Year 11 to Year 12 Transition Paper

Equations and Inequalities

Mark Scheme

Question	Scheme	Marks
1	drawing $y = 3x - 6$	M1
		M1
	drawing $2x + y = 12$	A1
	Correct region indicated	A1
		(4 marks)

Notes

M1 for drawing $y = 3x - 6$
M1 for drawing $2x + y = 12$
A2 for correctly indicating required region
(A1 for correctly indicating region satisfying 3 of the inequalities)

Question	Scheme	Marks
2	correct expansion of both brackets or expansion of $\frac{6}{5}(2 - 3x)$ or $\frac{5}{6}(x + 1)$	M1
	isolating terms in x, eg $7 < 23x$	M1
	$x > \frac{7}{23}$	A1
		(3 marks)

Question	Scheme	Marks
3(a)	writing in form $x^2 - 4x - 5\ (\geq 0)$ or $-x^2 + 4x + 5\ (\leq 0)$	M1
	establishing critical values, 5 and -1	M1
	$x \leq -1, x \geq 5$	A1
		(3)
(b)	use of $b^2 - 4ac < 0$ or $b^2 < 4ac$ or $b < 40$ or $-40 < b$	M1
	$-40 < b < 40$	A1
		(2)
		(5 marks)

Question	Scheme	Marks
4(a)	drawing $x = 3$ correctly	M1
	drawing $y - x = 5$ correctly	M1
	drawing $7x + 5y = 35$ correctly	M1
		A1
	Correct region indicated	A1
		(5)
(b)	(2, 5) (2, 6)	B1
		(2)
		(5 marks)

Notes

M1 for drawing $x = 3$ correctly
M1 for drawing $y - x = 5$ correctly
M1 for drawing $7x + 5y = 35$ correctly
A2 for correctly shading required region
(A1 for correct shading for 2 inequalities)
B1 for both correct and no extras

Question	Scheme	Marks
5	drawing $4x + 3y = 24$ correctly	M1
	drawing $x = -2$ correctly	M1
	drawing $3y = 9 - x$ correctly	M1
		A1
	Correct region indicated	A1
		(5 marks)

Notes

M3 for drawing $4x + 3y = 24$, $x = -2$ and $3y = 9 - x$ correctly
(M2 for drawing 2 lines correctly
M1 for drawing 1 line correctly)

A2 for correctly shading required region
(A1 for correct shading for 2 inequalities)

Question	Scheme	Marks
6	correct method to eliminate one variable	M1
	for quadratic (= 0) in one variable	M1
	correct method to solve their quadratic, eg correct factorisation or substitution into the formula	M1
	$x = -1,\ y = \frac{5}{2}$	A1
	$x = 2,\ y = -\frac{1}{2}$	A1
		(5 marks)

Notes

M1 for correct method to eliminate one variable

M1 (dep M1) for quadratic (= 0) in one variable

M1 (dep M2) for correct method to solve their quadratic,
eg correct factorisation or substitution into the formula

A1 $x = -1,\ x = 2$ or $y = \frac{5}{2},\ y = -\frac{1}{2}$
A1 $x = -1,\ y = \frac{5}{2}$ and $x = 2,\ y = -\frac{1}{2}$
(accept coordinate pairs)

Question	Scheme	Marks
7	drawing $x = -1$ correctly	M1
	drawing $2x + y = 6$ correctly	M1
	drawing $y = 4 - x$ correctly	M1
		A1
	Correct region indicated	A1
		(5 marks)

Notes

M1 for drawing $x = -1$ correctly
M1 for drawing $2x + y = 6$ correctly
M1 for drawing $y = 4 - x$ correctly
A2 for correctly shading required region
(A1 for correct shading for 2 inequalities)

Question	Scheme		Marks
8	$49 - 28x + 4x^2$ $147 - 84x + 12x^2 + 4x^2 = 43$	$49 - 14y + y^2$ $49 - 14y + y^2 + 3y^2 = 43$	M1
	$104 - 84x + 16x^2 = 0$ $4x^2 - 21x + 26 = 0$	$2y^2 - 7y + 3 = 0$	M1
	$(4x - 13)(x - 2) = 0$	$(2y - 1)(y - 3) = 0$	M1
	$x = 2, 3.25$ oe or $y = 3, 0.5$ oe		A1
	$x = 2, y = 3$ and $x = 3.25, y = 0.5$		A1
			(5 marks)

Notes

M1 for substitution of $y = 7 - 2x$ or $2x = 7 - y$ oe into the quadratic equation to eliminate one variable
M1 (dep on M1) for expansion of brackets within the quadratic
M1 (dep on M2) for equation of the form $ax^2 + bx + c$ (= 0)
A1 $x = 2, 3.25$ oe or $y = 3, 0.5$ oe
A1 for $x = 2, y = 3$ and $x = 3.25, y = 0.5$

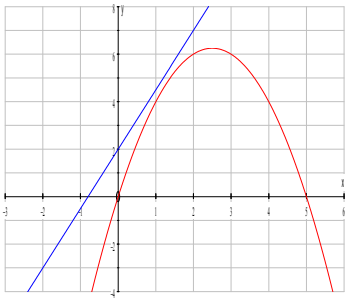
Question	Scheme	Marks
9	$y = 2x + 4 \Rightarrow 4x^2 + (2x+4)^2 + 20x = 0$ **or** $2x = y - 4$ or $x = \frac{y-4}{2}$ $\Rightarrow (y-4)^2 + y^2 + 10(y-4) = 0$	M1
	$8x^2 + 36x + 16 = 0$ or $2y^2 + 2y - 24 = 0$	M1 A1
	$(4)(2x+1)(x+4) = 0 \Rightarrow x = ...$ or $(2)(y+4)(y-3) = 0 \Rightarrow y = ...$	M1
	$x = -0.5, x = -4$ or $y = -4, y = 3$	A1 cso
	Sub into $y = 2x + 4$ or Sub into $x = \frac{y-4}{2}$	M1
	$y = 3,\ y = -4$ and $x = -4,\ x = -0.5$	A1
		(7 marks)

Question	Scheme	Marks
10	$y = -4x - 1$ $\Rightarrow (-4x-1)^2 + 5x^2 + 2x = 0$	M1
	$21x^2 + 10x + 1 = 0$	A1
	$(7x+1)(3x+1) = 0 \Rightarrow (x =) -\frac{1}{7}, -\frac{1}{3}$	dM1 A1
	$y = -\frac{3}{7}, \frac{1}{3}$	M1 A1
		(6 marks)

Question	Scheme	Marks
11(a)	$6x + x > 1 - 8$	M1
	$x > -1$	A1
		(2)
(b)	$(x + 3)(3x - 1)$ [= 0]	M1
	$x = -3$ and $\frac{1}{3}$	A1
		M1
	$-3 < x < \frac{1}{3}$	A1ft
		(4)
		(6 marks)

Question	Scheme	Marks
12(a)	$5x > 20$	M1
	$x > 4$	A1
		(2)
(b)	$x^2 - 4x - 12 = 0$ $(x+2)(x-6)$ [= 0]	M1
	$x = 6, -2$	A1
		M1
	$x < -2$, $x > 6$	A1ft
		(4)
		(6 marks)

Question	Scheme		Marks
13	$y^2 = 4 - 4x + x^2$	$x^2 = 4 - 4y + y^2$	M1
	$4(4 - 4x + x^2) - x^2 = 11$ or $4(2 - x)^2 - x^2 = 11$	$4y^2 - (4 - 4y + y^2) = 11$ or $4y^2 - (2 - y)^2 = 11$	M1
	$3x^2 - 16x + 5 = 0$	$3y^2 + 4y - 15 = 0$	A1
	$(3x - 1)(x - 5) = 0, \quad x = ...$	$(3y - 5)(y + 3) = 0, \quad y = ...$	M1
	$x = \frac{1}{3} \quad x = 5$	$y = \frac{5}{3} \quad y = -3$	A1
			M1
	$y = \frac{5}{3} \quad y = -3$	$x = \frac{1}{3} \quad x = 5$	A1ft
			(7 marks)

Question	Scheme		Marks
14(a)	$x(5 - x) = \frac{1}{2}(5x + 4)$ (o.e.)		M1
	$2x^2 - 5x + 4 (= 0)$ (o.e.) e.g. $x^2 - 2.5x + 2 (= 0)$		A1
	$b^2 - 4ac = (-5)^2 - 4 \times 2 \times 4$		M1
	$= 25 - 32 \quad < 0$, so no roots <u>or</u> no intersections <u>or</u> no solutions		A1
			(4)
(b)		Curve: ∩ shape and passing through (0, 0)	B1
		Curve: ∩ shape and passing through (5, 0)	B1
		Line : +ve gradient and no intersections with *C*. If no *C* drawn score B0	B1
		Line : Line passing through (0, 2) and (-0.8, 0) marked on axes	B1
			(4)
			(8 marks)

Question	Scheme	Marks
15(i)	$x^2-8x+17=(x-4)^2-16+17$	M1
	$=(x-4)^2+1$ with comment (see notes)	A1
	As $(x-4)^2..0 \Rightarrow (x-4)^2+1..1$ hence $x^2-8x+17>0$ for all x	A1
		(3)
(ii)	For an explanation that it may not always be true Tests say $x=-5 \quad (-5+3)^2=4$ whereas $(-5)^2=25$	M1
	States sometimes true and gives reasons Eg. when $x=5 \quad (5+3)^2=64$ whereas $(5)^2=25$ True When $x=-5 \quad (-5+3)^2=4$ whereas $(-5)^2=25$ Not true	A1
		(2)
		(5 marks)
Alternative methods may be accepted		