Prelim Examination 2006 / 2007
(Assessing Units 1 & 2)

MATHEMATICS

Advanced Higher Grade

Time allowed - 2 hours

Read Carefully

1. Calculators may be used in this paper.
2. Candidates should answer **all** questions.
3. **Full credit will be given only where the solution contains appropriate working.**
4. **This examination paper contains questions graded at all levels.**

All questions should be attempted

1. (*a*) Given $f(x) = e^{-2x}\tan 4x$, $0 < x < \frac{\pi}{8}$, obtain $f'(x)$. **3**

(*b*) For $y = \frac{\ln 5x}{x-1}$, where $x > 1$, determine $\frac{dy}{dx}$ in its simplest form. **3**

2. For what value of t does the system of equations

$$\begin{aligned} x + 2y - 3z &= -7 \\ 4x - y + 2z &= 9 \\ 3x - 2y + tz &= 13 \end{aligned}$$

have no solution? **5**

3. Verify that $1 - 3i$ is a solution of $z^4 - 4z^3 + 11z^2 - 14z - 30 = 0$.

Hence express $z^4 - 4z^3 + 11z^2 - 14z - 30$ in the form $(z + a)(z + b)(z^2 + cz + d)$, where a, b, c and d are real numbers. **5**

4. Use the substitution $x = 3\cos\theta$ to show that

$$\int_{\frac{3}{2}}^{3} \frac{dx}{\sqrt{9 - x^2}} = \frac{\pi}{3}$$ **6**

5. Obtain the binomial expansion of $\left(3a^2 - \frac{4}{b}\right)^5$. **3**

6. Use integration by parts to evaluate $\int_0^1 x^2 e^{-x}\,dx$. **5**

7. Determine whether the function $f(x) = x^2\cos x + x^3$ is odd, even or neither.

Justify your answer. **3**

8. A spherical balloon is being inflated.

Its volume, V cm^3, is increasing at the rate of $\frac{30\pi}{7}$ cm^3 per second.

Find the rate at which the radius is increasing with respect to time when the volume is $\frac{36\pi}{5}$ cm^3.

[**Note**: The volume of a sphere is given by $V = \frac{4}{3}\pi r^3$.] **5**

9. Prove that if n is odd then $n^4 - 1$ is divisible by 8. **3**

10. (*a*) Obtain partial fractions for

$$\frac{9}{x^2 - 9}$$ **2**

(*b*) Hence evaluate

$$\int_0^1 \frac{x^2}{x^2 - 9}\, dx .$$ **4**

11. The function f is defined by

$$f(x) = \frac{x^2}{x+3}, \quad x \neq -3.$$

(*a*) Obtain algebraically the asymptotes of the graph of f. **3**

(*b*) Find the stationary points of f and justify their nature. **5**

(*c*) Sketch the curve showing clearly the features found in (*a*) and (*b*). **2**

(*d*) Write down the coordinates of the stationary points of the graph of $g(x) = 10 + |f(x)|$. **2**

12. The first two terms of a series are $1 + \sqrt{2}$ and $1 + \dfrac{1}{\sqrt{2}}$.

(*a*) If the series is arithmetic, show that the common difference is $-\dfrac{1}{2}\sqrt{2}$.

Show also that the sum of the first ten terms is $\dfrac{5}{2}\left(4 - 5\sqrt{2}\right)$. **4**

(*b*) If the series is geometric, show that the sum to infinity exists.

Show also that $S_{\infty} = 4 + 3\sqrt{2}$. **5**

13. A solid is formed by rotating the curve $y = x^2 + 4$ between $x = 1$ and $x = t$, $t > 1$, through 360^0 about the y – axis.

Find the value of t given that the volume of the solid formed is 40π units^3. **6**

[*END OF QUESTION PAPER*]

Marking Scheme - Advanced Higher Grade 2006/2007
Prelim (Assessing Units 1 & 2)

	Give one mark for each •	Illustrations for awarding each mark
1(*a*)	**ans:** $f'(x) = 2e^{-2x}(2\sec^2 4x - \tan 4x)$ **3 marks** • knows to use product rule • differentiates e^{-2x} correctly • differentiates tan4*x*	 • • $-2e^{-2x}$ • $4\sec^2 4x$
1(*b*)	**ans:** $\frac{dy}{dx} = \frac{x(1-\ln 5x)-1}{x(x-1)^2}$ **3 marks** • knows to use the quotient rule • differentiates correctly • correct simplification for $\frac{dy}{dx}$	 • • $\frac{\frac{x-1}{x} - \ln 5x}{(x-1)^2}$ • $\frac{x-1-x\ln 5x}{x(x-1)^2}$
2	**ans:** $t = \frac{31}{9}$ **5 marks** • correct augmented matrix • first modified system correct • second modified system correct • third modified system correct • solves for *t*	 • $\begin{pmatrix} 1 & 2 & -3 & -7 \\ 4 & -1 & 2 & 9 \\ 3 & -2 & t & 13 \end{pmatrix}$ • $\begin{pmatrix} 1 & 2 & -3 & -7 \\ 0 & -9 & 14 & 37 \\ 3 & -2 & t & 13 \end{pmatrix}$ • $\begin{pmatrix} 1 & 2 & -3 & -7 \\ 0 & -9 & 14 & 37 \\ 0 & -8 & t+9 & 34 \end{pmatrix}$ • $\begin{pmatrix} 1 & 2 & -3 & -7 \\ 0 & -9 & 14 & 37 \\ 0 & 0 & t-\frac{31}{9} & \frac{10}{9} \end{pmatrix}$ • $t=\frac{31}{9}$

	Give one mark for each •	Illustrations for awarding each mark
3	**ans:** Proof, $(z-3)(z+1)(z^2-2z+10)$ **5 marks** • verifies that $1-3i$ is a solution • knows that $1+3i$ is a solution • uses $1+3i$ for substitution or synthetic division • finds $z^2-2z-3=(z-3)(z+1)$ • finds $z^2-2z+10$ factor	• correct substitution or synthetic division • $1+3i$ is a solution • correct substitution or synthetic division • $z^2-2z-3=(z-3)(z+1)$ • $z^2-2z+10$
4	**ans:** Proof **6 marks** • starts substitution • changes limits correctly • correct substitution • deals with denominator • correctly integrates • substitutes limits correctly	• $dx = -3\sin\theta\ d\theta$ • $\frac{3}{2}\to\frac{\pi}{3}, 3\to 0$ • $\int_{\frac{\pi}{3}}^{0}\frac{-3\sin\theta d\theta}{\sqrt{9-9\cos^2\theta}}$ • $\int_{\frac{\pi}{3}}^{0}\frac{-3\sin\theta d\theta}{3\sin\theta}$ • $-[\theta]_{\frac{\pi}{3}}^{0}$ • $\frac{\pi}{3}$
5	**ans:** $243a^{10}-\frac{1620a^8}{b}+\frac{4320a^6}{b^2}-\frac{5760a^4}{b^3}+\frac{3840a^2}{b^4}-\frac{1024}{b^6}$ **3 marks** • correct binomial expression • correct expansion • correct simplification	• $\sum_{r=0}^{5}\binom{5}{r}(3a^2)^{5-r}\left(\frac{-4}{b}\right)^r$ • $(3a^2)^5+5(3a^2)^4\left(\frac{-4}{b}\right)+10(3a^2)^3\left(\frac{-4}{b}\right)^2$ $10(3a^2)^2\left(\frac{-4}{b}\right)^3+5(3a^2)\left(\frac{-4}{b}\right)^4+\left(\frac{-4}{b}\right)^5$ • answer

	Give one mark for each •	Illustrations for awarding each mark
6	**ans:** $2 - 5e^{-1}$ **5 marks** • uses integration by parts correctly • uses integration by parts for a second time • integrates correctly • substitutes limits correctly • correct evaluation	• $\left[-x^2e^{-x}\right]_0^1 + \int_0^1 2xe^{-x}dx$ • $\left[-2xe^{-x}\right]_0^1 + \int_0^1 2e^{-x}dx$ • $\left[-2e^{-x}\right]_0^1$ • $-e^{-1} - 2e^{-1} - 2e^{-1} + 2e^0$ • $2 - \frac{5}{e}$
7	**ans:** Neither **3 marks** • knows to find $f(-x)$ • finds $f(-x)$ correctly • correct conclusion	• $f(-x) = (-x)^2\cos(-x) + (-x)^3$ • $f(-x) = x^2\cos x - x^3$ • Neither
8	**ans:** 0·35 [cm/s] **5 marks** • knows how find $\frac{dr}{dt}$ • finds $\frac{dr}{dV}$ correctly • finds correct formula for $\frac{dr}{dt}$ • finds correct radius • evaluates $\frac{dr}{dt}$ correctly	• $\frac{dr}{dt} = \frac{dr}{dV} \times \frac{dV}{dt}$ • $\frac{dr}{dV} = \frac{1}{4\pi r^2}$ • $\frac{dr}{dt} = \frac{15}{14r^2}$ • $r = 1{\cdot}75$ • $\frac{dr}{dt} = 0{\cdot}35$
9	**ans:** Proof **3 marks** • knows how to start proof : $n = 2k \pm 1$ • continues proof : simplifies $n = 2k \pm 1$ • completes proof : common factor of 8	• n is odd $\Rightarrow n = 2k \pm 1$ $(k \in Z)$ • $\Rightarrow n^4 - 1 = 16k^4 \pm 32k^3 + 24k^2 \pm 8k$ • $\Rightarrow n^4 - 1 = 8(2k^4 \pm 4k^3 + 3k^2 \pm k)$ which is divisible by 8

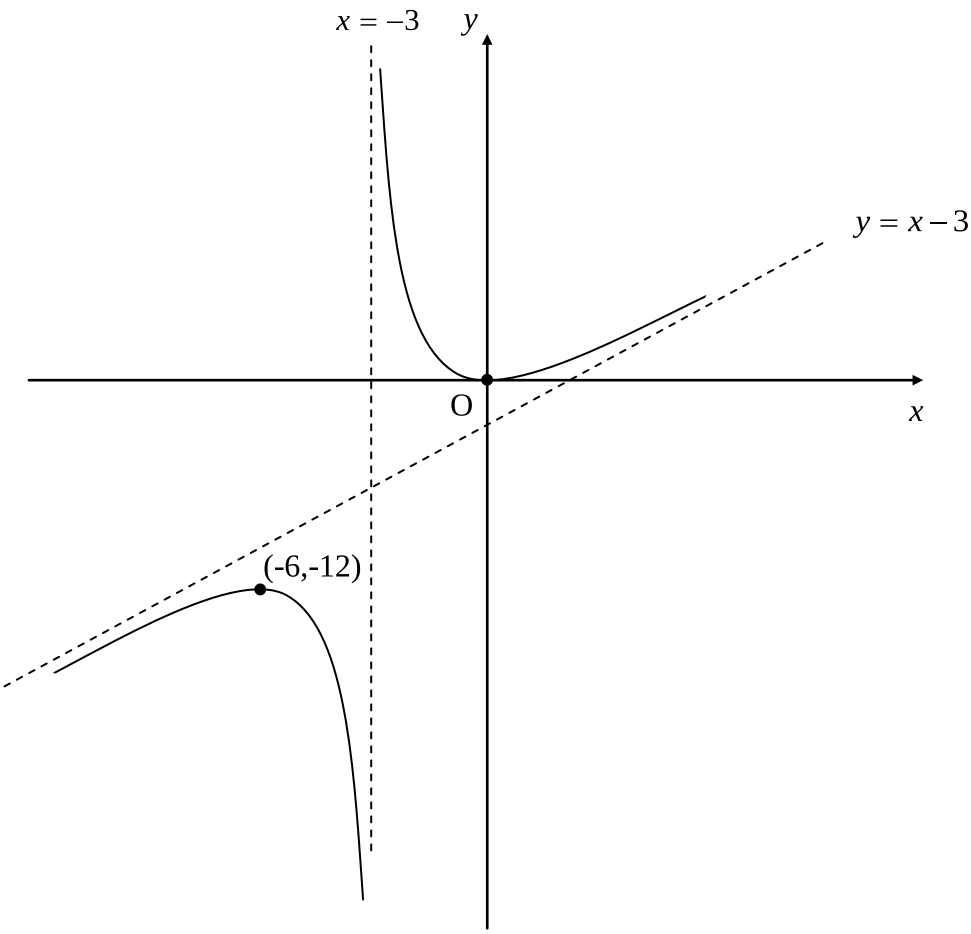
	Give one mark for each •	Illustrations for awarding each mark
10(*a*)	**ans:** $\frac{3}{2(x-3)}-\frac{3}{2(x+3)}$ **2 marks** • first fraction • second fraction	• $\frac{3}{2(x-3)}$ • $-\frac{3}{2(x+3)}$
10(*b*)	**ans:** $1+\frac{3}{2}\ln\frac{1}{2}$ **4 marks** • divides correctly • integrates correctly • substitutes limits correctly • evaluates correctly	• $1+\frac{9}{x^2-9}$ • $x+\frac{3}{2}\ln\lvert x-3\rvert-\frac{3}{2}\ln\lvert x+3\rvert$ • $\left(1+\frac{3}{2}\ln\lvert -2\rvert-\frac{3}{2}\ln\lvert 4\rvert\right)-\left(0+\frac{3}{2}\ln\lvert -3\rvert-\frac{3}{2}\ln\lvert 3\rvert\right)$ • $1+\frac{3}{2}(\ln 2-\ln 4)$
11(*a*)	**ans:** x = - 3 & $y = x$ - 3 **3 marks** • states equation of vertical asymptote • divides correctly • states equation of oblique asymptote	• x = - 3 • $f(x) = x-3+\frac{12}{x+3}$ • $y = x$ - 3
11(*b*)	**ans:** (0,0) $\rightarrow$ minimum turning point; (-6,-12) $\rightarrow$ maximum turning point **5 marks** • differentiates correctly • finds *x*-coordinates of stationary points • finds *y*-coordinates of stationary points • finds second derivative or nature table • correct nature of both points	• $f'(x)=\frac{x^2+6x}{(x+3)^3}$ • $f'(x)=0 \Rightarrow x=0,-6$ • (0,0) & (-6,-12) • $f''(x)=\frac{(2x+6)(x+3)^2-2(x^2+6x)(x+3)}{(x+3)^4}$ • $f''(0)>0 \Rightarrow (0,0)\,Min.T.P.$ & $f''(-6)<0 \Rightarrow (-6,-12)\,Max.T.P.$

	Give one mark for each •	**Illustrations for awarding each mark**
11(*c*)	**ans:** correct graph **2 marks** • turning points shown • completes graph ***see graph on next page***	 • correct turning points • correct behaviour at asymptotes
11(*d*)	**ans:** (0,10) & (-6,22) **2 marks** • one point correct • second point correct	 • (0,10) • (-6,22)
12(*a*)	**ans:** Proof **4 marks** • knows how to find common difference • simplifies correctly • knows how to find sum of first 10 terms • simplifies correctly	• $1+\frac{1}{\sqrt{2}}-\left(1+\sqrt{2}\right)$ • $\frac{1}{\sqrt{2}}-\sqrt{2}=\frac{1-2}{\sqrt{2}}=\frac{-1}{\sqrt{2}}$ • $\frac{10}{2}\left[2(1+\sqrt{2})+(10-1)\left(\frac{-1}{\sqrt{2}}\right)\right]$ • $5\left(2+2\sqrt{2}-\frac{9}{\sqrt{2}}\right)=\ldots=\frac{5}{2}(4-5\sqrt{2})$
12(*b*)	**ans:** Proof **5 marks** • knows to find common ratio • finds common ratio correctly • justifies that sum to infinity exists • knows how to find sum to infinity • simplifies correctly	• $\frac{1+\frac{1}{\sqrt{2}}}{1+\sqrt{2}}$ • $\frac{1}{\sqrt{2}}$ • $-1<\frac{1}{\sqrt{2}}<1$ • $\frac{1+\sqrt{2}}{1-\frac{1}{\sqrt{2}}}$ • $\frac{\sqrt{2}+2}{\sqrt{2}-1}=\ldots=4+3\sqrt{2}$

	Give one mark for each •	Illustrations for awarding each mark
13	**ans:** $t = 3$ **6 marks** • knows how to find volume of solid • finds limits of integration • integrates correctly • substitutes limits correctly • equates volumes • solves for t correctly	• $V = \int \pi(y-4)dy$ • $1 \to 5, t \to t^2+4$ • $\pi\left[\frac{y^2}{2} - 4y\right]$ • $\pi\left\{\left(\frac{(t^2+4)^2}{2} - 4(t^2+4)\right) - \left(\frac{5^2}{2} - 4(5)\right)\right\}$ • $40\pi = \pi\left(\frac{t^4}{2} - \frac{1}{2}\right)$ • $t = 3$

TOTAL MARKS = 74

Q11 (c)



Higher Still - 2006 / 2007

MATHEMATICS

Advanced Higher Grade – Mini Prelim
(Unit 3 + Units 1/2 Revision)

Time allowed - 1 hour 20 minutes

Read Carefully

1. Calculators may be used in this paper.
2. Candidates should answer **all** questions.
3. **Full credit will be given only where the solution contains appropriate working.**
4. **This test contains questions graded at all levels.**

All questions should be attempted

1. Find the general solution of the differential equation

$$x\frac{dy}{dx} + (x - 2)y = x^4.$$ **5**

Given that $y = 5e^{-1}$ when $x = 1$, find the particular solution. **2**

2. (*a*) Show that the matrix $A = \begin{pmatrix} 2 & 1 & 4 \\ 1 & 0 & 2 \\ 2 & 3 & 1 \end{pmatrix}$ is non-singular. **3**

(*b*) Use elementary row operations to find A^{-1}. **5**

(*c*) **Hence** solve the system of equations

$$\begin{aligned} 2x + y + 4z &= 2 \\ x \qquad + 2z &= 3 \\ 2x + 3y + z &= -6. \end{aligned}$$ **2**

3. (*a*) Obtain the first five terms in the Maclaurin expansion of $(1+3x)^{\frac{5}{3}}$. **4**

(*b*) For what values of x is this series valid? **2**

(*c*) Use the expansion to find an approximation for $1{\cdot}9^{\frac{5}{3}}$. **2**

4. (*a*) Express 458_6 in base 8. **3**

(*b*) Prove by induction that $n(n + 1)(n + 2)$ is divisible by 6 for all positive integers n. **6**

5. A function $y(x)$ is defined implicitly by $x^3 + 4xy = 3$.

Obtain formulae for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ in terms of x and y only. **5**

Hence evaluate $\frac{dy}{dx}$ at (1, 0) and $\frac{d^2y}{dx^2}$ at (2,-1). **2**

6. (*a*) Find the point of intersection of the line L_1

$$\frac{x-6}{2} = \frac{y+2}{1} = \frac{z+7}{-3}$$

and the plane with equation $3x - y - 2z = 12$. **4**

(*b*) Find the point of intersection of the line L_1 and the line L_2

$$\frac{x-6}{-1} = \frac{y+7}{2} = \frac{z}{-2}.$$ **4**

7. Let $z = \dfrac{1}{\cos\theta + i\sin\theta}$.

(*a*) Use de Moivre's theorem to express z^5 in the form $\cos p\theta - i\sin p\theta$, where p is a natural number. **2**

(*b*) Use the binomial theorem to express $\sin 5\theta$ in the form

$$q\sin\theta + r\sin^3\theta + t\sin^5\theta,$$

and state the values of q, r and t. **5**

[*END OF QUESTION PAPER*]

Mini Prelim (Assessing Unit 3 + Revision)

	Give one mark for each •	Illustrations for awarding each mark
1	**ans:** $y = x^3 - x^2 + \frac{Cx^2}{e^x}$ **5 marks** $y = x^3 - x^2 + \frac{5x^2}{e^x}$ **2 marks** • knows to find integrating factor correctly • finds correct integrating factor • uses integrating factor correctly • uses integration by parts correctly • finds general solution correctly • substitutes conditions correctly • finds particular solution correctly	• $e^{\int \frac{x-2}{x} dx}$ • $\frac{e^x}{x^2}$ • $\frac{e^x}{x^2} y = \int xe^x dx$ • $xe^x - \int e^x dx$ • $y = x^3 - x^2 + \frac{Cx^2}{e^x}$ • $5e^{-1} = 1 - 1 + \frac{C}{e}$ • $C = 5$
2(*a*)	**ans:** det $A = 3 \neq 0$ **3 marks** • knows how to find the determinant of a 3×3 matrix • finds determinant correctly • correct explanation	• det $A = \begin{vmatrix} 2 & 1 & 4 \\ 1 & 0 & 2 \\ 2 & 3 & 1 \end{vmatrix}$ • 3 • Since $\lvert A \rvert \neq 0$, A is non-singular
2(*b*)		

	ans: $A^{-1}=\frac{1}{3}\begin{pmatrix}-6 & 11 & 2\\ 3 & -6 & 0\\ 3 & -4 & -1\end{pmatrix}$ **5 marks** • correct augmented matrix • one correct row • a second correct row • the third row correct • identifies A^{-1}	• $\begin{pmatrix}2 & 1 & 4 & 1 & 0 & 0\\ 1 & 0 & 2 & 0 & 1 & 0\\ 2 & 3 & 1 & 0 & 0 & 1\end{pmatrix}$ • $\begin{pmatrix} & & & & & \\ 0 & 1 & 0 & 1 & -2 & 0\\ & & & & & \end{pmatrix}$ • $\begin{pmatrix} & & & & & \\ & & & & & \\ 0 & 0 & 1 & 1 & \frac{-4}{3} & \frac{-1}{3}\end{pmatrix}$ • $\begin{pmatrix}1 & 0 & 0 & -2 & \frac{11}{3} & \frac{2}{3}\\ & & & & & \\ & & & & & \end{pmatrix}$ • $A^{-1}=\begin{pmatrix}-2 & \frac{11}{3} & \frac{2}{3}\\ 1 & -2 & 0\\ 1 & \frac{-4}{3} & \frac{-1}{3}\end{pmatrix}$
2(c)	**ans:** $x=3, y=-4, z=0$ **2 marks** • knows to pre-multiply both sides by A^{-1} • correct solution	• $\frac{1}{3}\begin{pmatrix}-6 & 11 & 2\\ 3 & -6 & 0\\ 3 & -4 & -1\end{pmatrix}\begin{pmatrix}2\\ 3\\ -6\end{pmatrix}$ • $\begin{pmatrix}x\\ y\\ z\end{pmatrix}=\begin{pmatrix}3\\ -4\\ 0\end{pmatrix}$
3(a)	**ans:** $(1+3x)^{\frac{5}{3}}=1+5x+5x^2-\frac{5}{3}x^3+\frac{5}{3}x^4$ **4 marks** • evaluates $f(0)$ & $f'(0)$ correctly • evaluates $f''(0)$ correctly • evaluates $f'''(0)$ & $f^{iv}(0)$ correctly	• $f(0)=1$ & $f'(0)=5$ • $f''(0)=10$ • $f'''(0)=-10$ & $f^{iv}(0)=40$

	• correct expansion	• Correct expansion
3(*b*)	**ans:** $\|x\| < \frac{1}{3}$ **2 marks** • knows range of validity • solves inequality	• $\|3x\| < 1$ • $\|x\| < \frac{1}{3}$
3(*c*)	**ans:** 2·9185 **2 marks** • use expansion correctly • correct approximation	• $(1+3(0\cdot3))^{\frac{5}{3}} = 1+5(0\cdot3)+5(0\cdot3)^2 - \frac{5}{3}(0\cdot3)^3 + \frac{5}{3}(0\cdot3)^4$ • 2·9185

4(*a*)	**ans:** 266_8 **3 marks** • changes to base 10 • repeated division by 8 • correct answer in base 8	 • $458_6 = 182$ • $182 \div 8 = 22$ r 6, $22 \div 8 = 2$ r 6, $2 \div 8 = 0$ r 2 • 266_8
4(*b*)	**ans:** Proof **6 marks** • knows how to start proof; e.g. true for n=1 • assume true for $n=k$ • statement for $n=k+1$ • continues proof : consider n odd • continues proof : consider n even • completes proof	 • $n=1$:1(1+1)(1+2) = 6 which is divisible by 6 • $n=k$:$k(k+1)(k+2)$ [=6L] is divisible by 6 • $n=k+1$:$(k+1)(k+2)(k+3)$ is divisible by 6 • <u>k odd</u> [$=2m+1$]- $(k+1)(k+2)(k+3)$ $=6L+3(k+1)(k+2)$ $=6L+3(2m+2)(2m+3)$ $=6[L+(m+1)(2m+3)]$ which is divisible by 6 • <u>k even</u> [$=2m$]- $(k+1)(k+2)(k+3)$ $=6L+3(k+1)(k+2)$ $=6L+3(2m+1)(2m+2)$ $=6[L+(2m+1)(m+1)]$which is divisible by 6 • Since true for n=1 and [true for $n=k \Rightarrow$ true for $n=k+1$], the result is true for all positive integers n.
5	**ans:** $\frac{dy}{dx} = \frac{-3}{4}x - \frac{y}{x}$ $\frac{d^2y}{dx^2} = \frac{2y}{x^2}$ **5 marks** $\frac{dy}{dx} = \frac{-3}{4}$ $\frac{d^2y}{dx^2} = \frac{-1}{2}$ **2 marks** • knows how to use implicit differentiation • differentiates correctly • knows how to find second derivative • differentiates correctly • finds simplified answer (in terms of x and y only) • evaluates first derivative correctly • evaluates second derivative correctly	 • $3x^2 + 4y + 4x\frac{dy}{dx} = 0$ • $\frac{dy}{dx} = \frac{-3}{4}x - \frac{y}{x}$ • $\frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right)$ • $\frac{-3}{4} - \left\{-x^{-2}y + x^{-1}\frac{dy}{dx}\right\}$ • $\frac{d^2y}{dx^2} = \frac{2y}{x^2}$ • $\frac{-3}{4}$ • $\frac{-1}{2}$

6(*a*)	**ans:** (2,-4,-1) **4 marks** • expresses *x*, *y* and *z* in terms of *t* • substitutes in plane equation • solves for *t* • correct point	• $x = 2t + 6, y = t - 2, z = -3t - 7$ • $3(2t + 6) - (t - 2) - 2(-3t - 7) = 12$ • $t = -2$ • (2,-4,-1)
6(*b*)	**ans:** (4,-3,-4) **4 marks** • correct system of equations • integrates correct value for *t* • correct value for *s* • correct point	• $2t + s = 0, t - 2s = -5, -3t + 2s = 7$ • $t = -1$ • $s = 2$ • (4,-3,-4)
7(*a*)	**ans:** $z^5 = \cos 5\theta - i\sin 5\theta$ **2 marks** • applies de Moivre's theorem correctly • express answer in correct form	• $\cos(-5\theta) + i\sin(-5\theta)$ • $\cos 5\theta - i\sin 5\theta$
7(*b*)	**ans:** $\sin 5\theta = 5\sin\theta - 20\sin^3\theta + 16\sin^5\theta$ $q = 5, r = -20 \;\&\; t = 16$ **5 marks** • uses the binomial theorem correctly • equates imaginary parts • substitutes correctly • simplifies correctly • correct values of *q*, *r* & *t*.	• $z^5 = (\cos\theta)^5 + 5(\cos\theta)^4(-i\sin\theta) + 10(\cos\theta)^3(-i\sin\theta)^2 + 10(\cos\theta)^2(-i\sin\theta)^3 + 5(\cos\theta)(-i\sin\theta)^4 + (-i\sin\theta)^5$ • $\sin 5\theta = 5\cos^4\theta\sin\theta - 10\cos^2\theta\sin^3\theta + \sin^5\theta$ • $5(1-\sin^2\theta)^2\sin\theta - 10(1-\sin^2\theta)\sin^3\theta + \sin^5\theta$ • $5\sin\theta - 20\sin^3\theta + 16\sin^5\theta$ • $q = 5, r = -20 \;\&\; t = 16$

TOTAL MARKS = 56