



Simultaneous Questions Exam Questions Sheet 2

Q1.

Question Number	Scheme	Marks		
	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-right: 1px solid black; padding: 5px;"> Either $y^2 = 4 - 4x + x^2$ $4(4 - 4x + x^2) - x^2 = 11$ or $4(2 - x)^2 - x^2 = 11$ $3x^2 - 16x + 5 = 0$ $(3x - 1)(x - 5) = 0, \quad x =$ $x = \frac{1}{3} \quad x = 5$ $y = \frac{5}{3} \quad y = -3$ </td> <td style="width: 50%; padding: 5px;"> Or $x^2 = 4 - 4y + y^2$ $4y^2 - (4 - 4y + y^2) = 11$ or $4y^2 - (2 - y)^2 = 11$ $3y^2 + 4y - 15 = 0$ Correct 3 terms $(3y - 5)(y + 3) = 0, \quad y = \dots$ $y = \frac{5}{3} \quad y = -3$ $x = \frac{1}{3} \quad x = 5$ </td> </tr> </table>	Either $y^2 = 4 - 4x + x^2$ $4(4 - 4x + x^2) - x^2 = 11$ or $4(2 - x)^2 - x^2 = 11$ $3x^2 - 16x + 5 = 0$ $(3x - 1)(x - 5) = 0, \quad x =$ $x = \frac{1}{3} \quad x = 5$ $y = \frac{5}{3} \quad y = -3$	Or $x^2 = 4 - 4y + y^2$ $4y^2 - (4 - 4y + y^2) = 11$ or $4y^2 - (2 - y)^2 = 11$ $3y^2 + 4y - 15 = 0$ Correct 3 terms $(3y - 5)(y + 3) = 0, \quad y = \dots$ $y = \frac{5}{3} \quad y = -3$ $x = \frac{1}{3} \quad x = 5$	<p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1 A1</p> <p style="text-align: right;">(7) 7</p>
Either $y^2 = 4 - 4x + x^2$ $4(4 - 4x + x^2) - x^2 = 11$ or $4(2 - x)^2 - x^2 = 11$ $3x^2 - 16x + 5 = 0$ $(3x - 1)(x - 5) = 0, \quad x =$ $x = \frac{1}{3} \quad x = 5$ $y = \frac{5}{3} \quad y = -3$	Or $x^2 = 4 - 4y + y^2$ $4y^2 - (4 - 4y + y^2) = 11$ or $4y^2 - (2 - y)^2 = 11$ $3y^2 + 4y - 15 = 0$ Correct 3 terms $(3y - 5)(y + 3) = 0, \quad y = \dots$ $y = \frac{5}{3} \quad y = -3$ $x = \frac{1}{3} \quad x = 5$			
	<p>Notes</p> <p>1st M: Squaring to give 3 or 4 terms (need a middle term)</p> <p>2nd M: Substitute to give quadratic in one variable (may have just two terms)</p> <p>3rd M: Attempt to solve a 3 term quadratic.</p> <p>4th M: Attempt to find at least one y value (or x value). (The second variable)</p> <p>This will be by substitution or by starting again.</p> <p>If y solutions are given as x values, or vice-versa, penalise accuracy, so that it is possible to score M1 M1A1 M1 A0 M1 A0.</p> <p><u>“Non-algebraic” solutions:</u></p> <p>No working, and only one correct solution pair found (e.g. $x = 5, y = -3$): M0 M0 A0 M1 A0 M1 A0</p> <p>No working, and both correct solution pairs found, but not demonstrated: M0 M0 A0 M1 A1 M1 A1</p> <p>Both correct solution pairs found, and demonstrated: Full marks are possible (send to review)</p>			



Q2.

Question number	Scheme	Marks
	$y = 3x - 2 \quad (3x - 2)^2 - x - 6x^2 (= 0)$ $9x^2 - 12x + 4 - x - 6x^2 = 0$ $3x^2 - 13x + 4 = 0 \quad (\text{or equiv., e.g. } 3x^2 = 13x - 4)$ $(3x - 1)(x - 4) = 0 \quad x = \dots \quad x = \frac{1}{3} \text{ (or exact equivalent) } x = 4$ $y = -1 \quad y = 10 \quad (\text{Solutions need not be "paired"})$	M1 M1 A1cso M1 A1 M1 A1 [7]
	<p>1st M: Obtaining an equation in x only (or y only). Condone missing “= 0” Condone sign slips, e.g. $(3x + 2)^2 - x - 6x^2 = 0$, but <u>not</u> other algebraic mistakes (such as squaring individual terms... see bottom of page).</p> <p>2nd M: Multiplying out their $(3x - 2)^2$, which must lead to a 3 term quadratic, i.e. $ax^2 + bx + c$, where $a \neq 0$, $b \neq 0$, $c \neq 0$, and collecting terms.</p> <p>3rd M: Solving a 3-term quadratic (see general principles at end of scheme).</p> <p>2nd A: Both values.</p> <p>4th M: Using an x value, found algebraically, to attempt at least one y value (or using a y value, found algebraically, to attempt at least one x value)... allow b.o.d. for this mark in cases where the value is wrong but working is not shown.</p> <p>3rd A: Both values.</p> <p>If y solutions are given as x values, or vice-versa, penalise at the end, so that it is possible to score M1 M1A1 M1 A1 M0 A0.</p> <p><u>“Non-algebraic” solutions:</u> No working, and only one correct solution pair found (e.g. $x = 4, y = 10$): M0 M0 A0 M0 A0 M1 A0 No working, and both correct solution pairs found, but not demonstrated: M0 M0 A0 M1 A1 M1 A1 Both correct solution pairs found, and demonstrated: Full marks</p> <p><u>Alternative:</u> $x = \frac{y+2}{3} \quad y^2 - \frac{y+2}{3} - 6\left(\frac{y+2}{3}\right)^2 = 0 \quad \text{M1}$ $y^2 - \frac{y+2}{3} - 6\left(\frac{y^2+4y+4}{9}\right) = 0 \quad y^2 - 9y - 10 = 0 \quad \text{M1 A1}$ $(y+1)(y-10) = 0 \quad y = \dots \quad y = -1 \quad y = 10 \quad \text{M1 A1}$ $x = \frac{1}{3} \quad x = 4 \quad \text{M1 A1}$</p> <p><u>Squaring each term in the first equation.</u> e.g. $y^2 - 9x^2 + 4 = 0$, and using this to obtain an equation in x only could score at most 2 marks: M0 M0 A0 M1 A0 M1 A0.</p>	



Q3.

Question Number	Scheme	Notes	Marks
WAY 1			
	$y = -4x - 1$ $\Rightarrow (-4x - 1)^2 + 5x^2 + 2x = 0$	Attempts to makes y the subject of the linear equation and substitutes into the other equation. Allow slips e.g. substituting $y = -4x + 1$ etc.	M1
	$21x^2 + 10x + 1 = 0$	Correct 3 term quadratic (terms do not need to be all on the same side). The “= 0” may be implied by subsequent work.	A1
	$(7x+1)(3x+1) = 0 \Rightarrow (x =) -\frac{1}{7}, -\frac{1}{3}$	dM1: Solves a 3 term quadratic by the usual rules (see general guidance) to give at least one value for x . Dependent on the first method mark. A1: $(x =) -\frac{1}{7}, -\frac{1}{3}$ (two separate correct exact answers). Allow exact equivalents e.g. $(x =) -\frac{6}{42}, -\frac{14}{42}$	dM1 A1
	$y = -\frac{3}{7}, \frac{1}{3}$	M1: Substitutes to find at least one y value (Allow substitution into their rearranged equation above but not into an equation that has not been seen earlier). You may need to check here if there is no working and x values are incorrect. A1: $y = -\frac{3}{7}, \frac{1}{3}$ (two correct exact answers) Allow exact equivalents e.g. $y = -\frac{18}{42}, \frac{14}{42}$	M1 A1
Coordinates do not need to be paired			
Note that if the linear equation is explicitly rearranged to $y = 4x + 1$, this gives the correct answers for x and possibly for y . In these cases, if it is not already lost, deduct the final A1.			
			[6]
WAY 2			
	$x = -\frac{1}{4}y - \frac{1}{4}$ $\Rightarrow y^2 + 5(-\frac{1}{4}y - \frac{1}{4})^2 + 2(-\frac{1}{4}y - \frac{1}{4}) = 0$	Attempts to makes x the subject of the linear equation and substitutes into the other equation. Allow slips in the rearrangement as above.	M1
	$\frac{21}{16}y^2 + \frac{1}{8}y - \frac{3}{16} = 0$ ($21y^2 + 2y - 3 = 0$)	Correct 3 term quadratic (terms do not need to be all on the same side). The “= 0” may be implied by subsequent work.	A1
	$(7y+3)(3y-1) = 0 \Rightarrow (y =) -\frac{3}{7}, \frac{1}{3}$	dM1: Solves a 3 term quadratic by the usual rules (see general guidance) to give at least one value for y . Dependent on the first method mark. A1: $(y =) -\frac{3}{7}, \frac{1}{3}$ (two separate correct exact answers). Allow exact equivalents e.g. $(y =) -\frac{18}{42}, \frac{14}{42}$	dM1 A1
	$x = -\frac{1}{7}, -\frac{1}{3}$	M1: Substitutes to find at least one x value (Allow substitution into their rearranged equation above but not into an equation that has not been seen earlier). You may need to check here if there is no working and y values are incorrect. A1: $x = -\frac{1}{7}, -\frac{1}{3}$ (two correct exact answers) Allow exact equivalents e.g. $x = -\frac{6}{42}, -\frac{14}{42}$	M1 A1
Coordinates do not need to be paired			
Note that if the linear equation is explicitly rearranged to $x = (y + 1)/4$, this gives the correct answers for y and possibly for x . In these cases, if it is not already lost, deduct the final A1.			
			[6]
			6 marks

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Q4.

Question Number	Scheme	Marks
	$y - 2x - 4 = 0, 4x^2 + y^2 + 20x = 0$	
	$y = 2x + 4 \Rightarrow 4x^2 + (2x + 4)^2 + 20x = 0$ 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
	$(4)(2x + 1)(x + 4) = 0 \Rightarrow x = \dots$ or $(2)(y + 4)(y - 3) = 0 \Rightarrow y = \dots$	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)

Special Case: Uses $y = -2x - 4$		
	$y = 2x + 4 \Rightarrow 4x^2 + (-2x - 4)^2 + 20x = 0$	M1
	$8x^2 + 36x + 16 = 0$	M1A1
	$(4)(2x + 1)(x + 4) = 0 \Rightarrow x = \dots$	M1
	$x = -0.5, x = -4$	A0
	Sub into $y = 2x + 4$	Sub into $y = -2x - 4$ is M0
	$y = 3, y = -4$ and $x = -4, x = -0.5$	A0

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Q5.

Question number	Scheme	Marks
	<p>(a) $2x^2 - x(x - 4) = 8$ $x^2 + 4x - 8 = 0$ (*)</p> <p>(b) $x = \frac{-4 \pm \sqrt{4^2 - (4 \times 1 \times -8)}}{2}$ or $(x + 2)^2 \pm 4 - 8 = 0$</p> <p>$x = -2 \pm$ (any correct expression)</p> <p>$\sqrt{48} = \sqrt{16} \sqrt{3} = 4\sqrt{3}$ or $\sqrt{12} = \sqrt{4} \sqrt{3} = 2\sqrt{3}$</p> <p>$y = (-2 \pm 2\sqrt{3}) - 4$ M: Attempt at least one y value</p> <p><u>$x = -2 + 2\sqrt{3}, y = -6 + 2\sqrt{3}$</u> <u>$x = -2 - 2\sqrt{3}, y = -6 - 2\sqrt{3}$</u></p>	<p>M1</p> <p>A1cso (2)</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>M1</p> <p>A1 (5)</p> <p>7</p>
(a)	<p>M1 for correct attempt to form an equation in x only. Condone sign errors/slips but attempt at this line must be seen. E.g. $2x^2 - x^2 \pm 4x = 8$ is OK for M1.</p> <p>A1cso for correctly simplifying to printed form. No incorrect working seen. The $= 0$ is required.</p> <p>These two marks can be scored in part (b). For multiple attempts pick best.</p>	
(b)	<p>1st M1 for use of correct formula. If formula is not quoted then a fully correct substitution is required. Condone missing $x =$ or just $+$ or $-$ instead of \pm for M1.</p> <p>For completing the square must have as printed or better.</p> <p>If they have $x^2 - 4x - 8 = 0$ then M1 can be given for $(x - 2)^2 \pm 4 - 8 = 0$.</p> <p>1st A1 for $-2 \pm$ any correct expression. (The \pm is required but $x =$ is not)</p> <p>B1 for simplifying the surd e.g. $\sqrt{48} = 4\sqrt{3}$. Must reduce to $b\sqrt{3}$ so $\sqrt{16}\sqrt{3}$ or $\sqrt{4}\sqrt{3}$ are OK.</p> <p>2nd M1 for attempting to find at least one y value. Substitution into one of the given equations and an attempt to solve for y.</p> <p>2nd A1 for correct y answers. Pairings need <u>not</u> be explicit but they must say which is x and which y.</p> <p>Mis-labelling x and y loses final A1 only.</p>	



Q6.

Question Number	Scheme	Notes	Marks
11. (a)	$y = x + 2 \Rightarrow x^2 + 4(x + 2)^2 - 2x = 35$	Substitute $y = \pm x \pm 2$ into $x^2 + 4y^2 - 2x = 35$ to obtain an equation in x only.	M1
	Alternative: $\frac{2x - x^2 + 35}{4} = (x + 2)^2$ or $\sqrt{\frac{2x - x^2 + 35}{4}} = (x + 2)$		
	$5x^2 + 14x - 19 = 0$	Multiply out and collect terms producing 3 term quadratic in any form.	M1
	$(5x + 19)(x - 1) = 0 \Rightarrow x = ..$	Solves their quadratic, usual rules, as far as $x = ...$ Dependent on the first M1 i.e. a correct method for eliminating y (or x - see below)	dM1
	$x = -\frac{19}{5}, x = 1$	Both correct	A1 for both
	$y = -\frac{9}{5}, y = 3$	M1: Substitutes back into either given equation to find a value for y	M1
	Coordinates are $(-\frac{19}{5}, -\frac{9}{5})$ and $(1, 3)$	Correct matching pairs. Coordinates need not be given explicitly but it must be clear which x goes with which y	A1
(6)			
Alternative to part (a)	$x = y - 2 \Rightarrow (y - 2)^2 + 4y^2 - 2(y - 2) = 35$	Substitutes $x = \pm y \pm 2$ into $x^2 + 4y^2 - 2x = 35$	M1
	$5y^2 - 6y - 27 = 0$	Multiply out, collect terms producing 3 term quadratic in any form.	M1
	$(5y + 9)(y - 3) = 0 \Rightarrow y = ..$	Solves their quadratic, usual rules, as far as $y = ...$ Dependent on the first M1 i.e. a correct method for eliminating x	dM1
	$y = \frac{9}{5}, y = 3$	Both correct	A1 for both
	$x = -\frac{19}{5}, x = 1$	M1: Substitutes back into either given equation to find a value for x	M1
	Coordinates are $(-\frac{19}{5}, -\frac{9}{5})$ and $(1, 3)$	Correct matching pairs as above.	A1
(b)	$d^2 = (1 - -\frac{19}{5})^2 + (3 - -\frac{9}{5})^2$ $d = \sqrt{(1 - -\frac{19}{5})^2 + (3 - -\frac{9}{5})^2}$	M1: Use of $d^2 = (x_1 - x_2)^2 + (y_1 - y_2)^2$ or $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$ where neither $(x_1 - x_2)$ nor $(y_1 - y_2)$ are zero. A1ft: Correct ft expression for d or d^2 (may be un-simplified)	M1A1ft
	$d = \frac{24}{5}\sqrt{2}$	Allow $4.8\sqrt{2}$	A1cao
			(3)
[9]			

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