1	(b)	$3x - 8x < 3 - 15$ or $15 - 3 < 8x - 3x$		3	M1	accept as equation or with the wrong inequality sign.
		$-5x < -12$ or $12 < 5x$			M1	accept as equation or with the wrong inequality sign.
			$x > 2.4$		A1	Accept $2.4 < x$ or $x > \dfrac{12}{5}$ oe allow $(-\infty, 2.4)$ award M1 M1 A0 for 2.4 with = sign or no inequality or incorrect inequality sign.

2	d	$4x > 2 - 7$ oe			M1	accept as an equation or with wrong inequality sign.
			$x > -1.25$	2	A1	oe allow $(-1.25, (+)\infty)$ Note: award M1A0 for an answer on the answer line of -1.25 with no sign or the incorrect sign eg $x = -1.25$, $x < -1.25$

3	a	$5 - (x \pm q)^2 + 9$ oe **or** $p - (x - 3)^2$ oe **or** $p - q^2 + 2qx - x^2$ and one of $2q = 6$ **or** $p - q^2 = 5$			M1	may be seen in working eg $-[(x - 3)^2 - 9 - 5]$ **or** expanding $p - (x - q)^2$ correctly and equating one of the coefficient of x or the constant term
			$14 - (x - 3)^2$	2	A1	fully correct SCB1 for $(x - 3)^2 - 14$
	b	e.g. $(x - 3)^2 = 14 - y$ [or $(y - 3)^2 = 14 - x$]			M1	correct steps to isolate their bracket ft from (a) dep on expression in form $\pm p \pm (x - q)^2$
		$x = 3 \pm \sqrt{14 - y}$ [or $y = 3 \pm \sqrt{14 - x}$]			M1	complete method to find y in terms of x or x in terms of y. Condone + for $\pm$ ft from (a) dep on expression in form $\pm p \pm (x - q)^2$
		$(f^{-1}(x) =) 3 - \sqrt{14 - x}$			M1	for the correct inverse
					M1	method to solve $0 < 3 - \sqrt{14 - x}$ or a lower bound of 5 clearly shown, eg $x > 5$ as part of the answer
			$5 < x \le 14$	5	A1	cao
						Total 7 marks

4	(a)		$-1, 0, 1, 2, 3, 4$	2	B2	B1 for $-2, -1, 0, 1, 2, 3, 4$ or $-1, 0, 1, 2, 3$
	(b)		$y \le 6$ oe $x + y \ge 5$ oe $y \ge x - 3$ oe	2		B2 for 3 correct inequalities B1 for 2 correct inequalities SC B2 for $y \ge 6$ oe <u>and</u> $x + y \le 5$ oe <u>and</u> $y \le x - 3$ oe (In all cases allow $<$ in place of $\le$, and $>$ in place of $\ge$)
						Total 4 marks

5	(a)	$2x > 4 - 7$ or $x + 3.5 > 2$		2	M1	For a correct first step allow $2x = 4 - 7$ or $x + 3.5 = 2$ or an answer of $x = -1.5$ or $x < -1.5$ or -1.5
			$x > -1.5$		A1	for $x > -1.5$ oe

6	(a)		$-2, -1, 0, 1, 2$	2	B2	(B1 for 4 correct values and no incorrect values (eg $-1, 0, 1, 2$) **or** for 6 values with no more than one incorrect value (eg $-2, -1, 0, 1, 2, 3$))
	(b)	$7t - 2t \leq 31 + 3$ **or** $5t \leq 34$ **or** $-3 - 31 \leq 2t - 7t$ **or** $-34 \leq -5t$ oe		2	M1	t terms on one side and numbers on the other. Condone = rather than $\leq$ or any other sign for this mark.
		Working required	$t \leq 6.8$		A1	oe (dep on M1) eg $t \leq \dfrac{34}{5}$ **or** $t \leq 6\dfrac{4}{5}$ **or** $6.8 \geq t$ Must have correct sign on answer line (sight of correct answer in working space and just 6.8 oe on answer line gains M1 only)
						Total 4 marks

7	a		Correct number line	2	B2	for a fully correct number line e.g. shaded circle at -2, unshaded circle at 1 and a line drawn between them
					B1	for a shaded circle at -2 **or** an unshaded circle at 1 **or** circles at -2 and 1 with line in between but shading incorrect
	b		$-3, -2, -1, 0, 1, 2$	2	B2	fully correct values with no extras
					B1	for 5 correct values and none incorrect **or** all 6 correct values with no more than one additional incorrect value
						Total 4 marks

8	(c)(i)	$7t - 2t < 7 + 8$ oe eg $5t < 15$ oe		2	M1	Terms in t on one side and number terms the other side – may be in an equation or the incorrect inequality sign or an answer of $t = 3$ or eg $t \geq 3$
			$t < 3$		A1	
	(ii)		open circle at $t = 3$ and a line with an arrow to the left	1	B1ft	ft their inequality Allow a line without an arrow if it reaches to at least -5, with an arrow it can be any length

9		$-4x \leq 11 - 3$ **or** $-4x \leq 8$ **or** $-x \leq 2$ or $3 - 11 \leq 4x$ **or** $-8 \leq 4x$		2	M1	allow equals sign or condone incorrect inequality sign for M1 only
			$x \geq -2$		A1	allow $-2 \leq x$ SCB1 for x and -2 with an incorrect sign between them or -2 as an answer
						Total 2 marks

10		eg $\left(fg(x) =\right)\left(2x + 1\right)^2 - 4$		4	M1	for finding $fg(x)$
		eg $4x^2 + 4x - 3 \, (> 0)$ or $4x^2 + 4x - 3 (= 0)$ **or** $\left(2x + 1\right)^2 > 4$ or $\left(2x + 1\right)^2 = 4$			M1	For a correct expansion and $fg(x)$ written as a 3 term quadratic or a start to write quadratic in correct form for completing square
		$-\dfrac{3}{2}$ oe (**and**) $\dfrac{1}{2}$ oe			A1	for finding the two correct critical values (dep on previous M1) (values seen with any signs between)
			$x < -\dfrac{3}{2}, \ x > \dfrac{1}{2}$		A1	two fully correct inequalities, oe (dep on 2nd M1)
						Total 4 marks

11	(b)	$(2y+5)(y-6)$ or $\dfrac{--7\pm\sqrt{(-7)^2-4\times2\times-30}}{2\times2}$ $2\left[\left(y-\dfrac{7}{4}\right)^2-\dfrac{49}{16}\right]-30(=0)$ oe		3	M1	A correct method to solve the quadratic - allow factorisation that gives 2 out of 3 terms correct when expanded or use of quadratic formula – if using formula, allow one sign error and allow if simplified as far as $\dfrac{7\pm\sqrt{49+240}}{4}$ or use of completing the square with one sign error as far as shown
		$(y=)\,6,\,(y=)-2.5$			A1	Correct critical values **dep on M1**
			$-2.5 \,\square\, y \,\square\, 6$		A1	oe eg $y...-2.5$ (and) $y,,\,6$ or $[-2.5, 6]$ (do not penalise change of variable eg y to x) **dep on M1**

12	(a)		$-2, -1, 0, 1, 2$	2	B2	for $-2, -1, 0, 1, 2$ with no additions or repeats (B1 for 4 of $-2, -1, 0, 1, 2$ with no additions or repeats **or** for 6 values with no more than one incorrect value e.g. all of $-2, -1, 0, 1, 2, 3$ **or** for 5 values with one error)
	(b)		Closed circle at $x = 1$ and a line with an arrow to the left	1	B1	for a closed circle at $x = 1$ and a line with an arrow of any length to the left Allow] for a closed circle Allow a line without an arrow if it reaches to at least -3
						Total 3 marks

13		$3t^2-2\times4t+5$ or $3t^2-8t+5$		6		M1 for differentiation of s with 2 out of 3 terms correct (can be implied by subsequent working)
		$3t^2-2\times4t+5=0$ or $3t^2-8t+5=0$				M1 (dep on previous M1) for equating at least a 2TQ to zero (allow inequality signs), E.g. $3t^2-8t=0$ or $3t^2+5=0$ (can be implied by subsequent working)
		$(t=)\dfrac{5}{3}$ oe $(\text{and } t=1)$				A1 for $\dfrac{5}{3}$ (and $t=1$ may be crossed out or absent) (allow $\dfrac{5}{3}=1.6(66666)$ to 2 sf truncated or rounded)
		$2t-4=0$				M1 for differentiation of x to find $at+b=0$ (allow inequality signs) where $a=2$ and $b=-4$
		$(t=)2$				A1 for a correct value of t
			$(1<)t<\dfrac{5}{3}$ **and** $t>2$			A1 oe $(t>1)$ $t<\dfrac{5}{3}$ and $t>2$
						Total 6 marks

14	(a)	$4y>12-5$		2		M1 Allow $y=\dfrac{7}{4}$ oe or $y>-\dfrac{7}{4}$ or $y<\dfrac{7}{4}$
			$y>\dfrac{7}{4}$			A1 oe

15	(a)	$5x\le2+7$ **or** $5x\le9$ **or** $\dfrac{5x}{5}-\dfrac{7}{5}\le\dfrac{2}{5}$ oe		2	M1	allow any sign instead of $\le$ **or** for an answer of 1.8 oe **or** x and 1.8 oe with the incorrect sign
			$x\le1.8$		A1	oe

16	$(2x + 3)(x - 1) < 75$		5	B1	For writing the correct inequality sign with a correct calculation or correct value – this could be initially or saying that $x < 6$ at the end
	$2x^2 + x - 78 < 0$			M1	rearranged to form correct quadratic < 0 (allow = 0 or other incorrect inequality sign) oe
	$(x - 6)(2x + 13) \, (< 0)$ or $x = \dfrac{-1 \pm \sqrt{(1)^2 - (4 \times 2 \times -78)}}{2 \times 2}$ or $2\left(x + \dfrac{1}{4}\right)^2 - 2\left(\dfrac{1}{4}\right)^2 - 78 = 0$			M1	first step to find critical values from the correct quadratic
		$x = 6$		A1	$x = 6$ identified as critical value, ignore -6.5 if given
		$1 < x < 6$		A1	correct inequality
					Total 5 marks

17	(a)		$-3, -2, -1, 0, 1$	2	B2	for $-3, -2, -1, 0, 1$ If not B2 then award B1 for 4 correct values and no incorrect values (eg $-3, -2, -1, 0$) **or** for 6 values with no more than one incorrect value (eg $-4, -3, -2, -1, 0, 1$)
	(b)		$x > -1$	1	B1	accept $-1 < x$
						Total 3 marks

18	(b)		$x \leq 3$	1	B1 allow $3 \geq x$ Allow any letter for x
	(c)	$6 - 14 > 12w - 7w$ oe or $7w - 12w > 14 - 6$ oe		3	M1 Condone = rather than > or any other sign for this mark.
		$-8 > 5w$ or $-5w > 8$ or $-w > \dfrac{8}{5}$ or $w > -\dfrac{8}{5}$ or $w = -\dfrac{8}{5}$ oe			M1 Condone = rather than > or any other sign for this mark.
		Correct answer scores full marks (unless from obvious incorrect working)	$w < -\dfrac{8}{5}$		A1 oe accept $-\dfrac{8}{5} > w$ Must have correct sign on answer line dep on M1 (sight of correct answer in working space and just $(w =) -\dfrac{8}{5}$ oe on answer line gains M2 only)

19	(b)	$(x =) \dfrac{4 \pm \sqrt{(-4)^2 - (4 \times 3 \times -9)}}{2 \times 3}$ **or** $3\left[\left(x - \dfrac{2}{3}\right)^2 - \left(\dfrac{2}{3}\right)^2\right] - 9 (= 0)$		4	M1	for finding the critical values for a 3-term quadratic using any correct method - if using formula or completing the square allow one sign error and some simplification – allow as far as eg $\dfrac{4 \pm \sqrt{16 + 108}}{6}$ oe **or** eg $3\left(x - \dfrac{2}{3}\right)^2 - 10\dfrac{1}{3}$ oe)
			-1.19 and 2.52		A1	for critical values of -1.19 **and** 2.52 or better (for this A1 mark allow -1.2 or -1.18 **and** 2.5 **or** $\dfrac{2 \pm \sqrt{31}}{3}$ oe)
			$x < -1.19$		A1	awrt -1.19
			$x > 2.52$		A1	awrt 2.52

20	(a)	$-4x > 17 - 9$ or $-4x > 8$ or $9 - 17 > 4x$ or $-8 > 4x$ or $\dfrac{9}{4} - x > \dfrac{17}{4}$ oe or $-\dfrac{9}{4} + x < -\dfrac{17}{4}$ oe		2	M1 for a correct first step Condone = rather than > or any other sign for this mark.
		Correct answer scores full marks (unless from obvious incorrect working)	$x < -2$		A1 oe eg $-2 > x$ (sight of correct answer in working space and just $(x =)$ –2 on answer line gains M1 only)