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INTERNATIONAL A LEVEL MATHEMATICS • PURE 1

Pure Mathematics 1

Exam Questions by Topic: Mark Scheme

Pearson Edexcel International Advanced Level (WMA11/01) • Calculator allowed

Every question in the booklet, marked line by line the way an examiner marks it

Chapters (tap a chapter to jump to it)	Qs	Marks	Page	My score
1 Algebraic Expressions Indices, surds, expanding and factorising	10	57	own PDF	
2 Quadratics Completing the square, the discriminant, quadratic graphs	10	65	own PDF	
3 Equations and Inequalities Simultaneous equations, inequalities, regions	10	69	own PDF	
4 Graphs and Transformations Cubic and reciprocal graphs, intersections, transformations	10	68	own PDF	
5 Straight-line Graphs Gradients, equations of lines, parallel and perpendicular	10	68	3	
6 Trigonometric Ratios Sine and cosine rules, area of a triangle, trig graphs	10	66	own PDF	
7 Radians Radian measure, arc length, sector and segment areas	10	71	own PDF	
8 Differentiation Gradients, second derivatives, tangents and normals	10	71	own PDF	
9 Integration Integrating x^n , finding $y = f(x)$ from $f'(x)$	10	67	own PDF	

Question booklet

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How to use this mark scheme

The same marking rules Pearson examiners use for WMA11.

Mark every line, not just the answer. Method marks are given for a correct method even when the final answer is wrong. If you lost marks, find the *first* line where your working differs from the scheme. That is the thing to fix.

Code	Meaning
M1	Method mark: for knowing a correct method and attempting to apply it. Small slips in the working do not lose this mark.
dM1	Dependent method mark: can only be given if the method mark before it has been given.
A1	Accuracy mark: for a correct answer or line of working. It can only be given if the method mark it depends on has been given.
B1	Independent mark: for a correct result or statement, whatever method was used.
*	The answer is given in the question. Every step must be shown, and the answer must follow from correct working (cso).
cao	Correct answer only.
cso	Correct solution only: no errors anywhere in the working.
ft	Follow through: the mark can be given for correct work using your own earlier (wrong) answer.
oe	Or equivalent: any correct equivalent form is accepted.

“Solutions relying on calculator technology are not acceptable.” When a question says this, a correct final answer with no algebraic working scores **no marks**. The notes under each scheme line say when this applies.



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Chapter 5: Straight-line Graphs

Mark scheme. Marks are shown on the right of each line.

Question 1

4 marks

Part	Scheme	Marks
	$\text{Gradient} = \frac{-2-7}{4-(-2)} = -\frac{3}{2}$ $y-7 = -\frac{3}{2}(x+2) \text{ (or } y = -\frac{3}{2}x + c \text{ with } c \text{ found)}$ $3x + 2y - 8 = 0$ Final A1: any integer multiple, e.g. $-6x - 4y + 16 = 0$, but it must include “= 0”.	M1 A1 M1 A1 (4)
Total for Question 1: 4 marks		

Question 2

5 marks

Part	Scheme	Marks
(a)	$y = \frac{2}{5}x + 2$, so gradient $\frac{2}{5}$	B1 (1)
(b)	$\text{Gradient of } l_2 = -\frac{5}{2}$ $y+1 = -\frac{5}{2}(x-4)$ $y = -\frac{5}{2}x + 9$	B1ft M1 A1 (3)
(c)	$\left(\frac{18}{5}, 0\right)$	B1ft (1)
Total for Question 2: 5 marks		



Question 3

4 marks

Part	Scheme	Marks
	Midpoint of AB is $(1, 6)$	B1
	Gradient of $AB = \frac{4}{8} = \frac{1}{2}$, so the perpendicular gradient is -2	M1
	$y - 6 = -2(x - 1)$	M1
	$2x + y - 8 = 0$	A1
	Second M1: uses their midpoint with their perpendicular gradient. Using A or B instead of the midpoint scores M0.	
		(4)
Total for Question 3: 4 marks		

Question 4

7 marks

Part	Scheme	Marks
(a)	Attempts the gradients of PQ and QR $m_{PQ} = \frac{3-1}{2+2} = \frac{1}{2}$ and $m_{QR} = \frac{-3-3}{5-2} = -2$ $\frac{1}{2} \times (-2) = -1$, so PQ is perpendicular to QR and angle $PQR = 90^\circ$ Final A1*: needs the product -1 and a conclusion. A Pythagoras method ($PQ^2 + QR^2 = PR^2$: $20 + 45 = 65$) is equally valid.	M1 A1 A1*
(b)	Uses $\vec{QR} = \vec{PS}$, or $S = P + R - Q$ $S(1, -5)$	M1 A1 (2)
(c)	$PQ = \sqrt{20} = 2\sqrt{5}$ and $QR = \sqrt{45} = 3\sqrt{5}$, area $= 2\sqrt{5} \times 3\sqrt{5}$ 30 Decimal working such as 4.47×6.71 scores M1 A0, because the calculator warning requires the surd product to be shown.	M1 A1 (2)
Total for Question 4: 7 marks		



Question 5

6 marks

Part	Scheme	Marks
(a)	$205 = 3p + q$ and $405 = 7p + q$ Solves: $4p = 200$ $p = 50, q = 55$	M1 M1 A1 (3)
(b)	The cost increases by $\pounds 50$ for each extra day of hire	B1 (1)
(c)	$50d + 55 < 65d \Rightarrow d > \frac{11}{3}$ 4 days	M1 A1 (2)
Total for Question 5: 6 marks		

Question 6

8 marks

Part	Scheme	Marks
(a)	Gradient = $\frac{0 - 10}{5 - 0} = -2$ $y = -2x + 10$	M1 A1 (2)
(b)	Gradient of $l_2 = \frac{1}{2}$ $y = \frac{1}{2}x$	M1 A1 (2)
(c)	$\frac{1}{2}x = -2x + 10 \Rightarrow x = 4$ $P(4, 2)$	M1 A1 (2)
(d)	Area $OPA = \frac{1}{2} \times 10 \times 4 = 20$ and area $OPB = \frac{1}{2} \times 5 \times 2 = 5$ $20 = 4 \times 5$, so the area of OPA is four times the area of OPB * <i>Uses OA and OB on the axes as bases, with the coordinates of P as the heights. Alternatively $OP = 2\sqrt{5}$, $PA = 4\sqrt{5}$, $PB = \sqrt{5}$ with the right angle at P.</i>	M1 A1* (2)
Total for Question 6: 8 marks		



Question 7

8 marks

Part	Scheme	Marks
(a)	Midpoint $M(4, 6)$ Gradient of $AB = \frac{8}{6} = \frac{4}{3}$, so the gradient of l is $-\frac{3}{4}$ $y - 6 = -\frac{3}{4}(x - 4) \Rightarrow \boxed{3x + 4y - 36 = 0}$	B1 M1 A1 (3)
(b)	$AB = \sqrt{6^2 + 8^2} = \sqrt{100} = 10$ *	B1* (1)
(c)	C is on the perpendicular bisector, so MC is the height: $\frac{1}{2} \times 10 \times MC = 25 \Rightarrow MC = 5$ $C\left(c, \frac{36-3c}{4}\right): (c-4)^2 + \left(\frac{12-3c}{4}\right)^2 = 25$ $\frac{25}{16}(c-4)^2 = 25 \Rightarrow (c-4)^2 = 16$, so $c = 8$ or $c = 0$ $\boxed{(8, 3) \text{ and } (0, 9)}$ <i>Both points are needed for the final A1. Using AC or BC as the height scores M0.</i>	M1 M1 A1 A1 (4)
Total for Question 7: 8 marks		

Question 8

7 marks

Part	Scheme	Marks
(a)	$kx = x(6-x) \Rightarrow x(6-x-k) = 0$, so $x = 6-k$ at P $y = k(6-k) = 6k - k^2$, so $P(6-k, 6k - k^2)$ *	M1 A1* (2)
(b)	Gradient of $PA = \frac{0 - (6k - k^2)}{6 - (6-k)} = \frac{-k(6-k)}{k}$ $= -(6-k) = k-6$ *	M1 A1* (2)
(c)	Perpendicular: $k(k-6) = -1 \Rightarrow k^2 - 6k + 1 = 0$ $k = \frac{6 \pm \sqrt{32}}{2} = 3 \pm 2\sqrt{2}$ $\boxed{k = 3 + 2\sqrt{2}}$ (since $k > 1$) <i>$3 - 2\sqrt{2} \approx 0.17$ is rejected. Decimal answers score M1 M0 A0 because of the calculator warning.</i>	M1 M1 A1 (3)
Total for Question 8: 7 marks		



Question 9

9 marks

Part	Scheme	Marks
(a)	Gradient of $AB = \frac{3}{6} = \frac{1}{2}$; line through C : $y - 4 = \frac{1}{2}(x - 10)$ $y = \frac{1}{2}x - 1$	M1 A1 (2)
(b)	Gradient -2 through A $y = -2x + 4$	M1 A1 (2)
(c)	$\frac{1}{2}x - 1 = -2x + 4 \Rightarrow x = 2$ $D(2, 0)$	M1 A1 (2)
(d)	$AB = \sqrt{45} = 3\sqrt{5}$, $DC = \sqrt{80} = 4\sqrt{5}$, height $AD = \sqrt{20} = 2\sqrt{5}$ $\text{Area} = \frac{1}{2} (3\sqrt{5} + 4\sqrt{5}) \times 2\sqrt{5}$ 35 <i>AD is the height because angle $DAB = 90^\circ$ and AB is parallel to DC. Splitting into two triangles is equally valid.</i>	M1 M1 A1 (3)
Total for Question 9: 9 marks		



Question 10

10 marks

Part	Scheme	Marks
(a)	Gradient of $l = -\frac{1}{2}$, so the perpendicular gradient is 2 $y = 2x - 4$	M1 A1 (2)
(b)	$x + 2(2x - 4) - 2 = 0 \Rightarrow 5x = 10$ $N(2, 0)$	M1 A1 (2)
(c)	N is the midpoint of PP' : $P' = (2 \times 2 - 5, 2 \times 0 - 6)$ $P'(-1, -6)$	M1 A1 (2)
(d)	$PP' = \sqrt{6^2 + 12^2} = \sqrt{180} = 6\sqrt{5}$	B1 (1)
(e)	$PP' = 6\sqrt{5}$ and NQ is the height: $\frac{1}{2} \times 6\sqrt{5} \times NQ = 15 \Rightarrow NQ = \sqrt{5}$ $Q(2 - 2t, t)$ on l : $(2t)^2 + t^2 = 5 \Rightarrow t = \pm 1$ $(0, 1)$ and $(4, -1)$	M1 M1 A1 (3)
Total for Question 10: 10 marks		

