

MARKING GUIDELINES

General Marking Instructions

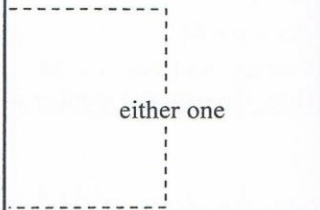
1. It is very important that all markers should adhere as closely as possible to the marking guidelines. In many cases, however, candidates will have obtained a correct answer by an alternative method not specified in the marking guidelines. In general, a correct answer merits **all the marks** allocated to that part, unless a particular method has been specified in the question. Markers should be patient in marking alternative solutions not specified in the marking guidelines.
2. In the marking guidelines, marks are classified into the following three categories:

'M' marks	awarded for correct methods being used;
'A' marks	awarded for the accuracy of the answers;
Marks without 'M' or 'A'	awarded for correctly completing a proof or arriving at an answer given in a question.

In a question consisting of several parts each depending on the previous parts, 'M' marks should be awarded to steps or methods correctly deduced from previous answers, even if these answers are erroneous. However, 'A' marks for the corresponding answers should NOT be awarded (unless otherwise specified).
3. For the convenience of markers, the marking guidelines were written as detailed as possible. However, it is still likely that candidates would not present their solution in the same explicit manner, e.g. some steps would either be omitted or stated implicitly. In such cases, markers should exercise their discretion in marking candidates' work. In general, marks for a certain step should be awarded if candidates' solution indicated that the relevant concept/technique had been used.
4. Use of notation different from those in the marking guidelines should not be penalized.
5. In marking candidates' work, the benefit of doubt should be given in the candidates' favour.
6. Marks may be deducted for wrong units (u) or poor presentation (pp).
 - a. The symbol $(u-1)$ should be used to denote 1 mark deducted for u . At most deduct **1 mark** for u in Section A. Do not deduct any marks for u in Section B.
 - b. The symbol $(pp-1)$ should be used to denote 1 mark deducted for pp . At most deduct **1 mark** for pp in each of Section A and Section B. For similar pp , deduct 1 mark for the first time that it occurs. Do not penalize candidates twice in the paper for the same pp .
 - c. At most deduct 1 mark in each question. Deduct the mark for u first if both marks for u and pp may be deducted in the same question.
 - d. In any case, do not deduct any marks for pp or u in those steps where candidates could not score any marks.
7. In the marking guidelines, 'r.t.' stands for 'accepting answers which can be rounded off to' and 'f.t.' stands for 'follow through'. Steps which can be skipped are shaded whereas alternative answers are enclosed with rectangles. All fractional answers must be simplified.

Solution	Marks	Remarks
<p>1. $\frac{(xy)^2}{x^{-5}y^6}$</p> $= \frac{x^2y^2}{x^{-5}y^6}$ $= \frac{x^{2-(-5)}}{y^{6-2}}$ $= \frac{x^7}{y^4}$	<p>1M</p> <p>1M</p> <p>1A</p> <p>----- (3)</p>	<p>for $(ab)^m = a^m b^m$</p> <p>for $\frac{a^m}{a^n} = a^{m-n}$</p>
<p>2. $a(b+7) = a+b$</p> $ab + 7a = a + b$ $7a - a = b - ab$ $6a = b(1-a)$ $b = \frac{6a}{1-a}$	<p>1M</p> <p>1M</p> <p>1A</p>	<p>for putting b on one side for factorization</p>
$b+7 = \frac{a+b}{a}$ $b - \frac{b}{a} = 1-7$ $b(1 - \frac{1}{a}) = -6$ $b(\frac{a-1}{a}) = -6$ $b = \frac{-6a}{a-1}$	<p>1M</p> <p>1M</p> <p>1A</p> <p>----- (3)</p>	<p>for putting b on one side for factorization</p>
<p>3. (a) $3m^2 - mn - 2n^2$</p> $= (3m+2n)(m-n)$ <p>(b) $3m^2 - mn - 2n^2 - m + n$</p> $= (3m+2n)(m-n) - m + n$ $= (3m+2n)(m-n) - (m-n)$ $= (m-n)(3m+2n-1)$	<p>1A</p> <p>1M</p> <p>1A</p> <p>----- (3)</p>	<p>for using (a)</p>
<p>4. (a) Let \$ x be the cost of the handbag.</p> $x(1+40\%) = 560$ $x = \frac{560}{1+40\%}$ $x = 400$ <p>Thus, the cost of the handbag is \$ 400 .</p>	<p>1M</p> <p>1A</p>	<p>u-1 for missing unit</p>
<p>(b) The percentage profit</p> $= \left(\frac{460-400}{400} \right) 100\%$ $= 15\%$	<p>1M</p> <p>1A</p> <p>----- (4)</p>	<p>accept without 100%</p>

Solution	Marks	Remarks
<p>Let x be the number of games that the champion wins. Then, the number of games drawn will be $36 - x$. Now, we have $3x + (36 - x) = 84$. Solving, we have $x = 24$. Thus, the required number of games is 24 .</p>	<p>1A 1M + 1A 1A</p>	<p>1M for $3x + (a - x)$</p>
<p>Let x be the number of games that the champion wins and y be the number of games that the champion draws. $\begin{cases} x + y = 36 \\ 3x + y = 84 \end{cases}$ Solving, we have $x = 24$. Thus, the required number of games is 24 .</p>	<p>1A 1M + 1A 1A</p>	<p>1M for $3x + y$</p>
------(4)		
<p>(a) $\frac{1}{3} \pi r^2 (12) = 2 \left[\frac{1}{2} \left(\frac{4}{3} \pi r^3 \right) \right]$ $r = 3$</p>	<p>1M 1A</p>	<p>for $V_1 = 2V_2$ u-1 for having unit</p>
<p>(b) The required volume $= \frac{1}{2} \left(\frac{4}{3} \pi r^3 \right) + \frac{1}{3} \pi r^2 (12)$ $= \frac{2}{3} \pi (3^3) + 4\pi (3^2)$ $= 54\pi \text{ cm}^3$</p>	<p>1M 1A</p>	<p>u-1 for missing unit</p>
<p>The required volume $= \frac{3}{2} \left(\frac{4}{3} \pi r^3 \right)$ $= 2\pi (3^3)$ $= 54\pi \text{ cm}^3$</p>	<p>1M 1A</p>	<p>u-1 for missing unit</p>
------(4)		
<p>Note that $\angle ABD = 90^\circ$. Also note that $\angle COD = \angle BAD = 38^\circ$. Further note that $\angle ADB = 180^\circ - 90^\circ - 38^\circ = 52^\circ$. Since $OC = OD$, we have $\angle ODC = \angle OCD$. So, we have $\angle ODC = \frac{180^\circ - 38^\circ}{2}$. Therefore, we have $\angle ODC = 71^\circ$.</p> <p>$\begin{aligned} \angle BDC &= \angle ODC - \angle ADB \\ &= 71^\circ - 52^\circ \\ &= 19^\circ \end{aligned}$</p>	<p>1A 1M 1M 1A</p>	<p>u-1 for missing unit</p>
<p>Join O and B . Since $OA = OB$, we have $\angle OBA = \angle OAB = 38^\circ$. So, we have $\angle BOC = \angle OBA = 38^\circ$. Thus, $\angle BDC = \frac{1}{2} \angle BOC$ $= \frac{1}{2} (38^\circ)$ $= 19^\circ$</p>	<p>1A 1M 1M 1A</p>	<p>u-1 for missing unit</p>
------(4)		

Solution	Marks	Remarks
8. (a) The coordinates of A' $= (5, 2)$	1A	pp-1 for missing '(' or ')'
The coordinates of A'' $= (2, 5)$	1A	pp-1 for missing '(' or ')'
(b) The slope of AA' $= \frac{5-2}{-2-5}$ $= \frac{-3}{7}$	1M	
The slope of OA'' $= \frac{5-0}{2-0}$ $= \frac{5}{2}$		
Note that the product of the slope of AA' and the slope of OA'' is not equal to -1 . Thus, AA' is not perpendicular to OA'' .	1M 1A	f.t.
	----- (5)	
9. (a) $x(1+20\%) = 72$ $x = \frac{72}{1+20\%}$ $x = 60$	1M 1A	 u-1 for having unit
(b) Let y be the angle subtended at the centre for the sector representing District C . y $= 360^\circ - 72^\circ - 120^\circ - 30^\circ - 60^\circ$ $= 78^\circ$	1M 1A	
Since the angle subtended at the centre for the sector representing District C is greater than that for District A , the number of traffic accidents occurred in District A is not greater than that in District C .	1M	
	----- (5)	

Solution	Marks	Remarks
10. (a) The quotient $= 5x + 2$	1M + 1A -----(2)	1M for division process
(b) (i) $a = 2$ and $b = -1$	1A	for both correct
(ii) $g(x) = 0$ $(5x + 2)(x^2 + 2x - 3) = 0$	1M	for using (a)
$(5x + 2)(x + 3)(x - 1) = 0$	1A	
Thus, we have $x = \frac{-2}{5}$, $x = -3$ or $x = 1$.	1M -----(4)	
11. (a) Let $C = as + bs^2$, where a and b are non-zero constants.	1A	
$\begin{cases} a(2) + b(2^2) = 356 \\ a(5) + b(5^2) = 1250 \end{cases}$	1M	for substitution
Solving, we have $a = 130$ and $b = 24$.	1A	for both correct
The required cost		
$= 130(6) + 24(6^2)$		
$= \$1644$	1A -----(4)	u-1 for missing unit
(b) $130s + 24s^2 = 539$		
$24s^2 + 130s - 539 = 0$	1M	
$(4s - 11)(6s + 49) = 0$		
$s = \frac{11}{4}$ or $s = \frac{-49}{6}$ (rejected)	1A	
Thus, the perimeter of the carpet is 2.75 metres.	-----(2)	u-1 for missing unit

Solution	Marks	Remarks
12. (a) Note that the slope of a line segment in the graph represents the average speed of that part of the journey. Since the slope of the line segment for Part I is the least, John drives at the lowest speed for Part I of the journey.	1M 1A -----(2)	can be absorbed
(b) Let x h be the time required to drive from B to C . $\frac{18-4}{x} = 56$ $x = \frac{1}{4}$ Thus, John will reach C at 8:26.	1M 1A -----(2)	
(c) The average speed $= \frac{27}{\frac{30}{60}}$ $= 54 \text{ km/h}$ $= \frac{(54)(1000)}{3600}$ $= 15 \text{ m/s}$	1M 1A -----(3)	for $\frac{27}{30}$

Solution	Marks	Remarks
<p>13. (a) Note that the equation of L_1 is $4x - 3y + 12 = 0$.</p> <p>So, the slope of L_1 is $\frac{4}{3}$.</p> <p>Therefore, the slope of L_2 is $-\frac{3}{4}$.</p> <p>The equation of L_2 is</p> $y - 9 = \frac{-3}{4}(x - 4)$ $3x + 4y - 48 = 0$ <p>(b) (i) Note that Γ is the perpendicular bisector of AB.</p> <p>Also, AB is perpendicular to L_2.</p> <p>Thus, Γ is parallel to L_2.</p> <p>(ii) The slope of Γ is $-\frac{3}{4}$.</p> <p>Putting $x = 0$ in $4x - 3y + 12 = 0$, we have $y = 4$.</p> <p>So, we have $B = (0, 4)$.</p> <p>Note that L_2 cuts the y-axis at $C(0, 12)$.</p> <p>The mid-point of BC is $(0, 8)$.</p> <p>The required equation is</p> $y = -\frac{3}{4}x + 8$ $3x + 4y - 32 = 0$	<p>1M</p> <p>1M</p> <p>1A</p> <p>------(3)</p> <p>1M</p> <p>1A</p> <p>1M</p> <p>1A</p> <p>1M</p> <p>1A</p>	<p></p> <p>accept Γ is a straight line</p>
<p>By solving $\begin{cases} 4x - 3y + 12 = 0 \\ 3x + 4y - 48 = 0 \end{cases}$, we have $A = \left(\frac{96}{25}, \frac{228}{25}\right)$.</p> <p>Putting $x = 0$ in $4x - 3y + 12 = 0$, we have $y = 4$.</p> <p>So, we have $B = (0, 4)$.</p> <p>The required equation is</p> $\sqrt{(x-0)^2 + (y-4)^2} = \sqrt{\left(x - \frac{96}{25}\right)^2 + \left(y - \frac{228}{25}\right)^2}$ $3x + 4y - 32 = 0$	<p>1M</p> <p>1A</p> <p>1M</p> <p>1A</p>	<p>either one</p>
<p>The slope of Γ is $-\frac{3}{4}$.</p> <p>By solving $\begin{cases} 4x - 3y + 12 = 0 \\ 3x + 4y - 48 = 0 \end{cases}$, we have $A = \left(\frac{96}{25}, \frac{228}{25}\right)$.</p> <p>Putting $x = 0$ in $4x - 3y + 12 = 0$, we have $y = 4$.</p> <p>So, we have $B = (0, 4)$.</p> <p>The mid-point of AB is $\left(\frac{48}{25}, \frac{164}{25}\right)$.</p> <p>The required equation is</p> $y - \frac{164}{25} = -\frac{3}{4}\left(x - \frac{48}{25}\right)$ $3x + 4y - 32 = 0$	<p>1M</p> <p>1A</p> <p>1M</p> <p>1A</p>	<p>either one</p>
	<p>------(6)</p>	

Solution	Marks	Remarks
14. (a) The median = 62% The mean $= \frac{55\% + 58\% + 62\% + 62\% + 63\%}{5}$ = 60%	1A 1A -----(2)	
(b) (i) 58% (ii) $a = 63$ $b = 57$	1A 1M 1M -----(3)	1M for either one of the following conditions satisfied: (1) $a + b = 120$ (2) $\begin{cases} a \geq 62 \\ 0 \leq b < 62 \end{cases}$ or $\begin{cases} 0 \leq a < 62 \\ b \geq 62 \end{cases}$
(c) Note that the data are collected from only one magazine stall. Also note that the week may not be randomly selected. Thus, the claim is disagreed.	1M 1M	accept any suitable reason
Note that the number of magazine stall in city H may be small. Also note that the stall may be randomly selected. Further note that the week may be randomly selected. Thus, the claim is agreed.	1M 1M -----(2)	accept any suitable reason

Solution	Marks	Remarks
<p>Let n be the number of rows of seats.</p> $\frac{n}{2}(2(12) + (n-1)3) \leq 930$ $\frac{3n^2}{2} + \frac{21n}{2} - 930 \leq 0$ $n^2 + 7n - 620 \leq 0$ $\frac{-7 - \sqrt{2529}}{2} \leq n \leq \frac{-7 + \sqrt{2529}}{2}$ <p>Therefore, the greatest value of n is 21 . Thus, the greatest number of rows of seats is 21 .</p>	<p>1M 1M 1A 1A</p> <p>------(4)</p>	<p>for sum of arithmetic sequence for quadratic inequality in n accept $-28.6 \leq n \leq 21.6$</p>
<p>(a) The required probability</p> $= \frac{C_2^5 C_2^4}{C_4^9}$ $= \frac{10}{21}$	<p>1M + 1A 1A</p>	<p>1M for numerator using C_2^n, $n = 4, 5$ 1A for denominator r.t. 0.476</p>
<p>The required probability</p> $= 6 \left(\frac{5}{9} \right) \left(\frac{4}{8} \right) \left(\frac{4}{7} \right) \left(\frac{3}{6} \right)$ $= \frac{10}{21}$	<p>1M + 1A 1A</p> <p>------(3)</p>	<p>1M for $\left(\frac{r}{n} \right) \left(\frac{r-1}{n-1} \right) \left(\frac{r-1}{n-2} \right) \left(\frac{r-2}{n-3} \right)$ 1A for $6p$, $0 < p < 1$ r.t. 0.476</p>
<p>(b) The required probability</p> $= 1 - \frac{10}{21}$ $= \frac{11}{21}$	<p>1M 1A</p>	<p>for $1 - (a)$ r.t. 0.524</p>
<p>The required probability</p> $= \frac{C_4^5 + C_4^4 + C_1^5 C_3^4 + C_3^5 C_1^4}{C_4^9}$ $= \frac{11}{21}$	<p>1M 1A</p>	<p>for considering 4 cases r.t. 0.524</p>
<p>The required probability</p> $= \left(\frac{5}{9} \right) \left(\frac{4}{8} \right) \left(\frac{3}{7} \right) \left(\frac{2}{6} \right) + \left(\frac{4}{9} \right) \left(\frac{3}{8} \right) \left(\frac{2}{7} \right) \left(\frac{1}{6} \right) + 4 \left(\frac{5}{9} \right) \left(\frac{4}{8} \right) \left(\frac{3}{7} \right) \left(\frac{2}{6} \right) + 4 \left(\frac{5}{9} \right) \left(\frac{4}{8} \right) \left(\frac{3}{7} \right) \left(\frac{4}{6} \right)$ $= \frac{11}{21}$	<p>1M 1A</p> <p>------(2)</p>	<p>for considering 10 cases r.t. 0.524</p>

Solution	Marks	Remarks
<p>17. Note that $6.4 = \log_8 E$.</p> <p>Therefore, we have $E = 8^{6.4}$.</p> <p>Also note that $M = \log_4 E$.</p> <p>$M = \log_4(8^{6.4})$</p> <p>$4^M = 8^{6.4}$</p> <p>$(2^2)^M = (2^3)^{6.4}$</p> <p>$2^{2M} = 2^{19.2}$</p> <p>$2M = 19.2$</p> <p>$M = 9.6$</p> <p>Thus, the magnitude of the explosion on Scale A is 9.6 .</p>	<p>1A</p> <p>1A</p> <p>1M</p> <p>1M</p> <p>1A</p>	
<p>M</p> <p>$= \log_4 E$</p> <p>$= \frac{\log_8 E}{\log_8 4}$</p> <p>$= \frac{6.4}{\log_8(8^{\frac{2}{3}})}$</p> <p>$= \frac{6.4}{\frac{2}{3}}$</p> <p>$= 9.6$</p> <p>Thus, the magnitude of the explosion on Scale A is 9.6 .</p>	<p>1A</p> <p>1M + 1A</p> <p>1M</p> <p>1A</p>	<p>for denominator</p>
-----(5)		

Solution	Marks	Remarks
<p>(a) By sine formula,</p> $\frac{BC}{\sin 45^\circ} = \frac{20}{\sin 30^\circ}$ $BC = 20\sqrt{2} \text{ cm}$ $BD = 20\sqrt{2} \cos 30^\circ$ $= 10\sqrt{6} \text{ cm}$	<p>1M</p> <p>1A</p> <p>1A</p> <p>-----(3)</p>	<p>accept finding CD and using sine twice</p>
<p>(b) (i) Note that the required angle is $\angle ADB$.</p> <p>Also note that $AD = 20 \cos 45^\circ = 10\sqrt{2} \text{ cm}$.</p> <p>By cosine formula,</p> $\cos \angle ADB = \frac{(10\sqrt{6})^2 + (10\sqrt{2})^2 - 18^2}{2(10\sqrt{6})(10\sqrt{2})}$ <p>$\angle ADB \approx 46.60320866^\circ$</p> <p>$\angle ADB \approx 46.6^\circ$</p>	<p>1A</p> <p>1M</p> <p>1A</p>	<p>accept using Pythagoras' theorem twice</p>
<p>(ii) Note that $AD = CD = 10\sqrt{2} \text{ cm}$.</p> <p>Also note that $\angle ADC = 90^\circ$.</p> <p>The volume of the tetrahedron $ABCD$</p> $= \frac{1}{3} \left(\frac{1}{2} (AD)(BD) \sin \angle ADB \right) (CD)$ $= \frac{1}{3} \left(\frac{1}{2} (10\sqrt{2})(10\sqrt{6})(\sin \angle ADB) \right) (10\sqrt{2})$ $= \frac{1000\sqrt{6} \sin \angle ADB}{3}$ <p>So, the volume of the tetrahedron varies directly as $\sin \angle ADB$.</p> <p>When $\angle ADB$ increases from 40° to 90° , the volume of the tetrahedron $ABCD$ increases.</p> <p>When $\angle ADB$ increases from 90° to 140° , the volume of the tetrahedron $ABCD$ decreases.</p>	<p>1M</p> <p>1A</p>	<p>either one</p>
<p>The volume of the tetrahedron $ABCD$</p> $= \frac{1}{3} (\text{The area of } \triangle ACD)(BD \sin \angle ADB)$ <p>Since the area of $\triangle ACD$ and the length of BD are constants, the volume of the tetrahedron varies directly as $\sin \angle ADB$.</p> <p>When $\angle ADB$ increases from 40° to 90° , the volume of the tetrahedron $ABCD$ increases.</p> <p>When $\angle ADB$ increases from 90° to 140° , the volume of the tetrahedron $ABCD$ decreases.</p>	<p>1M</p> <p>1A</p>	<p>either one</p>
	<p>-----(5)</p>	

Solution	Marks	Remarks
19. (a) (i) Join C and D . $\angle CDB = \angle CAB$ (\angle s in the same segment) $\angle QCD = \angle CAD$ (\angle in alt segment) $\angle QCD = \angle CDB$ (alt. \angle s , $PQ \parallel BD$) So, $\angle CAB = \angle CAD$ $AE = AE$ (common side) $AB = AD$ (given) $\triangle ABE \cong \triangle ABD$ (SAS)		
Marking Scheme:		
Case 1 Any correct proof with correct reasons.	3	
Case 2 Any correct proof without reasons.	2	
Case 3 Incomplete proof with any one correct step and one correct reason.	1	
(ii) By (a)(i), $\angle CAB = \angle CAD$. Therefore, AC is the angle bisector of $\angle BAD$. So, AC must pass through the in-centre of $\triangle ABD$. By (a)(i), $\angle AED = \angle AEB$. Note that $\angle AED + \angle AEB = 180^\circ$. Therefore, $\angle AED = \angle AEB = 90^\circ$. So, AE is an altitude of $\triangle ABD$. Hence, the orthocentre of $\triangle ABD$ lies on the straight line passing through A and E . Also, $BE = DE$. Therefore, AE is a median of $\triangle ABD$. So, AC passes through the centroid of $\triangle ABD$. Also note that AC is the perpendicular bisector of BD . So, AC passes through the circumcentre of $\triangle ABD$. Therefore, the in-centre, the orthocentre, the centroid and the circumcentre lie on the straight line passing through A and C . Thus, the in-centre, the orthocentre, the centroid and the circumcentre are collinear.	1A + 1A -----(6)	1A for any one correct 1A for any two correct f.t.
(b) The x -coordinate of the centre of the circle is $\frac{14+4}{2} = 9$. Let $(9, t)$ be the coordinates of the centre of the circle. $\sqrt{(9-4)^2 + (t-4)^2} = \sqrt{(9-8)^2 + (t-12)^2}$ $t = \frac{13}{2}$ The slope of the tangent PQ = the slope of BD $= \frac{12-4}{8-4}$ $= 2$ Let (a, b) be the coordinates of C . Note that AC passes through the centre of the circle. Then, we have $\frac{a+14}{2} = 9$ and $\frac{b+4}{2} = \frac{13}{2}$. So, we have $a = 4$ and $b = 9$. The required equation is $y - 9 = 2(x - 4)$ $2x - y + 1 = 0$	1A 1M 1M 1M 1M 1M 1A	for slope formula can be absorbed for mid-point formula

Solution	Marks	Remarks
<p>The x-coordinate of the centre of the circle is $\frac{14+4}{2} = 9$.</p> <p>Let $(9, t)$ be the coordinates of the centre of the circle.</p> $\sqrt{(9-4)^2 + (t-4)^2} = \sqrt{(9-8)^2 + (t-12)^2}$ $t = \frac{13}{2}$ <p>So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$.</p> <p>The slope of the tangent PQ = the slope of BD $= \frac{12-4}{8-4}$ $= 2$</p> <p>Let the equation of the tangent be $y = 2x + k$, where k is a constant.</p> <p>Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$.</p> <p>Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$.</p> <p>For tangency, we have $\Delta = 0$. $(4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0$ $k^2 + 23k - 24 = 0$ $k = 1$ or $k = -24$ (rejected)</p> <p>Thus, the required equation is $2x - y + 1 = 0$.</p>	<p>1A</p> <p>1M</p> <p>1M</p> <p>1M</p> <p>1M</p> <p>1M</p> <p>1A</p>	<p>for slope formula</p>
<p>Let the equation of the circle be $x^2 + y^2 + k_1x + k_2y + k_3 = 0$, where k_1, k_2 and k_3 are constants.</p> $\begin{cases} 14^2 + 4^2 + k_1(14) + k_2(4) + k_3 = 0 \\ 8^2 + 12^2 + k_1(8) + k_2(12) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{cases}$ <p>Solving, we have $k_1 = -18$, $k_2 = -13$ and $k_3 = 92$.</p> <p>So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$.</p> <p>The slope of the tangent PQ = the slope of BD $= \frac{12-4}{8-4}$ $= 2$</p> <p>Let the equation of the tangent be $y = 2x + k$, where k is a constant.</p> <p>Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$.</p> <p>Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$.</p> <p>For tangency, we have $\Delta = 0$. $(4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0$ $k^2 + 23k - 24 = 0$ $k = 1$ or $k = -24$ (rejected)</p> <p>Thus, the required equation is $2x - y + 1 = 0$.</p>	<p>1A</p> <p>1M</p> <p>1M</p> <p>1M</p> <p>1M</p> <p>1M</p> <p>1A</p>	<p>for solving</p> <p>for slope formula</p>

----- (7)

Paper 2

Question No.	Key	Question No.	Key
1.	C	31.	B
2.	C	32.	D
3.	C	33.	A
4.	A	34.	A
5.	C	35.	D
6.	D	36.	C
7.	D	37.	C
8.	A	38.	A
9.	C	39.	A
10.	A	40.	C
11.	C	41.	B
12.	B	42.	B
13.	D	43.	D
14.	C	44.	B
15.	B	45.	D
16.	B		
17.	A		
18.	B		
19.	A		
20.	A		
21.	B		
22.	C		
23.	B		
24.	D		
25.	A		
26.	D		
27.	D		
28.	B		
29.	D		
30.	B		