WESTERN REGION

2008
Preliminary Course
FINAL EXAMINATION

Mathematics

General Instructions

- Reading Time - 5 minutes.
- Working Time – 2 hours.
- Write using a black or blue pen.
- Board Approved calculators may be used.
- A table of standard integrals is provided at the back of this paper.
- All necessary working should be shown for every question.
- Begin each question on a fresh sheet of paper.

Total marks (**84**)

- Attempt Questions 1- 7.
- All questions are of equal value.

STANDARD INTEGRALS

$$\int x^n\,dx = \frac{1}{n+1}x^{n+1},\quad n\neq -1;\quad x\neq 0,\text{ if } n<0$$

$$\int \frac{1}{x}dx = \ln x,\quad x>0$$

$$\int e^{ax}\,dx = \frac{1}{a}e^{ax},\quad a\neq 0$$

$$\int \cos ax\,dx = \frac{1}{a}\sin ax,\quad a\neq 0$$

$$\int \sin ax\,dx = -\frac{1}{a}\cos ax,\quad a\neq 0$$

$$\int \sec^2 ax\,dx = \frac{1}{a}\tan ax,\quad a\neq 0$$

$$\int \sec ax\tan ax\,dx = \frac{1}{a}\sec ax,\quad a\neq 0$$

$$\int \frac{1}{a^2+x^2}dx = \frac{1}{a}\tan^{-1}\frac{x}{a},\quad a\neq 0$$

$$\int \frac{1}{\sqrt{a^2-x^2}}dx = \sin^{-1}\frac{x}{a},\quad a>0,\quad -a<x<a$$

$$\int \frac{1}{\sqrt{x^2-a^2}}dx = \ln\left(x+\sqrt{x^2-a^2}\right),\quad x>a>0$$

$$\int \frac{1}{\sqrt{x^2+a^2}}dx = \ln\left(x+\sqrt{x^2+a^2}\right)$$

NOTE : $\ln x = \log_e x,\quad x>0$

Question 1 (12 Marks) Use a Separate Sheet of paper **Marks**

a) If $s=\dfrac{a}{1-r}$ find s when $a=7, r=\dfrac{1}{3}$. **1**

b) Express the decimal $0.3\dot{5}\dot{7}$ as a fraction in simplest form. **1**

c) Show that $\dfrac{3\sqrt{2}-2\sqrt{3}}{3\sqrt{2}+2\sqrt{3}}$ can be expressed in the form $a+b\sqrt{6}$ and find a and b. **2**

d) Simplify $\dfrac{|x+3|}{x^2-9}$ for $x\neq\pm3$. **2**

e) Factorise the following expressions fully:

i) $8-27d^3$ **1**

ii) $mx^2+my^2-nx^2-ny^2$ **1**

f) Simplify $\dfrac{m^3+m^2}{x^2-x}\div\dfrac{m+1}{x-x^3}$ as a single fraction in simplest form. **1**

g) Solve for x:

i) $\dfrac{3x-2}{2}-5=4$ **1**

ii) $3x^2-x-3=0$ **2**

End of Question 1.

Question 2 (12 Marks) Use a Separate Sheet of paper **Marks**

a) Explain why $f(x)=3^x$ is neither an odd function nor an even function. **1**

b) If $f(x)=5x-x^2$, find $\dfrac{f(x+h)-f(x)}{h}$ **2**

c) Sketch the graphs of the following, stating the domain and range of each.

i) $y=\dfrac{2}{x}$ **2**

ii) $x^2+y^2=25$ **2**

iii) $3(x+2)-y=0$ **2**

d) Show the region of the number plane where the following hold simultaneously: **3**

$(x+1)^2+y^2\leq4$

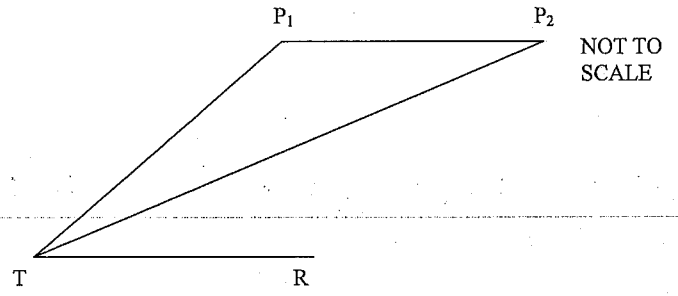
$y\leq2^x$

and $y\geq0$

End of Question 2.

Question 3 (12 Marks) Use a Separate Sheet of paper **Marks**

a) P_1 and P_2 are two planes which are at the same height and 2000 metres apart. T is the base of the airport observation tower and R the end of the runway. $\angle P_1TR = 15°$ and $\angle P_2TR = 10°$.



i) Copy the diagram and mark the relevant information on it. **1**

ii) Find the height of the planes to the nearest metre. **2**

b) Two straight roads intersect at a point I. Car A is 6.3 km along one road and is due east of the intersection. Car B is 4.2 km along the other road on a bearing of 162° from the intersection.

i) Draw a diagram and mark the relevant information on it. **1**

ii) Find the distance between the two cars, correct to 2 significant figures. **1**

iii) Hence or otherwise, find the bearing of Car B from Car A to the nearest degree? **2**

Question 3 continues on page 5

Question 3 (continued) **Marks**

c) Find the exact value of $\tan(-150°)$. **1**

d) i) Solve $2\cos\theta = -1$ for $0° \le \theta \le 360°$. **2**

ii) Prove $(1-\cos\theta)(1+\sec\theta) = \sin\theta\tan\theta$. **2**

End of Question 3.

Question 4 (12 Marks) Use a Separate Sheet of paper **Marks**

The points A(3,4), B(1,-6) and C(-5,2) are the vertices of a triangle.

a) Find the mid-point P of AB. **1**

b) Show that the equation of the line k joining A to C is $x-4y+13=0$ **2**

c) Find the equation of the line l through P parallel to BC. **2**

d) Find the point of intersection Q of the lines k and l. **2**

e) Show that Q is the mid-point of AC. **1**

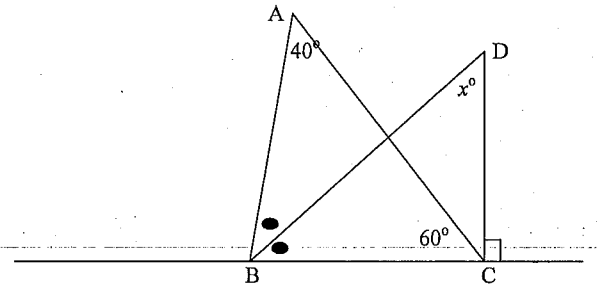
f) Show that $PQ=\frac{1}{2}BC$ **2**

g) Find the perpendicular distance from B to AC. **2**

End of Question 4.

Question 5 (12 Marks) Use a Separate Sheet of paper **Marks**

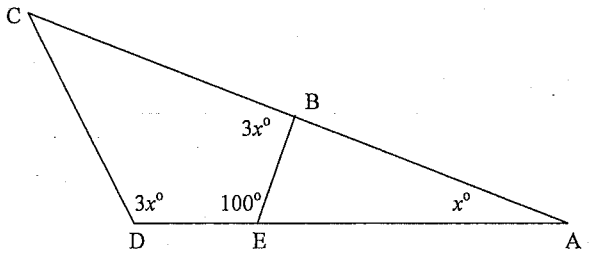
a) In the figure, BD bisects $\angle ABC$, DC is perpendicular to BC, $\angle ACB=60°$ $\angle BAC=40°$ $\angle BDC=x°$.



i) Draw a neat sketch of the diagram. **1**

ii) Calculate x giving reasons for each step in your calculation. **2**

b) As shown in the figure, the points B and E lie on AC and DA respectively of ΔACD. **3**



Use the information shown on the figure to find the value of x and hence find $\angle ACD$ in degrees. Give reasons for your answers.

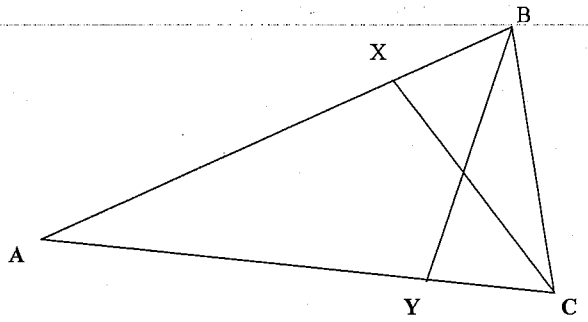
Question 5 continues on page 9

Question 5 (continued) **Marks**

c) i) Find the sum of the interior angles of a regular 11 sided polygon. **2**

ii) How large is each exterior angle to the nearest minute? **1**

d) In the figure below ΔABC is isosceles where AB = AC. **3**
If XB = YC, prove that $\Delta BCY \equiv \Delta BCX$ and hence that XC = YB.



End of Question 5.

Question 6 (12 Marks) Use a Separate Sheet of paper **Marks**

a) Express $5x^2+2x-3$ in the form $A(x+1)^2+B(x+1)+C$. **2**

b) Solve $9^x-10(3^x)+9=0$. **2**

c) Find values of k for which $x^2+kx+16$ is positive definite. **2**

d) For the equation $2x^2+x-3=0$ with roots α and β, find the value of:

i) $\alpha+\beta$ **1**

ii) $\alpha\beta$ **1**

iii) $\frac{1}{\alpha}+\frac{1}{\beta}$ **1**

e) For the parabola defined by $x^2+4x-8y+12=0$, find the:

i) Coordinates of the vertex. **1**

ii) Coordinates of the focus. **1**

iii) Equation of the directrix. **1**

End of Question 6.

Question 7 (12 Marks) Use a Separate Sheet of paper **Marks**

a) Find the derivative of the following: (You do not need to simplify your answers after finding the derivative.)

i) $-4x^5-4x^3+11$ **1**

ii) $\sqrt[5]{x^2}$ **1**

iii) $\dfrac{1}{x+3}$ **1**

b) i) Find $f'(2)$ for $f(x)=\left(3x^2-5x\right)^5$. **2**

ii) If $y=\dfrac{2}{(x+1)^3}$ find $\dfrac{dy}{dx}$. **1**

iii) Given $y=\dfrac{x^2-1}{x^2+1}$ find y'. **2**

iv) Find $g'(x)$ if $g(x)=(x+2)^3(x-1)^4$. **2**

c) Find the gradient of the curve $y=\dfrac{x}{x^2+1}$ at the origin and hence find the equation of the tangent to this curve at the origin. **2**

End of Examination.

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Mathematics

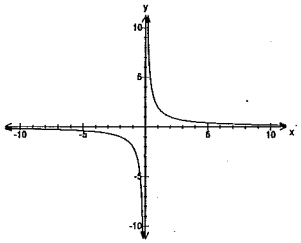
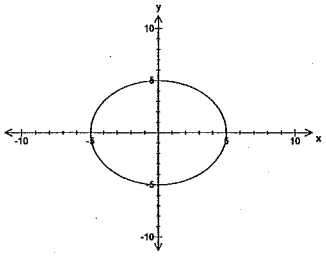
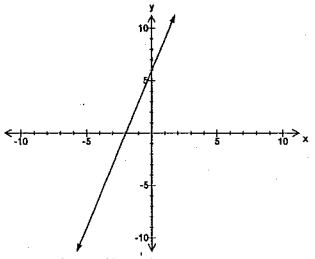
SOLUTIONS

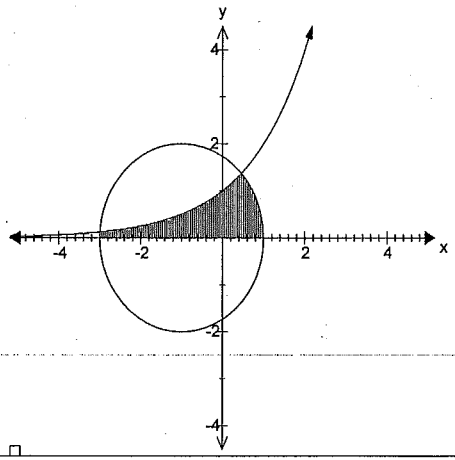
Question 1	Preliminary HSC Examination- Mathematics		2008	
Part	Solution		Marks	Comment
(a)	$S=\frac{a}{1-r}$ $S=\frac{7}{1-\frac{1}{3}}$ $S=10\frac{1}{2}$		1	
(b)	Let $x=0.3\dot{5}\dot{7}$ $100x=35.7\dot{5}\dot{7}$ - $x=0.3\dot{5}\dot{7}$ $99x=35.4$ $x=\frac{354}{990}$ $x=\frac{59}{165}$	Let $x=0.3\dot{5}\dot{7}$ $10x=3.\dot{5}\dot{7}$ $1000x=357.\dot{5}\dot{7}$ $990x=354$ $x=\frac{354}{990}$ $x=\frac{59}{165}$	1	
(c)	$\frac{3\sqrt{2}-2\sqrt{3}}{3\sqrt{2}+2\sqrt{3}}\times\frac{3\sqrt{2}-2\sqrt{3}}{3\sqrt{2}-2\sqrt{3}}$ $=\frac{(3\sqrt{2}-2\sqrt{3})^2}{18-12}$ $=\frac{18-6\sqrt{6}+12}{6}$ $=\frac{30-12\sqrt{6}}{6}$ $=\frac{\cancel{6}(5-2\sqrt{6})}{\cancel{6}}$ $=5-2\sqrt{6}$ $\therefore a=5$ and $b=-2$		2	1 for multiplying correctly. 1 for finding a and b

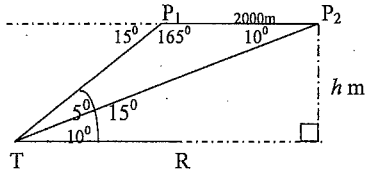
Question 1	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(d)	$\frac{\lvert x+3\rvert}{x^2-9}$ $=\frac{(x\neq 3)}{(x\neq 3)(x-3)}$ if $x+3>0$ or $\frac{-(x\neq 3)}{(x\neq 3)(x-3)}$ if $x+3<0$ $=\frac{1}{x-3}$ if $x>-3$ $=\frac{-1}{x-3}$ if $x<-3$	2	Only 1 if both cases not considered 2 marks for full solution
(e)	i) $8-27d^3$ $=(2-3d)(4+6d+9d^2)$	1	
	ii) $mx^2+my^2-nx^2-ny^2$ $=m(x^2+y^2)-n(x^2+y^2)$ $=(x^2+y^2)(m-n)$	1	
(f)	$\frac{m^3+m^2}{x^2-x}\div\frac{m+1}{x-x^3}$ $=\frac{m^2(m+1)}{x(x-1)}\times\frac{-x(x^2-1)}{m+1}$ $=\frac{m^2(m\neq 1)}{x(x-1)}\times\frac{-x(x+1)(x-1)}{m\neq 1}$ $=-m^2(x+1)$	1	

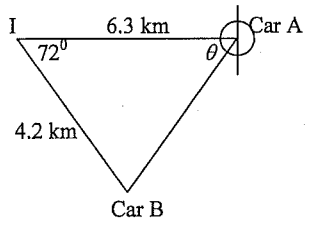
Question 1	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(g)	i) $\frac{3x-2}{2}-5=4$ $\frac{3x-2}{2}=9$ $3x-2=18$ $3x=20$ $x=\frac{20}{3}$	1	
	ii) $3x^2-x-3=0$	2	
	$=\frac{--1\pm\sqrt{(-1)^2-4\times 3\times -3}}{2\times 3}$ $=\frac{1\pm\sqrt{1+36}}{6}$ $=\frac{1\pm\sqrt{37}}{6}$		1 for sub in formula 1 for simplifying

Question 2	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(a)	$f(x)=3^x$ $f(-x)=3^{-x}$ $=\frac{1}{3^x}$ $\neq f(x)$ or $-f(x)$ $\therefore$ the function is neither.	1	
(b)	$f(x)=5x-x^2$ $f(x+h)=5(x+h)-(x+h)^2$ $=\frac{5x+5h-x^2-2xh-h^2-5x+x^2}{h}$	2	1
	$=\frac{h(5-2x-h)}{h}$ $=5-2x-h$		1

Question 2	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(c)	i)  Domain: All real x ; $x \neq 0$ Range: All real y ; $y \neq 0$	2	1 for graph 1 for domain and range, if either wrong, no mark.
	ii)  Domain: $-5 \leq x \leq 5$ Range: $-5 \leq y \leq 5$	2	1 for graph 1 for domain and range, if either wrong, no mark.
	iii)  Domain: All real x Range: All real y	2	1 for graph 1 for domain and range, if either wrong, no mark.

Question 2	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(d)		3	2 for correct graphs 1 for correct region shaded

Question 3	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(a)	i) 	1	
	ii) $\frac{P_2T}{\sin 165^\circ} = \frac{2000}{\sin 5^\circ}$ $P_2T = \frac{2000 \times \sin 165^\circ}{\sin 5^\circ} = 5939.2$ $\sin 10^\circ = \frac{h}{P_2T}$ $h = P_2T \sin 10^\circ$ $h = \left[\frac{2000 \times \sin 165^\circ}{\sin 5^\circ}\right] \times \sin 10^\circ \approx 5939.2 \times \sin 10^\circ$ $h = 1031\text{m}$	2	1 for finding P_2T (or P_1T) 1 for finding height using either P_1T or P_2T. Don't take a mark off for any rounding.

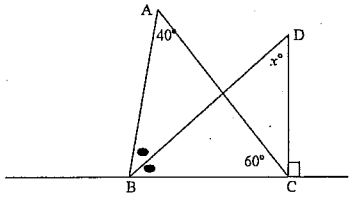
Question 3	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(b)	i)  	1	
	ii) $c^2 = a^2 + b^2 - 2bc\cos A$ $AB^2 = 6.3^2 + 4.2^2 - 2\times 6.3\times 4.2\cos 72°$ $AB = 6.4$ km	1	
	iii) $\frac{\sin A}{a} = \frac{\sin B}{b}$ $\frac{\sin\theta}{4.2} = \frac{\sin 72°}{6.4}$ $\theta = 38°37'$ $\theta = 39°$ $\therefore 270° - 39° = 231°$ $\therefore$ Bearing of Car B from Car A is 231°T	2	1 for finding angle 1 for bearing
(c)	$\tan(-150°) = \tan 210°$ $= \tan 30°$ $= \frac{1}{\sqrt{3}}$	1	

Question 3	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(d)	i) $2\cos\theta = -1 \qquad 0° \le \theta \le 360°$ $\cos\theta = \frac{-1}{2}$ $\cos 60° = \frac{1}{2}$ and $\cos\theta$ is negative in quad 2 & 3 $\therefore \theta = 180° - 60° = 120°$ $\theta = 180° + 60° = 240°$ $\therefore \theta = 120°, 240°$	2	1 for acute value 1 for solution
	ii) $(1+\cos\theta)(1+\sec\theta) = \sin\theta\tan\theta$ *LHS* $= 1 + \sec\theta - \cos\theta - \cos\theta\sec\theta$ $= 1 + \sec\theta - \cos\theta - \cos\theta\times\frac{1}{\cos\theta}$ $= 1 + \sec\theta - \cos\theta - 1$ $= \frac{1}{\cos\theta} - \cos\theta$ $= \frac{1-\cos^2\theta}{\cos\theta}$ $= \frac{\sin^2\theta}{\cos\theta}$ $= \sin\theta\times\frac{\sin\theta}{\cos\theta}$ $= \sin\theta\tan\theta$ $= RHS$	2	1 for expansion 1 for proof using any method.

Question 4	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(a)	$\text{Midpt} = \left(\frac{3+1}{2}, \frac{4+-6}{2}\right)$ $P = (2.-1)$	1	
(b)	Equation AC $m = (\frac{2-4}{-5-3})$ $m = \frac{-2}{-8}$ $m = \frac{1}{4}$ $m = \frac{1}{4}$ & pt $A(3,4)$ $y - y_1 = m(x - x_1)$ $y - 4 = \frac{1}{4}(x-3)$ $4y - 16 = x - 3$ $x - 4y + 13 = 0$	2	1 for gradient 1 for equation
(c)	$m_{BC} = (\frac{2--6}{-5-1})$ $m = \frac{8}{-6}$ $m_{BC} = -\frac{4}{3}$ $m_1 = m_2$ lines parallel $m_l = -\frac{4}{3}$ & pt $P(2,-1)$ $y - y_1 = m(x - x_1)$ $y - -1 = -\frac{4}{3}(x-2)$ $3y + 3 = -4x + 8$ $4x + 3y - 5 = 0$	2	1 for gradient of parallel lines 1 for equation

Question 4	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(d)	Equation_k : $x - 4y + 13 = 0$ Equation_l : $4x + 3y - 5 = 0$ $x = 4y - 13$ from (1) sub into (2) $4(4y-13) + 3y - 5 = 0$ $16y - 52 + 3y - 5 = 0$ $19y - 57 = 0$ $19y = 57$ $y = 3$ sub into (2) $4x + 3 \times 3 - 5 = 0$ $4x + 9 - 5 = 0$ $4x + 4 = 0$ $4x = -4$ $x = -1$ $\therefore Q = (-1,3)$	2	1 for x and 1 for y
(e)	$\text{Midpt}_{AC}\left(\frac{3+-5}{2}, \frac{4+2}{2}\right)$ $= \left(\frac{-2}{2}, \frac{6}{2}\right)$ $\text{Midpt}_{AC} = (-1,3) = Q$	1	
(f)	$PQ = \frac{1}{2}BC$ $d_{PQ} = \sqrt{(3--1)^2 + (-1-2)^2}$ $= \sqrt{16+9}$ $= 5 units$ $d_{BC} = \sqrt{(2--6)^2 + (-5-1)^2}$ $= \sqrt{64+36}$ $= 10 units$ $\therefore PQ = \frac{1}{2} \times BC$ $5 = \frac{1}{2} \times 10$	2	1 for each distance PQ and BC.

Question 4	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(g)	$d=\left\|\dfrac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right\|$ $=\left\|\dfrac{1(1)+-4(-6)+13}{\sqrt{1^2+(-4)^2}}\right\|$ $=\left\|\dfrac{38}{\sqrt{17}}\right\|$ $=\dfrac{38}{\sqrt{17}}$	2	1 for sub in formula 1 for answer, no need to rationalise of simplify.

Question 5	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(a)	i)  ii) $\angle DCA=30°$ $(\angle$ angle sum straight line $=180°)$ $\angle ABC=180°-100°=80°$ ($\angle$ angle sum $\Delta=180°$) $\therefore \angle DBC=40°$ (given equal angles) $x=$ $180°-90°-40°$($\angle$ angle sum $\Delta BDC=180°$) $x=50°$	1 2	1 for angle 1 for reasons
(b)	$\angle DCA=360°-[6x+100]$ ($\angle$sum quad $=360°$) $\angle DCA=180-[4x]$ ($\angle$sum ΔACD $=180°$) $360°-6x-100°=180°-4x$ $260°-6x=180°-4x$ $80°=2x$ $x=40°$ If $x=40°$ $\angle ACD=180°-(4\times 40°)$ from above $\therefore \angle ACD=20°$	3	1 for any appropriate working 1 for x 1 for $\angle ACD$
(c)	i) $S=(2n-4)\times 90$ $=2\times 11-4\times 90$ $=1620°$ ii) Sum of exterior angles $=$ $360°$ $360°\div 11$ $=32°44'$	2 1	1 1

Question 5	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(d)	$YC = XB$ (given) $\angle ABC = \angle ACB$ (base $\angle$'s isosceles Δ=) BC is common $\Delta BCY \equiv \Delta BCX (SAS)$ $\therefore XC = YB$ (Corresponding sides of congruent triangles)	3	1 for correct data for congruence 1 for congruence reason 1 for hence conclusion

Question 6	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(a)	$A(x+1)^2 B(x+1)+C$ $= Ax^2 + 2Ax + A + Bx + B + C$ $= Ax^2 + x(2A+B) + A + B + C$ equating coefficients $\therefore A = 5$ $2A + B = 2$ $10 + B = 2$ $\therefore B = -8$ $A + B + C = -3$	2	1 for expansion
	$5 - 8 + C = -3$ $\therefore C = 0$ $\therefore 5x^2 + 2x - 3 = 5(x+1)^2 - 8(x+1)$		1 for correct A, B, C
(b)	Let $m = 3^x$ $\therefore m^2 - 10m + 9 = 0$ $(m-9)(m-1) = 0$ $3^x = 9$ or $3^x = 1$ $x = 2$ or 0	2	1 for solving after sub 1 for answers
(c)	i) $x^2 + kx + 16$ $\Delta < 0$ $b^2 - 4ac < 0$ $k^2 - 4 \times 1 \times 16 < 0$ $k^2 - 64 < 0$ $(k-8)(k+8) < 0$ $-8 < k < 8$	2	1 for $\Delta < 0$ 1 for k

Question 6	Preliminary HSC Examination- Mathematics	2008	
Part	Solution	Marks	Comment
(d)	i) $\alpha+\beta=\frac{-b}{a}$ $=\frac{-1}{2}$	1	
	ii) $\alpha\beta=\frac{c}{a}$ $=\frac{-3}{2}$	1	
	iii) $\frac{1}{\alpha}+\frac{1}{\beta}=\frac{\alpha\beta}{\alpha+\beta}$ $=\frac{-\frac{1}{2}}{-\frac{3}{2}}$ $=\frac{1}{3}$	1	
(e)	$x^2+4x+4=8y-12+4$ (Completing the square) $(x+2)^2=8(y-1)$ parabola in the form $(x-h)^2=4a(y-k)$ $\therefore h=-2, k=1 \& a=2$ i) Vertex $=(-2,1)$ ii) Focus $=(-2,3)$ iii) Directrix $y=-1$	1 1 1	

Question 7	Preliminary HSC Examination- Mathematics		2008
Part	Solution	Marks	Comment
(a)	i) $\frac{d}{dx}\left(-4x^5-4x^3+11\right)$ $=-20x^4-12x^2$	1	
	ii) $\frac{d}{dx}\left(x^{\frac{2}{5}}\right)$ $=\frac{2}{5}x^{-\frac{3}{5}}$ or $\frac{2}{5\sqrt[5]{x^3}}$	1	
	iii) $\frac{d}{dx}\left(\frac{1}{x+3}\right)=(x+3)^{-1}$ $=-(x+3)^{-2}$ or $\frac{-1}{(x+3)^2}$	1	

Question 7	Preliminary HSC Examination- Mathematics		2008
Part	Solution	Marks	Comment
(b)	i) $f(x)=(3x^2-5x)^5$ $f'(x)=5(6x-5)(3x^2-5x)^4$ $=(30x-25)(3x^2-5x)^4$ $f'(2)=(30\times2-25)(3\times2^2-5\times2)^4$ $=560$	2	1 for $f'(x)$ 1 for $f'(2)$
	ii) $y=\dfrac{2}{(x+1)^3}$ $\dfrac{d}{dx}\left(2(x+1)^{-3}\right)=-6(x+1)^{-4}$ or $\dfrac{-6}{(x+1)^4}$	1	
	iii) $y=\dfrac{x^2-1}{x^2+1}$ $u=x^2-1 \quad v=x^2+1$ $du=2x \quad dv=2x$ $y'=\dfrac{2x(x^2+1)-2x(x^2-1)}{(x^2+1)^2}$ $=\dfrac{2x^3+2x-2x^3+2x}{(x^2+1)^2}$ $=\dfrac{4x}{(x^2+1)^2}$	2	1 for correct du and dv 1 for correct quotient rule or equivalent. No need to simplify.
	iv) $g(x)=(x+2)^3(x-1)^4$ $u=(x+2)^3 \quad v=(x-1)^4$ $du=3(x+2)^2 \quad dv=4(x-1)^3$ $g'(x)=3(x+2)^2(x-1)^4+4(x-1)^3(x+2)^3$ $=(x-1)^3(x+2)^2\left[3(x-1)+4(x+2)\right]$ $=(x-1)^3(x+2)^2(7x+5)$	2	1 for correct du and dv 1 for correct product rule. No need to simplify

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(c)	$y=\dfrac{x}{x^2+1}$ $u=x \quad v=x^2+1$ $du=1 \quad dv=2x$ $y'=\dfrac{x^2+1-2x^2}{(x^2+1)^2}$ $=\dfrac{1-x^2}{(x^2+1)^2}$ when $x=0, y'=1$ $\therefore m=1$ pt$(0,0)$ $y-y_1=m(x-x_1)$ $y-0=1(x-0)$ $\therefore y=x$ is the tangent to the curve $y=\dfrac{x}{x^2+1}$ at the origin	2	1 for derivative 1 for equation