		Solution	Marks	Remarks
	(x	2	DEPOSITE TO THE PARTY OF THE PA	
	x-	$\frac{(xy)^2}{(x^5y)^6}$		
	~ Y	$\frac{z^{2}y^{2}}{z^{-5}y^{6}}$ $\frac{z^{2}-5}{z^{-6}}$ $\frac{z^{-6}-5}{z^{-6}}$ $\frac{z^{-6}-5}{z^{-6}}$		
	$=\frac{\lambda}{r}$	y -5,16	1M	for $(ab)^m = a^m b^m$
	1	2-(-5)	Library and a light of the	m
	$=\frac{x}{}$	6-2	1M	for $\frac{a^m}{a^n} = a^{m-n}$
	y	2	military of the second	a"
	$=\frac{x'}{}$	7	1A	Line IT INCOMES A 1
	y	4		
			(3)	
	a(b -	(+7) = a + b		
		a = a + b	we ditam	
		-a = b - ab	1M	for putting b on one side
		=b(1-a)	1M	for factorization
	h = -	<u>6a</u> 1 – a	1A	
1	1	1 – a	***	
	b + 7	$7 = \frac{a+b}{a}$ $\frac{b}{a} = 1-7$	artwood in highlight	encember 198
	1	a h	1M	for putting b on one side
	b	$\frac{b}{a} = 1 - 7$	1144	101 putting 0 on one star
	1/1	1,	1M	for factorization
	b(1-	$(a-\frac{1}{a}) = -6$		
	$b(\frac{a}{})$	$\frac{a}{-\frac{1}{a}} = -6$ $\frac{-1}{a} = -6$ $\frac{-6a}{a-1}$		
	0	$\frac{a}{a}$) = -0		
	b = -	<u>-6a</u>	1A	
L	Li	7 – 1	(3)	
		n nationym i Indiag seas ar - n nii beraden armiy i birade	Committee (Constitution)	
	(a)	$3m^2 - mn - 2n^2$	The second secon	
		= (3m+2n)(m-n)	1A	
		2 - 2		
	(b)	$3m^2 - mn - 2n^2 - m + n$	11/4	0(-)
		= (3m + 2n)(m - n) - m + n	1M	for using (a)
		= (3m + 2n)(m - n) - (m - n)	14	
		=(m-n)(3m+2n-1)	1A	
			(3)	
	(a)			
		x(1+40%) = 560	1M	
		$x = \frac{560}{1 + 400\%}$		
		1 + 40 %	1.4	
		x = 400 Thus, the cost of the handbag is \$400.	1A	u-1 for missing unit
		Thus, the cost of the national is \$ 4400.		u-1 101 massing unit
((b)	The percentage profit		
		$= \left(\frac{460 - 400}{400}\right) 100\%$	1M	t without 100%
		= 400	11/1	accept without 100%
		=15%	1A	
			(4)	
			(.)	

Solution	Marks	Remarks
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 .	1A 1M+1A 1A	1M for $3x + (a - x)$
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 .	1A 1M + 1A 1A	1M for $3x + y$
	(4)	Shi tagaharif
(a) $\frac{1}{3}\pi r^2(12) = 2\left[\frac{1}{2}\left(\frac{4}{3}\pi r^3\right)\right]$	1M	for $V_1 = 2V_2$
r=3	1A	u−1 for having unit
(b) The required volume $= \frac{1}{2} \left(\frac{4}{3} \pi r^3 \right) + \frac{1}{3} \pi r^2 (12)$ $= \frac{2}{3} \pi (3^3) + 4\pi (3^2)$	1M	
$= 54\pi \text{ cm}^3$	1A	u-1 for missing unit
The required volume $= \frac{3}{2} \left(\frac{4}{3} \pi r^3 \right)$ $= 2\pi (3^3)$	1M	
$= 2\pi(3)$ $= 54\pi \text{ cm}^3$	1A	u-1 for missing unit
	(4)	
Note that $\angle ABD = 90^{\circ}$.	1A	100 = 30
Also note that $\angle COD = \angle BAD = 38^{\circ}$.	1M	arral Significaçõe está par
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 $\angle ODC = 71^{\circ}$.	1M	
$\angle BDC$ = $\angle ODC - \angle ADB$		nginkaijan ats amë mmag ta 1 mërdil
$=71^{\circ} - 52^{\circ}$ = 19°	1A	u-1 for missing unit
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, $\angle BDC = \frac{1}{2} \angle BOC$ $= \frac{1}{2} (38^{\circ})$	1A 1M 1M	
= 19°	1A	u-1 for missing unit
	(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	either one
		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 negative equal to -1 . Thus, AA' is not perpendicular to OA'' .	1M 1A	f.t.
		alargh-ocal to he		
				Landon la moran et 2 1 S
9.	(a)	x(1+20%) = 72	1M	, (0)46 = (ma els6 =) -
		$x = \frac{72}{1 + 20\%}$ $x = 60$	1A	u-1 for having unit
	(b)	Let y be the angle subtended at the centre for the sector representing District C .	g	
		y = 360° - 72° - 120° - 30° - 60° = 78°	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 A	C. 1M	1011 - 5 A177 S
			16	
		97		

(a) The quotient $= 5x + 2$	e en la maria de	Solution	Marks	Remarks
(ii) $g(x) = 0$ $(5x + 2)(x^2 + 2x - 3) = 0$ (5x + 2)(x - 3)(x - 1) = 0 Thus, we have $x = \frac{-2}{5}$, $x = -3$ or $x = 1$. (a) Let $C = as + bs^2$, where a and b are non-zero constants. $\begin{cases} a(2) + b(2^2) = 356 \\ a(5) + b(5^2) = 1250 \end{cases}$ Solving, we have $a = 130$ and $b = 24$. The required cost $= 130(6) + 24(6^2)$ $= 1644 (b) $130s + 24s^2 = 539$ $24s^2 + 130s - 539 = 0$ $(4s - 11)(6s + 49) = 0$ $s = \frac{11}{4}$ or $s = \frac{-49}{6}$ (rejected) Thus, the perimeter of the carpet is 2.75 metres.	. (a)			1M for division process
$(5x+2)(x^2+2x-3) = 0 \\ (5x+2)(x+3)(x-1) = 0 \\ \text{Thus, we have } x = \frac{-2}{5}, \ x = -3 \text{ or } x = 1.$ $\begin{cases} a(2) + b(2^2) = 356 \\ a(5) + b(5^2) = 1250 \end{cases}$ Solving, we have $a = 130$ and $b = 24$. The required cost $= 130(6) + 24(6^2)$ $= \$1644$ $(b) 130s + 24s^2 = 539$ $24s^2 + 130s - 539 = 0$ $(4s-11)(6s+49) = 0$ $s = \frac{11}{4} \text{ or } s = \frac{-49}{6} \text{ (rejected)}$ Thus, the perimeter of the carpet is 2.75 metres.	(b)	(i) $a = 2$ and $b = -1$	1A	for both correct
$\begin{cases} a(2) + b(2^2) = 356 \\ a(5) + b(5^2) = 1250 \end{cases}$ Solving, we have $a = 130$ and $b = 24$. The required cost $= 130(6) + 24(6^2)$ $= \$1644$ $(b) 130s + 24s^2 = 539$ $24s^2 + 130s - 539 = 0$ $(4s - 11)(6s + 49) = 0$ $s = \frac{11}{4} \text{ or } s = \frac{-49}{6} \text{ (rejected)}$ Thus, the perimeter of the carpet is 2.75 metres. IM for substitution $1A$ $u-1 \text{ for missing unit}$		$(5x+2)(x^2+2x-3) = 0$ (5x+2)(x+3)(x-1) = 0	1A 1M	for using (a)
Solving, we have $a = 130$ and $b = 24$. The required cost $= 130(6) + 24(6^{2})$ $= 1644 1A (4) (b) $130s + 24s^{2} = 539$ $24s^{2} + 130s - 539 = 0$ $(4s - 11)(6s + 49) = 0$ $s = \frac{11}{4} \text{ or } s = \frac{-49}{6} \text{ (rejected)}$ Thus, the perimeter of the carpet is 2.75 metres.	(a)	$\int a(2) + b(2^2) = 356$		for substitution
(b) $130s + 24s^2 = 539$ $24s^2 + 130s - 539 = 0$ (4s - 11)(6s + 49) = 0 $s = \frac{11}{4}$ or $s = \frac{-49}{6}$ (rejected) Thus, the perimeter of the carpet is 2.75 metres. 1A u-1 for missing unit		Solving, we have $a = 130$ and $b = 24$. The required cost	1A	for both correct
$24s^{2} + 130s - 539 = 0$ $(4s - 11)(6s + 49) = 0$ $s = \frac{11}{4} \text{ or } s = \frac{-49}{6} \text{ (rejected)}$ Thus, the perimeter of the carpet is 2.75 metres. 1A u-1 for missing unit		= \$ 1 644	1	u-1 for missing unit
Thus, the perimeter of the carpet is 2.75 metres. u-1 for missing unit	(b)	$24s^2 + 130s - 539 = 0$ $(4s - 11)(6s + 49) = 0$		
			(2)	u-1 for missing unit
			-	
				,

	Solution	Marks	Remarks
2. (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. $\frac{18-4}{x} = 56$ $x = \frac{1}{4}$	1M	
	Thus, John will reach C at 8:26.	1A (2)	
(c)	The average speed $= \frac{27}{\frac{30}{60}}$ $= 54 \text{ km/h}$	1M	for $\frac{27}{30}$
	$=\frac{(54)(1000)}{3600}$	1M	10C=018=0 m
	= 15 m/s	1A (3)	
			(0 MG = 1946) 644 1
			,
			¥
	99		

-		Solution	Marks	Remarks
. (a)	Not	te that the equation of L_1 is $4x - 3y + 12 = 0$.		mitesers of 5 mm
	So,	the slope of L_1 is $\frac{4}{3}$.	114	P - ward Da son
	The	erefore, the slope of L_2 is $\frac{-3}{4}$.	1M	
		e equation of L_2 is		
)	$y - 9 = \frac{-3}{4}(x - 4)$	1M	E 10 21 58 J.
	3	3x + 4y - 48 = 0	1A (3)	=8.0 (I) (II)
(b)	(i)	Note that Γ is the perpendicular bisector of AB . Also, AB is perpendicular to L_2 .	1M	accept Γ is a straight line
		Thus, Γ is parallel to L_2 .	1A	=
	(ii)	The slope of Γ is $\frac{-3}{4}$.	1M	to a diameter
		Putting $x = 0$ in $4x - 3y + 12 = 0$, we have $y = 4$. So, we have $B = (0, 4)$. Note that L_2 cuts the y-axis at $C(0, 12)$.	1A	
		The mid-point of BC is $(0,8)$. The required equation is	1M	
		$y = \frac{-3}{4}x + 8$ $3x + 4y - 32 = 0$	1A	
		By solving $\begin{cases} 4x - 3y + 12 = 0 \\ 3x + 4y - 48 = 0 \end{cases}$, we have $A = \left(\frac{96}{25}, \frac{228}{25}\right)$. Putting $x = 0$ in $4x - 3y + 12 = 0$, we have $y = 4$.	1M	either one
		So, we have $B = (0, 4)$. The required equation is	1A	
		$\sqrt{(x-0)^2 + (y-4)^2} = \sqrt{\left(x - \frac{96}{25}\right)^2 + \left(y - \frac{228}{25}\right)^2}$	1M	
		3x + 4y - 32 = 0	1A	
		The slope of Γ is $\frac{-3}{4}$.	1M	
		By solving $\begin{cases} 4x - 3y + 12 = 0 \\ 3x + 4y - 48 = 0 \end{cases}$, we have $A = \left(\frac{96}{25}, \frac{228}{25}\right)$. Putting $x = 0$ in $4x - 3y + 12 = 0$, we have $y = 4$.		either one
		So, we have $B = (0, 4)$.	1A	,
		The mid-point of AB is $\left(\frac{48}{25}, \frac{164}{25}\right)$.	1M	
		The required equation is $y - \frac{164}{25} = \frac{-3}{4} \left(x - \frac{48}{25} \right)$ $3x + 4y - 32 = 0$	1A	
			(6)	

			Solution		Marks	Remarks
4. ((a)	The median = 62%			1A	
		The mean $= \frac{55\% + 58\% + 62\% + 6}{12}$	52% + 63%			eth million the
		5 = 60%			1A (2)	at temperatural
((b)	(i) 58%			1A	Haller three
		(ii) $a = 63$ b = 57			1M 1M	1M for either one of the following conditions satisfied:
					the statement of the st	(1) $a+b=120$ (2) $\begin{cases} a \ge 62 \\ 0 \le b < 62 \end{cases}$ or $\begin{cases} 0 \le a < 62 \\ b \ge 62 \end{cases}$
					(3)	A to special training
((c)	Note that the data are co Also note that the week the Thus, the claim is disagr	may not be randomly		1M 1M	accept any suitable reason
		Note that the number of Also note that the stall m Further note that the wee Thus, the claim is agreed	ay be randomly select k may be randomly s	cted.	1M 1M	accept any suitable reason
					(2)	1 - 71 - 3 1 1
					i est est	W. Clark VIII
					2 (1 - 1 - 1) 2 (1 - 1) 3 (1)	
				(E-1/1)		a light all a
					0-	1-92 ()
						11- te seula of t
) e li e qui	and self-in-
						of the second second
						in tribigation will
						, , ,
				101		

Solution	Marks	Remarks
Let n be the number of rows of seats.		
$\frac{\pi}{2}(2(12) + (n-1)3) \le 930$	1M	for sum of arithmetic sequence
		and the sequence
$\frac{3m^2}{2} + \frac{21n}{2} - 930 \le 0$	1M	for quadratic inequality in n
$m^2 + 7n - 620 \le 0$		
$\frac{-7 - \sqrt{2529}}{2} \le n \le \frac{-7 + \sqrt{2529}}{2}$	1A	accept $-28.6 \le n \le 21.6$
Therefore, the greatest value of n is 21.	1A	Gri- ud
Thus, the greatest number of rows of seats is 21.	(4)	A TO TA
		1.00
(a) The required probability		
$=\frac{C_2^5 C_2^4}{C_4^9}$	1M + 1A	1M for numerator using C_2^n , $n=4$
	IM + IA	1A for denominator
$=\frac{10}{21}$	1A	r.t. 0.476
The required and billy		
The required probability $= 6(5)(4)(4)(3)$		1M for $\left(\frac{r}{r}\right)\left(\frac{r-1}{r-1}\right)\left(\frac{r-2}{r-2}\right)$
$= 6\left(\frac{5}{9}\right)\left(\frac{4}{8}\right)\left(\frac{4}{7}\right)\left(\frac{3}{6}\right)$	1M + 1A	$\begin{cases} 1M & \text{for } \left(\frac{r}{n}\right)\left(\frac{r-1}{n-1}\right)\left(\frac{r-1}{n-2}\right)\left(\frac{r-2}{n-3}\right) \\ 1A & \text{for } 6p, 0$
$=\frac{10}{21}$	1A	r.t. 0.476
21	(3)	
(b) The required probability		
$=1-\frac{10}{21}$	1M	for 1 – (a)
$=\frac{11}{21}$		101 1 (4)
$-{21}$	1A	r.t. 0.524
The required probability		
$=\frac{C_4^5 + C_4^4 + C_1^5 C_3^4 + C_3^5 C_1^4}{C_4^9}$	1M	for considering 4 cases
	1141	for considering 4 cases
$=\frac{11}{21}$	1A	r.t. 0.524
The required probability		
$= \left(\frac{5}{9}\right)\left(\frac{4}{8}\right)\left(\frac{3}{7}\right)\left(\frac{2}{6}\right) + \left(\frac{4}{9}\right)\left(\frac{3}{8}\right)\left(\frac{2}{7}\right)\left(\frac{1}{6}\right) + 4\left(\frac{5}{9}\right)\left(\frac{4}{8}\right)\left(\frac{3}{7}\right)\left(\frac{2}{6}\right) + 4\left(\frac{5}{9}\right)\left(\frac{4}{8}\right)\left(\frac{3}{7}\right)\left(\frac{4}{6}\right)$) 116	
$(9 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$) IM	for considering 10 cases
$=\frac{11}{21}$	1A	r.t. 0.524
	(2)	

Altern 7	Solutio	n		Marks	Remarks
Note that $6.4 = \log_8 E$.				pure to a	197 (1175 (111 11 11 11 11 11 11 11 11 11 11 11 1
Therefore, we have $E = 8^{6.4}$. 50			1A	-0.7 × (10 10.6 c)
Also note that $M = \log_4 E$					
$M = \log_4(8^{6.4})$				1A	0.000 - 72 2
$4^M = 8^{6.4}$					
$(2^2)^M = (2^3)^{6.4}$				1M	
$2^{2M} = 2^{19.2}$					
2M = 19.2				1M	
M = 9.6				1A	
Thus, the magnitude of the ex	xplosion or	Scale A is 9.6.		100	
M					
$=\log_4 E$					
$-\frac{\log_8 E}{}$				1A	
$=\frac{\log_8 E}{\log_8 4}$			-	IA	
6.4				1M + 1A	
$=\frac{1}{\log_8(8^{\frac{2}{3}})}$				IIVI - IA	Tests of the second
10g ₈ (8°)					
$=\frac{6.4}{\frac{2}{3}}$				1M	for denominator
3				To Harrison	
= 9.6				1A	
Thus, the magnitude of the ex	plosion on	Scale A is 9.6.		(5)	
				(3)	
					people's residence and
					1,1-
					The state of the s
					1.4
				The state	of the property of the
					State (15) etc.)
				The San Area	21/20/7000
					-
			03		

		Solution	Marks	Remarks
(2)	sin 4 BC BI	$\frac{45^{\circ}}{45^{\circ}} = \frac{1}{\sin 30^{\circ}}$ $= 20\sqrt{2} \text{ cm}$	1M 1A	accept finding CD and using sine twice
		$0\sqrt{2}\cos 30^{\circ}$ $0\sqrt{6}$ cm	1A (3)	
(b)	(i)	Note that the required angle is $\angle ADB$.	1A	
		Also note that $AD = 20 \cos 45^\circ = 10\sqrt{2} \text{ cm}$.		
		By cosine formula, $\cos \angle ADB = \frac{(10\sqrt{6})^2 + (10\sqrt{2})^2 - 18^2}{2(10\sqrt{6})(10\sqrt{2})}$ $\angle ADB \approx 46.60320866^{\circ}$	1M	accept using Pythagoras' theorem twice
		∠ <i>ADB</i> ≈ 46.6°	1A	mail our a
	(ii)	Note that $AD = CD = 10\sqrt{2}$ cm. Also note that $\angle ADC = 90^{\circ}$. The volume of the tetrahedron $ABCD$		
		$= \frac{1}{3} \left(\frac{1}{2} (AD)(BD) \sin \angle ADB \right) (CD)$	1M	
		$= \frac{1}{3} \left(\frac{1}{2} (10\sqrt{2})(10\sqrt{6})(\sin \angle ADB) \right) (10\sqrt{2})$		either one
		$=\frac{1000\sqrt{6}\sin\angle ADB}{3}$		
		So, the volume of the tetrahedron varies directly as $\sin \angle ADB$.		
		When $\angle ADB$ increases from 40° to 90°, the volume of the	1	
		tetrahedron $ABCD$ increases. When $\angle ADB$ increases from 90° to 140°, the volume of the tetrahedron $ABCD$ decreases.	} 1A	
		The volume of the tetrahedron ABCD		
		$=\frac{1}{3}$ (The area of $\triangle ACD$)(BD sin $\angle ADB$)	1M	
		Since the area of $\triangle ACD$ and the length of BD are constants,	1	either one
		the volume of the tetrahedron varies directly as $\sin \angle ADB$.		
		When $\angle ADB$ increases from 40° to 90°, the volume of the		
		tetrahedron $ABCD$ increases. When $\angle ADB$ increases from 90° to 140°, the volume of the		
		tetrahedron ABCD decreases.	(5)	,
				Markey of State
		104		

). (a)			Solution		Marks	Remarks
	(i)	Join C and D $\angle CDB = \angle CAD$ $\angle QCD = \angle CAD$ $\angle QCD = \angle CD$ So, $\angle CAB = \angle CD$ $AE = AE$ $AB = AD$ $\triangle ABE \cong \triangle ABD$	B D B CCAD	(∠s in the same segment) (∠ in alt segment) (alt. ∠s, PQ // BD) (common side) (given) (SAS)		
		Marking Sche	me:	ith correct reasons.	3	
		Case 2 Any	correct proof w		2	
	(ii)	of $\angle BAD$. S By (a)(i), $\angle A$. Therefore, $\angle A$.	o, AC must pass $ED = \angle AEB$. No $AED = \angle AEB = 9$	Therefore, AC is the angle bisector is through the in-centre of $\triangle ABD$. Note that $\angle AED + \angle AEB = 180^{\circ}$.	1A	1A for any one correct
		passing through Also, $BE = D$ passes through Also note that	h A and E . E. Therefore, A the centroid of AC is the perpendicular.	ndicular bisector of BD. So, AC	1A	1A for any one correct 1A for any two correct
		Therefore, the circumcentre li	e on the straight ntre, the orthocer	the of $\triangle ABD$. The centroid and the line passing through A and C . The centroid and the line, the centroid and the	1A	f.t.
(b)				circle is $\frac{14+4}{2} = 9$. centre of the circle.	1A	
	$\sqrt{(9)}$	$(-4)^2 + (t-4)^2$	$= \sqrt{(9-8)^2 + (t-1)^2}$	$\overline{\cdot 12)^2}$	1M	Table to the first of
	t = -	$\frac{13}{2}$ the slope of the tage slope of BD	angent PQ			
	$=\frac{12}{8}$ $=2$	2-4			1M	for slope formula
	$= \frac{12}{8}$ $= 2$ Let	(a, b) be the c	oordinates of C			The second
	$= \frac{12}{8}$ $= 2$ Let Note	(a,b) be the ce that AC passes	s through the cen	tre of the circle.	1M 1M 1M	for slope formula can be absorbed for mid-point formula
	$= \frac{12}{8}$ $= 2$ Let Note Ther	(a,b) be the ce that AC passes	is through the center of $\frac{14}{2} = 9$ and $\frac{b+2}{2}$ and $\frac{b+3}{2}$ and $\frac{b+3}{2}$ on is	tre of the circle.	1M	can be absorbed
	$= \frac{12}{8}$ $= 2$ Let Note Ther	(a,b) be the central that AC passes in, we have $\frac{a+\frac{1}{2}}{2}$ we have $a=4$ required equation $y-9=2(x-4)$	is through the center of $\frac{14}{2} = 9$ and $\frac{b+2}{2}$ and $\frac{b+3}{2}$ and $\frac{b+3}{2}$ on is	tre of the circle.	1M 1M	can be absorbed

$\sqrt{(9-4)^2 + (t-4)^2} = \sqrt{(9-8)^2 + (t-12)^2}$ $t = \frac{13}{2}$ $t = \frac{13}{2}$ So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ $= \text{the slope of } BD$ $= \frac{12-4}{8-4}$ $= 2$ Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. For tangency, we have $\Delta = 0$. 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. $\begin{bmatrix} 14^2 + 4^2 + k_1(14) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 4^2 + k_1(2) + k_2(2) + k_3 = 0 \\ 4^2 + 2^2 + k_1(2) + k_2(2) + k_1(2) + k_2(2) + k_1(2) +$	Solution	Marks	Remarks
Let $(9,t)$ be the coordinates of the centre of the circle. $\sqrt{(9-4)^2+(t-4)^2} = \sqrt{(9-8)^2+(t-12)^2}$ $t = \frac{13}{3}$ So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. IM The slope of the tangent PQ the slope of BD $= \frac{12-4}{8-4}$ $= 2$ Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. IM Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. For tangency, we have $-6x + 2x + $	The x-coordinate of the centre of the circle is $\frac{14+4}{14+4} = 9$	1.4	
$\sqrt{(9-4)^2 + (t-4)^2} = \sqrt{(9-8)^2 + (t-12)^2}$ $t = \frac{13}{2}$ $t = \frac{13}{2}$ The slope of the tangent PQ $the slope of the tangent PQ the slope of PD = \frac{12-4}{8-4} = 2 Let the equation of the tangent be y = 2x + k, where k is a constant. Putting y = 2x + k in x^2 + y^2 - 18x - 13y + 92 = 0, we have x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0. Therefore, we have 5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0. For tangency, we have \Delta = 0. (4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0 k^2 + 23k - 24 = 0 k = 1 \text{ or } k - 24 \text{ (rejected)} Thus, the required equation is 2x - y + 1 = 0. Let the equation of the circle be x^2 + y^2 + k_1x + k_2y + k_3 = 0, where k_1, k_2 and k_3 are constants. [14^2 + 4^2 + k_1(14) + k_2(4) + k_3 = 0 4^2 + 2^2 + k_1(4) + k_2(4) + k_3 = 0 4^2 + 2^2 + k_1(4) + k_2(4) + k_3 = 0 Solving, we have k_1 = -18, k_2 = -13 and k_3 = 92. Solving, we have k_1 = -18, k_2 = -13 and k_3 = 92. The slope of the tangent PQ = \text{the slope of } BD = \frac{12-4}{8-4} = 2 Let the equation of the circle is x^2 + y^2 - 18x - 13y + 92 = 0. The slope of the tangent PQ = \text{the slope of } BD = \frac{12-4}{8-4} = 2 Let the equation of the tangent be y = 2x + k, where k is a constant. Putting y = 2x + k in x^2 + y^2 - 18x - 13y + 92 = 0, we have x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0. Therefore, we have 5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0. For tangency, we have \Delta = 0. (4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0 k^2 + 23k - 24 = 0$		171	
So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ = the slope of BD = $\frac{12 - 4}{8 - 4}$ = 2 Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. For tangency, we have $\Delta = 0$. Let the equation of the since be $(4k - 44)x + (k^2 - 13k + 92) = 0$. For tangency, we have $\Delta = 0$. Let the equation of the circle be $(4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0$. Let the equation of the circle be $(4k - 44)x + (4k - 44$		1M	
So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ = the slope of BD = $\frac{12-4}{8-4}$ = 2 Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $\Delta = 0$. $(4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0$ $k^2 + 23k - 24 = 0$ $k^2 + 23k - 24 = 0$ $k^2 + 2^2 + k$, $k^2 + k + k + k + k + k + k + k + k + k + $		1111	
The slope of the tangent PQ = the slope of BD = $\frac{12-4}{8-4}$ = 2 Let the equation of the tangent be $y=2x+k$, where k is a constant. Putting $y=2x+k$ in $x^2+y^2-18x-13y+92=0$, we have $x^2+(2x+k)^2-18x-13(2x+k)+92=0$. Therefore, we have $5x^2-(4k-44)x+(k^2-13k+92)=0$. 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) Thus, the required equation is $2x-y+1=0$. 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. $\begin{bmatrix} 14^2+4^2+k_1(4)+k_2(4)+k_3=0\\ 4^2+2^2+k_1(4)+k_2(4)+k_3=0\\ 82+12^2+k_1(4)+k_2(4)+k_3=0\\ 820 \text{ long}, \text{ we have } k_1=-18$, $k_2=-13$ and $k_3=92$. So, the equation of the circle is $x^2+y^2-18x-13y+92=0$. The slope of the tangent PQ = the slope of BD $\frac{12-4}{8-4}=2$ Let the equation of the tangent be $y=2x+k$, where k is a constant. Putting $y=2x+k$ in $x^2+y^2-18x-13y+92=0$, we have $x^2+(2x+k)^2-18x-13(2x+k)+92=0$. Therefore, we have $5x^2-(4k-44)x+(k^2-13k+92)=0$. 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)	$t = \frac{13}{2}$		
Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. For tangency, we have $\Delta = 0$. $(4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0$ IM $k^2 + 23k - 24 = 0$ $k = 1 \text{ or } k = -24 \text{ (rejected)}$ Thus, the required equation is $2x - y + 1 = 0$. IA 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. $\begin{bmatrix} 14^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \\ 8^2 + 12^2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. IM The slope of the tangent PQ ethe slope of BD = $\frac{12 - 4}{8 - 4}$ IM for slope formula $\frac{12 - 4}{8 - 4} = 2$ Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. For tangency, we have $\Delta = 0$. $(4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0$ $k^2 + 23k - 24 = 0$	The slope of the tangent PQ	1M	
Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. For tangency, we have $\Delta = 0$. $(4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0$ IM $k^2 + 23k - 24 = 0$ $k = 1 \text{ or } k = -24 \text{ (rejected)}$ Thus, the required equation is $2x - y + 1 = 0$. 1A 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. $\begin{bmatrix} 14^2 + 4^2 + k_1(14) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ IA $\begin{bmatrix} 14^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ IS Solving, we have $k_1 - 18$, $k_2 - 13$ and $k_3 = 92$. $\begin{bmatrix} 14 + 4 + 2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ IM for solving So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. $\begin{bmatrix} 14 + 4 + 2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ IM for slope formula $\begin{bmatrix} 14 + 4 + 2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 2^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ IM for slope formula $\begin{bmatrix} 14 + 4 + 2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ IM for slope formula $\begin{bmatrix} 14 + 4 + 2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 2^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ IM for slope formula $\begin{bmatrix} 14 + 4 + 2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 2^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ IM for slope formula $\begin{bmatrix} 14 + 4 + 2 + k_1(4) + k_2(4) + k_3 = 0 \\ 4^2 + 2^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ IM for slope formula $\begin{bmatrix} 14 + 4 + k_1(4) + k_1(4) + k_2(4) + k_1(4) + k$		1M	for slope formula
$x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0.$ Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. For tangency, we have $\Delta = 0$. $(4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0$ $k^2 + 23k - 24 = 0$ $k = 1 \text{ or } k = -24 \text{ (rejected)}$ Thus, the required equation is $2x - y + 1 = 0$. Let the equation of the circle be $x^2 + y^2 + k_1x + k_2y + k_3 = 0, \text{ where } k_1, k_2 \text{ and } k_3 \text{ are constants.}$ $\begin{bmatrix} 14^2 + 4^2 + k_1(14) + k_2(4) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ $\begin{cases} 8^2 + 12^2 + k_1(8) + k_2(12) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{cases}$ Solving, we have $k_1 = -18$, $k_2 = -13$ and $k_3 = 92$. So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ = the slope of BD $= \frac{12 - 4}{8 - 4} = 2$ Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)	Let the equation of the tangent be $y = 2x + k$, where k is a constant.		
$(4k-44)^2-4(5)(k^2-13k+92)=0 \\ k^2+23k-24=0 \\ k=1 \text{ or } k=-24 \text{ (rejected)} \\ \text{Thus, the required equation is } 2x-y+1=0 \text{ .} \\ \text{Let the equation of the circle be} \\ x^2+y^2+k_1x+k_2y+k_3=0 \\ 8^2+12^2+k_1(3)+k_2(3)+k_3=0 \\ 4^2+4^2+k_1(4)+k_2(4)+k_3=0 \\ \text{Solving, we have } k_1=-18 \text{ , } k_2=-13 \text{ and } k_3=92 \text{ .} \\ \text{So, the equation of the circle is } x^2+y^2-18x-13y+92=0 \text{ .} \\ \text{The slope of the tangent } PQ \\ \text{the slope of } BD \\ =\frac{12-4}{8-4} \\ =2 \\ \text{Let the equation of the tangent be } y=2x+k \text{ , where } k \text{ is a constant.} \\ \text{Putting } y=2x+k \text{ in } x^2+y^2-18x-13y+92=0 \text{ , we have } x^2+(2x+k)^2-18x-13(2x+k)+92=0 \text{ .} \\ \text{Therefore, we have } 5x^2-(4k-44)x+(k^2-13k+92)=0 \text{ .} \\ \text{For tangency, we have } \Delta=0 \text{ .} \\ (4k-44)^2-4(5)(k^2-13k+92)=0 \\ k^2+23k-24=0 \\ k=1 \text{ or } k=-24 \text{ (rejected)} \\ \end{cases}$	$x^{2} + (2x + k)^{2} - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^{2} - (4k - 44)x + (k^{2} - 13k + 92) = 0$.	1M	
Thus, the required equation is $2x - y + 1 = 0$. 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. $\begin{bmatrix} 14^2 + 4^2 + k_1(14) + k_2(4) + k_3 = 0 \\ 8^2 + 12^2 + k_1(8) + k_2(12) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{bmatrix}$ Solving, we have $k_1 = -18$, $k_2 = -13$ and $k_3 = 92$. So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ = the slope of BD = $\frac{12 - 4}{8 - 4}$ = 2 Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)	$(4k - 44)^2 - 4(5)(k^2 - 13k + 92) = 0$	1M	
$x^2 + y^2 + k_1x + k_2y + k_3 = 0 \text{ , where } k_1 \text{ , } k_2 \text{ and } k_3 \text{ are constants.}$ $\begin{cases} 14^2 + 4^2 + k_1(14) + k_2(4) + k_3 = 0 \\ 8^2 + 12^2 + k_1(8) + k_2(12) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{cases}$ Solving, we have $k_1 = -18$, $k_2 = -13$ and $k_3 = 92$. So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ = the slope of BD = $\frac{12 - 4}{8 - 4}$ = 2 Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)		1A	
$x^2 + y^2 + k_1x + k_2y + k_3 = 0 \text{ , where } k_1 \text{ , } k_2 \text{ and } k_3 \text{ are constants.}$ $\begin{cases} 14^2 + 4^2 + k_1(14) + k_2(4) + k_3 = 0 \\ 8^2 + 12^2 + k_1(8) + k_2(12) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{cases}$ Solving, we have $k_1 = -18$, $k_2 = -13$ and $k_3 = 92$. So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ = the slope of BD = $\frac{12 - 4}{8 - 4}$ = 2 Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)	Let the equation of the circle be		
$\begin{cases} 14^2 + 4^2 + k_1(14) + k_2(4) + k_3 = 0 \\ 8^2 + 12^2 + k_1(8) + k_2(12) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{cases}$ Solving, we have $k_1 = -18$, $k_2 = -13$ and $k_3 = 92$. So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ $= \text{the slope of } BD$ $= \frac{12 - 4}{8 - 4}$ $= 2$ Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)			
$\begin{cases} 8^2 + 12^2 + k_1(8) + k_2(12) + k_3 = 0 \\ 4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0 \end{cases}$ Solving, we have $k_1 = -18$, $k_2 = -13$ and $k_3 = 92$. So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ $= \text{the slope of } BD$ $= \frac{12 - 4}{8 - 4}$ $= 2$ Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)	$\left[14^2 + 4^2 + k_1(14) + k_2(4) + k_3 = 0\right]$		and the second
Solving, we have $k_1 = -18$, $k_2 = -13$ and $k_3 = 92$. So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ = the slope of BD = $\frac{12 - 4}{8 - 4}$ = 2 Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)	$\begin{cases} 8^2 + 12^2 + k_1(8) + k_2(12) + k_3 = 0 \end{cases}$	1A	
Solving, we have $k_1 = -18$, $k_2 = -13$ and $k_3 = 92$. So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ = the slope of BD = $\frac{12 - 4}{8 - 4}$ = 2 Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)	$4^2 + 4^2 + k_1(4) + k_2(4) + k_3 = 0$		or final formation?
So, the equation of the circle is $x^2 + y^2 - 18x - 13y + 92 = 0$. The slope of the tangent PQ = the slope of BD = $\frac{12 - 4}{8 - 4}$ = 2 Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)		1M	for solving
The slope of the tangent PQ = the slope of BD = $\frac{12-4}{8-4}$ = 2 Let the equation of the tangent be $y=2x+k$, where k is a constant. Putting $y=2x+k$ in $x^2+y^2-18x-13y+92=0$, we have $x^2+(2x+k)^2-18x-13(2x+k)+92=0$. Therefore, we have $5x^2-(4k-44)x+(k^2-13k+92)=0$. 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)		00000000	
8-4 = 2 Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)	The slope of the tangent PQ		
Let the equation of the tangent be $y = 2x + k$, where k is a constant. Putting $y = 2x + k$ in $x^2 + y^2 - 18x - 13y + 92 = 0$, we have $x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)	8 – 4	1M	for slope formula
$x^2 + (2x + k)^2 - 18x - 13(2x + k) + 92 = 0$. Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)	Let the equation of the tangent be $y = 2x + k$, where k is a constant.		
Therefore, we have $5x^2 - (4k - 44)x + (k^2 - 13k + 92) = 0$. 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)			
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)		1M	F
$(4k-44)^{2}-4(5)(k^{2}-13k+92) = 0$ $k^{2}+23k-24 = 0$ $k=1 \text{ or } k=-24 \text{ (rejected)}$			-
$k^2 + 23k - 24 = 0$ k = 1 or $k = -24$ (rejected)		1 1 1	
k = 1 or $k = -24$ (rejected)		I IVI	
Thus, the required equation is $2x - y + 1 = 0$.	Thus, the required equation is $2x - y + 1 = 0$.	1A	
	106		

Paper 2

Question No.	Key	Question No.	Key
1.	C	31.	В
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.	Α	38.	A
9.	C	39.	A
10.	Α	40.	С
11.	C	41.	В
12.	В	42.	В
13.	D	43.	D
14.	C	44.	В
15.	В	45.	D
16.	В		
17.	A		
18.	В		
19.	A		
20.	Α		
21.	В		
22.	C		
23.	В		
24.	D		
25.	A		
26.	D		
27.	D		
28.	В		
29.	D		
30.	В		