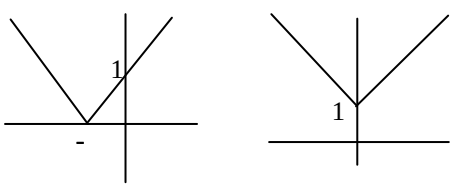
1			$\|3-2x\| = 4\|x\|$ $\Rightarrow \quad 3-2x = 4x,\ x = ½$ or $\quad 3-2x = -4x,\ x = -1½$ ***or*** $(3-2x)^2 = 16x^2$ $\Rightarrow 12x^2 + 12x - 9\ [= 0]$ $\Rightarrow x = ½,\ -1½$	 M1A1 M1A1 M1 A1 A1 A1 **[4]**	 not 3/(−2) squaring both sides correct quadratic o.e. but with single x^2 term	If 3 or more final answers offered, −1 for each incorrect additional answer −1 for final ans written as an inequality $(3-2x)^2 = 4x^2$ is M0

2			$1 < x < 3 \Rightarrow \quad -1 < x-2 < 1$ $\Rightarrow \quad \|x-2\| < 1$	 B1 B1 **[2]**	oe [or $a = 2$ and $b = 1$]	

3	**(i)**		$a = ½$ $b = 1$	B1 B1 **[2]**	or 0.5
	(ii)		$½\|x + 1\| = \|x\|$ $\Rightarrow$ $½(x + 1) = x$, $\Rightarrow x = 1, y = 1$ or $½(x + 1) = -x$, $\Rightarrow x = -1/3, y = 1/3$	 M1 A1 M1 A1	 o.e. ft their a ($\neq 0$) , b (but allow recovery to correct values) or verified by subst $x = 1$, $y = 1$ into $y = ½\|x + 1\|$ and $y = \|x\|$ unsupported answers M0A0 o.e., ft their a. b ; or verified by subst $(-1/3, 1/3)$ into $y = ½\|x + 1\|$ and $y = \|x\|$ or 0.33, −0.33 or better unsupported answers M0A0
			or $¼(x + 1)^2 = x^2$ $\Rightarrow 3x^2 - 2x - 1 = 0$ $\Rightarrow x = -1/3$ or 1 $y = 1/3$ or 1	 M1 M1ft A1 A1 **[4]**	 ft their a and b obtaining a quadratic = 0,ft their previous line, but must have an x^2 term SC3 for (1, 1) (−1/3, 1/3) and one or more additional points

4 $\quad \|2x+1\| \geq 4$ $\Rightarrow$ $2x + 1 \geq 4 \Rightarrow x \geq 1½$ or $2x + 1 \leq -4 \Rightarrow x \leq -2½$	M1 A1 M1 A1 [4]	allow M1 for 1½ seen allow M1 for −2½ seen	Same scheme for other methods, e.g. squaring, graphing Penalise both > and < once only. −1 if both correct but final ans expressed incorrectly, e.g $-2½ \geq x \geq 1½$ or $1½ \leq x \leq -2½$ (or even $-2½ \leq x \leq 1½$ from previously correct work) e.g. SC3

5 $\lvert 2x-1\rvert = \lvert x\rvert$ $\Rightarrow$ $2x - 1 = x$, $x = 1$ or $-(2x - 1) = x$, $x = 1/3$	M1A1 M1A1 [4]	www www, or $2x - 1 = -x$ must be exact for A1 (e.g. not 0.33, but allow $0.\dot{3}$) condone doing both equalities in one line e.g. $-x = 2x - 1 = x$, etc	allow unsupported answers or from graph or squaring $\Rightarrow 3x^2 - 4x + 1 = 0$ M1 $\Rightarrow (3x - 1)(x - 1) = 0$ M1 factorising, formula or comp. square $\Rightarrow x = 1, 1/3$ A1 A1 allow M1 for sign errors in factorisation –1 if more than two solutions offered, but isw inequalities

6 $\text{fg}(x) = \lvert x+1\rvert$ $\quad$ $\text{gf}(x) = \lvert x\rvert + 1$  	B1 B1 B1 B1 [4]	soi from correctly-shaped graphs (i.e. without intercepts) graph of $\lvert x+1\rvert$ only graph of $\lvert x\rvert + 1$	but must indicate which is which bod gf if negative x values are missing 'V' shape with (–1, 0) and (0, 1) labelled 'V' shape with (0, 1) labelled (0, 1)

7 $\lvert x-1\rvert < 3 \Rightarrow -3 < x-1 < 3$ $\Rightarrow \quad -2 < x < 4$	M1 A1 B1 [3]	or $x - 1 = \pm 3$, or squaring $\Rightarrow$ correct quadratic $\Rightarrow$ $(x + 2)(x – 4)$ (condone factorising errors) or correct sketch showing $y = 3$ to scale $-2 <$ < 4 (penalise $\leq$ once only)

8 $g(x) = 2\lvert x-1\rvert$ $\Rightarrow \quad b = 2\lvert 0-1\rvert = 2$ or (0, 2) $2\lvert x-1\rvert = 0$ $\Rightarrow \quad x = 1$, so $a = 1$ or (1, 0)	B1 M1 A1 [3]	Allow unsupported answers. www $\lvert x\rvert = 1$ is A0 www

9 $\lvert 2x-1\rvert \leq 3$ $\Rightarrow \quad -3 \leq 2x - 1 \leq 3$ $\Rightarrow \quad -2 \leq 2x \leq 4$ $\Rightarrow \quad -1 \leq x \leq 2$ *or* $(2x – 1)^2 \leq 9$ $\Rightarrow \quad 4x^2 – 4x – 8 \leq 0$ $\Rightarrow \quad (4)(x + 1)(x – 2) \leq 0$ $\Rightarrow \quad -1 \leq x \leq 2$	M1 A1 M1 A1 M1 A1 A1 A1 [4]	$2x – 1 \leq 3$ (or =) $x \leq 2$ $2x – 1 \geq –3$ (or =) $x \geq –1$ squaring and forming quadratic = 0 (or $\leq$) factorising or solving to get $x = –1, 2$ $x \geq –1$ $x \leq 2$ (www)

10 **(i)** P is (2, 1)	B1	
(ii) $\lvert x\rvert = 1\frac{1}{2}$ $\Rightarrow x = (-1\frac{1}{2})$ or $1\frac{1}{2}$ $\lvert x-2\rvert + 1 = 1\frac{1}{2} \Rightarrow \lvert x-2\rvert = \frac{1}{2}$ $\Rightarrow x = (2\frac{1}{2})$ or $1\frac{1}{2}$	M1 A1 M1 E1	allow x = 1½ unsupported or $\left\lvert 1\frac{1}{2} - 2\right\rvert + 1 = \frac{1}{2} + 1 = 1\frac{1}{2}$
or by solving equation directly: $\lvert x-2\rvert + 1 = \lvert x\rvert$ $\Rightarrow \quad 2 - x + 1 = x$ $\Rightarrow \quad x$ = 1½ $\Rightarrow \quad y = \lvert x\rvert$ = 1½	M1 M1 A1 E1 [4]	equating from graph or listing possible cases

11 $\lvert 3x-2\rvert = x$ $\Rightarrow \quad 3x - 2 = x \Rightarrow 2x = 2 \Rightarrow x = 1$ or $\quad -3x = x \Rightarrow 2 = 4x \Rightarrow x = ½$ *or* $\quad (3x-2)^2 = x^2$ $\Rightarrow 8x^2 - 12x + 4 = 0 \Rightarrow 2x^2 - 3x + 1 = 0$ $\Rightarrow (x-1)(2x-1) = 0,$ $\Rightarrow \quad x$ = 1, ½	B1 M1 A1 M1 A1 A1 [3]	x = 1 solving correct quadratic

12 $3x + 2 = 1 \Rightarrow x = -1/3$ $3x + 2 = -1$ $\Rightarrow x = -1$	B1 M1 A1	$x = -1/3$ from a correct method – must be exact
or $\quad (3x+2)^2 = 1$ $\Rightarrow \quad 9x^2 + 12x + 3 = 0$ $\Rightarrow \quad 3x^2 + 4x + 1 = 0$ $\Rightarrow \quad (3x+1)(x+1) = 0$ $\Rightarrow \quad x = -1/3$ or $x = -1$	M1 B1 A1 [3]	Squaring and expanding correctly $x = -1/3$ $x = -1$