

Question 1 Trial HSC Examination - Mathematics Extension								
Part	Solution	L		Μ	arks	Comment		
a)	Domain	and range of y =	$=4\cos^{-1}\left(\frac{3x}{2}\right)$	2				
	$y = \cos x \\ 0 \le y \le x$		n $-1 \le x \le 1$ and	range		1 for range and		
	So for	$y = 4\cos^{-1}\left(\frac{3x}{2}\right)$	i.e. $\frac{y}{4} = \cos^{-1}\left(\frac{3}{2}\right)$	$\left(\frac{x}{2}\right)$		1 for domain		
			Range given	by		Or if both answers		
	$-1 \leq \frac{3x}{2}$		$0 \le \frac{y}{4} \le \pi$			wrong 1 mark for reasonable		
	$-2 \leq 3$		$0 \le y \le 4\pi$			attempt to deduce D and R.		
b)	$-\frac{2}{3} \le x$ $x - 3y = -\frac{1}{3}$	$\frac{5}{3}$	x - 2y = 0	2		1 for gradients of		
,	2	3y = x - 2	-	C		the two lines		
		5 5	$y = \frac{x}{2}$			1 for evaluating the angle		
		ient = $\frac{1}{3}$	Gradient $=\frac{1}{2}$.					
	$tan \theta =$	$\left \frac{m_1-m_2}{1+m_1m_2}\right $						
	=	$\left \frac{\frac{1}{2} - \frac{1}{3}}{1 + \frac{1}{2} \cdot \frac{1}{3}} \right $	0					
	=	$\begin{vmatrix} \frac{1}{6} \\ \frac{7}{6} \end{vmatrix}$ $\frac{1}{7}$						
	θ =	$\tan^{-1}\left(\frac{1}{7}\right)$						
	1	8° (nearest deg	ree)					
				I		L		

-	tion 1 Trial HSC Examination - Mathematics E		2011
Part	Solution	Marks	Comment
c)	Root of $y = e^{x} - 2x^{2}$ using $x = 2.5$ $f(x) = e^{x} - 2x^{2}$	2	1 for values of
	$f'(x) = e^x - 4x$		f(2.5) and $f'(2.5)$
	f(2.5) = -0.318		
	f'(2.5) = 2.182		
	$x_1 = 2.5 - \frac{f(2.5)}{f'(2.5)}$		
	$= 2.5 - \frac{-0.318}{2.182}$		1 use of N M to
	= 2.5 - (-0.145)		obtain answer.
	= 2.645		
d)	To find asymptote to $y = \frac{3x^2 - 2x + 1}{x^2 - x}$	3	1 mark for each asymptote.
	For horizontal asymptote divide		
	$\frac{3}{x^2 - x) 3x^2 - 2x + 1}$		Or 2 marks for
	$\frac{x - x - 3x - 2x + 1}{\frac{3x^2 - 3x}{x + 1}}$		horizontal
	x + 1 So		asymptote correct and attempt at
	$y = 3 + \frac{x+1}{x^2 - x}$		discontinuities
	as $x \to \pm \infty$; $\frac{x+1}{x^2} \to 0$		Or 1 mark if some
	$x - x$ so $y \rightarrow 3$		progress made toward both
	Horizontal asymptote is $y = 3$		horizontal and vertical but
	Discontinuities when $x^2 - x = 0$ so vertical		answers wrong.
	asymptotes where $x(x-1) = 0$		
	i.e. when $x = 0$ and $x = 1$		
	Vertical asymptotes where $x = 0$ and $x = 1$.		

-	tion 1	Trial HSC Examination - Mathem					
Part	Solution		Μ	arks	Comment		
e)		$\frac{2x}{x-1} \ge 6 ; x \neq 1$	3		1 for multiplying		
					by $(x-1)^2$		
		$\frac{2x}{-1}(x-1)^2 \ge 6(x-1)^2$			correctly		
	л	$2x(x-1) \ge 6(x^2 - 2x + 1)$					
					1 for solving		
		$2x^2 - 2x \ge 6x^2 - 12x + 6$			inequality		
		$0 \ge 4x^2 - 10x + 6$					
	4 <i>x</i> ²	$x^2 - 10x + 6 \le 0$			1 for final answer including $x \neq 1$.		
	$4x^2 - 4x^2$	$4x - 6x + 6 \le 0$					
	4x(x-1)	$-6(x-1) \leq 0$					
	2(2 <i>x</i>	$-3)(x-1) \le 0$					
		$1 \le x \le \frac{3}{2}$					
		But $x \neq 1$					
		so $1 < x \le \frac{3}{2}$					
			/1	2			

Question 2 Trial HSC Examination - Mathematics Extension 1				2011
Part	Solution		Mar	ks Comment
a)		x^2	3	1 for
		$y = \frac{x}{8}$		gradient
		$\frac{dy}{dx} = \frac{2x}{8} = \frac{x}{4}$		1 for sub in
		$\frac{1}{dx} - \frac{1}{8} - \frac{1}{4}$		equation of
		when $x = 4p$		line.
		$\frac{dy}{dx} = \frac{4p}{4} = p$		\square
	Gradient	of normal = $-\frac{1}{p}$		
		r		1 for
	Equation	$y - 2p^2 = -\frac{1}{p}(x - 4p)$		simplifying
		$py - 2p^3 = -x + 4p$		
		$\frac{x + py = 2p^3 + 4p}{\cos(2x + x)}$		
b)	$\cos 3x =$	cos(2x + x)	3	1 for use of
	=	$\cos 2x. \cos x - \sin 2x. \sin x$		the sum
		(2 2 1)		result to star
	=	$(2\cos^2 x - 1).\cos x - 2\sin x.\cos x.$	sinx	the
	=	$2\cos^3 x - \cos x - 2\cos x \cdot \sin^2 x$		expression.
	=	$2\cos^3 x - \cos x - 2\cos x(1 - \cos^2 x)$)	2 for using
				the double
	=	$2\cos^3 x - \cos x - 2\cos x + 2\cos^3 x$	x	angle and
	=	$4\cos^3 x - 3\cos x$		eliminating
				sinx
				3 for
				simplifying
				and
				obtaining
				final result.

	ion 2 Trial HSC Examination - Mathematics Exte		2011
Part	Solution	Marks	Comment
c)	$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$	3	1 if
			substitute
	$= \lim_{h \to 0} \frac{(x+h)^3 + (x+h) - (x^3 + x)}{h}$		correctly into formula
	$= \lim_{h \to 0} \frac{x^3 + 3x^2h + 3xh^2 + h^3 + x + h - x^3 - x}{h}$		1 for
			expanding
	$= \lim_{h \to 0} \frac{3x^2h + 3xh^2 + h^3 + h}{h}$		
			1 for
	$= \lim_{h \to 0} \frac{h(3x^2 + 3xh + h^2 + 1)}{h}$		applying the
			limit correctly
	$= \lim_{h \to 0} (3x^2 + 3xh + h^2 + 1)$		concerty
d)	$= 3x^{2} + 1$ $T_{k+1} = {}^{15}\mathbf{C}_{k} \left(\frac{4}{x}\right)^{15-k} (x^{2})^{k}$	3	1 mark for
u)	$T_{k+1} = {}^{15}\mathbf{C}_k \left(\frac{4}{x}\right)^{-1} \left(x^2\right)^k$	3	general term
	$= {}^{15}\mathbf{C}_{k} 4 {}^{15-k} {}^{k-15} {}^{2k} {}^{2k}$		C
	Ň		
	$= {}^{15}\mathbf{C}_k 4^{15-k} . x^{3k-15}$		
	For term independent of <i>x</i>		1 mark for
	3k - 15 = 0		setting power = 0
	3k = 15		and solve.
	k = 5		
	$T_6 = {}^{45}\mathbf{C}_5 \left(\frac{4}{x}\right)^{15-5} {(x^2)}^5$		
	$= {}^{15}\mathbf{C}_5 \frac{4^{10}}{x^{10}} \cdot x^{10}$		
	$= {}^{10}C_5 \frac{10}{x} x$		
	$= {}^{15}\mathbf{C}_5(4^{10})$		1 mark for term (left in
	$= 3003(1\ 048\ 576)$		${}^{n}\mathbf{C}_{r}$ form is
	= 3148873728		okay)
	- 3 148 873 728	/12	

	Question 3 Trial HSC Examination - Mathematics Extension 1					
Part	Solution				Mark	ks Comment
a)	d (-1 (-1			2	1 for initial
	$\frac{dx}{dx}(\cos t^2)$	$4x)) = \frac{-1}{\sqrt{\left(\frac{1}{4}\right)^2}}$	2			substitution
		$\sqrt{\left(\frac{1}{4}\right)}$	$-x^{}$			in rule.
		=	_			1.0
		$=\frac{-1}{\sqrt{\frac{1}{16}}}$	x^2			1 for
		N 16				expanding and
		1				simplifying
		$=\frac{-1}{\sqrt{\frac{1-1}{10}}}$	<u> </u>			binipini jing
		$\sqrt{\frac{1-1}{1}}$	$\frac{6x}{6}$			
		=4				
		$=\frac{-4}{\sqrt{1-16}}$	$\frac{1}{x^2}$			
b)	A(-4, 3) ar	nd B(-8, -9)			2	1 mark for x
	Externally	so use 2:-3				
	$x = \frac{-3(-4)}{2}$	$\frac{)+2(-8)}{+(-3)}$	$y = \frac{-3(3) + 3}{2}$	$\frac{2(-9)}{2}$		1 mark for y
				-3)		
	$=\frac{12-1}{-1}$	<u>6</u>	$=\frac{-9-18}{-1}$			
	-1		-1			
	$=\frac{-4}{-1}$		$=\frac{-27}{-1}$			
	-					
	= 4		= 27			
	D' (1	: . (1. 27)				
	P is the po	oint (4, 27)				
					1	l
		7				

Ques	2011			
Part	Solution		Marks	Comment
c)	u = 1 +	$-3x^2$ so $\frac{du}{dx} = 6x$ and $du = 6x dx$	4	1 for correct
		dx = 1, u = 4 and when $x = 4, u = 49$		value of du
	$\int_{1}^{4} \int_{1}^{4} \int_{1}^{1}$	$\frac{1}{2} = 1, u = 4$ and when $x = 4, u = 4$		
	$2x\sqrt{1}$	$\overline{1+3x^2} dx = \frac{1}{3} \int_{1}^{4} 6x \sqrt{1+3x^2} dx$		
		1		1 for limits
		$=\frac{1}{3}\int_{4}^{49}\sqrt{u} du$		
		$3 J_4$		1 for
		$=\frac{1}{3}\int_{4}^{49}u^{\frac{1}{2}}du$		substitution
		$= \frac{1}{3} \int_{4}^{3} u du$		
		□ 3 □ ⁴⁹		
		$=\frac{1}{3}\left[\frac{2}{3}u^{\frac{3}{2}}\right]_{4}^{49}$		
				1 for integral
		$=\frac{1}{3}\left(\frac{2}{3}\sqrt{49^{3}}-\frac{2}{3}\sqrt{4^{3}}\right)$		
		$=\frac{2}{9}(343-8)$		
		$=74\frac{4}{9}$		
7				

Solution Step 1 show true of $n = 1$ $4^1 + 8 = 12$ 12 is divisible by 6 \therefore true for $n = 1$		Marks 4	Comment
$4^{1} + 8 = 12$ 12 is divisible by 6		4	
$4^{1} + 8 = 12$ 12 is divisible by 6			
12 is divisible by 6			1 mark for
•			step 1
\dots the for $n = 1$			
Step 2 Assume true for $n =$	k and prove true for		2 marks for
n = k + 1			step 2
ik o t			Or 1 mark for significant
Assume that $4^{+}+8^{-}=6p(p)$	is a positive integer)		progress or a
Want to prove that			simple error
want to prove that			in step 2
$4^{k+1} = 6q$ (q is a positive i	nteger)		
$LHS = 4^{k+1} + 8$			
$= 4(4^k) + 8$			
. ,			
= 4(6p) - 24			
= 24p - 24			
= 6(4p-4)			
= 6q (q is positive integ)	ger > 1 since $p > 1$)		
= RHS			
			1 mark for
			step 3
		/12	
		/ 1 =	
	Want to prove that $4^{k+1} = 6q (q \text{ is a positive is})$ $LHS = 4^{k+1} + 8$ $= 4(4^{k}) + 8$ $= 4(4^{k} + 8 - 8) + 8$ $= 4(4^{k} + 8) - 32 + 8$ $= 4(6p) - 24$ $= 24p - 24$ $= 6(4p - 4)$ $= 6q (q \text{ is positive integs})$ $= RHS$ Step 3 Using the principle of Since true for $n = 1$, and sin	$4^{k+1} = 6q (q \text{ is a positive integer})$ LHS = $4^{k+1} + 8$ = $4(4^k) + 8$ = $4(4^k + 8 - 8) + 8$ = $4(4^k + 8) - 32 + 8$ = $4(6p) - 24$ = $24p - 24$ = $6(4p - 4)$ = $6q (q \text{ is positive integer} > 1 \text{ since } p > 1)$	Want to prove that $4^{k+1} = 6q (q \text{ is a positive integer})$ $LHS = 4^{k+1} + 8$ $= 4(4^{k}) + 8$ $= 4(4^{k} + 8 - 8) + 8$ $= 4(4^{k} + 8) - 32 + 8$ $= 4(6p) - 24$ $= 24p - 24$ $= 6(4p - 4)$ $= 6q (q \text{ is positive integer} > 1 \text{ since } p > 1)$ $= RHS$ Step 3 Using the principle of induction Since true for $n = 1$, and since if true for $n = k$ is also

	ion 4 Trial HSC Examination - Mathematics Extension 1		
Part	Solution	Marks	Comment
a) (i)	Aim prove $\angle AOB = 2 \times \angle DAB$	2	2 marks fo complete proof. 1 mark if some relevant facts are stated or proof is incomplete
	$\angle DAB = \angle ACB \ (\angle bet tangent \& chord = \angle in alt segment)$ $\angle AOB = 2 \times \angle ACB \ (\angle at centre is twice \angle at circ on same arc)$ $\therefore \angle AOB = 2 \times \angle DAB \ (since \angle DAB = \angle ACB)$		
(ii)	$\angle DAO = \angle DBO = 90^{\circ}$ (tangent perpendicular to radius $\therefore \angle DAO + \angle DBO = 180^{\circ}$ (sum of two right angles) \therefore opposite angles of <i>AOBD</i> are supplementary $\therefore AOBD$ is a cyclic quadrilateral.	1	1 mark as long as statement that opposite angles are supplemen ary, and why.
(iii)	 Aim: Prove that <i>E</i> is the midpoint of <i>AB</i>. <i>AO</i> = <i>BO</i> (equal radii) <i>AD</i> = <i>BD</i> (tangents from an external point are equal in length.) <i>AOBD</i> is a kite <i>OD</i> bisects AB (symmetry of a kite) <i>E</i> is midpoint of AB. 	2	Can also be done by isosceles triangles 2 marks for complete proof. 1 mark if some relevant facts are stated or

b) (i) $x = 30t \cos 72^{\circ}$ $y = 30t \sin 72^{\circ} - 4.9t^{2}$ At ground level when $y = 0$ $y = 30t \sin 72^{\circ} - 4.9t^{2} = 0$ $t(30\sin 72^{\circ} - 4.9t) = 0$ $t = 0$ and $30\sin 72^{\circ} - 4.9t = 0$ $4.9t = 30\sin 72^{\circ}$ $t = \frac{30\sin 72^{\circ}}{4.9t}$ $t = 5.8 \sec$ (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $t = 30\sin 72^{\circ} - 4.9t^{2}$ $t = 30\sin 72^{\circ} - 4.9t^{2}$ $y' = 30\sin 72^{\circ} - 9.8t$ $y' = 0$ $30\sin 72^{\circ} - 9.8t = 0$ $9.8t = 30\sin 72^{\circ}$ $t = \frac{30\sin 72^{\circ}}{9.8}$ $t = 2.9 \sec$ Height: $y = 30(2.9)\sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5m$ M is in the int for the full to the full	b) (i) $x = 30t \cos 72^{\circ}$ $y = 30t \sin 72^{\circ} - 4.9t^{2}$ At ground level when $y = 0$ $y = 30t \sin 72^{\circ} - 4.9t^{2} = 0$ $t = 0$ $4.9t = 30\sin 72^{\circ}$ $t = \frac{30\sin 72^{\circ}}{4.9}$ $t = 5.8 \sec$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30\sin 72^{\circ} - 4.9t^{2}$ $y' = 30\sin 72^{\circ} - 9.8t$ $y' = 0$ $30\sin 72^{\circ} - 9.8t = 0$ $9.8t = 30\sin 72^{\circ}$ $t = \frac{30\sin 72^{\circ}}{9.8}$ $t = 2.9 \sec$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ 2 marks f full solut 1 mark is simple mistake made in correct method 2 Can also 0 blain t = 2 marks f full solut 1 mark is 1 mark is 2 marks f 1 mark is 2 marks f 1 mark is 2 marks f 1 mark is 2 marks f 2 m	Question 4 Trial HSC Examination - Mathematics Extension 1					
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$t(30sin 72^{\circ} - 4.9t) = 0$ $t = 0$ and $30sin 72^{\circ} - 4.9t = 0$ $4.9t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{4.9}$ $t = 5.8 \sec$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30sin 72^{\circ} - 9.8t$ $y' = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \sec$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multice which is the formula formul	$t(30sin 72^{\circ} - 4.9t) = 0$ $t = 0$ and $30sin 72^{\circ} - 4.9t = 0$ $4.9t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{4.9}$ $t = 5.8 \sec$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30sin 72^{\circ} - 9.8t$ $y' = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \sec$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Matin and the second se						
$t = 0$ and $30sin 72^{\circ} - 4.9t = 0$ $4.9t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{4.9}$ $t = 5.8 \text{ sec}$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30sin 72^{\circ} - 9.8t$ $y' = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Movie which is the intervalue of the second sec	$t = 0$ and $30\sin 72^\circ - 4.9t = 0$ $4.9t = 30\sin 72^\circ$ $t = \frac{30\sin 72^\circ}{4.9}$ $t = 5.8 \sec$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^\circ - 4.9t^2$ $y' = 30\sin 72^\circ - 9.8t$ $y' = 0$ $30\sin 72^\circ - 9.8t = 0$ $9.8t = 30\sin 72^\circ$ $t = \frac{30\sin 72^\circ}{9.8}$ $t = 2.9 \sec$ Height : $y = 30(2.9)\sin 72^\circ - 4.9(2.9)^2$ $= 41.5 m$ Mode in the correct interval is the second sec		$t(2)$ give 72°			mistake	
and $30\sin 72^{\circ} - 4.9t = 0$ $4.9t = 30\sin 72^{\circ}$ $t = \frac{30\sin 72^{\circ}}{4.9}$ $t = 5.8 \sec$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30\sin 72^{\circ} - 9.8t$ y' = 0 $30\sin 72^{\circ} - 9.8t = 0$ $9.8t = 30\sin 72^{\circ}$ $t = \frac{30\sin 72^{\circ}}{9.8}$ $t = 2.9 \sec$ Height : $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ = 41.5m Multic which is which is the interval of the second	and $30\sin 72^\circ - 4.9t = 0$ $4.9t = 30\sin 72^\circ$ $t = \frac{30\sin 72^\circ}{4.9}$ $t = 5.8 \sec$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^\circ - 4.9t^2$ $y' = 30\sin 72^\circ - 9.8t$ y' = 0 $30\sin 72^\circ - 9.8t = 0$ $9.8t = 30\sin 72^\circ$ $t = \frac{30\sin 72^\circ}{9.8}$ $t = 2.9 \sec$ Height: $y = 30(2.9) \sin 72^\circ - 4.9(2.9)^2$ = 41.5 m Multicely in the interval of the sector		1(50sin 72 -				
$4.9t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{4.9}$ $t = 5.8 \text{ sec}$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30sin 72^{\circ} - 9.8t$ $y' = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Music which 15 m is the integration of the sec	$4.9t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{4.9}$ $t = 5.8 \text{ sec}$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30sin 72^{\circ} - 9.8t$ $y' = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multic beil beild 1.5 m (2000)		1.00				
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$t = 5.8 \text{ sec}$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30sin 72^{\circ} - 9.8t$ $y' = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Model is the interval	$t = 5.8 \text{ sec}$ The ball is in the air for 5.8 sec. (ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30sin 72^{\circ} - 9.8t$ $y' = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Motion the interval is 5 m to correct			$4.9t = 30sin 72^{\circ}$			
The ball is in the air for 5.8 sec.2(ii)Maximum height occurs when vertical motion = 02 $y = 30t \sin 72^\circ - 4.9t^2$ 2 $y' = 30sin 72^\circ - 9.8t$ 30sin 72^\circ - 9.8t $y' = 0$ 30sin 72^\circ - 9.8t = 0 $9.8t = 30sin 72^\circ$ 2 $t = \frac{30sin 72^\circ}{9.8}$ 2 $t = 2.9 \sec$ 1Height : $y = 30(2.9) \sin 72^\circ - 4.9(2.9)^2$ $= 41.5 m$ 5	The ball is in the air for 5.8 sec.(ii)Maximum height occurs when vertical motion = 02Can also obtain t = $y = 30t sin 72^\circ - 4.9t^2$ $y' = 30sin 72^\circ - 9.8t$ 2D $y' = 0$ $30sin 72^\circ - 9.8t = 0$ $9.8t = 30sin 72^\circ$ $t = \frac{30sin 72^\circ}{9.8}$ $t = 2.9$ sec 1 mark is simpleHeight : $y = 30(2.9) sin 72^\circ - 4.9(2.9)^2$ $= 41.5 m$ 1 mark is simple			$t = \frac{30sin 72^{\circ}}{4.9}$			
(ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30\sin 72^{\circ} - 9.8t$ $y' = 0$ $30\sin 72^{\circ} - 9.8t = 0$ $9.8t = 30\sin 72^{\circ}$ $t = \frac{30\sin 72^{\circ}}{9.8}$ $t = 2.9 \sec$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiplication is the interval of the interval	(ii) Maximum height occurs when vertical motion = 0 $y = 30t \sin 72^\circ - 4.9t^2$ $y' = 30\sin 72^\circ - 9.8t$ y' = 0 $30\sin 72^\circ - 9.8t = 0$ $9.8t = 30\sin 72^\circ$ $t = \frac{30\sin 72^\circ}{9.8}$ $t = 2.9 \sec$ Height : $y = 30(2.9) \sin 72^\circ - 4.9(2.9)^2$ = 41.5 m Maximum height occurs when vertical motion = 0 2 Can also obtain t = 2.9 by halving answer fr part (i) 2 marks f full solution 1 mark is simple mistake made in correct			t = 5.8 sec			
$y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30\sin 72^{\circ} - 9.8t$ $y' = 0$ $30\sin 72^{\circ} - 9.8t = 0$ $9.8t = 30\sin 72^{\circ}$ $t = \frac{30\sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height : $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Model in the last of the second secon	$y = 30t \sin 72^{\circ} - 4.9t^{2}$ $y' = 30\sin 72^{\circ} - 9.8t$ $y' = 0$ $30\sin 72^{\circ} - 9.8t = 0$ $9.8t = 30\sin 72^{\circ}$ $t = \frac{30\sin 72^{\circ}}{9.8}$ $t = 2.9 \sec$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiplication of the second s						
$y' = 30sin 72^{\circ} - 9.8t$ $y' = 30sin 72^{\circ} - 9.8t$ $y' = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height : $y = 30(2.9) sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiplication is the interval of the second	$y' = 30 \sin 72^{\circ} - 9.8t$ $y' = 30 \sin 72^{\circ} - 9.8t$ $y' = 0$ $30 \sin 72^{\circ} - 9.8t = 0$ $9.8t = 30 \sin 72^{\circ}$ $t = \frac{30 \sin 72^{\circ}}{9.8}$ $t = 2.9 \sec$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiplication is being the interval to a state of the interv	(ii)			2		
$y' = 30sin 72^{\circ} - 9.8t$ $y' = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiplication of the interval of	$y' = 30sin 72^{\circ} - 9.8t$ $y' = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiplication of the interval of the sector of the						
$y = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiply the initial set of the initial se	$y = 0$ $30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiply to the interval 15 m to correct		У	$' = 30sin 72^{\circ} - 9.8t$		halving	
$30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiply the interval of the interval	$30sin 72^{\circ} - 9.8t = 0$ $9.8t = 30sin 72^{\circ}$ $t = \frac{30sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiplication is the interval in 5 metric interval in 5 metric in the interval in 5 metric i		У	' = 0			
$t = \frac{30 \sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiply the interval of	$t = \frac{30 \sin 72^{\circ}}{9.8}$ $t = 2.9 \sec$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiply to the interval is a simple in correct		$30sin 72^{\circ} - 9.3$	8t = 0			
$t = \frac{30 \sin 72^{\circ}}{9.8}$ $t = 2.9 \text{ sec}$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiply to the integration of the integrati	$t = \frac{30 \sin 72^{\circ}}{9.8}$ $t = 2.9 \sec$ Height: $y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$ $= 41.5 m$ Multiply in the integration of the integrated of the integrated of the integrated of the integrated of the		9.	$8t = 30sin 72^{\circ}$		2	
Height: $y = 30(2.9) \sin 72^\circ - 4.9(2.9)^2$ = 41.5 m Simple mistake made in correct	Height: $y = 30(2.9) \sin 72^\circ - 4.9(2.9)^2$ = 41.5 m Simple mistake made in correct			$t = \frac{30sin 72^{\circ}}{9.8}$		full solution	
Height : $y = 30(2.9) \sin 72^\circ - 4.9(2.9)^2$ = 41.5 m and a made in correct	Height : $y = 30(2.9) \sin 72^\circ - 4.9(2.9)^2$ = 41.5 m mistake made in correct			t = 2.9 sec		1 mark is	
= 41.5 m made in correct	= 41.5 m made in correct		Height :	$y = 30(2.9) \sin 72^{\circ} - 4.9(2.9)^{2}$			
correct	correct		8				
method			Maximum heig				
						method	
		K	T				
		~					

Question 4 Trial HSC Examination - Mathematics Extension 1					
Part	Solution	Marks	Commen		
(iii)	Dist from O to Q is x value	3	3 marks f		
	For 72°		full soluti		
	$x = 30(5.8) \cos 72^{\circ}$		2 marks f		
	= 53.8 metres		correct		
	If angle changes to 60°		solution		
	$y = 30t \sin 60^{\circ} - 4.9t^{2}$		with a		
	At ground level when $y = 0$ $y = 30t \sin 60^{\circ} - 4.9t^{2} = 0$		minor er		
	-				
	$t(30\sin 60^{\circ} - 4.9t) = 0$				
	$30sin\ 60^{\circ}\ -4.9t=0$		1 1 0		
	$4.9t = 30sin\ 60^\circ$		1 mark for attempted		
			solution		
	$t = \frac{30\sin 60^{\circ}}{4.9}$		with		
	t = 5.3 sec		multiple errors		
	$x = 30(5.3) \cos 60^{\circ}$		citors		
	x = 79.5 metres		1 mark if		
	The horizontal distance would be an extra 25.7 metres.		just sub 6		
	The nonzontal distance would be an extra 25.7 metres.		into origi equation		
			x		
		/12			

<u> </u>	Question 5 Trial HSC Examination - Mathematics Extension 1			
Part	Solution	Marks	Comment	
a)	$p(x) = x^{3} + ax + b$ has $(x - 5)$ as one of its factors	3	1 mark for use	
	p(5) = 0		of factor	
	125 + 5a + b = 0		theorem	
	Remainder = -60 when divided by $(x + 5)$.			
	p(-5) = -60		1 mark for us	
	-125 - 5a + b = -60		of remainder	
	-125 - 5a + b = -60 Solve simultaneously to find <i>a</i> and <i>b</i> .		theorem	
	5a + b + 125 = 0 ①			
	-5a + b - 65 = 0 ②			
			1 mark for	
	2b + 60 = 0		solving simultaneous	
	2b = -60		sinuitaneous	
	b = -30			
	5a - 30 + 125 = 0		Part marks as	
	5a = -95		appropriate if	
	a = -19		other	
	u = -1		approaches taken	
b)	P(win first and last) = P(WLLLW)	1	Give mark if	
(i)	$= 0.3 \times 0.7 \times 0.7 \times 0.7 \times 0.3$	-	calculation	
	= 0.03087		only is given.	
(ii)	$P(W, q) = 5q q q^2 = q q^3$	1	Give mark if	
(11)	$P(W=2) = {}^{5}\mathbf{C}_{2}0.3^{2} \times 0.7^{3}$	1	calculation	
	$= 10 \times 0.03087$		only is given.	
	= 0.3087		• •	
(iii)	Wins no more than 2 games	2	2 marks for	
	= P(W=0) + P(W=1) + P(W=2)		full solution	
	$5\sigma = 2^{0}$ σ^{-5} $5\sigma = 2^{1}$ σ^{-4} $5\sigma = 2^{2}$	- ³	1 mark if	
	$= {}^{5}\mathbf{C}_{0}0.3^{0} \times 0.7^{5} + {}^{5}\mathbf{C}_{1}0.3^{1} \times 0.7^{4} + {}^{5}\mathbf{C}_{2}0.3^{2} \times 0.3^{2} \times $	J./	missed a term	
	= 0.10807 + 0.30013 + 0.3087 = -0.83692		or used wron	
	0.03072		terms, or	
			arithmetic	
			error.	
ζ	•			

		Trial HSC Examination - Mathematics Extension 1		
Part	Solution	Marks	Comment	
c)	$\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \cos^2 2x dx = \frac{1}{2} \int_{\frac{\pi}{3}}^{\frac{\pi}{2}} 1 + \cos 4x dx$	2	1 mark for obtaining integral	
	$= \frac{1}{2} \left[x + \frac{1}{4} \sin 4x \right]^{\frac{\pi}{2}}_{\frac{\pi}{3}}$ $= \left(\frac{\pi}{4} + \frac{1}{8} \sin 2\pi \right) - \left(\frac{\pi}{6} + \frac{1}{8} \sin \frac{4\pi}{3} \right)$		5	
	$= \frac{\pi}{4} + \frac{1}{8} \times 0 - \frac{\pi}{6} - \frac{1}{8} \times \frac{\sqrt{3}}{2}$ $= \frac{\pi}{12} - \frac{\sqrt{3}}{16}$		1 mark for correct substitution	
d)	(= 0.154)		1 if	
(i)	$y = \frac{xe}{2}$ $y' = \frac{x}{2} \cdot \frac{d}{dx}(e^{x}) + e^{x} \cdot \frac{d}{dx}\left(\frac{x}{2}\right)$ $= \frac{x}{2} \cdot e^{x} + e^{x} \cdot \frac{1}{2}$		differentiatio and explanation both correct.	
	$= \frac{xe^{x} + e^{x}}{2}$ Now for $x \ge 0$, $e^{x} \ge 1$			
	\therefore $x e^{x} > 0$ (positive \times positive)			
	$\therefore xe^{x} + e^{x} > 0 \text{ (positive + positive)}$ $\therefore xe^{x} + e^{x} > 0 \text{ (positive + positive)}$ $\therefore xe^{x} + e^{x} > 0 \text{ (positive + positive)}$			
(ii)	A function only has an inverse if it is a one to one function for the domain given.	1	1 mark for mention of	
	i.e. a horizontal line only intersects it at most in one		1-1 function	
$\mathbf{\rangle}$	point. Since $y = f(x)$ is defined for $x > 0$ it is always increasing, so has no turning points and a horizontal 1	ine	increasing function	
	will intersect it at most once.	-	horizontal lin test	

		Trial HSC Examination - Mathematics Extensi		
Part	Solution		Marks	Comment
(iii)	y	+ /	1	
	3–	y = x		As long as graph appears
				to be reflection
				of original curve in $y = x$
	2-	$y = \bar{f}^{-1}(x)$		give the mark
		$\left(\frac{e}{8},1\right)$		
	1-	y = f(x)		
		$\left(1,\frac{e}{8}\right)$		
		1 2 3 <i>x</i>		
			/12	

Quest	tion 6	Trial HSC Examination - Mathematics Extension 1		2011
Part	Solution		Marks	Comment
a)	Ways of arrang	ging 8 different tiles = 8!	1	
(i)		= 40 320		
(ii)	Ways of arrang	ging 4 chosen from $8 = {}^{8}\mathbf{P}_{4}$	1	
(iii)	Warna a fa ala a a	= 1680	1	
(III)	ways of choos	$ \begin{array}{l} \operatorname{ing} 4 \operatorname{from} 8 = {}^{8}\mathbf{C}_{4} \\ = 70 \end{array} $	1	
(iv)	Ways of arrang	$\frac{1}{100}$ s different tiles with 2 M's and 3 I's =	1	
	$\frac{8!}{3! \times 2!} = 3.3$	60		
(v)	$3! \times 2!$ With M's place	ed at the ends, leaves 6 to arrange, with 3 I's.	1	
(v)	Ways of arrang	ging 6 different tiles with 3 I's	1	
	$=\frac{6!}{3!}=120$			
1 \	3!			
b)	E			
		EF = FO = 3 cm		
		EF = FO = 5 cm		
	G	F H		
	$\int GF = 4.5$			
	A = EC =	= 12 cm _O		
		D		
		OC = 6 cm		
		\mathbb{V}_X		
(1-)			2	1 6
(b) (i)		$DY^2 = CY XF$ (ratio of second = second of tangent)	2	1 for use of correct
(-)		$DX^2 = CX \cdot XE$ (ratio of secant = square of tangent)		theorem
		$8^2 = CX. (CX + 12)$		
		$64 = CX^2 + 12CX$		
	$CX^2 + 12CX$	-64 = 0		
	(CX + 16)(CX			1 for colving
		CX = -16 or CX = 4		1 for solving for CX
	Take positive v	value		
		CX = 4		

Quest			2011
Part	Solution	Marks	Comment
(b)	GF. FH = EF. FC (Products of intercepts on chords are equal)	2	1 for use of
(ii)	4.5. $FH = 3.9$		correct theorem.
	4.5 FH = 27		incorem.
	FH = 6		
	GH = FH + GF		1 for solving for GH
	= 6 + 4.5		
	GH = 10.5 cm		
c) i)	$x = 2\cos\left(3t + \frac{\pi}{3}\right)$	2	1 mark for correct differentiations
	$\dot{x} = -2\sin\left(3t + \frac{\pi}{3}\right).3$		
	$\dot{x} = -6\sin\left(3t + \frac{\pi}{3}\right)$		
	$\ddot{x} = -6\cos\left(3t + \frac{\pi}{3}\right). 3$		1 mark for writing in the
	$= -18 \cos\left(3t + \frac{\pi}{3}\right)$		correct form and stating a conclusion
	$\ddot{x} = -9\left(2\cos\left(3t + \frac{\pi}{3}\right)\right)$		
	$\ddot{x} = -3^2 x$		
	which is of the form $\ddot{x} = -n^2 x$		
ii)	\therefore particle is in SHM	1	
11)	Period $=\frac{2\pi}{n}$	1	
	$=\frac{2\pi}{3}$		
		/12	

Questio			
Part	Solution	Marks	Comment
a)(i)	If $\sin x - \sqrt{3} \cos x = R\sin(x - \alpha)$ then	2	1 mark for R
	$R = \sqrt{1^2 + (\sqrt{3})^2}$ and $\tan \alpha = \sqrt{3}$		and
	$\therefore R = 2$ and $\alpha = \frac{\pi}{3}$		1 mark for α
	So $\sin x - \sqrt{3} \cos x = 2 \sin \left(x - \frac{\pi}{3} \right)$		
a) (ii)	$\sin x - \sqrt{3} \cos x = 1$	2	1 for writing in form
	$2\sin\left(x-\frac{\pi}{3}\right) = 1$		$sin\left(x-\frac{\pi}{3}\right) = \frac{1}{2}$
	$\sin\left(x-\frac{\pi}{3}\right) = \frac{1}{2}$		
	$x-\frac{\pi}{3}=\frac{\pi}{6},\frac{5\pi}{6}$		1 for solving for x
	$x = \frac{\pi}{2}, \ \frac{7\pi}{6}$		
b)	x = 3t - 4 ①	3	1 for t subject
	$y = 2t^2 - t \textcircled{2}$		
	From \textcircled{O} x + 4 = 3t		
	$t = \frac{x+4}{3}$		
	Sub in ②		1 for subst into
	$y = 2\left(\frac{x+4}{3}\right)^2 - \frac{x+4}{3}$		equation 2
	$y = \frac{2(x^2 + 8x + 16)}{9} - \frac{x + 4}{3}$		
	$y = \frac{2x^2 + 16x + 32 - 3x - 12}{9}$		
	$y = \frac{2x^2 + 13x + 20}{9}$		1 for Cartesian equation
c) (i)	$N = 650 + A e^{-kt}$	1	Need to differentiate and
	$\frac{dN}{dt} = -kA e^{-kt}$		rearrange for the mark
•	$\frac{dN}{dt} = -k(N - 650)$		

Question 7 Trial HSC Examination - Mathematics Extension 1			2011	
Part	Solution	Marks	Comment	
c) (ii)	Let 2001 represent $t = 0$.	2		
	$2400 = 650 + Ae^{0}$			
	A = 2400 - 650		1 mark for A.	
	= 1750		T Mark 10171.	
	$N = 650 + 1750e^{-kt}$			
	When $t = 4$, $N = 2000$			
	$2000 = 650 + 1750e^{-4k}$			
	$\frac{1350}{1750} = e^{-4k}$			
	$-4k = ln\left(\frac{27}{35}\right)$			
			1 mark for k	
	$k = -\frac{1}{4} ln\left(\frac{27}{35}\right)$			
c) (iii)	$k = 0.065 (2 \text{ sig figs})$ $N = 650 + 1750 e^{-0.065(8)}$	1	1 for answer	
	N = 1691			
	There are 1691 wallabies in 2005.			
c) (iv)	$1000 > 650 + 1750 e^{-0.065t}$	1	1 for answer as	
	$0.2 > e^{-0.065t}$		24.8 years,25 years or in	
	-0.065t < ln(0.2)		the year 2026.	
	$t > \frac{ln(0.2)}{-0.065}$			
	t > 24.8 Population falls below 1000 after 25 years. (in the			
	year 2026)			
		/12		