Student Number ________________________

Class ___________________________________

2014

Higher School Certificate

Assessment 1

Mathematics Extension 1

General Instructions

- Reading time – 5 minutes
- Working time – 90 minutes
- Board approved calculators may be used
- Write using black or blue pen
- Marks may not be awarded for careless or badly arranged work
- A table of standard integrals is provided
- All necessary working should be shown

Write your student number and/or name at the top of every page

Total marks – 63

This examination consists of 7 questions worth 9 marks each.

The answers to all questions are to be returned in separate bundles clearly labelled Question 1, Question 2, etc.

This paper MUST NOT be removed from the examination room.

Question 1 (Start a new page) **9 Marks**

(a) Given that $f(x) = sin^{-1}x$, find $f'(\frac{1}{2})$ 2

(b) Given $y = \tan^{-1}\left(\frac{a}{x}\right)$, show that $\frac{dy}{dx} = \frac{-a}{x^2 + a^2}$ 1

(c) Evaluate $\int_1^4 y\, dx$ if $xy = 1$. Leave answer in exact form.

2

(d) Find $\int \cos^2(2x)\sin(2x)\, dx$ 2

(e) Find the coefficient of x^3 in the expansion of $(3-2x)(x+1)^4$ 2

Question 2 (Start a new page) **9 Marks**

(a) (i) Differentiate $y = xsin^{-1}x + \sqrt{1 - x^2}$ 2

(ii) Hence evaluate $\int_0^1 sin^{-1}x\, dx$ 1

(b) Use the substitution $u = sin^2x$ to evaluate $\int_{\frac{\pi}{4}}^{\frac{\pi}{3}} \frac{\sin 2x}{1+\sin^2 x} dx$

4

(c) The curve $y = \frac{1}{\sqrt{1+x^2}}$ is rotated about the x-axis. Find the volume of revolution of the solid enclosed by $x = \frac{1}{\sqrt{3}}$ and $x = \sqrt{3}$ 2

Question 3 (Start a new page) **9 Marks**

(a) The function f(x) = sec x for $0 \le x < \frac{\pi}{2}$, and is not defined for other values of x.

(i) State the domain and range of the inverse function $f^{-1}(x)$ 2

(ii) Show that $f^{-1}(x) = cos^{-1}\left(\frac{1}{x}\right)$ 1

(iii) Hence find $\frac{d}{dx} f^{-1}(x)$ 1

(b) Find the exact values of x and y which satisfy the simultaneous equations

$\sin^{-1}x + \frac{1}{2}\cos^{-1}y = \frac{\pi}{3}$ and

$3\sin^{-1}x - \frac{1}{2}\cos^{-1}y = \frac{2\pi}{3}$ 2

(c) Find and simplify the term independent of x in the expansion of $\left(\frac{3x^2}{2} - \frac{1}{3x}\right)^9$ 3

Question 4 (Start a new page) **9 Marks**

(a) Evaluate $\int_1^e \frac{1}{t}\, dt$

1

(b) The rate of descent of a submarine into an ocean, starting from the surface, is given in terms of the descent t seconds by $\frac{dh}{dt} = 1 - (1+t)^{-2}$, where h is the depth of the submarine in metres.

(i) Find an expression for h in terms of t. 2

(ii) Hence find the depth of the submarine after 1 minute. 1

(c) (i) Sketch the curve $y = (x-1)^2 - 2$ 1

(ii) Find the largest positive domain such that the graph defines a function $y = f(x)$ which has an inverse. 1

(iii) Write down the equation of its inverse function $y = f^{-1}(x)$ and state its domain and range. 2

(iv) On the same graph as (i), draw a neat sketch of $y = f^{-1}(x)$. 1

Question 5 (Start a new page) **9 Marks**

(a) Use the substitution $u = x + 1$ to evaluate $\int_0^1 \frac{x}{\sqrt{x+1}} dx$ 3

(b) (i) Write the expansion $(x + 2y)^{10}$ in the form $\sum_{k=0}^{n} T_k$

1

(ii) Find the ratio $\frac{T_{k+1}}{T_k}$ 2

(iii) Find the greatest term if $x = \frac{1}{2}$ and $y = \frac{1}{3}$. 1

(c) Prove that $\frac{n!}{r!(n-r)!} + \frac{n!}{(r-1)!(n-r+1)!} = \frac{(n+1)!}{r!(n-r+1)!}$ 2

Question 6 (Start a new page) **9 Marks**

(a) Find $\int \frac{dx}{x(\log_e x)^{11}}$ using the substitution $u = \log_e x$ 3

(b) If $(1 + px)^{\mathrm{n}} = 1 + 15x + 90x^2 + \ldots\ldots\ldots$ find the values of p and n. 3

(c) Given $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$,

Show that: $x^2 + y^2 + z^2 + 2xyz = 1$ 3

Question 7 (Start a new page) **9 Marks**

(a) Express $\cos(\tan^{-1} x)$ in terms of *x*, $0 \le x \le \frac{\pi}{2}$ 1

(b) By using the binomial expansion, show that

(i) $(q + p)^n - (q - p)^n = 2\binom{n}{1} q^{n-1}p + 2\binom{n}{3} q^{n-3}p^3 + \cdots$. 2

(ii) What is the last term in the expansion when n is odd? 1

(iii) What is the last term in the expansion when n is even? 1

(c) (i) Differentiate $y = \tan^{-1}\frac{1}{x}$, $x \neq 0$, and hence show that 2

$$\frac{d}{dx}\left(\tan^{-1} x + \tan^{-1}\frac{1}{x}\right) = 0$$

(ii) Sketch the curve $y = \left(\tan^{-1} x + \tan^{-1}\frac{1}{x}\right)$ 2

END OF EXAMINATION

MATHEMATICS Extension 1 : Question...1....

Suggested Solutions	Marks	Marker's Comments
a) $\frac{d}{dx}(\sin^{-1}x) = \frac{1}{\sqrt{1-x^2}}$	1	Well done
$f'\left(\frac{1}{2}\right) = \frac{1}{\sqrt{1-\frac{1}{4}}}$		Some students introduced $\pm$ or $\lvert\,\rvert$ which were irrelevant
$= \frac{2}{\sqrt{3}}$	1	
(b) $f'(x) = \dfrac{-\frac{a}{x^2}}{1+\frac{a^2}{x^2}}$		well done
$= \frac{-a^2}{x^2+a^2}$	1	
(c) $y = \frac{1}{x}$		
$\int_1^4 \frac{1}{x}\,dx = \left[\ln x\right]_1^4$	1	
$= \ln 4 - \ln 1$		
$= \ln 4$ OR $2\ln 2$	1	
(d) $\int \cos^2 2x \sin 2x\,dx$		1 for $\cos^3 2x$
$= -\frac{\cos^3 2x}{6} + c$		1 for correct $-\frac{1}{6}$.
students didn't recognize this and did a number of conversions please note the ~~of~~ relation $\sin u + \sin v = 2\sin\frac{u+v}{2}\sin\frac{u-v}{2}$ — must be proven.		poorly done students spent a lot of time not going anywhere

MATHEMATICS Extension 1 : Question........

Suggested Solutions	Marks	Marker's Comments
(e) $(3-2x)(1+4x+6x^2+4x^3+x^4)$	1	students tried to use formulaes those who expanded more likely to get correct answer.
coefficient of x^3		
$3\times 4 + -2\times 6$		
$= 12-12$		
$= 0$	1	students stated $12x^3-12x^3=0$ but never commented on the coefficient

Ext 1 2014 T4 Yr 11/12 Q2

a i) $y = x\sin^{-1}x + \sqrt{1-x^2}$

$y' = \frac{x}{\sqrt{1-x^2}} + \sin^{-1}x + \frac{-\cancel{2}x}{\cancel{2}\sqrt{1-x^2}}$

$y' = \sin^{-1}x$

1m for $\frac{x}{\sqrt{1-x^2}} + \sin^{-1}x$
or
1m for $\frac{-\cancel{2}x}{\cancel{2}\sqrt{1-x^2}}$
2m for getting everything correct

ii) $\int_0^1 \sin^{-1}x\,dx = \left[x\sin^{-1}x + \sqrt{1-x^2}\right]_0^1$

$= (\sin^{-1}1 + 0) - (0+1)$

$= \frac{\pi}{2} - 1$

1m

b) $\int_{\frac{\pi}{4}}^{\frac{\pi}{3}} \frac{\sin 2x}{1+\sin^2 x}\,dx = \int_{\frac{\pi}{4}}^{\frac{\pi}{3}} \frac{2\sin x\cos x\,dx}{1+\sin^2 x}$

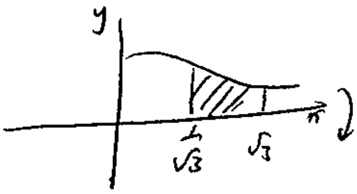
$= \int_{\frac{1}{2}}^{\frac{3}{4}} \frac{du}{1+u} = \ln(1+u)\Big]_{\frac{1}{2}}^{\frac{3}{4}}$ $\quad \left\{\begin{array}{l} u = \sin^2 x \\ x = \frac{\pi}{4},\ u = \frac{1}{2} \\ x = \frac{\pi}{3},\ u = \frac{3}{4} \end{array}\right\}$

$= \ln\frac{7}{4} - \ln\frac{3}{2} = \ln\frac{7}{4}\times\frac{2}{3}$

$= \ln\left(\frac{7}{6}\right)$ #

1m for changing the limit $u = \frac{1}{2}$ & $u = \frac{3}{4}$
1m for $\frac{du}{1+u}$
1m for $\ln(1+u)$
1m for simplifying answer
accept 0.154 (3 dp)
many students wrote $\int_{\frac{1}{2}}^{\frac{3}{4}} \frac{du}{1+u^2} = \tan^{-1}u\Big]_{\frac{1}{2}}^{\frac{3}{4}}$ max 2m

c) $\int_{\frac{1}{\sqrt{3}}}^{\sqrt{3}} \frac{\pi\,dx}{1+x^2}$



$= \pi\tan^{-1}x\Big]_{\frac{1}{\sqrt{3}}}^{\sqrt{3}}$

$= \pi\left(\tan^{-1}\sqrt{3} - \tan^{-1}\frac{1}{\sqrt{3}}\right)$

$= \pi\left(\frac{\pi}{3} - \frac{\pi}{6}\right)$

$= \frac{\pi^2}{6}$ unit³ #

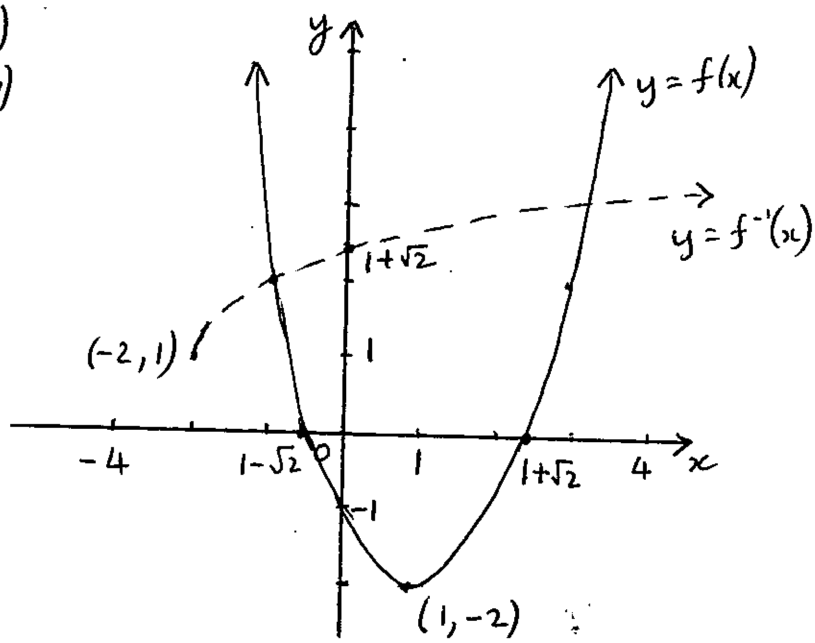
1m for $\pi\cdot\tan^{-1}x$

1m for $\frac{\pi^2}{6}$
many student forget $\frac{\pi^2}{6}$ wrote $\frac{\pi}{6}$.

MATHEMATICS Extension 1 : Question.....

Suggested Solutions	Marks	Marker's Comments
(a)(i) $y = \sec x$ D: $0 \le x < \frac{\pi}{2}$ R: $y \ge 1$ $\therefore$ Inverse function is D: $x \ge 1$ R: $0 \le y < \frac{\pi}{2}$		1 mark each; totally right to get the mark.
(ii) $y = \sec x$ For the inverse function, interchange x and y. $\therefore x = \sec y$ $x = \frac{1}{\cos y}$ $\cos y = \frac{1}{x}$ $\therefore y = \cos^{-1}\left(\frac{1}{x}\right)$ $\therefore f^{-1}(x) = \cos^{-1}\left(\frac{1}{x}\right)$	1 1	* some students did not write what they were doing * some students tried to work backwards from the answer and scored zero!
(iii) $\frac{d}{dx}\left(\cos^{-1}\frac{1}{x}\right) = \frac{-1}{\sqrt{1-\left(\frac{1}{x}\right)^2}} \times \frac{-1}{x^2}$ $= \frac{1}{x^2\sqrt{1-\frac{1}{x^2}}}$ $= \frac{1}{x\sqrt{x^2-1}}$ $x > 1$		* A lot of students forgot to multiply by $\frac{-1}{x^2}$:(1
(b) $\sin^{-1}x + \frac{1}{2}\cos^{-1}y = \frac{\pi}{3}$ ---- ① $3\sin^{-1}x - \frac{1}{2}\cos^{-1}y = \frac{2\pi}{3}$ ---- ② ① + ② $4\sin^{-1}x = \pi$ $\sin^{-1}x = \frac{\pi}{4}$ $\therefore x = \frac{1}{\sqrt{2}}$	 1	

MATHEMATICS Extension 1 : Question..3..... continued.		
Suggested Solutions	**Marks**	**Marker's Comments**
sub $x = \frac{1}{\sqrt{2}}$ into ① $\therefore \frac{\pi}{4} + \frac{1}{2}\cos^{-1} y = \pi/3$ $\frac{1}{2}\cos^{-1} y = \frac{\pi}{6}$ $\therefore \cos^{-1} y = \pi/3$ $y = \frac{\sqrt{3}}{2}$	1	
(5) $T_K = {}^9C_K \left(\frac{3x^2}{2}\right)^{9-K} \left(\frac{-1}{3x}\right)^K$ $= {}^9C_K (-1)^K 3^{9-K} \cdot 2^{K-9} \cdot 3^{-K} x^{-K} (x^2)^{9-K}$ $= {}^9C_K (-1)^K \cdot 3^{9-2K} \cdot 2^{K-9} x^{18-3K}$	1	
constant term is when x^0 ie $x^{18-3K} = x^0$ $18 - 3K = 0$ $K = 6$	1	
$\therefore$ coefficient $= {}^9C_6 (-1)^6 3^{-3} \cdot 2^{-3}$ $= \frac{7}{18}$	1	don't leave it like this, the question asked for the simplified term.

Suggested Solutions	Marks	Marker's Comments
a) $\int_1^e \frac{dt}{t} = \left[\ln t\right]_1^e$ $= \ln e - \ln 1$ $= 1 - 0 = \underline{\underline{1}}$	1	Better <u>not</u> to leave answer in form $\ln e$
b) i) $\frac{dh}{dt} = 1 - \frac{1}{(1+t)^2}$ $\therefore h = t + \frac{1}{(1+t)} + c$ But, when $t=0, h=0$. $\therefore c = -1$ $\therefore h = \underline{\underline{t + \frac{1}{1+t} - 1}} = \underline{\underline{\frac{t^2}{1+t}}}$	1 1	Surprising number of people forgot the constant of integration.
ii) When $t = 60$ (seconds!) $h = \frac{60^2}{61} = \underline{\underline{59\tfrac{1}{61} = 59.02\,m}}$	1	No marks were awarded if a 'c' left in the answer.
c) i) iv) 	1 1	If no intercepts shown on curve, a mark was lost. The curve $y = f^{-1}(x)$ should be vertical at $(-2,1)$. Few showed this. $y = f^{-1}(x)$ is increasing for all $x \geq -2$

Suggested Solutions	Marks	Marker's Comments
c) ii) Largest positive domain to allow inverse is $\{x : x \geq 1\}$	1	Equality needed to be included
iii) Swap x, y in equation and make y subject. $x = (y-1)^2 - 2$ $x+2 = (y-1)^2$ $(y-1) = \pm\sqrt{x+2}$ $y = 1 \pm \sqrt{x+2}$ But if $x \geq 1$ in $f(x)$ then $y \geq 1$ in $f^{-1}(x)$ $\therefore$ use + sign. $y = 1 + \sqrt{x+2}$	1	
Domain $x \geq -2$ Range $y \geq 1$	1	

Maths Extension **Task 1 Term 4** **2014**

Question 5

	Solution	**Marks**	**Comments**
(a)	$$I = \int_0^1 \frac{x}{\sqrt{x+1}}\,dx$$		
	Let $u = x + 1 \Rightarrow du = dx$ and $x = u - 1$		
	When $x = 0,\ u = 1$ And $x = 1,\ u = 2$		
	$$\therefore I = \int_1^2 \frac{u-1}{\sqrt{u}}\,du$$	1	Correctly changing the limits of integration and correctly replacing x by u.
	$$= \int_1^2 (u^{\frac{1}{2}} - u^{-\frac{1}{2}})\,du$$		
	$$= \tfrac{2}{3}u^{\frac{3}{2}} - 2u^{\frac{1}{2}}\,]_1^2$$	1	Correctly integrating
	$$= \left(\tfrac{2}{3}\sqrt{8} - 2\sqrt{2}\right) - \left(\tfrac{2}{3} - 2\right)$$	1	Correctly substituting the upper and lower limits
	$$= \frac{4-2\sqrt{3}}{3}$$		
(b) (i)	$$(x+2y)^{10} = \sum_{k=0}^{10} \binom{10}{k} x^k (2y)^{10-k}$$		
	$$= \sum_{k=0}^{10} \binom{10}{k} 2^{10-k} x^k y^{10-k}$$	1	Correct expression for T_k
	Where $T_k = \binom{10}{k} 2^{10-k} x^k y^{10-k}$.		
(ii)	Now $T_{k+1} = \binom{10}{k+1} 2^{9-k} x^{k+1} y^{9-k}$		
	i.e. $$\frac{T_{k+1}}{T_k} = \frac{\binom{10}{k+1} 2^{9-k} x^{k+1} y^{9-k}}{\binom{10}{k} 2^{10-k} x^k y^{10-k}}$$		
	$$= \frac{10!}{(k+1)!(9-k)!} \cdot \frac{1}{2} \cdot \frac{x}{y} \div \frac{10!}{k!(10-k)!}$$	1	Correctly obtaining an un-simplified expression for the ratio

	$= \frac{k!(10-k)!}{(k+1)!(9-k)!} \cdot \frac{x}{2y}$ $= \frac{k!(10-k)(9-k)!}{(k+1)k!(9-k)!} \cdot \frac{x}{2y}$ $= \frac{(10-k)}{2(k+1)} \cdot \frac{x}{y}$ <u>NOTE</u>: (α) If $T_k = \binom{10}{k}x^{10-k}(2y)^k$, then $\frac{T_{k+1}}{T_k} = \frac{(11-k)}{k} \cdot \frac{2x}{y}$ (β) If $T_k = \binom{10}{k}x^k(2y)^{10-k}$, then $\frac{T_{k+1}}{T_k} = \frac{(10-k)}{k+1} \cdot \frac{x}{2y}$	1	Correct final expression
(iii)	For the greatest term, when $x = \frac{1}{2}, y = \frac{1}{3}$, $\frac{T_{k+1}}{T_k} > 1$ i.e. $\frac{(10-k)}{2(k+1)} \cdot \frac{\frac{1}{2}}{\frac{1}{3}} > 1$ $\frac{10-k}{k+1} > \frac{4}{3}$ $30 - 3k > 4k + 4$ $k < 3\frac{5}{7}$ Hence $k = 3$ The greatest term is $T_4 = \binom{10}{4}2^6\left(\frac{1}{2}\right)^4\left(\frac{1}{3}\right)^6$ $= \frac{\binom{10}{4}4}{729}$ $= \frac{280}{243}$	1	Correct greatest term

(c)	<u>R.T.P.:</u> $\frac{n!}{r!(n-r)!}+\frac{n!}{(r-1)!(n-r+1)!}$		
	<u>Proof:</u> <u>Method i:</u> LHS $=\frac{n!(n-r+1)}{r!(n-r+1)!}+\frac{n!\,r}{r!(n-r+1)!}$ $=\frac{n!(n-r+1)+n!r}{r!(n-r+1)!}$	1	For correctly rewriting $r!$ and $(n-r+1)!$
	$=\frac{n!(n-r+1+r)}{r!(n-r+1)!}$ $=\frac{n!(n+1)}{r!(n-r+1)!}$ $=\frac{(n+1)!}{r!(n-r+1)}=$ RHS	1	For correctly simplifying and arriving at the desired result
	<u>Method ii:</u> $\frac{n!}{r!\,(n-r)!}={}^{n}C_{n-r}$ and $\frac{n!}{(r-1)!(n-r+1)!}={}^{n}C_{n-r+1}$ also, $\frac{(n+1)!}{r!(n-r+1)}={}^{n+1}C_{n-r+1}$	2	
	But ${}^{n}C_{n-r}+{}^{n}C_{n-r+1}={}^{n+1}C_{n-r+1}$ (${}^{n+1}C_k={}^{n}C_{k-1}+{}^{n}C_k$ Pascal's triangle result: each coefficient is the sum of the two coefficients in the row above it) Hence $\frac{n!}{r!(n-r)!}+\frac{n!}{(r-1)!(n-r+1)!}$ is true.		

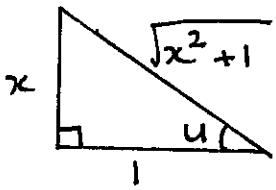
EXTENSION I

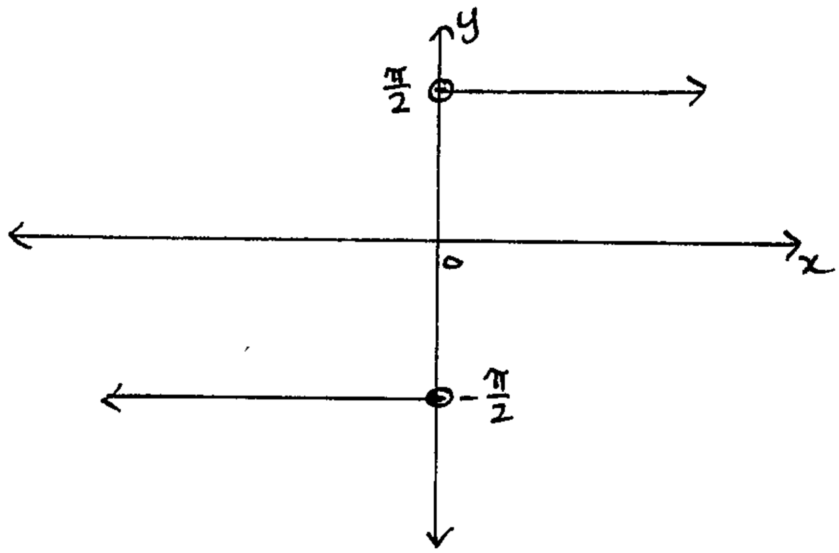
MATHEMATICS: Question 6

Suggested Solutions	Marks	Marker's Comments
(a) $\int \frac{dx}{x(\log_e x)^{11}}$ $\quad u = \log_e x$, $\frac{du}{dx} = \frac{1}{x}$	1	$\frac{du}{dx}$
$= \int \frac{1}{(\log_e x)^{11}} \cdot \frac{1}{x} \, dx$		
$= \int \frac{1}{u^{11}} \, du$	1	correct substitution
$= \int u^{-11} \, du$		
$= \frac{u^{-10}}{-10} + C$		
$= \frac{-1}{10(\ln x)^{10}} + C$	1	correct answer No Loss for no +C.
(b) $(1+px)^n = 1 + 15x + 90x^2 \cdots$		
$= {}^nC_0 + {}^nC_1 px + {}^nC_2 p^2x^2 \cdots$		
$\therefore$ Equate terms of equal powers of x		
${}^nC_1 p = 15$ and ${}^nC_2 p^2 = 90$	1	equate terms
$\frac{n!}{(n-1)!} p = 15$ $\qquad \frac{n!}{(n-2)!\,2!} p^2 = 90$	1	Expand combination terms
$pn = 15$ $\qquad p^2(n)(n-1) = 180$		
$p = \frac{15}{n}$ $\qquad \frac{(15)^2}{n^2} n(n-1) = 180$		
$225n - 225 = 180n$		
$45n = 225$		
$n = 5$		
$\therefore p = 3$	1	correct solution with working
c) $\cos^{-1}x + \cos^{-1}y + \cos^{-1}z = \pi$		
$\cos^{-1}x + \cos^{-1}y = \pi - \cos^{-1}z$		
Let $a = \cos^{-1}x$ $\quad 0 < a < \pi$ $\quad \cos a = x$.		
$b = \cos^{-1}y$ $\quad 0 < b < \pi$ $\quad \cos b = y$		
$c = \cos^{-1}z$ $\quad 0 < c < \pi$ $\quad \cos c = z$		Applying "cos" to LHS and expanding correctly
$\cos(a+b) = \cos(\pi - c)$		
$\cos a \cos b - \sin a \sin b = -\cos c$	1	
$\sin a = +\sqrt{1-x^2}$ as $0 < a < \pi$		
$\sin b = +\sqrt{1-y^2}$ as $0 < b < \pi$	1	correct sub of "sin" expressions and cos of RHS
$\therefore xy - (\sqrt{1-x^2})(\sqrt{1-y^2}) = -z$		
$xy + z = \sqrt{1-x^2-y^2+x^2y^2}$		
$\cancel{x^2y^2} + 2xyz + z^2 = 1 - x^2 - y^2 + \cancel{x^2y^2}$		*($\cos\pi = -1$) if used.
$\therefore x^2+y^2+z^2+2xyz = 1$	1	simplifying to get correct answer

No Loss for not including restrictions

MATHEMATICS Extension 1 : Question…7…

Suggested Solutions	Marks	Marker's Comments
a) $\cos(\tan^{-1}x)$		
let $u = \tan^{-1}x$ $\tan u = x$ 		
$\therefore \cos u = \dfrac{1}{\sqrt{x^2+1}}$		
$\therefore \cos(\tan^{-1}x) = \dfrac{1}{\sqrt{x^2+1}}$	1	
b) i) $(q+p)^n - (q-p)^n$		
$= \cancel{{}^nC_0 q^n} + {}^nC_1 q^{n-1}p + \cancel{{}^nC_2 q^{n-2}p^2} + \dots + {}^nC_n p^n$ $- (\cancel{{}^nC_0 q^n} - {}^nC_1 q^{n-1}p + \cancel{{}^nC_2 q^{n-2}p^2} + \dots)$	1	
$= 2\,{}^nC_1 q^{n-1}p + 2\,{}^nC_3 q^{n-3}p^3 + \dots$		
$= 2\binom{n}{1}q^{n-1}p + 2\binom{n}{3}q^{n-3}p^3 + \dots$	1	
ii) $2\binom{n}{n}p^n = 2p^n$	1	
iii) $2\binom{n}{n-1}qp^{n-1} = 2nqp^{n-1}$	1	
c) i) $y = \tan^{-1}\frac{1}{x}$		
$\dfrac{dy}{dx} = \dfrac{1}{1+(\frac{1}{x})^2} \times \dfrac{-1}{x^2}$ $= \dfrac{-1}{x^2+1}$	1	
$\dfrac{d}{dx}(\tan^{-1}\frac{1}{x} + \tan^{-1}x)$ $= \dfrac{-1}{x^2+1} + \dfrac{1}{x^2+1}$ $= 0$	1	

MATHEMATICS Extension 1 : Question....7...		
Suggested Solutions	**Marks**	**Marker's Comments**
ii) when $x=1$, $y=\tan^{-1}1+\tan^{-1}1$ $=\frac{\pi}{4}+\frac{\pi}{4}$ $=\frac{\pi}{2}$ when $x=-1$, $y=\tan^{-1}(-1)+\tan^{-1}(-1)$ $=-\frac{\pi}{4}-\frac{\pi}{4}$ $=-\frac{\pi}{2}$ 	2	1 for the two different lines 1 for open circles