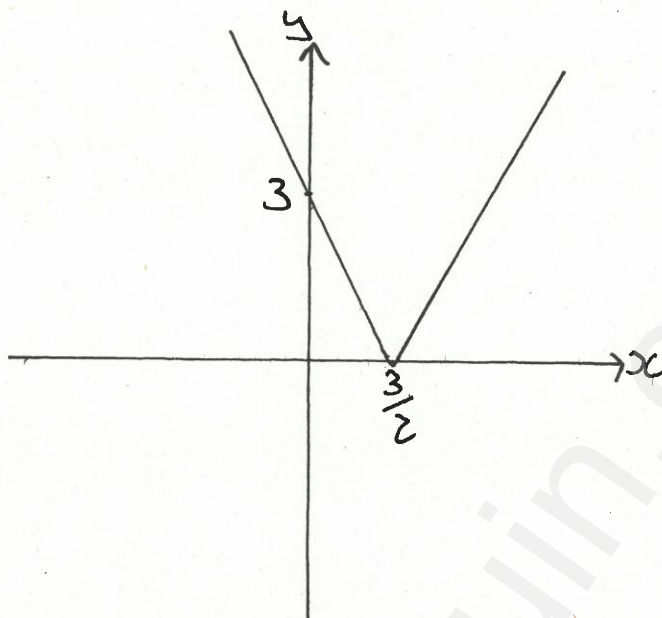
$$5x = -6$$

$$x = -\frac{6}{5}$$

$x < -4$	$-4 < x < -\frac{6}{5}$	$x > -\frac{6}{5}$
eg. $x = -5$	eg. $x = -2$	eg. $x = 0$
$3(-5) + 5 < 2(-5) + 1 $	$3(-2) + 5 < 2(-2) + 1 $	$3(0) + 5 < 2(0) + 1 $
$-10 < -10 + 1 $	$-6 + 5 < -4 + 1 $	$5 < 1 $
$-10 < -9 $	$-1 < -3 $	$5 < 1$
$-10 < 9$ ✓	$-1 < 3$ ✓	$5 < 1$ ✗
so $x < -\frac{6}{5}$		

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

[1]



- (b) Solve the inequality $|2x - 3| < 3x + 2$.

[3]

+/- method:

critical values: ①: $2x - 3 = 3x + 2$ ②: $-(2x - 3) = 3x + 2$
 $-3 = x + 2$ $-2x + 3 = 3x + 2$
 $x = -5$ $3 = 5x + 2$

$$5x = 1$$

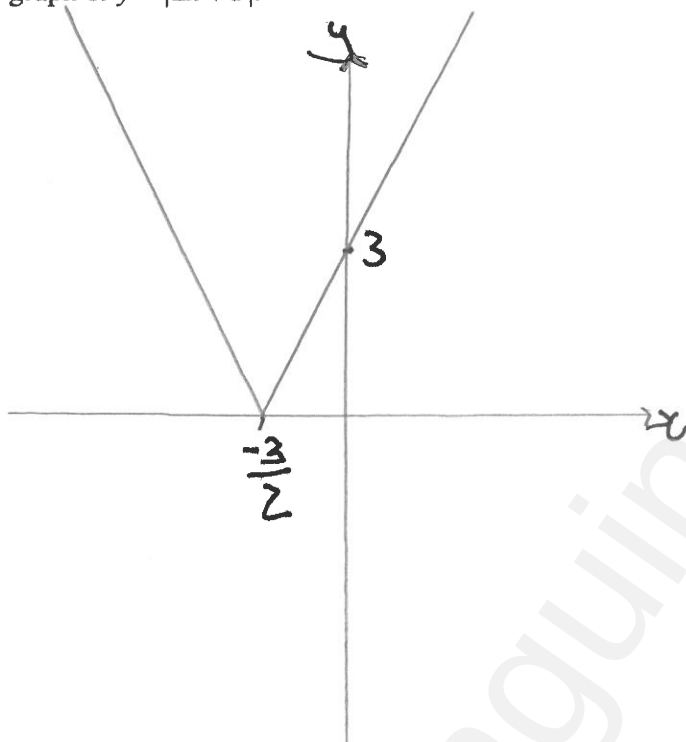
$$x = \frac{1}{5}$$

$x < -5$	$-5 < x < \frac{1}{5}$	$x > \frac{1}{5}$
eg. $x = -10$	eg. $x = 0$	eg. $x = 1$
$ 2(-10) - 3 < 3(-10) + 2$	$ 2(0) - 3 < 3(0) + 2$	$ 2(1) - 3 < 3(1) + 2$
$ -20 - 3 < -30 + 2$	$ -3 < 2$	$ 2 - 3 < 3 + 2$
$ -23 < -28$	$3 < 2$	$ -1 < 5$
$23 < -28$	$\times$	$1 < 5$
$\times$		$\checkmark$

so $x > \frac{1}{5}$

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

[1]



- (b) Solve the inequality
- $3x + 8 > |2x + 3|$
- .

[3]

+/- method: critical values:

$$+ : 3x + 8 = 2x + 3 \quad - : 3x + 8 = -(2x + 3)$$

$$x + 8 = 3$$

$$3x + 8 = -2x - 3$$

$$x = -5$$

$$5x + 8 = -3$$

$$5x = -11$$

$$x = -\frac{11}{5}$$

$$x < -5$$

$$-5 < x < -\frac{11}{5}$$

$$x > -\frac{11}{5}$$

$$\text{eg. } x = -10$$

$$\text{eg. } x = -3$$

$$\text{eg. } x = 0$$

$$3(-10) + 8 > |2(-10) + 3|$$

$$3(-3) + 8 > |2(-3) + 3|$$

$$3(0) + 8 > |2(0) + 3|$$

$$-30 + 8 > |-17|$$

$$-9 + 8 > |-3|$$

$$8 > |3|$$

$$-22 > 17$$

$$-1 > 3$$

$$8 > 3$$

X

X

✓

$$\text{so } x > -\frac{11}{5}$$

1 Solve the inequality $|5x - 3| < 2|3x - 7|$.

[4]

+/- method: critical values:

$$+: 5x - 3 = 2(3x - 7) \quad -: -(5x - 3) = 2(3x - 7)$$

$$5x - 3 = 6x - 14$$

$$-5x + 3 = 6x - 14$$

$$-3 = x - 14$$

$$3 = 11x - 14$$

$$x = 11$$

$$11x = 17$$

$$x = \frac{17}{11}$$

$x < \frac{17}{11}$	$\frac{17}{11} < x < 11$	$x > 11$
e.g. $x = 0$	e.g. $x = 5$	e.g. $x = 12$
$ 5(0) - 3 < 2 3(0) - 7 $	$ 5(5) - 3 < 2 3(5) - 7 $	$ 5(12) - 3 < 2 3(12) - 7 $
$ -3 < 2 -7 $	$ 22 < 2 8 $	$ 57 < 2 29 $
$3 < 2 \times 7$	$ 22 < 2 \times 8$	$57 < 2 \times 29$
$3 < 14$	$22 < 16$	$57 < 58$
✓	✗	✓

So $\underline{x < \frac{17}{11}}$ or $\underline{x > 11}$

1 Solve the inequality $|2x - 1| < 3|x + 1|$.

[4]

+/- method:Critical values: ①: $2x - 1 = 3(x + 1)$ ②: $-(2x - 1) = 3(x + 1)$

$$2x - 1 = 3x + 3$$

$$-2x + 1 = 3x + 3$$

$$-1 = x + 3$$

$$1 = 5x + 3$$

$$x = -4$$

$$5x = -2$$

$$x = -\frac{2}{5}$$

$x < -4$	$-4 < x < -\frac{2}{5}$	$x > -\frac{2}{5}$
eg. $x = -5$	eg. $x = -2$	eg. $x = 0$
$ 2(-5) - 1 < 3 -5 + 1 $	$ 2(-2) - 1 < 3 -2 + 1 $	$ 2(0) - 1 < 3 0 + 1 $
$ -10 - 1 < 3 -4 $	$ -4 - 1 < 3 -1 $	$ -1 < 3 1 $
$ -11 < 3 \times 4$	$ -5 < 3 \times 1$	$1 < 3$
$11 < 12$	$5 < 3$	
✓	✗	✓

so $x < -4$ or $x > -\frac{2}{5}$

1 Solve the inequality $|2x - 1| > 3|x + 2|$.

[4]

+/- method:Critical Values: ① $2x - 1 = 3(x + 2)$ ② $-(2x - 1) = 3(x + 2)$

$$\begin{array}{rcl} 2x - 1 & = & 3x + 6 \\ -2x & & -2x \end{array} \quad \begin{array}{rcl} -2x + 1 & = & 3x + 6 \\ +2x & & +2x \end{array}$$

$$-1 = x + 6$$

$$1 = 5x + 6$$

$$x = -7$$

$$5x = -5$$

$$x = -1$$

$x < -7$	$-7 < x < -1$	$x > -1$
e.g. $x = -10$	e.g. $x = -2$	e.g. $x = 0$
$ 2(-10) - 1 > 3 -10 + 2 $	$ 2(-2) - 1 > 3 -2 + 2 $	$ 2(0) - 1 > 3 0 + 2 $
$ -20 - 1 > 3 -8 $	$ -4 - 1 > 3 0 $	$ -1 > 3 2 $
$ -21 > 3 \times 8$	$ -5 > 0$	$1 > 6$
$21 > 24$	$5 > 0$	
X	✓	X

so $-7 < x < -1$

1 Solve the inequality $2|3x - 1| < |x + 1|$.

[4]

*+/- method:*critical values: ① $2(3x - 1) = x + 1$ ② $-2(3x - 1) = x + 1$

$$6x - 2 = x + 1$$

$$-6x + 2 = x + 1$$

$$5x - 2 = 1$$

$$2 = 7x + 1$$

$$5x = 3$$

$$1 = 7x$$

$$x = \frac{3}{5}$$

$$x = \frac{1}{7}$$

$$x < \frac{1}{7}$$

$$\frac{1}{7} < x < \frac{3}{5}$$

$$x > \frac{3}{5}$$

e.g. $x = 0$

e.g. $x = \frac{1}{5}$

e.g. $x = 1$

$$2|3(0) - 1| < |0 + 1|$$

$$2|3(\frac{1}{5}) - 1| < |\frac{1}{5} + 1|$$

$$2|3(1) - 1| < |1 + 1|$$

$$2|-1| < |1|$$

$$2|\frac{3}{5} - 1| < |\frac{6}{5}|$$

$$2|2| < |2|$$

$$2 < 1$$

$$2|\frac{-2}{5}| < \frac{6}{5}$$

$$4 < 2$$

~~X~~

$$\frac{4}{5} < \frac{6}{5}$$

✓

~~X~~

$$\text{so } \frac{1}{7} < x < \frac{3}{5}$$

1 Solve the inequality $|2x + 3| > 3|x + 2|$.

[4]

+/- method:

Critical values: ①: $(2x + 3) = 3(x + 2)$ ②: $-(2x + 3) = 3(x + 2)$

$$\begin{array}{rcl} 2x + 3 & = & 3x + 6 \\ -2x & & -2x \end{array} \qquad \begin{array}{rcl} -2x - 3 & = & 3x + 6 \\ +2x & & +2x \end{array}$$

$$3 = x + 6$$

$$-3 = 5x + 6$$

$$\underline{x = -3}$$

$$5x = -9$$

$$\underline{x = -\frac{9}{5}}$$

$x < -3$	$-3 < x < -\frac{9}{5}$	$x > -\frac{9}{5}$
e.g. $x = -5$	e.g. $x = -2$	e.g. $x = 0$
$ 2(-5) + 3 > 3 (-5) + 2 $	$ 2(-2) + 3 > 3 (-2) + 2 $	$ 2(0) + 3 > 3 0 + 2 $
$ -10 + 3 > 3 -3 $	$ -4 + 3 > 3 0 $	$ 3 > 3 2 $
$ -7 > 3 \times 3$	$ -1 > 0$	$3 > 6$
$7 > 9$	$1 > 0$	
X	✓	X

so $\underline{-3 < x < -\frac{9}{5}}$

1 Solve the inequality $2 - 5x > 2|x - 3|$.

[4]

+/- method:Critical values: ①: $2 - 5x = 2(x - 3)$ ②: $2 - 5x = -2(x - 3)$

$$2 - 5x = 2x - 6$$

$$2 = 7x - 6$$

$$7x = 8$$

$$x = \frac{8}{7}$$

$$2 - 5x = -2x + 6$$

$$2 = 3x + 6$$

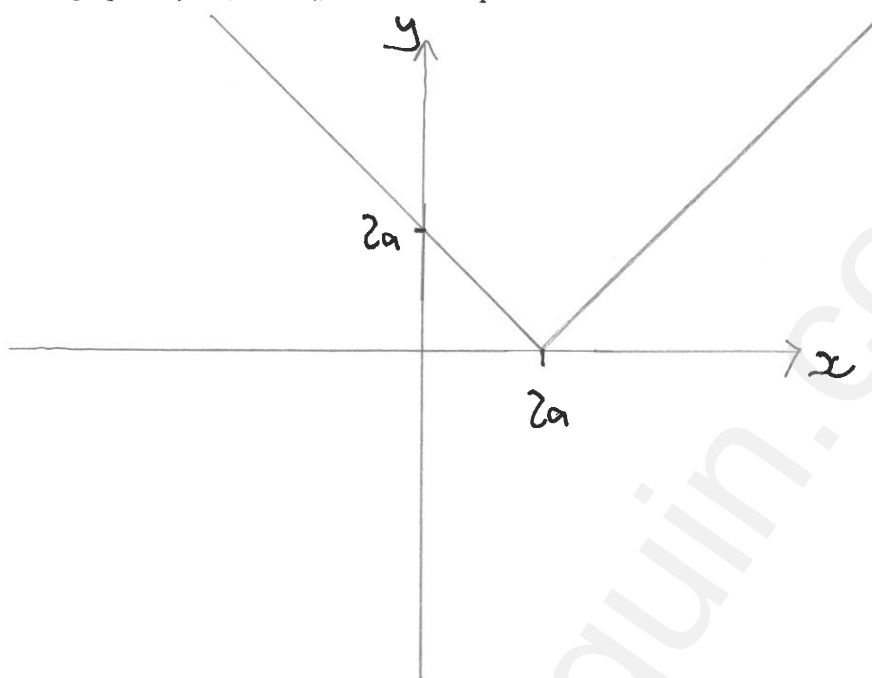
$$-4 = 3x$$

$$x = -\frac{4}{3}$$

$x < -\frac{4}{3}$	$-\frac{4}{3} < x < \frac{8}{7}$	$x > \frac{8}{7}$
eg. $x = -2$	eg. $x = 0$	eg. $x = 2$
$2 - 5(-2) > 2 -2 - 3 $	$2 - 5(0) > 2 0 - 3 $	$2 - 5(2) > 2 2 - 3 $
$2 - -10 > 2 -5 $	$2 > 2 -3 $	$2 - 10 > 2 -1 $
$12 > 2 \times 5$	$2 > 2 \times 3$	$-8 > 2 \times 1$
$12 > 10$	$2 > 6$	$-8 > 2$
✓	✗	✗

$$\text{so } x < -\frac{4}{3}$$

- 1 (a) Sketch the graph of $y = |x - 2a|$, where a is a positive constant. [1]



- (b) Solve the inequality $2x - 3a < |x - 2a|$. [2]

+/- method: critical values.

+: $2x - 3a = x - 2a$

$$x - 3a = -2a$$

$$x = a$$

-: $2x - 3a = -(x - 2a)$

$$2x - 3a = -x + 2a$$

$$3x - 3a = 2a$$

$$3x = 5a$$

$$x = \frac{5}{3}a$$

$x < a$ e.g. $x = 0$	$a < x < \frac{5}{3}a$ e.g. $x = \frac{4}{3}a$	$x > \frac{5}{3}a$ e.g. $x = 2a$
$2(0) - 3a < 0 - 2a $ $-3a < 2a$ ✓	$2(\frac{4}{3}a) - 3a < \frac{4}{3}a - 2a $ $\frac{8}{3}a - 3a < -\frac{2}{3}a $ $-\frac{1}{3}a < \frac{2}{3}a$ ✓	$2(2a) - 3a < 2a - 2a $ $4a - 3a < 0$ $a < 0$ ✗

so $x < \frac{5}{3}a$

- 2 Solve the inequality $|3x - a| > 2|x + 2a|$, where a is a positive constant.

[4]

+/- method:

Critical values: ①: $3x - a = 2(x + 2a)$

$$\begin{array}{rcl} 3x - a & = & 2x + 4a \\ -2x & & -2x \\ x - a & = & 4a \end{array}$$

$$x = 5a$$

②: $3x - a = -2(x + 2a)$

$$\begin{array}{rcl} 3x - a & = & -2x - 4a \\ +2x & & +2x \\ 5x - a & = & -4a \end{array}$$

$$5x = -3a$$

$$x = -\frac{3a}{5}$$

$x < -\frac{3a}{5}$	$-\frac{3a}{5} < x < 5a$	$x > 5a$
eg. $x = -a$	eg. $x = 0$	eg. $x = 10a$
$ 3(-a) - a > 2 -a + 2a $	$ 3(0) - a > 2 0 + 2a $	$ 3(10a) - a > 2 10a + 2a $
$ -4a > 2 a $	$ -a > 2 2a $	$ 29a > 2 12a $
$4a > 2a$	$a > 4a$	$29a > 24a$
✓	✗	✓

$$\text{So } \underline{x < -\frac{3a}{5}} \text{ or } \underline{x > 5a}$$

- 1 Find, in terms of a , the set of values of x satisfying the inequality

$$2|3x + a| < |2x + 3a|,$$

where a is a positive constant.

[4]

+/- method:

Critical values: ①: $2(3x + a) = 2x + 3a$

$$6x + 2a = 2x + 3a$$

$$4x + 2a = 3a$$

$$4x = a$$

$$x = \frac{a}{4}$$

②: $-2(3x + a) = 2x + 3a$

$$-6x - 2a = 2x + 3a$$

$$-2a = 8x + 3a$$

$$8x = -5a$$

$$x = \frac{-5a}{8}$$

$$x < \frac{-5a}{8}$$

$$\frac{-5a}{8} < x < \frac{a}{4}$$

$$x > \frac{a}{4}$$

eg. $x = -a$

eg. $x = 0$

eg. $x = a$

$$2|3(-a) + a| < |2(-a) + 3a|$$

$$2|3(0) + a| < |2(0) + 3a|$$

$$2|3(a) + a| < |2(a) + 3a|$$

$$2|-3a + a| < |-2a + 3a|$$

$$2|a| < |3a|$$

$$2|4a| < |5a|$$

$$2|-2a| < |a|$$

$$2a < 3a$$

$$8a < 5a$$

$$2 \times 2a < a$$

$$4a < a$$

X

✓

X

so $\frac{-5a}{8} < x < \frac{a}{4}$

- 1 Find the set of values of x satisfying the inequality $|2^{x+1} - 2| < 0.5$, giving your answer to 3 significant figures. [4]

+/- method:

$$+ : (2^{x+1} - 2) < 0.5$$

$$2^{x+1} - 2 < 0.5$$

$$2^{x+1} < 2.5$$

$$\log_2 2^{x+1} < \log_2 2.5$$

$$x+1 < \log_2 2.5$$

$$x < \log_2 2.5 - 1$$

$$x < 0.322$$

$$- : -(2^{x+1} - 2) < 0.5$$

$$-2^{x+1} + 2 < 0.5$$

$$-2^{x+1} < -1.5$$

$$2^{x+1} > 1.5$$

(flip sign)

$$\log_2 2^{x+1} > \log_2 1.5$$

$$x+1 > \log_2 1.5$$

$$x > \log_2 1.5 - 1$$

$$x > -0.415$$

$$\underline{-0.415 < x < 0.322}$$

- 1 Solve the equation $4|5^x - 1| = 5^x$, giving your answers correct to 3 decimal places.

[4]

+/- method: critical values:

$$\textcircled{1}: 4(5^x - 1) = 5^x$$

$$4 \times 5^x - 4 = 5^x$$

$$3 \times 5^x - 4 = 0$$

$$3 \times 5^x = 4$$

$$5^x = \frac{4}{3}$$

$$\log_5 5^x = \log_5 \left(\frac{4}{3} \right)$$

$$x = \log_5 \left(\frac{4}{3} \right) \\ = \underline{0.179}$$

$$\textcircled{2}: -4(5^x - 1) = 5^x$$

$$-4 \times 5^x + 4 = 5^x$$

$$-5 \times 5^x + 4 = 0$$

$$-5 \times 5^x = -4$$

$$5^x = \frac{4}{5}$$

$$\log_5 5^x = \log_5 \left(\frac{4}{5} \right)$$

$$x = \log_5 \left(\frac{4}{5} \right) \\ = \underline{-0.139}$$