



## EXAM PAPERS PRACTICE

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Practice questions created by actual examiners and assessment experts

Detailed mark scheme

Suitable for all boards

Designed to test your ability and thoroughly prepare you

2002

# XVIII

1583

Time allowed

Score

Percentage

/

%

# Maths

**AQA**  
**AS & A LEVEL**

**Mark Scheme**

Coordinate geometry in the (  $x$  ,  $y$  ) plane



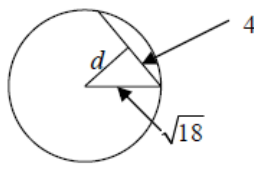
2(a)(i)	$15 + 4k = 7 \Rightarrow 4k = -8 \Rightarrow k = -2$	B1	1	AG (condone verification or $y = -2$ )
(ii)	$\frac{1}{2}(x_1 + x_2)$ or $\frac{1}{2}(y_1 + y_2)$ Midpoint coordinates $\left(3, -\frac{1}{2}\right)$	M1 A1	2	One coordinate correct implies M1
(b)	Attempt at $\Delta y / \Delta x$ or $y = -\frac{3}{4}x + \frac{7}{4}$ Gradient $AB = -\frac{3}{4}$	M1 A1	2	(Not $x$ over $y$ )(may use $M$ instead of $A/B$ ) -0.75 etc any correct equivalent
(c)(i)	$m_1 m_2 = -1$ used or stated Hence gradient $AC = \frac{4}{3}$	1 A1✓	2	Follow through their gradient of $AB$ from part (b)
(ii)	$y - 1 = \frac{4}{3}(x - 1)$ or $3y = 4x - 1$ etc	B1✓	1	Follow through their gradient of $AC$ from part (c) (i) must be <b>normal</b> & (1,1) used
(iii)	$y = 0 \Rightarrow x - 1 = -\frac{3}{4}$ $x = \frac{1}{4}$	M1 A1	2	Putting $y = 0$ in their $AC$ equation and attempting to find $x$ CSO. $C$ has coordinates $\left(\frac{1}{4}, 0\right)$
<b>Total</b>			<b>10</b>	

(b)(i)	$12 - 2x = x^2 - 4x + 9$ $\Rightarrow x^2 - 2x - 3 = 0$	B1	1	Or $x^2 - 4x + 9 + 2x = 12$ AG (be convinced) (must have = 0)
(ii)	$(x - 3)(x + 1) = 0$ $x = 3, -1$ Substitute one value of $x$ to find $y$ Points are (3, 6) and (-1, 14)	M1 A1 M1 A1	4	Attempt at factors or quadratic formula or one value spotted Both values correct & simplified May substitute into equation for $L$ or $C$ $y$ -coordinates correct linked to $x$ values



<b>5(a)</b>	$(x-4)^2 + (y+3)^2$ $(11+16+9=36)$ RHS = $6^2$	B2 B1	3	B1 for one term correct Condone 36
<b>(b)(i)</b>	Centre $(4, -3)$	B1✓	1	Ft their $a$ and $b$ from part (a)
<b>(ii)</b>	Radius = 6	B1✓	1	Ft their $r$ from part (a)
<b>(c)(i)</b>	$CO^2 = (-4)^2 + 3^2$ $CO = 5$	M1 A1✓	2	Accept + or - with numbers but must add Full marks for answer only
<b>(ii)</b>	Considering $CO$ and radius $CO < r \Rightarrow O$ is <b>inside</b> the circle	M1 A1✓	2	Ft outside circle when 'their $CO$ ' > $r$ or on the circle when 'their $CO$ ' = $r$ SC B1✓ if no explanation given
<b>Total</b>			<b>9</b>	

<b>1(a)(i)</b>	Gradient $AB = \frac{1-7}{5-1}$ $= -\frac{6}{4} = -\frac{3}{2} = -1.5$	M1 A1	2	Must be $y$ on top and subtr'n of cords Any correct equivalent
<b>(ii)</b>	$y-7 = m(x-1)$ or $y-1 = m(x-5)$ leading to $3x+2y = 17$	M1 A1	2	Verifying 2 points or $y = -\frac{3}{2}x + c$ AG (or grad & 1 point verified)
<b>(b)</b>	Attempt to eliminate $x$ or $y$ : $7x = 42$ etc $x = 6$ $y = -\frac{1}{2}$	M1 A1 A1	3	Solving $x-4y = 8$ ; $3x+2y = 17$ $C$ is point $(6, -\frac{1}{2})$
<b>(c)</b>	Grad of perp = $-1$ / their gradient $AB$ $= \frac{2}{3}$ $y-7 = \frac{2}{3}(x-1)$ or $3y - 2x = 19$	M1 A1✓ A1	3	Or $m_1m_2 = -1$ used or stated ft their gradient $AB$ CSO Any correct form of equation
<b>Total</b>			<b>10</b>	

7(a)(i)	$(x-2)^2$ centre has $x$ -coordinate = 2 and $y$ -coordinate = 0	M1 A1 B1	3	Attempt to complete square for $x$ M1 implied if value correct or -2 Centre (2,0)
(ii)	RHS = 18 Radius = $\sqrt{18}$ Radius = $3\sqrt{2}$	B1 M1 A1	3	Withhold if circle equation RHS incorrect Square root of RHS of equation (if $> 0$ )
(b)	Perpendicular bisects chord so need to use Length of 4 $d^2 = (\text{radius})^2 - 4^2$ $d^2 = 18 - 16$ so perpendicular distance = $\sqrt{2}$	B1 M1 A1	3	
(c)(i)	$x^2 + (2k-x)^2 - 4x - 14 = 0$ $(2k-x)^2 = 4k^2 - 4kx + x^2$ $\Rightarrow 2x^2 + 4k^2 - 4kx - 4x - 14 = 0$ $(\Rightarrow x^2 + 2k^2 - 2kx - 2x - 7 = 0)$ $\Rightarrow x^2 - 2(k+1)x + 2k^2 - 7 = 0$	M1 B1 A1	3	AG (be convinced about algebra and = 0)
(ii)	$4(k+1)^2 - 4(2k^2 - 7)$ $4k^2 - 8k - 32 = 0$ or $k^2 - 2k - 8 = 0$	M1 A1		“ $b^2 - 4ac$ ” in terms of $k$ (either term correct) $b^2 - 4ac = 0$ correct quadratic equation in $k$
	$(k-4)(k+2) = 0$ $k = -2, k = 4$	m1 A1	4	Attempt to factorise, solve equation SC B1, B1 for -2, 4 (if M0 scored)
(iii)	Line is a tangent to the circle	E1	1	Line touches circle at one point etc
<b>Total</b>			<b>17</b>	

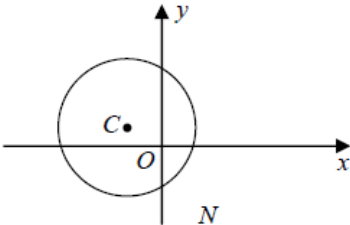
2(a)(i)	$y = -\frac{3}{5}x + \dots$ ; Gradient $AB = -\frac{3}{5}$	M1		Attempt to find $y =$ or $\Delta y / \Delta x$
(ii)	$m_1 m_2 = -1$ Gradient of perpendicular = $\frac{5}{3}$ $\Rightarrow y + 2 = \frac{5}{3}(x - 6)$	A1 M1 A1 ✓	2	Gradient correct – condone slip in $y = \dots$ Stated or used correctly ft gradient of $AB$
(b)	Eliminating $x$ or $y$ (unsimplified) $x = -9$ $y = 7$	M1 A1 A1	3	CSO Any correct form eg $y = \frac{5}{3}x - 12$ , $5x - 3y = 36$ etc Must use $3x + 5y = 8$ ; $2x + 3y = 3$ $B(-9, 7)$
(c)	$4^2 + (k+2)^2 (= 25)$ or $16 + d^2 = 25$ $k = 1$ or $k = -5$	M1 A1 A1	3	Diagram with 3,4, 5 triangle Condone slip in one term (or $k + 2 = 3$ ) SC1 with no working for spotting one correct value of $k$ . Full marks if both values spotted with no contradictory work
<b>Total</b>			<b>11</b>	



4(a)	$(x+1)^2 + (y-6)^2$ $(1+36 - 12 = 25) \quad \text{RHS} = 5^2$	B2 B1	3	B1 for one term correct or missing + sign Condone 25
(b)(i)	Centre $(-1, 6)$	B1✓	1	FT their $a$ and $b$ from part (a) or correct
(ii)	Radius = 5	B1✓	1	FT their $r$ from part (a) RHS must be $> 0$
(c)	Attempt to solve "their" $x^2 + 2x + 12 = 0$  (all working correct) so no real roots or statement that does not intersect	M1  A1	  2	Or comparing "their" $y_c = 6$ and their $r = 5$ may use a diagram with values shown $\left\{ \begin{array}{l} r < y_c \text{ so does not intersect} \\ \text{condone } \pm 1 \text{ or } \pm 6 \text{ in centre for A1} \end{array} \right.$
(d)(i)	$(4-x)^2 = 16 - 8x + x^2$ $x^2 + (4-x)^2 + 2x - 12(4-x) + 12 = 0$ or $(x+1)^2 + (-2-x)^2 = 25$ $\Rightarrow 2x^2 + 6x - 20 = 0 \Rightarrow x^2 + 3x - 10 = 0$	B1 M1 A1	  3	Or $(-2-x)^2 = 4 + 4x + x^2$ Sub $y = 4-x$ in circle eqn (condone slip) or "their" circle equation AG CSO (must have = 0)
(ii)	$(x+5)(x-2) = 0 \Rightarrow x = -5, x = 2$ $Q$ has coordinates $(-5, 9)$	M1 A1	2	Correct factors or unsimplified solution to quadratic (give credit if factorised in part (i)) SC2 if $Q$ correct. Allow $x = -5 \quad y = 9$
(iii)	Mid point of 'their' $(-5, 9)$ and $(2, 2)$ $\left(-1\frac{1}{2}, 5\frac{1}{2}\right)$	M1 A1	2	Arithmetic mean of either $x$ or $y$ coords Must follow from correct value in (ii)
<b>Total</b>			<b>14</b>	

1(a)(i)	Gradient $AB = \frac{-1-5}{6-2}$ or $\frac{5-1}{2-6}$ $= \frac{-6}{4} = -\frac{3}{2}$	M1 A1	2	$\pm \frac{6}{4}$ implies M1 AG
(ii)	$\left. \begin{array}{l} y-5 \\ y+1 \end{array} \right\} = -\frac{3}{2} \left\{ \begin{array}{l} (x-2) \\ (x-6) \end{array} \right.$  $\Rightarrow 3x + 2y = 16$	M1  A1	  2	or $y = -\frac{3}{2}x + c$ and attempt to find $c$ OE: must have integer coefficients
(b)(i)	Gradient of perpendicular = $\frac{2}{3}$  $\Rightarrow y - 5 = \frac{2}{3}(x - 2)$	M1  A1	  2	or use of $m_1 m_2 = -1$ $3y - 2x = 11$ (no misreads permitted)
(ii)	Substitute $x = k, y = 7$ into their (b)(i)  $\Rightarrow 2 = \frac{2}{3}(k - 2) \Rightarrow k = 5$	M1  A1	  2	or grads $\frac{7-5}{k-2} \times \frac{-3}{2} = -1$ or Pythagoras $(k-2)^2 = (k-6)^2 + 8$
<b>Total</b>			<b>8</b>	



5(a)(i)	Centre $(-3, 2)$	M1		$\pm 3$ or $\pm 2$
		A1	2	correct
(ii)	Radius = 5	B1	1	accept $\sqrt{25}$ but not $\pm\sqrt{25}$
(b)(i)	$3^2 + (-4)^2 = 9 + 16 = 25$ $\Rightarrow N$ lies on circle	B1	1	must have $9 + 16 = 25$ or a statement
(ii)		M1		must draw axes; fit their centre in correct quadrant
		A1	2	correct (reasonable freehand circle enclosing origin)
(iii)	Attempt at gradient of $CN$ $\text{grad } CN = -\frac{4}{3}$ $y = -\frac{4}{3}x - 2$ (or equivalent)	M1		withhold if subsequently finds tangent
		A1		CSO
		A1✓	3	fit their grad $CN$
(c)(i)	$P(2, 6)$ Hence $PC^2 = 5^2 + 4^2$	M1		“their” $PC^2$
	$\Rightarrow PC = \sqrt{41}$	A1	2	
(ii)	Use of Pythagoras correctly $PT^2 = PC^2 - r^2 = 41 - 25,$ where $T$ is a point of contact of tangent $\Rightarrow PT = 4$	M1		
		A1✓		fit their $PC^2$ and $r^2$
		A1	3	<b>Alternative</b> sketch with vertical tangent M1 showing that tangent touches circle at point $(2, 2)$ A1 hence $PT = 4$ A1
<b>Total</b>			<b>14</b>	