Mark Scheme

Summer 2023

Pearson Edexcel Level 3 Award
In Algebra (AAL30)

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NOTES ON MARKING PRINCIPLES

1   Types of mark
M marks: method marks
A marks: accuracy marks
B marks: unconditional accuracy marks (independent of M marks)

2   Abbreviations
cao – correct answer only   ft – follow through
isw – ignore subsequent working   SC: special case
oe – or equivalent (and appropriate)   dep – dependent
indep - independent

3   No working
If no working is shown then correct answers normally score full marks
If no working is shown then incorrect (even though nearly correct) answers score no marks.

4   With working
If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.
If there is no answer on the answer line then check the working for an obvious answer.
Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader.
If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

6   Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect cancelling of a fraction that would otherwise be correct

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

7   Parts of questions

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

8   Use of ranges for answers

If an answer is within a range this is inclusive, unless otherwise stated.

Question	Working	Answer	Mark	Notes
1 (a)		$7cd(3c - 5d)$	2	B2 for correct factorisation (B1 for a correct partial factorisation as a product of 3 factors, eg $7d(3c^2 - 5cd)$)
(b)		$2(2k - 1)(k + 3)$	2	B2 for correct factorisation (B1 for correct partial factorisation as a product of 2 linear factors, eg $(4k - 2)(k + 3)$)
(c)		$2w^2 - 2w + 85$	2	M1 for correct expansion of at least one of $(w + 6)^2$ or $(w - 7)^2$, eg $w^2 + 12w + 36$ or $w^2 - 14w + 49$ or for 2 out of 3 terms correct A1 cao
2	$\dfrac{-9 \pm \sqrt{9^2 - 4 \times 10 \times 2}}{2 \times 10}$	$-\dfrac{2}{5}, -\dfrac{1}{2}$	2	M1 for factorising to $(5y + 2)(2y + 1)$ oe or correct substitution into the quadratic formula or correct completion of square. A1 for $-\dfrac{2}{5}, -\dfrac{1}{2}$ oe
3		Correct region indicated	5	M1 for drawing $y = x$ M1 for drawing $x + 5y = 5$ M1 for drawing $x - 3y = 5$ A2 for correctly shading required region (A1 for correct shading for 2 inequalities)

Question	Working	Answer	Mark	Notes
4 (a)	$\dfrac{--4 \pm \sqrt{(-4)^2 - 4 \times 3 \times -5}}{2 \times 3}$	$\dfrac{2 \pm \sqrt{19}}{3}$	3	M1 for stating the quadratic formula or correct substitution into formula M1 for simplification to $\dfrac{4 \pm \sqrt{76}}{6}$ A1 cao
(b)		$-\dfrac{3}{2}, \dfrac{1}{2}$	3	M1 for start to method for finding values, eg correct expansion of $(x + p)^2$ or $4px = -6x$ or $2p^2 + q = 5$ or for $(x - \dfrac{3}{2})^2$ oe A1 for $p = -\dfrac{3}{2}$ or $-1\dfrac{1}{2}$ or -1.5 or for $2(x - \dfrac{3}{2})^2 + \dfrac{1}{2}$ oe A1 for $p = -\dfrac{3}{2}$, $q = \dfrac{1}{2}$ oe
(c)		-3	2	M1 for sum $= -\dfrac{b}{a}$ $(= -\dfrac{12}{4})$ or for $4x^2 + 12x - 5 (= 0)$ A1 cao

Question	Working	Answer	Mark	Notes
5 (a)		Circle centre (0, 0), radius 5 drawn	2	M1 for using (0, 0) as the centre of a circle or a circle of radius 5 drawn A1 for fully correct circle.
(b)		$y = \pm \sqrt{25 - x^2}$	3	M1 for a correct first step, eg divide through by 3 or subtract $3x^2$ from both sides A1 for $y = \sqrt{\frac{75-3x^2}{3}}$ or $y = \sqrt{25 - x^2}$ or for $y = -\sqrt{25 - x^2}$ A1 for $y = \pm \sqrt{25 - x^2}$ oe
6		$\dfrac{1}{x - 2}$	3	M1 for one correct factorisation, $(x-2)(x+3)$ or $(x-3)(x+3)$ or for inverting the second fraction and multiplying M1 for a correct full expression with both factorisations, $(x-2)(x+3)$ and $(x-3)(x+3)$ or for a correct full expression with one factorisation and inverting second fraction and multiplying A1 cao

Question	Working	Answer	Mark	Notes
7 (a)		3	2	M1 for correct substitution, eg $\frac{1+4\sqrt{25}}{12-\sqrt{25}}$ oe A1 cao
(b)		$4(6-\sqrt{2})$	3	M1 for reduction of surd, eg $\sqrt{32}=4\sqrt{2}$, $\sqrt{32}=2\sqrt{8}$ or $\sqrt{8}=2\sqrt{2}$ M1 for correct expansion of brackets, eg $40-5\sqrt{32}+8\sqrt{8}-\sqrt{256}$ A1 for $4(6-\sqrt{2})$ or $2(12-\sqrt{8})$
8 (a)		2, 5, 6	2	M1 for correct expansion of brackets, eg $\frac{10}{5}x^0 + \frac{10}{2}x^6$ or $2+5x^6$ or for 1 term out of 2 terms correct, either 2 or $5x^6$ A1 cao
(b)		$40t^4$	3	M1 for $\left(2t^{\frac{2}{3}}\right)^3 = 8t^2$ or $(125t^6)^{\frac{1}{3}} = 5t^2$ or for ct^4, $c \neq 40$ or for $40t^n$, $n \neq 4$ M1 for $\left(2t^{\frac{2}{3}}\right)^3 = 8t^2$ and $(125t^6)^{\frac{1}{3}} = 5t^2$ A1 cao

Question	Working	Answer	Mark	Notes
9 (a)		$y = \frac{1}{2}x + \frac{7}{2}$	3	M1 for method to find the gradient, eg $\frac{6-3}{5--1}$ or $\frac{3-6}{-1-5}$ or gradient $= \frac{1}{2}$. M1 for method to find c, eg $3 = "\frac{1}{2}" \times -1 + c$ or for correct equation not in required form, eg, $y - 3 = "\frac{1}{2}"(x--1)$ A1 for $y = \frac{1}{2}x + \frac{7}{2}$ oe in required form
(b)		$2x + y = 6$	3	M1 for use of product of gradients equals -1, eg $\frac{1}{-0.5}$ or for gradient $= -2$ M1 for method to find c, eg $-2 = -2 \times 4 + c$ or for correct equation not in required form, eg, $y - -2 = -2(x - 4)$ A1 for $2x + y = 6$ oe in required form, ft (a)
10 (a)		(4), 36, 38, (22), 0, -16, (-14), (18)	2	B2 for all 4 missing values correct (B1 for 2 or 3 values)
(b)		Correct curve drawn	2	M1 (dep B1) for plotting at least 7 of their points correctly. A1 correct curve

| Question	Working	Answer	Mark	Notes
11 (a)		$p = \frac{1}{2}\sqrt{n}$	3	M1 for $p \propto \sqrt{n}$ or $p = k\sqrt{n}$ oe, may be implied by substitution M1 for substitution to find k, eg $5 = k\sqrt{100}$ A1 for $p = \frac{1}{2}\sqrt{n}$
(b)		1600	2	M1 for substitution in equation of form $p = k\sqrt{n}$, eg $20 = \frac{1}{2}\sqrt{n}$ A1 cao
12 (a)		1.8, 8.2	2	M1 for rearrangement to form $x^2 - 10x + 45 = 30$ or uses $y = 30$ on graph or shows clear translation of graph by $\binom{0}{-30}$ or gives one correct solution A1 for 1.8 and 8.2
(b)		256.5	3	M1 for using values, eg $(y_0 =)$ 45, $(y_1 =)$24, $(y_2 =)$ 21, $(y_3 =)$ 36, allow 35 - 36 (condone 1 error) M1(dep) for substituting "values" and $h = 3$ into trapezium rule, eg $\frac{1}{2} \times 3\{(45 + 36) + 2(24 + 21)\}$ A1 for 255 to 256.5 oe

Question	Working	Answer	Mark	Notes
13		Sketch	2	M1 for correct shape and orientation or for correct shape in one quadrant with (2, 0) as intercept or for a fully correct sketch of $x = -y^2 + 2$ with (2, 0) as intercept A1 for correct curve symmetrical about x-axis and (2, 0) as intercept
14 (a)		950	2	M1 for substitution into $a + (n-1)d$ oe eg $-50 + (51 - 1)20$ A1 cao
(b)		15	3	M1 for use of $\frac{1}{2}n[2a + (n-1)d]$ or use of $\frac{1}{2}n(a+l)$ M1(dep M1) for setting up a correct equation in a, eg $\frac{1}{2} \times 200(2 \times a + (200 - 1) \times 2) = 42800$ A1 cao
15		exponential, reciprocal, linear	3	B3 for 3 correct (B2 for 2 correct B1 for 1 correct)

Question	Working	Answer	Mark	Notes
16 (a)		12	3	M1 for correct method to calculate a relevant area, eg $\frac{1}{2} \times 2 \times 8$ or 8×0.5

M1 for a complete method, eg $\frac{1}{2} \times 2 \times 8 + 8 \times 0.5$

A1 cao |
| (b) | | $\frac{8}{3}$ | 2 | M1 for complete method to find the gradient, eg $(-)\frac{8-0}{5.5-2.5}$ or for 2.6

A1 for $\frac{8}{3}$ oe, accept 2.7 or better, accept + or − |
| 17 (a) | | Graph drawn | 2 | M1 for translation parallel to y-axis

A1 for translation parallel to y-axis by $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$ |
| (b) | | Graph drawn | 2 | M1 for stretch parallel to x-axis from the y axis

A1 for stretch, factor $\frac{1}{2}$, parallel to x-axis |

Question	Working	Answer	Mark	Notes
18		$x = \dfrac{10\sqrt{2}}{3},\ y = -\dfrac{8\sqrt{2}}{3}$ $x = -\dfrac{10\sqrt{2}}{3},\ y = \dfrac{8\sqrt{2}}{3}$	5	M1 for substitution of $y = -\frac{4}{5}x$ or $x = -\frac{5}{4}y$ into $x^2 - y^2 = 8$ to obtain equation in one variable eg, $x^2 - \left(-\frac{4}{5}x\right)^2 = 8$ or $\left(-\frac{5}{4}y\right)^2 - y^2 = 8$ M1 for simplifying and collecting terms, eg $\frac{9}{25}x^2 - 8 = 0$ oe or $\frac{9}{16}y^2 - 8 = 0$ oe M1 for method to find the value(s) for x or the value(s) for y, eg $x = (\pm)\sqrt{\frac{200}{9}}$ oe or $y = (\pm)\sqrt{\frac{128}{9}}$ oe A1 $x = \pm\frac{10\sqrt{2}}{3}$ or $y = \pm\frac{8\sqrt{2}}{3}$ or $x = \frac{10\sqrt{2}}{3}, y = -\frac{8\sqrt{2}}{3}$ or $x = -\frac{10\sqrt{2}}{3}, y = \frac{8\sqrt{2}}{3}$ oe A1 for $x = \frac{10\sqrt{2}}{3}, y = -\frac{8\sqrt{2}}{3}$ and $x = -\frac{10\sqrt{2}}{3}, y = \frac{8\sqrt{2}}{3}$ oe, must be paired
19		Sketch	2	M1 for correct general shape intersecting x-axis at 0, 180, 360 only A1 fully correct graph with maximum and minimum values at 1 and -1

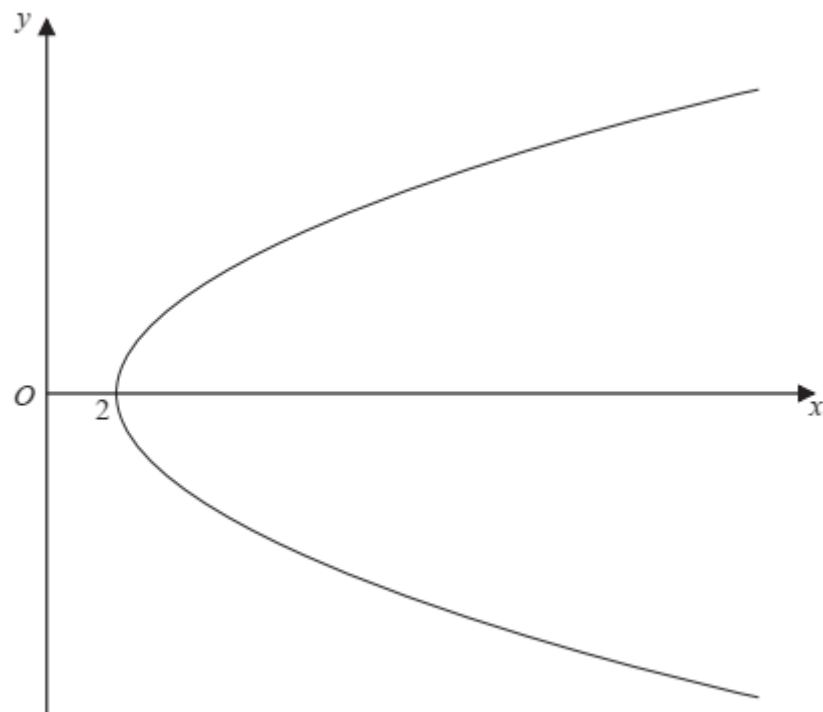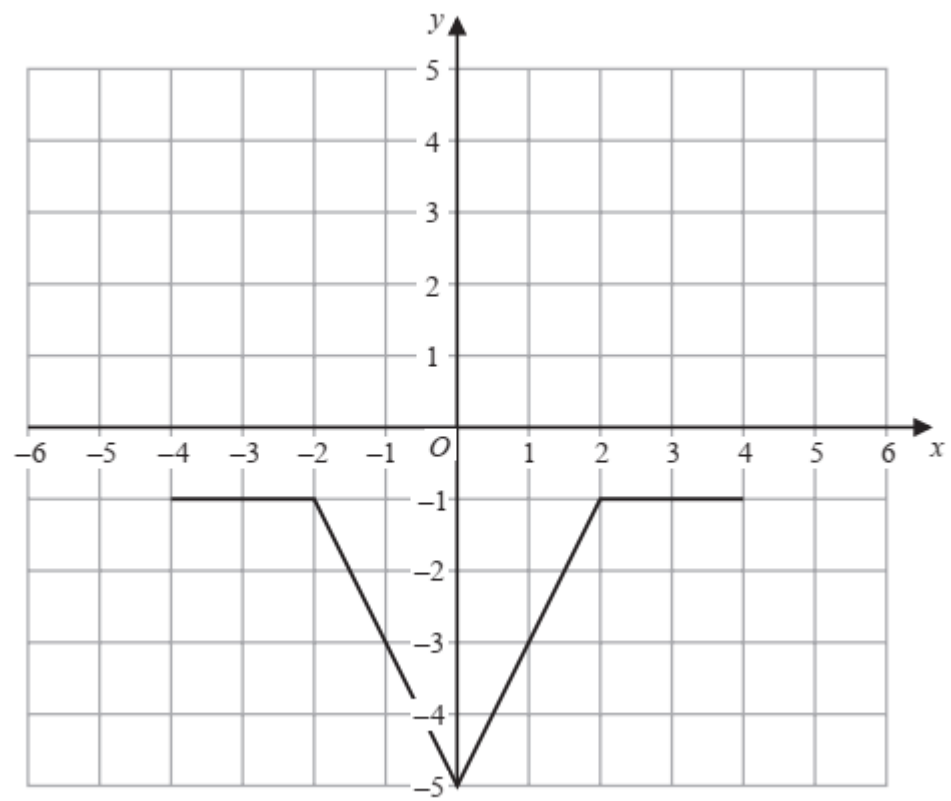| Question		Working	Answer	Mark	Notes
20	(a)		Result shown	3	M1 for $b^2 - 4ac < 0$ if no real roots oe
					M1 for substitution eg $t^2 - 4 \times t \times -9$
					A1 (dep M2) for $t^2 + 36t$ leading to $t(t + 36) < 0$
	(b)		$-36 < t < 0$	2	M1 for critical values $0, -36$ or for $t > -36$ or for $t < 0$
					A1 for $-36 < t < 0$ oe

Question 3
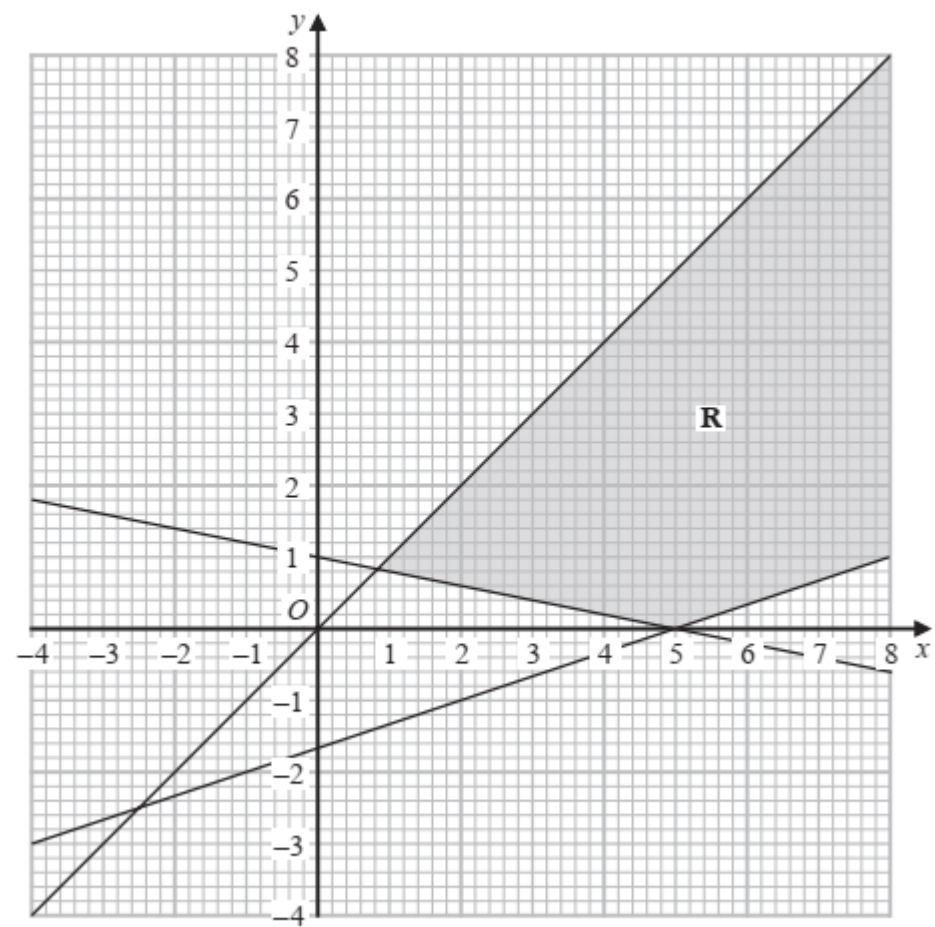
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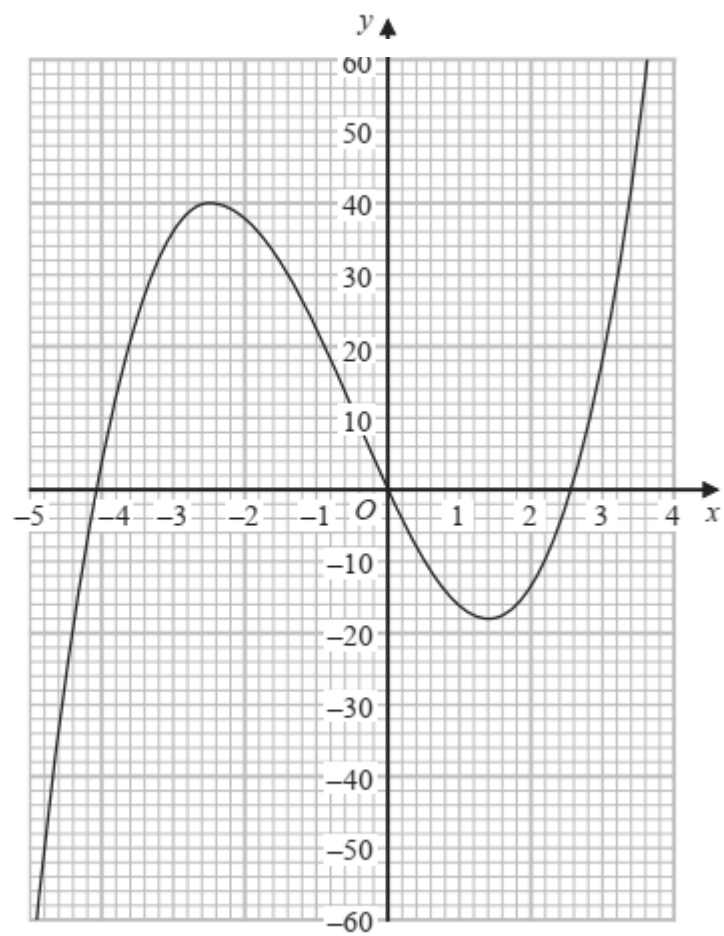
Question 13

Question 17(a)

Question 17(b)