2008 附加數學

評卷參考*

* 此部分只設英文版本。

Marking Scheme

This document was prepared for markers' reference. It should not be regarded as a set of model answers. Candidates and teachers who were not involved in the marking process are advised to interpret its contents with care.

General Instructions To Markers

1. It is very important that all markers should adhere as closely as possible to the marking scheme. In many cases, however, candidates will have obtained a correct answer by an alternative method not specified in the marking scheme. In general, a correct alternative solution 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 scheme.

2. For the convenience of markers, the marking scheme was written as detailed as possible. However, it is 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.

3. In marking candidates' work, the benefit of doubt should be given in the candidates' favour.

4. Unless the form of the answer is specified in the question, alternative simplified forms of answers different from those in the marking scheme should be accepted if they are correct.

5. Unless otherwise specified in the question, use of notations different from those in the marking scheme should not be penalised.

6. In the marking scheme, marks are classified into the following three categories:

'M' marks	–	awarded for applying correct methods
'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 the 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. (I.e. Markers should follow through candidates' work in awarding 'M' marks.) However, 'A' marks for the corresponding answers should NOT be awarded, unless otherwise specified.

7. In the marking scheme, steps which can be skipped are enclosed by dotted rectangles, whereas alternative answers are enclosed by solid rectangles.

8. (a) Unless otherwise specified in the question, numerical answers not given in exact values should not be accepted.
   (b) In case a certain degree of accuracy had been specified in the question, answers not accurate up to that degree should not be accepted. For answers with an excess degree of accuracy, deduct 1 mark (*pp*) for the first time it happened. In any case, do not deduct any marks for excess degree of accuracy in those steps where candidates failed to score any marks.

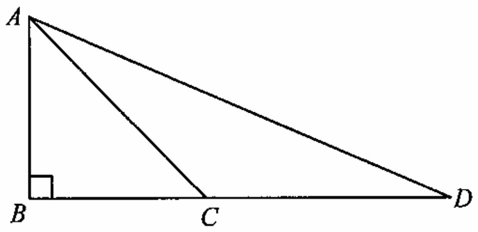
* 此部分只設英文版本。

9. Marks may be deducted for poor presentation (*pp*). The symbol (*pp-1*) should be used to denote 1 mark deducted for *pp*.
   (a) In section A, at most deduct 1 mark for *pp* in each question, up to a maximum of 2 marks. For similar *pp*, deduct 1 mark for the first time that it occurs. Do not penalize candidates twice in section A for the same *pp*.
   (b) In section B, at most deduct 1 mark for *pp* in the whole section.
   (c) In any case, do not deduct any marks for *pp* in those steps where candidates could not score any marks.

10. In section B, marks may be deducted for wrong / no unit (*u*). The symbol (*u-1*) should be used to denote 1 mark deducted for *u*.
   (a) At most deduct 1 mark for *u* in the whole section B.
   (b) In any case, do not deduct any marks for *u* in those steps where candidates could not score any marks.

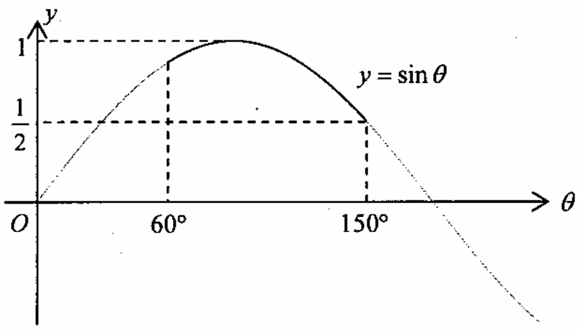
11. Marks entered in the Page Total Box should be the NET total scored on that page.

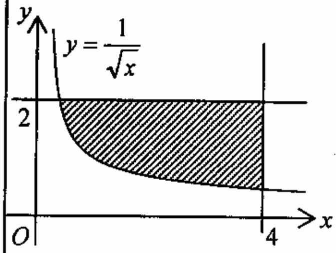
Solution	Marks	Remarks
1. $\int (8x+5)^{250}\,dx$		
$= \dfrac{(8x+5)^{251}}{251\,(8)} + c$	1M	For $\dfrac{(8x+5)^{251}}{251}$
$= \dfrac{(8x+5)^{251}}{2008} + c$	1A	(pp-1) if c was omitted
	(2)	
2. (a) $\left(2x+\dfrac{1}{x}\right)^3 = (2x)^3 + 3(2x)^2\left(\dfrac{1}{x}\right) + 3(2x)\left(\dfrac{1}{x}\right)^2 + \left(\dfrac{1}{x}\right)^3$	1M	For binomial coef. (1,3,3,1) (Accept C_r^3 notation)
Alternative Solution: $\left(2x+\dfrac{1}{x}\right)^3 = \left(2x+\dfrac{1}{x}\right)\left(4x^2+4+\dfrac{1}{x^2}\right)$	1A	For $4x^2+4+\dfrac{1}{x^2}$
$= 8x^3 + 12x + \dfrac{6}{x} + \dfrac{1}{x^3}$	1A	
(b) $(3x^2-x-5)\left(2x+\dfrac{1}{x}\right)^3 = (3x^2-x-5)\left(8x^3+12x+\dfrac{6}{x}+\dfrac{1}{x^3}\right)$		
$\therefore$ the coefficient of $x = 3\cdot 6 - 5\cdot 12$	1M	For collecting like terms
$= -42$	1A	
	(4)	
3. Let $t = \tan 22.5°$.		
$\because \tan(2\times 22.5°) = \dfrac{2\tan 22.5°}{1-\tan^2 22.5°}$	1M	For $45° = 2\times 22.5°$
$\therefore 1 = \dfrac{2t}{1-t^2}$	1A	OR $1 = \dfrac{2\tan 22.5°}{1-\tan^2 22.5°}$
$t^2 + 2t - 1 = 0$		
$t = \dfrac{-2+\sqrt{8}}{2}$ or $\dfrac{-2-\sqrt{8}}{2}$ (rejected since $t>0$)	1A	
i.e. $t = \sqrt{2}-1$	1A	
Alternative Solution (1)		
Let $t = \tan 22.5°$.		
$\tan 22.5° = \tan(45° - 22.5°)$	1M	For $22.5° = 45° - 22.5°$
$= \dfrac{\tan 45° - \tan 22.5°}{1+\tan 45°\tan 22.5°}$		
i.e. $t = \dfrac{1-t}{1+t}$	1A	OR $\tan 22.5° = \dfrac{1-\tan 22.5°}{1+\tan 22.5°}$
$t^2 + 2t - 1 = 0$		
$t = \dfrac{-2+\sqrt{8}}{2}$ or $\dfrac{-2-\sqrt{8}}{2}$ (rejected since $t>0$)	1A	
i.e. $t = \sqrt{2}-1$	1A	

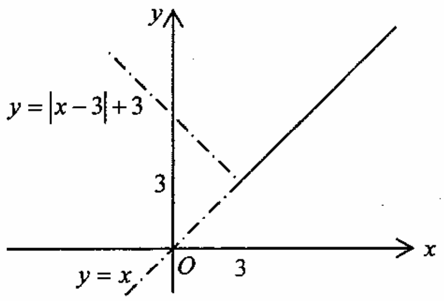
Solution	Marks	Remarks
Alternative Solution (2)		
$\tan 22.5° = \dfrac{\sin 22.5°}{\cos 22.5°}$		
$= \dfrac{2\sin 22.5° \cos 22.5°}{2\cos^2 22.5°}$		
$= \dfrac{\sin 45°}{1+\cos 45°}$	1M+1A	1M for $45° = 2 \times 22.5°$
$= \dfrac{\frac{1}{\sqrt{2}}}{1+\frac{1}{\sqrt{2}}}$	1A	
$= \dfrac{1}{\sqrt{2}+1}$	1A	
$= \sqrt{2}-1$		
Alternative Solution (3)		
$\tan 22.5° = \dfrac{\sin 22.5°}{\cos 22.5°}$		
$= \dfrac{\sqrt{\sin^2 22.5°}}{\sqrt{\cos^2 22.5°}}$ (since $\sin 22.5°$ and $\cos 22.5°$ are both positive)		
$= \sqrt{\dfrac{\frac{1}{2}(1-\cos 45°)}{\frac{1}{2}(1+\cos 45°)}}$	1M+1A	1M for $45° = 2 \times 22.5°$
$= \sqrt{\dfrac{1-\frac{1}{\sqrt{2}}}{1+\frac{1}{\sqrt{2}}}}$	1A	
$= \sqrt{\dfrac{\sqrt{2}-1}{\sqrt{2}+1}}$		
$= \sqrt{(\sqrt{2}-1)^2}$		
$= \sqrt{2}-1$	1A	
Alternative Solution (4)		
Construct a right-angled triangle ABC with $AB = BC = 1$ and extend BC to D such that $AC = CD$.	1M	
		
$\angle ACB = 45°$		
$\angle ADC = \dfrac{\angle ACB}{2} = 22.5°$	1A	
$AC = \sqrt{1^2+1^2} = \sqrt{2}$		
$\therefore CD = \sqrt{2}$	1A	

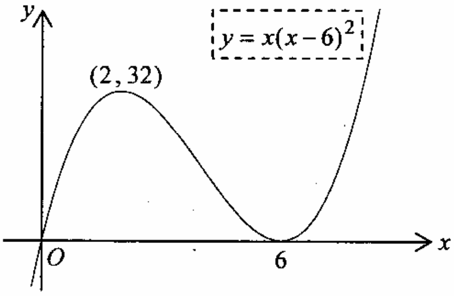
Solution	Marks	Remarks
$\because \tan\angle ADB = \dfrac{AB}{BD}$		
$\therefore \tan 22.5° = \dfrac{1}{1+\sqrt{2}}$	1A	
$= \sqrt{2}-1$		
	(4)	
4. Since the graph of $y = kx^2 - x + 9k$ lies below the x-axis,		
$(-1)^2 - 4(k)(9k) < 0$ and $k < 0$	1M+1A	1M for $\Delta < 0$ 1A for $k < 0$
Alternative Solution		
$kx^2 - x + 9k = k\left[x^2 - \dfrac{1}{k}x + \dfrac{1}{(2k)^2} - \dfrac{1}{4k^2}\right] + 9k$	1M	1M for completing square
$= k\left(x - \dfrac{1}{2k}\right)^2 + 9k - \dfrac{1}{4k}$		
Since the graph of $y = kx^2 - x + 9k$ lies below the x-axis, $9k - \dfrac{1}{4k} < 0$ and $k < 0$	1A	
$k^2 > \dfrac{1}{36}$ and $k < 0$		
$\left(k > \dfrac{1}{6} \text{ or } k < \dfrac{-1}{6}\right)$ and $k < 0$	1M	For solving a quad ineq correctly
$k < \dfrac{-1}{6}$	1A	
	(4)	
5. For $n = 1$,		
L.H.S. $= 1^3 = 1$		
R.H.S. $= \dfrac{1}{4}(1)^2(1+1)^2 = 1$		
$\therefore$ L.H.S. = R.H.S. and so the statement is true for $n = 1$.	1	(pp-1) if "the statement is true for $n = 1$ " was omitted
Assume $1^3 + 2^3 + 3^3 + \cdots + k^3 = \dfrac{1}{4}k^2(k+1)^2$, where k is a positive integer.	1	
$\therefore 1^3 + 2^3 + 3^3 + \cdots + k^3 + (k+1)^3 = \dfrac{1}{4}k^2(k+1)^2 + (k+1)^3$ (by the assumption)	1	
$= \dfrac{1}{4}(k+1)^2\left[k^2 + 4(k+1)\right]$		
$= \dfrac{1}{4}(k+1)^2(k+2)^2$	1	
$= \dfrac{1}{4}(k+1)^2[(k+1)+1]^2$		
Hence the statement is also true for $n = k+1$.		(pp-1) if this line was omitted
By the principle of mathematical induction, the statement is true for all positive integers n .	1	Follow through
	(5)	

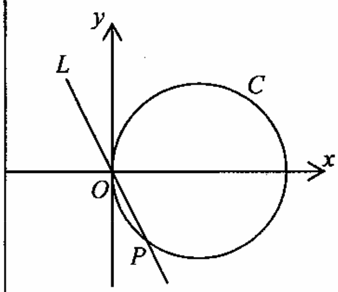
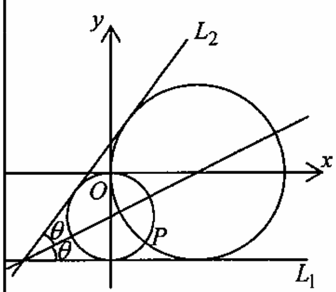
Solution	Marks	Remarks
6. $y=\dfrac{3x}{x^2+2}$		
$\dfrac{dy}{dx}=\dfrac{(x^2+2)(3)-(3x)(2x)}{(x^2+2)^2}$	1M+1A	OR $3(x^2+2)^{-1}+3x[-(x^2+2)^{-2}\cdot 2x]$ 1M for using differentiation
$=\dfrac{6-3x^2}{(x^2+2)^2}$		
$\therefore \left.\dfrac{dy}{dx}\right\|_{x=2}=\dfrac{-1}{6}$	1A	
Hence the equation of the tangent at $(2,1)$ is		
$y-1=\dfrac{-1}{6}(x-2)$	1M	For pt-slope form of tangent
Alternative Solution Let the equation of the tangent be $y=\dfrac{-1}{6}x+c$ $\therefore 1=\dfrac{-1}{6}(2)+c$ $c=\dfrac{4}{3}$	1M	
i.e. the equation of tangent is $x+6y-8=0$	1A	
	(5)	
7. $\because \overrightarrow{PB}=2\overrightarrow{AP}$		
$\therefore \overrightarrow{OP}=\dfrac{2\overrightarrow{OA}+\overrightarrow{OB}}{3}$	1M	For $\dfrac{2\mathbf{u}+\mathbf{v}}{3}$
$=\dfrac{2(2\mathbf{i}+3\mathbf{j})+(5\mathbf{i}+6\mathbf{j})}{3}$		
$=3\mathbf{i}+4\mathbf{j}$	1A	
Alternative Solution $\because \overrightarrow{PB}=2\overrightarrow{AP}$ $\therefore \overrightarrow{OB}-\overrightarrow{OP}=2(\overrightarrow{OP}-\overrightarrow{OA})$ $5\mathbf{i}+6\mathbf{j}-\overrightarrow{OP}=2\overrightarrow{OP}-2(2\mathbf{i}+3\mathbf{j})$ $\overrightarrow{OP}=3\mathbf{i}+4\mathbf{j}$	1M 1A	
$\left\|\overrightarrow{OP}\right\|=\sqrt{3^2+4^2}$	1M	
$=5$		
Hence the unit vector in the direction of $\overrightarrow{OP}=\dfrac{3\mathbf{i}+4\mathbf{j}}{5}$.	1M+1A	(pp-1) for omitting vector signs in most cases
	(5)	
8. Let P be (x,y) .		
$2x+y-3=0$ -- (1)		
$\left\|\dfrac{1}{2}\begin{vmatrix}1 & 3\\ 2 & 2\\ x & y\\ 1 & 3\end{vmatrix}\right\|=1$	1M	For $\dfrac{1}{2}\begin{vmatrix}1 & 3\\ 2 & 2\\ x & y\\ 1 & 3\end{vmatrix}$

Solution	Marks	Remarks
$2+2y+3x-6-2x-y=\pm 2$	1M	For expansion and $\pm$ sign
$x+y=6$ or $x+y=2$ ---------- (2)	1A	For either one
Alternative Solution		
Since P lies on $2x+y-3=0$, therefore we can let P be $(x,3-2x)$.	1A	OR $\left(\frac{3-y}{2},y\right)$
$\left\|\frac{1}{2}\begin{vmatrix}1 & 3\\ 2 & 2\\ x & 3-2x\\ 1 & 3\end{vmatrix}\right\|=1$	1M	For $\frac{1}{2}\begin{vmatrix}1 & 3\\ 2 & 2\\ x & 3-2x\\ 1 & 3\end{vmatrix}$
$2+6-4x+3x-6-2x-3+2x=\pm 2$	1M	For expansion and $\pm$ sign
Solving for x : $x=-3$ or 1	1A	OR $y=9$ or 1
$\therefore (x,y)=(-3,9)$ or $(1,1)$ (rejected since P lies on the 2nd quadrant)		
i.e. $(x,y)=(-3,9)$	1A	
	(5)	
9. (a) Let $\sin x+\sqrt{3}\cos x=r\sin(x+\alpha)$		
$=r\sin x\cos\alpha+r\cos x\sin\alpha$		
$\therefore r\cos\alpha=1$ and $r\sin\alpha=\sqrt{3}$		For either r or α
Solving, $r=2$ and $\alpha=60°$.	1A	(pp-1) for $\alpha=\frac{\pi}{3}$
i.e. $\sin x+\sqrt{3}\cos x=2\sin(x+60°)$	1A	(pp-1) if this line was omitted
(b) $\because 0°\le x\le 90°$		
$\therefore 60°\le x+60°\le 150°$		
		
Reading from the graph, $\frac{1}{2}\le\sin(x+60°)\le 1$	1M	
$\therefore 1\le 2\sin(x+60°)\le 2$		
Alternative Solution		
For $x=0°$, $\sin(x+60°)=\frac{\sqrt{3}}{2}$		
$y=\sin(x+60°)$ is increasing for $0°\le x\le 30°$		
For $x=30°$, $\sin(x+60°)=1$ which is the greatest value	1M	
$y=\sin(x+60°)$ is decreasing for $30°\le x\le 90°$		
For $x=90°$, $\sin(x+60°)=\frac{1}{2}$		
Hence the least value of $\sin(x+60°)=\frac{1}{2}$ for $0°\le x\le 90°$.		
Therefore the least value of $\sin x+\sqrt{3}\cos x$ is 1 ,	1A	
and the greatest value of $\sin x+\sqrt{3}\cos x$ is 2 .	1A	
	(5)	

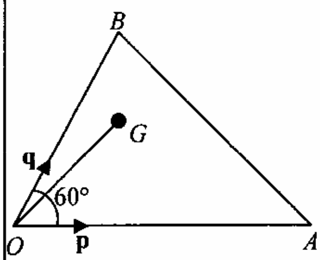
Solution	Marks	Remarks
10. Solving for x from $y=\frac{1}{\sqrt{x}}$ and $y=2$, we have $x=\frac{1}{4}$.	1A	
Area $=\int_{\frac{1}{4}}^{4}\left(2-\frac{1}{\sqrt{x}}\right)\mathrm{d}x$	1M+1A	1M for $\int(y_1-y_2)\,\mathrm{d}x$
$=\left[2x-2\sqrt{x}\right]_{\frac{1}{4}}^{4}$	1A	For $2x-2\sqrt{x}$
$=\frac{9}{2}$	1A	
Alternative Solution (1)		
Solving for x from $y=\frac{1}{\sqrt{x}}$ and $y=2$, we have $x=\frac{1}{4}$.	1A	
Area $=2\left(4-\frac{1}{4}\right)-\int_{\frac{1}{4}}^{4}\frac{1}{\sqrt{x}}\mathrm{d}x$	1M+1A	1M for "rectangle $-\int y\,\mathrm{d}x$ "
$=\frac{15}{2}-\left[2\sqrt{x}\right]_{\frac{1}{4}}^{4}$	1A	For $2\sqrt{x}$
$=\frac{9}{2}$	1A	
Alternative Solution (2)		
Solving for y from $y=\frac{1}{\sqrt{x}}$ and $x=4$, we have $y=\frac{1}{2}$.	1A	
Area $=\int_{\frac{1}{2}}^{2}\left(4-\frac{1}{y^2}\right)\mathrm{d}y$	1M+1A	1M for $\int(x_1-x_2)\,\mathrm{d}y$
$=\left[4y+\frac{1}{y}\right]_{\frac{1}{2}}^{2}$	1A	For $4y+\frac{1}{y}$
$=\frac{9}{2}$	1A	
	(5)	
11. (a) For $x\le 3$, $\lvert x-3\rvert+3=x$ becomes		
$-(x-3)+3=x$	1A	For $\lvert x-3\rvert=-(x-3)$
$x=3$	1A	
Alternative Solution		
$\lvert x-3\rvert+3=x$		
$\lvert x-3\rvert=x-3$		
$\therefore x-3\ge 0$	1A	
$x\ge 3$		
$\because x\le 3$, $\therefore$ the solution can only be $x=3$	1A	
(b) For $x>3$, $\lvert x-3\rvert+3=x$ becomes	1M	For considering $x>3$
$x-3+3=x$		
which is true for all real x		
Hence the solution in this case is $x>3$.	1A	
Hence the overall solution is $x\ge 3$.	1A	

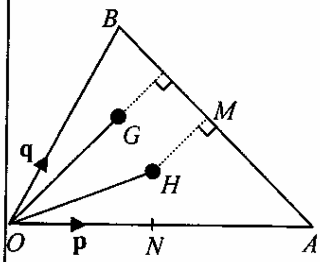
Solution	Marks	Remarks
Alternative Solution (1)		
$\lvert x-3\rvert+3=x$		
$\lvert x-3\rvert=x-3$		
$\therefore x-3\ge 0$	1M+1A	1M for using def. of $\lvert f(x)\rvert$
$x\ge 3$	1A	
Alternative Solution (2)		
	1M	For attempting to use graphical method (Drawing at least 1 line)
	1A	For either graph
From the graph, we see that the condition for $\lvert x-3\rvert+3=x$ is $x\ge 3$.	1A	
	(5)	
12. (a) The equation of L_2 is $x+ky=0$	1A	
Solving L_2 and $L_1: y=kx+1$, we have		
$x=\dfrac{-k}{k^2+1}$ ---------- (1)	1A	
$\therefore y=\dfrac{1}{k^2+1}$ ---------- (2)	1A	
i.e. the coordinates of P are $\left(\dfrac{-k}{k^2+1},\dfrac{1}{k^2+1}\right)$		
(b) $(1)\div(2)$: $k=\dfrac{-x}{y}$ ---------- (3)	1M	For writing k as the subject
Substitute (3) into (2) : $y=\dfrac{1}{\left(\dfrac{-x}{y}\right)^2+1}$	1M	For eliminating k
$\therefore 1=\dfrac{y}{x^2+y^2}$	1A	
Alternative Solution		
By (2), $k=\pm\sqrt{\dfrac{1}{y}-1}$ ---------- (3)	1M	Accept without $\pm$ sign
Substitute (3) into (2) : $x=\dfrac{\mp\sqrt{\dfrac{1}{y}-1}}{\dfrac{1}{y}-1+1}$	1M	
$\therefore x^2=y^2\left(\dfrac{1}{y}-1\right)$	1A	
i.e. $x^2+y^2-y=0$ (excluding $(0,0)$) which is the locus of P .		
	(6)	

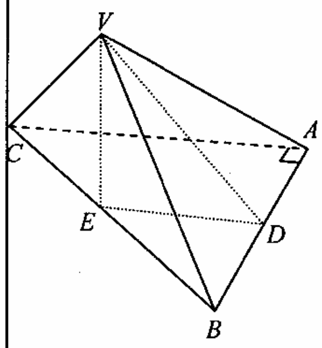
Solution	Marks	Remarks
13. (a) $y=x(x-6)^2$		
$\frac{dy}{dx}=(x-6)^2+x\cdot 2(x-6)$	1M	For product rule
$=3x^2-24x+36$		
Alternative Solution $y=x^3-12x^2+36x$ $\frac{dy}{dx}=3x^2-24x+36$	1M	
$\frac{dy}{dx}=0$		
$3x^2-24x+36=0$	1M	
$x=2$ or 6		
$\frac{d^2y}{dx^2}=6x-24$		
$\left.\frac{d^2y}{dx^2}\right\vert_{x=2}=-12<0$ and $\left.\frac{d^2y}{dx^2}\right\vert_{x=6}=12>0$	1M	OR using sign test
$\therefore$ maximum point is $(2,32)$ and minimum point is $(6,0)$.	1A+1A	
(b) 	1M 1A	For shape For all correct (pp-1) for axes or origin not labelled, or origin / arrow sign missed
	(7)	

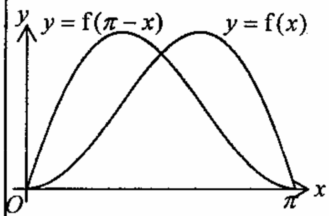
Solution	Marks	Remarks
14. (a) All circles in F pass through the intersections of $\begin{cases} x^2+y^2-10x=0 \\ 2x+y=0 \end{cases}$	1A	
Alternative Solution Substitute, say, $k=0$ into F: $x^2+y^2-10x=0$; Substitute, say, $k=1$ into F: $x^2+y^2-8x+y=0$	1A	
Solving, we get $\begin{cases} x=0 \\ y=0 \end{cases}$ or $\begin{cases} x=2 \\ y=-4 \end{cases}$		
$\therefore$ the coordinates of P are $(2,-4)$.	1A	
	(2)	
(b) $F: x^2+y^2+(2k-10)x+ky=0$	1A	
Centre of $F=\left(-k+5, \frac{-k}{2}\right)$	1A	
Let $x=-k+5$ and $y=\frac{-k}{2}$		
Eliminating k: $x=2y+5$ which is the required locus.	1M+1A	1M for elimination
Alternative Solution (1) The centres of circles in F lie on the straight line passing through the centre of $C: x^2+y^2-10x=0$ and perpendicular to $L: 2x+y=0$.		
Centre of $C=(5,0)$	1A	
Slope of $L=-2$	1A	
Hence the required locus is $y-0=\frac{1}{2}(x-5)$	1M	
i.e. $x-2y-5=0$	1A	
Alternative Solution (2) Since OP is a common chord to all circles in F, their centres lie on the perpendicular bisector of OP.		
Mid-point of $OP=(1,-2)$	1A	
Slope of $OP=-2$	1A	
Hence the required locus is $y+2=\frac{1}{2}(x-1)$	1M	
i.e. $x-2y-5=0$	1A	
	(4)	
(c) (i) By symmetry, L_1, L_2 and the straight line joining the two centres are concurrent.		
$\therefore Q$ is the intersection of $x-2y-5=0$ and $y+5=0$	1M	
Solving, $Q=(-5,-5)$	1A	
(ii) $x-2y-5=0$, whose slope is $\frac{1}{2}$, is the angle bisector of L_1 and L_2 .		
Let m be the slope of L_2 .		
$\therefore \left\lvert \dfrac{m-\frac{1}{2}}{1+\left(\frac{1}{2}\right)(m)} \right\rvert = \frac{1}{2}$	1M+1M	1M for $\frac{m_1-m_2}{1+m_1m_2}$; 1M for equating the slopes (Accept no absolute sign)
$m=\frac{4}{3}$ [or 0]	1A	

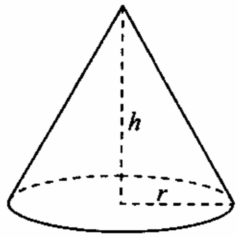
Solution	Marks	Remarks
Alternative Solution (1)		
Let the slope of $x-2y-5=0$ be $\tan\theta = \frac{1}{2}$.		
Therefore the slope of $L_2 = \tan 2\theta$	1M	1M for slope of $L_2 = \tan 2\theta$
$= \dfrac{2\left(\frac{1}{2}\right)}{1-\left(\frac{1}{2}\right)^2} = \dfrac{4}{3}$	1M+1A	1M for $\tan 2\theta = \dfrac{2\tan\theta}{1-\tan^2\theta}$
Alternative Solution (2)		
$\begin{cases} F: x^2+y^2+(2k-10)x+ky=0 \\ L_1: y+5=0 \end{cases}$		
$\therefore x^2+(-5)^2+(2k-10)x+k(-5)=0$		
$x^2+2(k-5)x+25-5k=0$		
For a circle in F touches L_1 ,		
$\Delta = 2^2(k-5)^2-4(25-5k)=0$	1M	OR use method of “$d = r$”
$k^2-5k=0$		
$k=0$ or 5		
For $k=0$, the circle is $x^2+y^2-10x=0$ with centre $(5,0)$ and $r=5$	1A	For the eq of circle with either $k=0$ or 5, which is $x^2+y^2+5y=0$
By (i), let L_2 be $y+5=m(x+5)$		
i.e. $mx-y+5m-5=0$		
$\left\lvert \dfrac{m(5)-0+5m-5}{\sqrt{m^2+(-1)^2}} \right\rvert = 5$	1M	OR use method of “$\Delta = 0$”
$3m^2-4m=0$		
$m=\frac{4}{3}$ or 0 (rej)		
Hence the equation of L_2 is $y+5=\frac{4}{3}(x+5)$		
i.e. $4x-3y+5=0$	1A	
Alternative Solution of (c) (i) and (ii)		
$\begin{cases} F: x^2+y^2+(2k-10)x+ky=0 \\ L_1: y+5=0 \end{cases}$		
$\therefore x^2+(-5)^2+(2k-10)x+k(-5)=0$		
$x^2+2(k-5)x+25-5k=0$		
For a circle in F touches L_1 ,		
$\Delta = 2^2(k-5)^2-4(25-5k)=0$	1M	OR use method of “$d = r$”
$k^2-5k=0$		
$k=0$ or 5		
For $k=0$, the circle is $x^2+y^2-10x=0$ with centre $(5,0)$ and $r=5$	} 1A	For the eq of BOTH circles
For $k=5$, the circle is $x^2+y^2+5y=0$ with centre $\left(0,\frac{-5}{2}\right)$ and $r=\frac{5}{2}$		

Solution	Marks	Remarks
Let L_2 be $mx-y+c=0$.		
If L_2 is a common tangent to the two circles, then		
$\left\lvert\dfrac{m(5)-0+c}{\sqrt{m^2+(-1)^2}}\right\rvert=5$ and $\left\lvert\dfrac{0-\left(\frac{-5}{2}\right)+c}{\sqrt{m^2+(-1)^2}}\right\rvert=\dfrac{5}{2}$	1M	OR use method of "$\Delta=0$"
$\therefore\begin{cases}10mc=25-c^2\\25m^2=4c^2+20c\end{cases}$		
Solving, $25\left(\dfrac{25-c^2}{10c}\right)^2=4c^2+20c$	1M	For eliminating m
$(5-c)^2(5+c)^2=4c^2\cdot 4c(c+5)$		
$(c+5)(15c^3+5c^2+25c-125)=0$		
$(c+5)(3c-5)(c^2+2c+5)=0$		
$c=\dfrac{5}{3}$ or -5		
$\therefore 10m\left(\dfrac{5}{3}\right)=25-\left(\dfrac{5}{3}\right)^2$ or $10m(-5)=25-(-5)^2$		
i.e. $m=\dfrac{4}{3}$ or 0		
Hence the equation of L_2 is $y=\dfrac{4}{3}x+\dfrac{5}{3}$	1A	
Therefore the intersection of L_1 and L_2 is $Q=(-5,-5)$.	1A	
	(6)	
15. (a) $\mathbf{p}\cdot\mathbf{q}=(1)(1)\cos 60^\circ$		
$=\dfrac{1}{2}$	1A	
	(1)	
(b) $\overrightarrow{OG}\cdot\overrightarrow{AB}=\left(\dfrac{2}{3}\mathbf{p}+\dfrac{5}{3}\mathbf{q}\right)\cdot(3\mathbf{q}-4\mathbf{p})$	1M	For considering $\overrightarrow{OG}\cdot\overrightarrow{AB}$
$=5\lvert\mathbf{q}\rvert^2+2\mathbf{p}\cdot\mathbf{q}-\dfrac{20}{3}\mathbf{p}\cdot\mathbf{q}-\dfrac{8}{3}\lvert\mathbf{p}\rvert^2$		
$=5(1)^2-\dfrac{14}{3}\left(\dfrac{1}{2}\right)-\dfrac{8}{3}(1)^2$	1M	
$=0$		
$\therefore OG\perp AB$	1	
$\overrightarrow{BG}\cdot\overrightarrow{OA}=\left(\dfrac{2}{3}\mathbf{p}+\dfrac{5}{3}\mathbf{q}-3\mathbf{q}\right)\cdot(4\mathbf{p})$	1A	For $\overrightarrow{BG}=\dfrac{2}{3}\mathbf{p}+\dfrac{5}{3}\mathbf{q}-3\mathbf{q}$
$=\dfrac{8}{3}\lvert\mathbf{p}\rvert^2-\dfrac{16}{3}\mathbf{p}\cdot\mathbf{q}$		
$=\dfrac{8}{3}(1)^2-\dfrac{16}{3}\left(\dfrac{1}{2}\right)$		Either one
$=0$		
$\overrightarrow{AG}\cdot\overrightarrow{OB}=\left(\dfrac{2}{3}\mathbf{p}+\dfrac{5}{3}\mathbf{q}-4\mathbf{p}\right)\cdot(3\mathbf{q})$		For $\overrightarrow{AG}=\dfrac{2}{3}\mathbf{p}+\dfrac{5}{3}\mathbf{q}-4\mathbf{p}$

Solution	Marks	Remarks
$= 5\lvert\mathbf{q}\rvert^2 - 10\mathbf{p}\cdot\mathbf{q}$		
$= 5(1)^2 - 10\left(\frac{1}{2}\right)$		
$= 0$		
Therefore G is the orthocentre of ΔOAB .	1	Follow through
	(5)	
(c) $\overrightarrow{HM} = t\left(\frac{2}{3}\mathbf{p} + \frac{5}{3}\mathbf{q}\right)$	1A	
$\overrightarrow{MN} = \frac{1}{2}\overrightarrow{BO} = \frac{-3\mathbf{q}}{2}$ (mid-point theorem)		
$\overrightarrow{HN} = \overrightarrow{HM} + \overrightarrow{MN}$	1M	OR $\overrightarrow{HM} + \overrightarrow{MO} + \overrightarrow{ON}$ OR $\overrightarrow{HM} + \overrightarrow{MA} + \overrightarrow{AN}$ OR $\overrightarrow{HM} + \overrightarrow{MB} + \overrightarrow{BO} + \overrightarrow{ON}$
$= \frac{2t}{3}\mathbf{p} + \left(\frac{5t}{3} - \frac{3}{2}\right)\mathbf{q}$	1A	
$\overrightarrow{HN}\cdot\overrightarrow{OA} = 0$		
$\left[\frac{2t}{3}\mathbf{p} + \left(\frac{5t}{3} - \frac{3}{2}\right)\mathbf{q}\right]\cdot(4\mathbf{p}) = 0$	1M	
$\frac{2t}{3}(1)^2 + \left(\frac{5t}{3} - \frac{3}{2}\right)\left(\frac{1}{2}\right) = 0$		
Alternative Solution $\overrightarrow{HN} // \overrightarrow{BG}$ $\left[\frac{2t}{3}\mathbf{p} + \left(\frac{5t}{3} - \frac{3}{2}\right)\mathbf{q}\right] // \left(\frac{2}{3}\mathbf{p} - \frac{4}{3}\mathbf{q}\right)$ $\frac{\frac{2t}{3}}{\frac{2}{3}} = \frac{\frac{5t}{3} - \frac{3}{2}}{\frac{-4}{3}}$	1M	
$t = \frac{1}{2}$	1A	
$\therefore \overrightarrow{OH} = \overrightarrow{OM} + \overrightarrow{MH}$		
$= \frac{4\mathbf{p} + 3\mathbf{q}}{2} - \left(\frac{1}{2}\right)\left(\frac{2}{3}\mathbf{p} + \frac{5}{3}\mathbf{q}\right)$		
$= \frac{5}{3}\mathbf{p} + \frac{2}{3}\mathbf{q}$	1A	(pp-1) for omitting vector / dot signs in most cases or using the expression $\mathbf{v}^2, \vec{v}^2$
Alternative Solution $\therefore \overrightarrow{OH} = \overrightarrow{ON} + \overrightarrow{NH}$ $= 2\mathbf{p} - \frac{2}{3}\left(\frac{1}{2}\right)\mathbf{p} - \left[\frac{5}{3}\left(\frac{1}{2}\right) - \frac{3}{2}\right]\mathbf{q}$ $= \frac{5}{3}\mathbf{p} + \frac{2}{3}\mathbf{q}$	1A	
	(6)	

Solution	Marks	Remarks
16. (a) $\because \angle VAB = 60° \neq 90°$,		
$\therefore$ the angle between the planes VAB and ABC cannot be represented by $\angle VAC$.	1	Follow through
	(1)	
(b) (i) $\because \Delta VAB$ is equilateral and D is the mid-point of AB,		
$\therefore \angle VDB = 90°$	1A	OR $VD \perp AB$
$\because D$ and E are mid-points of AB and BC respectively,		
$\therefore DE // AC$ (mid-point theorem)	1M	
$\therefore \angle BDE = \angle BAC = 90°$ (corresponding angles, $DE // AC$)		
Hence the angle between the planes VAB and ABC can be represented by $\angle VDE$.	1	Follow through
(ii) It is given that $VA = AB = VB = VC = AC = 2$ cm		
$\because D$ and E are mid-points of AB and BC respectively,		
$\therefore DE = \frac{1}{2} AC = 1$ cm (mid-point theorem)	1A	
$BE = \sqrt{1^2 + 1^2} = \sqrt{2}$ (Pythagoras' theorem)		
$\because \Delta VBC$ is isosceles and E is the mid-point of BC,		
$\therefore \angle VEB = 90°$		
$\therefore VE = \sqrt{2^2 - \sqrt{2}^2} = \sqrt{2}$ cm	1A	
$VD = \sqrt{2^2 - 1^2} = \sqrt{3}$ cm (Pythagoras' theorem)	1A	
$\because VE^2 + ED^2 = \sqrt{2}^2 + 1^2 = 3 = VD^2$		
$\therefore \angle VED = 90°$ (converse of Pythagoras' theorem)	1	Follow through
	(7)	
(c) Area of $\Delta ABC = \frac{1}{2}(2)(2) = 2\text{ cm}^2$		
$\because \angle VEB = \angle VED = 90°$		
$\therefore VE$ is the height of the pyramid with respect to the base ABC.	1M	
Hence the volume of the pyramid		
$= \frac{1}{3}(2)(\sqrt{2}) = \frac{2\sqrt{2}}{3}\text{ cm}^3$	1A	
Area of $\Delta VAB = \frac{1}{2}(2)(\sqrt{3}) = \sqrt{3}\text{ cm}^2$		
Let h be the distance between C and plane VAB .		
$\therefore \frac{1}{3}(\sqrt{3})h = \frac{2\sqrt{2}}{3}$	1M	
i.e. $h = 2\sqrt{\frac{2}{3}}$ cm	1A	(u-1) if unit was omitted
	(4)	

Solution	Marks	Remarks
17. (a) (i) $\int_0^{\pi}[\mathrm{f}(x)+\mathrm{f}(\pi-x)]\mathrm{d}x=\int_0^{\pi}[x\sin x+(\pi-x)\sin(\pi-x)]\mathrm{d}x$		
$=\int_0^{\pi}[x\sin x+(\pi-x)\sin x]\mathrm{d}x$	1A	For $(\pi-x)\sin x$
$=\pi\int_0^{\pi}\sin x\,\mathrm{d}x$	1A	For $\pi\sin x$
$=\pi[-\cos x]_0^{\pi}$	1A	For $-\cos x$
$=2\pi$	1	
(ii) By considering the symmetry of the graphs of $y=\mathrm{f}(x)$ and $y=\mathrm{f}(\pi-x)$,		
$\int_0^{\pi}\mathrm{f}(x)\,\mathrm{d}x=\int_0^{\pi}\mathrm{f}(\pi-x)\,\mathrm{d}x$		
$\therefore\int_0^{\pi}\mathrm{f}(x)\,\mathrm{d}x=\frac{1}{2}\int_0^{\pi}[\mathrm{f}(x)+\mathrm{f}(\pi-x)]\mathrm{d}x$		
i.e. $\int_0^{\pi}x\sin x\,\mathrm{d}x=\pi$	1A	
	(5)	
(b) (i) $\frac{\mathrm{d}}{\mathrm{d}x}(x^2\sin x)=x^2\cos x+2x\sin x$	1A	
$\therefore\int_0^{\pi}x^2\cos x\,\mathrm{d}x=[x^2\sin x]_0^{\pi}-2\int_0^{\pi}x\sin x\,\mathrm{d}x$	1M	
$=-2\pi$ (by (a)(ii))	1A	
(ii) $\because\cos x=1-2\sin^2\frac{x}{2}$		
$\therefore\sin^2\frac{x}{2}=\frac{1-\cos x}{2}$	1A	
Hence the volume of revolution		
$=\pi\int_0^{\pi}(x\sin\frac{x}{2})^2\,\mathrm{d}x$	1M	For $\pi\int y^2\mathrm{d}x$
$=\pi\int_0^{\pi}x^2\sin^2\frac{x}{2}\mathrm{d}x$		
$=\pi\int_0^{\pi}x^2\left(\frac{1-\cos x}{2}\right)\mathrm{d}x$		
$=\frac{\pi}{2}\int_0^{\pi}x^2\,\mathrm{d}x-\frac{\pi}{2}\int_0^{\pi}x^2\cos x\,\mathrm{d}x$		
$=\frac{\pi}{2}\left[\frac{x^3}{3}\right]_0^{\pi}-\frac{\pi}{2}(-2\pi)$	1M	For using (b)(i)
$=\frac{\pi^4}{6}+\pi^2$	1A	
	(7)	

Solution	Marks	Remarks
18. (a) The volume of the cone is $V=\frac{1}{3}\pi r^2 h$.		
$\therefore 0=\frac{\pi}{3}\left(2r\frac{dr}{dt}h+r^2\frac{dh}{dt}\right)$	1M+1A	1M for product rule (Accept diff. wrt r or h)
$2\frac{dr}{dt}h+r(-2)=0$	*1A*	For $\frac{dh}{dt}=-2$
$\frac{dr}{dt}=\frac{r}{h}$	1	
	(4)	
(b) (i) $S=\pi r\sqrt{h^2+r^2}$	1A	
$S^2=\pi^2(r^2h^2+r^4)$		
$\frac{d}{dt}(S^2)=\pi^2\left(r^2\cdot 2h\frac{dh}{dt}+2r\frac{dr}{dt}\cdot h^2+4r^3\frac{dr}{dt}\right)$	1A	
$=\pi^2\left[2r^2h(-2)+(2rh^2+4r^3)\left(\frac{r}{h}\right)\right]$ (by (a))	1M	For sub. $\frac{dh}{dt}$ and $\frac{dr}{dt}$
$=\pi^2\left(-4r^2h+2r^2h+\frac{4r^4}{h}\right)$		
$=\frac{2\pi^2r^2}{h}(2r^2-h^2)$	1	
(ii) When $t=0$, $h_0=1.2r_0$.		
$\therefore \frac{d}{dt}(S^2)\Big\|_{t=0}=\frac{2\pi^2{r_0}^2}{1.2r}(2{r_0}^2-1.2^2{r_0}^2)$	1M	For substitution
$=\frac{14}{15}\pi^2{r_0}^3$		OR $\frac{175}{324}\pi^2h^3$
>0	1A	Accept ≥ 0
As t increases, r increases and h (> 0) decreases and therefore $(2r^2-h^2)$ increases. Hence $\frac{d}{dt}(S^2)$ increases for all $t\geq 0$.	1M	
i.e. $\frac{d}{dt}(S^2)>0$ for all $t\geq 0$		Cannot be skipped
$\therefore \frac{dS}{dt}>0$ when $t\geq 0$		
The gatekeeper's claim is agreed.	1	Follow through
	(8)	

考生表現

甲部（必答題）

題號		一般表現
1		甚佳
2	(a)	甚佳
	(b)	甚佳
3		甚劣
4		差劣
5		甚佳
6		良好
7		尚可
8		尚可
9	(a)	良好
	(b)	甚劣
10		良好
11	(a)	良好
	(b)	甚劣
12	(a)	尚可
	(b)	甚劣
13	(a)	良好
	(b)	尚可

乙部（5題選答4題）

題號			選題百分率	一般表現
14	(a)		66	良好
	(b)			尚可
	(c)	(i)		尚可
		(ii)		差劣
15	(a)		89	甚佳
	(b)			良好
	(c)			尚可
16	(a)		85	良好
	(b)	(i)		尚可
		(ii)		良好
	(c)			甚劣
17	(a)	(i)	87	良好
		(ii)		良好
	(b)	(i)		尚可
		(ii)		尚可
18	(a)		73	良好
	(b)	(i)		尚可
		(ii)		甚劣

考生在每題的表現

Q.1 部分考生忘記寫出積分常數，亦有考生未能應用正確的公式。以下是常見的錯誤：

$$\int(8x+5)^{250}\,\mathrm{d}x=\frac{(8x+5)^{251}}{8}+C$$ 。

Q.2 部分考生在展式中得出錯誤的係數或指數。在展開(b)部分的數式時，少數考生漏了以"..."記號來表示其他不相關的項。

Q.3 很多考生能夠正確地求得 22.5° 和 45° 之間直接的關係，卻未能再進一步。在能夠設立二次方程得出答案的考生之中，部分忘記了排除負根。

Q.4 大部分考生能夠作出Δ < 0，但未能說明曲線是凹向下的，從而蘊涵 $k<0$。此外，很多考生沒有正確地求解 $k^2>\frac{1}{36}$，以下是常見的錯誤：

$k^2>\frac{1}{36}$ 蘊涵 $k>\pm\frac{1}{6}$

Q.5 考生的作業中發現有很多錯誤和含糊的陳述：

- 「設 $n=1$ 爲真」
- 在整個作業中，沒有把陳述定義爲 $S(n)$，但卻運用了這記號；
- 在第二個步驟，「假設陳述對<u>所有</u>正整數爲真」；
- 在完成第一個及/或第二個步驟之後，沒有說明「陳述對 n=1 爲真」 及/或 「陳述同時對 $n=k+1$ 爲真」；
- 把英文 "true"字串錯爲 "ture" 。

部分考生在證明時省略了必須的步驟，只是直接從 $\frac{1}{4}k^2(k+1)^2+(k+1)^3$ 寫出答案 $\frac{1}{4}(k+1)^2(k+2)^2$ ，而沒有顯示適當的項組合及因式分解。在這情況下，考生的證明被視爲不完整。.

Q.6 部分考生未能正確地應用商法則，以下是十分常見的錯誤：

$(\frac{u}{v})'=\frac{uv'+vu'}{v^2}$ （在分子運用加法而非減法）。

部分考生在簡化數式及代入法方面出錯。大部分考生能夠運用正確的點斜式求出切線的方程。

Q.7 很多考生不知道單位向量的含義。部分考生在求出 $|\overrightarrow{OP}|$ 便停止作答，其中小部分考生以爲 $|\overrightarrow{OP}|$ 就是單位向量作答。

Q.8 大部分考生能夠運用面積公式寫下方程。然而，在展開數式時，很多考生忘記了應該有 ± 值。考生如果未能察覺兩個方程及兩個可能的點，然後作出消去法，則即使得出正確答案，亦不會獲給分。部分考生留意到「P 處於第二象限之內」，然後設 P 爲 $(-x, y)$，其中不少被已知的方程 $2x+y-3=0$ 中的變項混淆了，因而未能求出正確答案。

Q.9 在(a)部分，考生因下列錯誤而失分：

- 沒有步驟；
- 沒有清楚寫出答案為 $r\sin(x+\alpha)$ ；
- 把角 α 寫成弧度。

在(b)部分，差不多所有考生都沒有考慮在已知範圍中函數的增減。大部分考生只考慮正弦函數的極值。部分考生則只代入 x 的終值，以求出答案。

Q.10 部分考生混淆垂直與水平線的計算，因而得出下列錯誤數式：

1. $\int_a^b (4-\frac{1}{\sqrt{x}})\mathrm{d}x$ 2. $\int_a^b (2-\frac{1}{y^2})\mathrm{d}y$

其他考生在減去適當的面積時犯錯。很多考生未能正確地處理 $\int\frac{1}{\sqrt{x}}\mathrm{d}x$ ，因而得出錯誤的答案。

Q.11 在(a)部分，小部分考生未有留意條件 $x\le 3$，然後作出步驟為
$|x-3|+3=x$
$(x-3)+3=x$ 或 $(-x+3)+3=x$ 。
其後，他們被邏輯論證混淆，因而未能得出正確答案。
至於嘗試答(b)部分的考生，很多都知道應考慮 $x>3$ 或 $x\ge 3$ 。但當方程轉為 $x-3+3=x$ ，很多考生錯誤地得出「無解」。至於正確地得出「所有實數 x」的考生，大多數忽略在這情況下的取值範圍。

Q.12 在(a)部分，頗多考生未能小心處理代入法，且有少數考生忘記簡化答案。
在(b)部分，只有少數考生知道求出軌跡方程的方法是從下列其一之中消去 k：
1. 在(a)得出的 P 的坐標，或
2. 方程 L_1 和 L_2 。

小部分考生得出答案為 $x^2y+y^3-y^2=0$ 或同等形式，但忘記把它簡化。

Q.13 在(a)部分，部分考生求出 $\frac{\mathrm{d}y}{\mathrm{d}x}=3x^2-24x+36$ ，並且在列出 $\frac{\mathrm{d}y}{\mathrm{d}x}=0$ 時，錯誤地簡化這結果為 $x^2-8x+12$ 。因此，他們得出錯誤的 $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$ 而失分。
在(b)部分，頗多考生只繪畫曲線至原點。部分考生漏了標示重要的點、軸和原點。部分考生未能繪畫流暢的曲線。小部分考生把曲線表示為正弦。

Q.14 (b) 部分考生未能從中心 $\left(-k+5,\frac{-k}{2}\right)$ 的坐標消去 k ，以得出題目所要求的軌跡。

(c) (i) 很多考生沒有察覺 Q 點是 $y+5=0$ 與(b)部的軌跡的交點。
(ii) 大部分考生未能求出 L_2 的斜率。一般而言，能夠粗略繪出有關圓形的考生在這部分的表現較佳。

Q.15 (a) 部分考生錯誤地假設 $|\mathbf{p}|=4$ & $|\mathbf{q}|=3$。

(b) 很多考生沒有察覺，證明 OG 、 AG 或 BG 中任何兩條是頂垂線能足以證明 G 是垂心。

(c) 很多考生未能應用 $\overrightarrow{HN}\cdot\overrightarrow{OA}=0$ 來計算 t。

Q.16 (b) (i) 部分考生首先假設 $\angle VDA = 90°$，以嘗試證明 $\angle VDA = 90°$。

(c) 很多考生以爲題目要求的高度爲 CF，其中 F 是處於 VD 上的一點。

Q.17 (a) (ii) 部分考生錯誤地假設 $\int x\sin x dx = x\int \sin x dx$。

(b) (i) 很多考生混淆了數式 $x^2 \sin x$ 和 $[x^2 \sin x]_0^{\pi}$。

Q.18 (a) 部分考生沒有察覺 r 和 h 兩者均爲 t 的函數。

(b) (ii) 很多考生看漏了條件 $h = 1.2r$ 是在 $t = 0$ 時方爲有效。這部分難度較高，只有小部分考生能夠作出完整而合乎邏輯的解釋。

一般評論及建議：

1. 考生應該學習在沒有導向指示的情況下（例如Q3）處理簡單的題目。固定模式的導向題目可能妨礙考生解決問題技巧方面的創意。

2. 考生應該注意題目所指明變項的限制。考生在求解方程時，應該合理地排除多餘的解。此外，考生在考慮三角函數的極值時，必須核對在指明的範圍內端點與轉向點產生的值，而不是過分簡化地引用正弦函數的最大和最小值而不考慮所指明的值域。

3. 考生應該清楚顯示所有步驟，並且提供適當的解釋，以顯示完整而合乎邏輯的解法。考生應該避免不適當的做法，例如死記硬背或遺漏必須的步驟。

4. 考生在除去括號時應該避免常見錯誤，例如

$(2x)^2 = 2x^2$ ； $\dfrac{3(x^2+2)-(2x)(3x)}{(x^2+2)^2} = \dfrac{3x^2+2-6x^2}{(x^2+2)^2}$

5. 在步驟和答案中，角的量度單位（無論以度數或弧度來顯示），必須與題目所採用的一致。

6. 考生在作業中應該運用箭嘴符號或適當的記號表示向量，並應該盡量避免 $\dfrac{\overrightarrow{PB}}{\overrightarrow{AP}} = 2$ 等不適當的表示。

7. 考生應熟習觀察二次函數的圖表，並應更深入理解曲線的凹度與函數首項係數符號之間的關係。.

8. 考生應該多加練習 $\int x^n dx$ ，其中 n 爲負值及/或分數。

9. 考生在數學歸納法方面應該注意用字和表達。

10. 考生應該改善處理結構性題目的技巧。很多考生未能聯繫同一題目不同部分之間的關係。

11. 在處理涉及坐標幾何的問題時，當題目沒有給予數字，考生的表現便會較爲遜色，這反映了他們對實際幾何情況缺乏基本的理解。

12. 考生應該深入了解向量的表達，並避免 $\mathbf{p}^2$ ， $\frac{\overrightarrow{HM}}{\overrightarrow{OG}}=t$ ，以 $\mathbf{p}\times\mathbf{q}$ 表示 $\mathbf{p}\cdot\mathbf{q}$ 等的錯誤。