

2010
TRIAL HSC
EXAMINATION

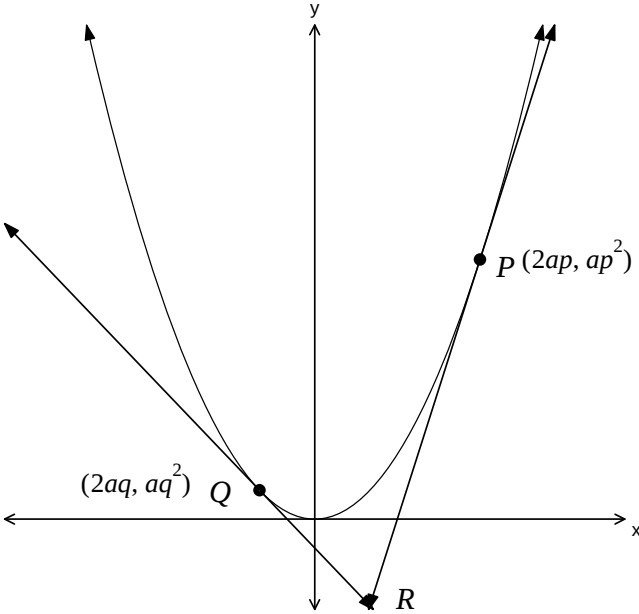
Mathematics Extension 1

SOLUTIONS

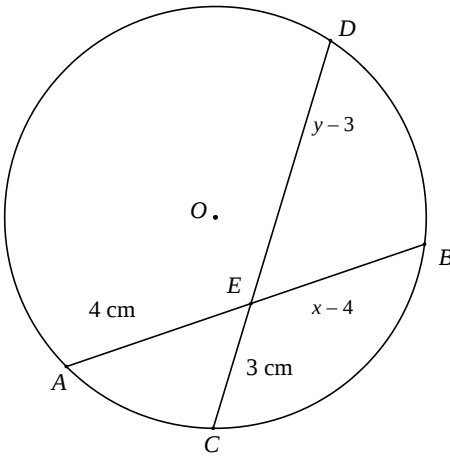
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Question 1		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
a)	$x = \frac{kx_2 + lx_1}{k + l} \qquad y = \frac{ky_2 + ly_1}{k + l}$ $3 = \frac{3x_2 + 2 \times 6}{3 + 2} \qquad 2 = \frac{3y_2 + 2 \times -1}{3 + 2}$ $15 = 3x_2 + 12 \qquad 10 = 3y_2 - 2$ $3 = 3x_2 \qquad 12 = 3y_2$ $x_2 = 1 \qquad y_2 = 4$ The point M is (1, 4)	2	1 for correct substitution in formula 1 for point.	
b)	$\int \frac{2}{\sqrt{x^2 + 25}} dx = 2 \int \frac{1}{\sqrt{x^2 + 25}} dx$ $= \int \frac{1}{\sqrt{x^2 + 5^2}} dx$ $= 2 \ln(x + \sqrt{x^2 + 25}) + C \text{ Using Standard Integrals.}$	2	1 for changing to standard form 1 for integral.	
c)	$\frac{2x}{x-3} \leq 2$ $x \neq 3$ from denominator. $\frac{2x}{x-3} (x-3)^2 \leq 2(x-3)^2$ $2x(x-3) \leq 2x^2 - 12x + 18$ $2x^2 - 6x \leq 2x^2 - 12x + 18$ $6x \leq 18$ $x \leq 3 \text{ But } x \neq 3$ So $x < 3$	3	1 for eliminating the denominator 1 for working solution to a linear equation 1 for solution	
d)	$\sum_{r=1}^5 r^2 + 2r = 1^2 + 2 \times 1 + 2^2 + 2 \times 2 + 3^2 + 2 \times 3 + 4^2 + 2 \times 4 + 5^2 + 2 \times 5$ $= 3 + 8 + 15 + 24 + 35$ $= 85$	1	1 for answer	

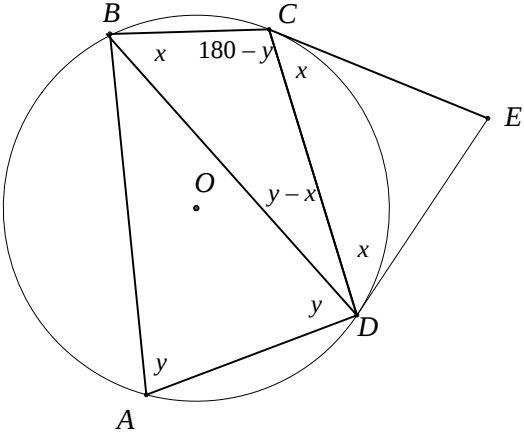
Question 1		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
e)	$P(x) = x^3 - 19x - 30$ $P(-3) = (-3)^3 - 19(-3) - 30$ $= -27 + 57 - 30$ $= 0$ $\therefore (x - -3) = (x + 3) \text{ is a factor of } P(x)$ Test $P(-5) = (-5)^3 - 19(-5) - 30$ $= -125 + 95 - 30 = -60$ $P(5) = (5)^3 - 19(5) - 30$ $= 125 - 95 - 30 = 0$ $\therefore (x - 5) \text{ is a factor of } P(x)$	2	1 for showing (x+3) is a factor 1 for finding either of other factors	
f)	$u = x^2 - 2$ $du = 2x \, dx$ $\int \frac{x}{\sqrt{x^2 - 2}} \, dx = \frac{1}{2} \int \frac{2x}{\sqrt{x^2 - 2}} \, dx$ $= \frac{1}{2} \int \frac{du}{\sqrt{u}}$ $= \frac{1}{2} \int u^{-\frac{1}{2}} \, du$ $= u^{\frac{1}{2}} + C$ $= \sqrt{x^2 - 2} + C$	2	1 For correct method of substitution including du 1 for integral	
		/12		

Question 2		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
a) (i)	 Equations of tangents: $y = px - ap^2$ and $y = qx - aq^2$ To find R, solve simultaneously $px - ap^2 = qx - aq^2$ $px - qx = ap^2 - aq^2$ $x(p - q) = a(p + q)(p - q)$ $x = a(p + q)$ $y = p \times a(p + q) - ap^2$ $= ap^2 + apq - ap^2$ $= apq$ R is the point $(a(p + q), apq)$	2	NB Graph not needed for marks. 1 for reasonable attempt to solve simultaneously 1 for correct result.	
a) (ii)	Substitute $(0, a)$ into $y = \frac{p+q}{2}x - apq$ $a = \frac{p+q}{2} \times 0 - apq$ $-apq = a$ $pq = -1$	1 mark		

Question 2		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
a) (iii)	If chord passes through $(0, a)$ then $pq = -1 \text{ and } p = -\frac{1}{q}$ R is the point $(a(p + q), apq)$. Which becomes $\left(a\left(-\frac{1}{q} + q\right), a \times (-1)\right)$ $x = a\left(-\frac{1}{q} + q\right) \quad \text{and} \quad y = -a$ $x = -y\left(\frac{q^2 - 1}{q}\right)$ $qx = y(1 - q^2)$ $y = \frac{qx}{1 - q^2} \text{ OR SIMILARLY } y = \frac{px}{1 - p^2}$	2	1 for introducing $pq = -1$ to eliminate p or q 1 for relating x and y and obtaining the equation of the locus.	
b)	$\cos 2A = 1 - 2\sin^2 A$ $2\sin^2 A = 1 - \cos 2A$ $\sin^2 A = \frac{1}{2}(1 - \cos 2A)$ $\int \sin^2 6x \, dx = \frac{1}{2} \int 1 - \cos 12x \, dx$ $= \frac{1}{2} \left(x - \frac{1}{12} \sin 12x \right) + C$ $= \frac{x}{2} - \frac{\sin 12x}{24} + C$	2	1 for transformation of the integral or recalling a formula 1 for integration	
c)	There are 8P_8 ($8!$) ways the 8 vehicles can park. If the two utes are together, treat them as one, so there are 7 vehicles. These can park in 7P_7 ($7!$) ways with 2P_2 ($2!$) ways of arranging the utes among themselves. So the 7 are arranged in $\frac{7!}{2!}$ ways. $\text{Probability} = \frac{7!}{2!} \div 8!$ $= \frac{7!}{8! \, 2!}$ $= \frac{1}{8 \times 2}$ $= \frac{1}{16}$	2	1 for arrangement of vehicles with utes together. 1 for probability	

Question 2		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
d)	 Since $AB = x$, $EB = x - 4$ and since $CD = y$, $ED = y - 3$ $AE \cdot EB = CE \cdot ED$ (Ratio of intercepts on chords) $4(x - 4) = 3(y - 3)$ $4x - 16 = 3y - 9$ $4x = 3y + 7$	3	1	1
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Question 3		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
a) (i)	$f(x) = (x^3 - 12x)^{\frac{1}{3}}$ $f'(x) = \frac{1}{3}(x^3 - 12x)^{-\frac{2}{3}} \cdot (3x^2 - 12)$	1	No need to simplify further	
a) (ii)	$x_1 = -3.3$ $f(x_1) = ((-3.3)^3 - 12(-3.3))^{\frac{1}{3}}$ ≈ 1.54 $f'(x_1) = \frac{1}{3}((-3.3)^3 - 12(-3.3))^{-\frac{2}{3}} \times (3(-3.3)^2 - 12)$ ≈ 2.90 $x_2 = x_1 - \frac{f(x_1)}{f'(x_1)}$ $= -3.3 - \frac{1.54}{2.90}$ $\approx -3.83 \text{ (2 dec places)}$	2	1 for evaluating function and derivative. 1 for substitution into Newtons Method formula.	
a) (iii)	As Newtons Method uses the intercept that the tangent makes, from the graph, the tangent at -3.3 is quite flat compared to the sudden drop in the curve to meet the axis. Hence the tangent would meet the axis much further along than the graph, so the second approximation is not as good as the first.	1	Mark for mention of the tangent meeting the axis or similar	
b) (i)	$\sin \frac{\pi}{4} = \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}}$ $\sin\left(x + \frac{\pi}{4}\right) = \sin x \cos \frac{\pi}{4} + \cos x \sin \frac{\pi}{4}$ $= (\sin x) \times \frac{1}{\sqrt{2}} + (\cos x) \times \frac{1}{\sqrt{2}}$ $= \frac{\sin x + \cos x}{\sqrt{2}}$	2	1 correct definition 1 correct evaluation	
b) (ii)	$\frac{\sin x + \cos x}{\sqrt{2}} = \frac{\sqrt{3}}{2}$ $\sin\left(x + \frac{\pi}{4}\right) = \frac{\sqrt{3}}{2}$ $x + \frac{\pi}{4} = \frac{\pi}{3} \text{ or } \frac{2\pi}{3} \quad \left(\frac{\pi}{4} \leq x + \frac{\pi}{4} \leq \frac{9\pi}{4}\right)$ $x = \frac{\pi}{12} \text{ or } \frac{5\pi}{12} \quad (0 \leq x \leq 2\pi)$	2	1 for initial solution of $\frac{\pi}{3}$ and set. 1 for final solution for x	

c) (i)	 $\angle EDC = \angle CBD = x$ (Angle between a tangent and a chord is equal to the angle in the alternate segment) Similarly $\angle ECD = \angle CBD = x$ Hence $\angle ECD = \angle EDC = x$ Or $EC = ED$ (Tangents from an external point are equal) Hence $\angle ECD = \angle EDC = x$ $\angle CED = 180 - \angle ECD - \angle EDC$ (Angle sum of triangle) $\angle CED = (180 - 2x)^\circ$	2	1 for partially completed proof with some of the required points or with single error 2 for completely correct proof Or any other valid proof
c) (ii)	$\angle BCD = 180 - y^\circ$ (Opposite angles of cyclic quadrilateral are supplementary) $\angle BDC = 180 - \angle CBD - \angle BCD$ $= 180 - x - (180 - y)$ $= 180 - x - 180 + y$ $= (y - x)^\circ$	2	1 for cyclic quad or similar partial proof. 2 for full proof.
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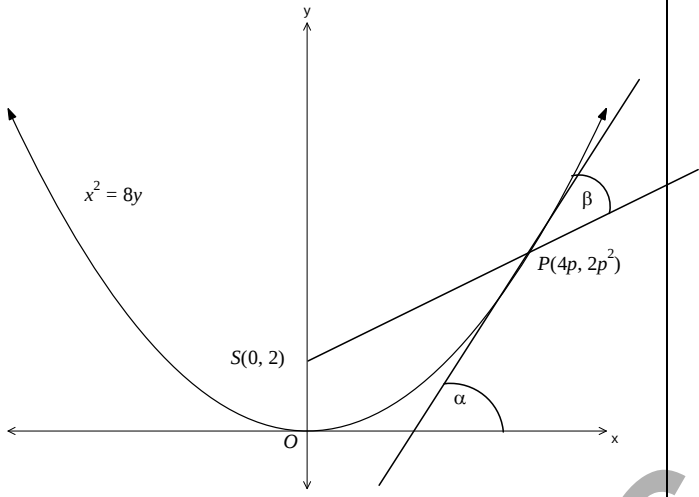
Question 4		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
a)	In expansion of $(a + b)^n$ $T_{r+1} = {}^nC_r a^{n-r} b^r$ $T_{r+1} = {}^9C_r (x^2)^{9-r} \left(-\frac{2}{x}\right)^r$ $= {}^9C_r x^{18-2r} (-2)^r x^{-r}$ $= {}^9C_r (-2)^r x^{18-3r}$ In the expansion of $\left(x^2 - \frac{2}{x}\right)^9$ For the term independent of x, $18 - 3r = 0$ $3r = 18$ $r = 6$ $T_7 = {}^9C_6 (-2)^6 x^0$ $= 84 \times 64$ $= 5\,376$ Accept ${}^9C_6 (-2)^6$ for full marks.	3	1 for writing the general term or starting to write out the expansion. 1 for simplifying the term in x and setting to zero. 1 for term either as a single number or the unexpanded expression given.	

d) (iii)	$P(\text{at least 4 heavy}) =$ $1 - P(0 H) - P(1 H) - P(2 H) - P(3 H)$ $= 1 - {}^{25}C_0 (0.95)^{25} \times (0.05)^0 - {}^{25}C_1 (0.95)^{24} \times (0.05)^1$ $= {}^{25}C_2 (0.95)^{23} \times (0.05)^2 - {}^{25}C_3 (0.95)^{22} \times (0.05)^3$ $= 1 - 0.2774 - 0.3650 - 0.2305 - 0.0930$ $= 0.034 \text{ (2 sig fig)}$	2	1 for identifying complement and terms required 1 for answer
		/12	

[illegible]

Question 5		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
a) (ii)	$\int_0^1 \sin^{-1} x \, dx$ corresponds to the area EFG, which is congruent to the area ABC by symmetry of inverse functions about $y = x$. Together with area BCD which corresponds to $\int_0^{\frac{\pi}{2}} \sin x \, dx$. they form the rectangle $ABCD$ which has area $A = 1 \times \frac{\pi}{2} = \frac{\pi}{2}$ So $\int_0^1 \sin^{-1} x \, dx + \int_0^{\frac{\pi}{2}} \sin x \, dx = \frac{\pi}{2}$ And hence $\int_0^1 \sin^{-1} x \, dx = \frac{\pi}{2} - \int_0^{\frac{\pi}{2}} \sin x \, dx.$	2	1 mark for a partial explanation that relates the areas of the two functions 2 marks for a fuller explanation that clearly relates the areas to the rectangle and explains the required relationship	
b) (i)	$(1+x)^{n-1} = \binom{n-1}{0} 1^{n-1} + \binom{n-1}{1} 1^{n-2} x + \binom{n-1}{2} 1^{n-3} x^2 + \dots$ $\dots + \binom{n-1}{n-2} 1^1 x^{n-2} + \binom{n-1}{n-1} x^{n-1}$ Let $x = 1$ $(1+1)^{n-1} = \binom{n-1}{0} 1^{n-1} + \binom{n-1}{1} 1^{n-2} (1) + \binom{n-1}{2} 1^{n-3} (1)^2 + \dots$ $\dots + \binom{n-1}{n-2} 1^1 (1)^{n-2} + \binom{n-1}{n-1} (1)^{n-1}$ $\left(\binom{n-1}{1} 1^{n-2} (1) + \binom{n-1}{2} 1^{n-3} (1)^2 + \dots \right.$ $\left. \dots + \binom{n-1}{n-2} 1^1 (1)^{n-2} + 2 = 2^{n-1} \right.$ $\left(\binom{n-1}{1} + \binom{n-1}{2} + \dots \right.$ $\left. \dots + \binom{n-1}{n-2} \right) = 2^{n-1} - 2$	2	1 for the expansion of $(1+x)^n$ 1 for obtaining required result	

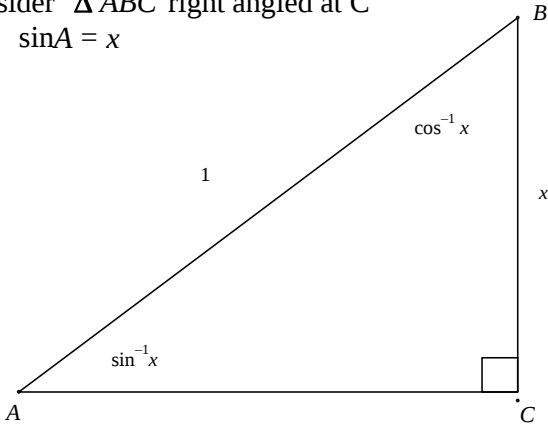
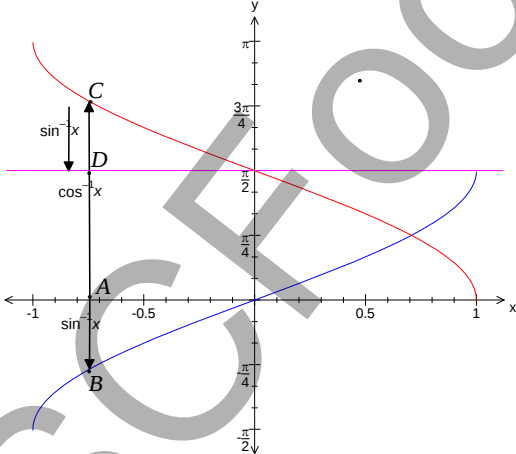
Question 5		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
b) (ii)	$2^{n-1} - 2 > 1000$ $2^{n-1} > 1002$ $(n-1) \ln 2 > \ln 1002$ $n-1 > \frac{\ln 1002}{\ln 2}$ $n-1 > 9.9$ $n > 10.9$ Least positive integer, $n = 11$	2	1 for using logs or trial and error 1 for answer	
c) (i)	Endpoints where $v = 0$ $v^2 = 24 + 2x - x^2 = 0$ $(6-x)(4+x) = 0$ $x = 6 \text{ and } x = -4$	1	1 mark for two endpoints	
c) (ii)	$v^2 = 24 + 2x - x^2 = 0$ Acceleration $= \frac{d}{dx} \left(\frac{1}{2} v^2 \right)$ $= \frac{d}{dx} \left(\frac{24 + 2x - x^2}{2} \right)$ $= \frac{2 - 2x}{2}$ Acceleration $= 1 - x$	2	1 mark for $a = \frac{d}{dx} \left(\frac{1}{2} v^2 \right)$ 1 mark for answer	
c) (iii)	$a = -n^2 x$ $\ddot{x} = 1 - x$ $\ddot{x} = -1^2(x - 1)$ $n = 1$ Period $T = \frac{2\pi}{n}$ Period $T = 2\pi$ seconds	1	1 mark for answer	
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Question 6		Trial HSC Examination - Mathematics Extension 1	2010
Part	Solution	Marks	Comment
a) (i)	 $x^2 = 8y$ $S(0, 2)$ $P(4p, 2p^2)$ $y = \frac{x^2}{8}$ $\frac{dy}{dx} = \frac{2x}{8} = \frac{x}{4}$ $\text{At } P(4p, 2p^2) \frac{dy}{dx} = \frac{4p}{4} = p$	1	1 mark for using derivative
(ii)	$\text{Grad SP} = \frac{2p^2 - 2}{4p - 0}$ $= \frac{p^2 - 1}{2p}$	1	1 mark for using gradient form correctly

Question 6		Trial HSC Examination - Mathematics Extension 1	2010
Part	Solution	Marks	Comment
(iii)	$\tan \beta = \frac{m_1 - m_2}{1 + m_1 m_2}$ $= \frac{p - \frac{p^2 - 1}{2p}}{1 + p \left(\frac{p^2 - 1}{2p} \right)}$ $= \frac{\frac{2p^2 - p^2 + 1}{2p}}{\frac{2 + p^2 - 1}{2}}$ $= \frac{\frac{p^2 + 1}{2p}}{\frac{p^2 + 1}{2}}$ $= \frac{p^2 + 1}{2p} \times \frac{2}{p^2 + 1}$ $= \frac{1}{p}$	2	1 for formula for angle between two lines. 1 for simplifying Or any other valid method
(iv)	$\tan \alpha = p$ $\tan \beta = \frac{1}{p} = \frac{1}{\tan \alpha} = \cot \alpha$ $\cot \alpha = \tan \left(\frac{\pi}{2} - \alpha \right)$ So $\tan \beta = \tan \left(\frac{\pi}{2} - \alpha \right)$ $\beta = \frac{\pi}{2} - \alpha$ $\alpha + \beta = \frac{\pi}{2}$	1	1 mark for any reasonable relating of α and β to get required result.

Question 6		Trial HSC Examination - Mathematics Extension 1	2010
Part	Solution	Marks	Comment
b)	Show true for $n = 1$ $4^1 + 14 = 14 + 4$ $= 18 = 6 \times 3$ $\therefore$ true for $n = 1$ Assume true for $n = k$ $4^k + 14 = 6p$ Consider $n = k + 1$ $4^{k+1} + 14 = 4 \times 4^k + 14$ $= 4 \times 4^k + 4 \times 14 - 3 \times 14$ $= 4(4^k + 14) - 3 \times 14$ $= 4 \times 6p - 6 \times 7$ $= 6(4p - 7)$ $\therefore 4^k + 14$ is divisible by 6 Hence if proposition is true for $n = k$ it is true for $n = k + 1$ But since true for $n = 1$ by induction is true for all $n \geq 1$	3	1 mark for showing true for $n = 1$ 1 mark for showing case for $n = k + 1$ 1 mark if all necessary steps for induction are done, including the statement of assumption and the conclusion
c)	$f(x) = 4x^2 - 5x$ $\frac{f(x+h) - f(x)}{h} = \frac{4(x+h)^2 - 5(x+h) - 4x^2 + 5x}{h}$ $= \frac{4(x^2 + 2xh + h^2) - 5(x+h) - 4x^2 + 5x}{h}$ $= \frac{4x^2 + 8xh + 4h^2 - 5x - 5h - 4x^2 + 5x}{h}$ $= \frac{8xh + 4h^2 - 5h}{h}$ $= \frac{h(8x + 4h - 5)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(8x + 4h - 5)}{h}$ $= \lim_{h \rightarrow 0} (8x + 4h - 5)$ $= 8x - 5$	2	1 mark for substitution into formula and simplifying 1 mark for eliminating h and obtaining required result

Question 6		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
d)	$\frac{d}{dx}(2x^2 \cos^{-1} 2x) = 2x^2 \frac{-1}{\sqrt{\frac{1}{4} - x^2}} + 4x \cos^{-1} 2x$ $= 2x^2 \frac{-2}{\sqrt{1 - 4x^2}} + 4x \cos^{-1} 2x$ $= \frac{-4x^2}{\sqrt{1 - 4x^2}} + 4x \cos^{-1} 2x$	2	1 mark for use of product rule 1 mark for completing derivatives and simplifying (2 nd last line or equivalent is acceptable as the answer)	
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Question 7		Trial HSC Examination - Mathematics Extension 1	2010
Part	Solution	Marks	Comment
(a)	Consider $\triangle ABC$ right angled at C with $\sin A = x$  $\sin A = x \Rightarrow \angle A = \sin^{-1} x$$\cos B = x \Rightarrow \angle B = \cos^{-1} x$$\angle A + \angle B = \frac{\pi}{2} \quad (\text{angle sum of right triangle})$$\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$ OR  $AB = \sin^{-1} x$$CD = \sin^{-1} x \quad (\text{By symmetry of graphs})$$AC = \cos^{-1} x$$DA = \frac{\pi}{2}$$AC + CD = AD$$\cos^{-1} x + \sin^{-1} x = \frac{\pi}{2}$	2	1 mark for graph or diagram 1 mark for explanation Other possible explanations and graphs are acceptable.

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Part	Solution	Marks	Comment	
b) (i)	$\ddot{x} = -x$ $\frac{d}{dx}\left(\frac{1}{2}v^2\right) = -x \quad (v = \dot{x})$ $\frac{1}{2}v^2 = -\frac{x^2}{2} + C$ At $x = 0, \quad \dot{x} = v = 1$ $\frac{1}{2}(1)^2 = 0 + C$ $C = \frac{1}{2}$ $\frac{1}{2}v^2 = -\frac{x^2}{2} + \frac{1}{2}$ $v^2 = 1 - x^2$ $ \dot{x} = \sqrt{1 - x^2}$	2	1 mark for using $\frac{d}{dx}\left(\frac{1}{2}v^2\right)$ Or other way of relating v in terms of x 1 mark for working to required result	
b) (ii)	Let $x = a\cos(nt + \alpha)$ $a = 1$ and $n = 1$ $x = \cos(t + \alpha)$ $x = 0$, when $t = 0$ $0 = \cos\alpha$ $\alpha = \frac{\pi}{2}$ $x = \cos\left(t + \frac{\pi}{2}\right)$ Let $x = a\sin(nt + \alpha)$ $a = 1$ and $n = 1$ $x = \sin(t + \alpha)$ $x = 0$, when $t = 0$ $0 = \sin\alpha$ $\alpha = 0$ $x = \sin(t)$	2	1 for form of equation either sin or cos. 1 for correct values of constants	

Question 7		Trial HSC Examination - Mathematics Extension 1		2010
Part	Solution	Marks	Comment	
c) (i)	$\frac{dV}{dt} = 0.5$ $V = 0.5t + C$ When $t = 0$, $V = 0$ $V = \frac{t}{2}$ $V = \frac{4}{3}\pi r^3$ $\frac{t}{2} = \frac{4}{3}\pi r^3$ $3t = 8\pi r^3$ $r^3 = \frac{3t}{8\pi}$ $r = \sqrt[3]{\frac{3t}{8\pi}}$	2	1	1

Question 7		Trial HSC Examination - Mathematics Extension 1	2010
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c) (ii)	$r = \sqrt[3]{\frac{3t}{8\pi}}$ $r = \left(\frac{3t}{8\pi}\right)^{\frac{1}{3}}$ $r = \left(\frac{3}{8\pi}\right)^{\frac{1}{3}} \times t^{\frac{1}{3}}$ $\frac{dr}{dt} = \left(\frac{3}{8\pi}\right)^{\frac{1}{3}} \times \frac{t^{-\frac{2}{3}}}{3}$ $A = 4\pi r^2$ $\frac{dA}{dr} = 8\pi r$ $\frac{dA}{dt} = \frac{dA}{dr} \cdot \frac{dr}{dt}$ $= 8\pi r \times \left(\frac{3}{8\pi}\right)^{\frac{1}{3}} \times \frac{t^{-\frac{2}{3}}}{3}$ $= 8\pi \left(\left(\frac{3t}{8\pi}\right)^{\frac{1}{3}}\right) \times \left(\left(\frac{3}{8\pi}\right)^{\frac{1}{3}} \times \frac{t^{-\frac{2}{3}}}{3}\right)$ When $t = 8$ $\frac{dA}{dt} = 8\pi \left(\left(3\frac{8}{8\pi}\right)^{\frac{1}{3}}\right) \times \left(\left(\frac{3}{8\pi}\right)^{\frac{1}{3}} \times \frac{(8)^{-\frac{2}{3}}}{3}\right)$ $= 8\pi \times \left(\frac{3}{\pi}\right)^{\frac{1}{3}} \times \frac{1}{2} \left(\frac{3}{\pi}\right)^{\frac{1}{3}} \times \frac{1}{12}$ $= \frac{\pi}{3} \left(\frac{3}{\pi}\right)^{\frac{2}{3}}$ $= \frac{\pi}{3} \left(\frac{\pi}{3}\right)^{-\frac{2}{3}}$ $= \left(\frac{\pi}{3}\right)^{\frac{1}{3}}$ $= \sqrt[3]{\frac{\pi}{3}}$	3	1 mark for obtaining $\frac{dr}{dt}$ 1 mark for expression for $\frac{dA}{dt}$ 1 mark for evaluating this when $t = 8$

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	OR $r = \sqrt[3]{\frac{3t}{8\pi}}$ $r = \left(\frac{3t}{8\pi}\right)^{\frac{1}{3}}$ $\frac{dr}{dt} = \frac{1}{3} \times \frac{3}{8\pi} \times \left(\frac{3t}{8\pi}\right)^{-\frac{2}{3}}$ $= \frac{1}{8\pi} \left(\frac{3t}{8\pi}\right)^{-\frac{2}{3}}$ $A = 4\pi r^2$ $\frac{dA}{dr} = 8\pi r$ $\frac{dA}{dt} = \frac{dA}{dr} \times \frac{dr}{dt}$ $\frac{dA}{dt} = 8\pi r \times \frac{1}{8\pi} \left(\frac{3t}{8\pi}\right)^{-\frac{2}{3}}$ $= r \times \left(\frac{3t}{8\pi}\right)^{-\frac{2}{3}}$ $= \left(\frac{3t}{8\pi}\right)^{\frac{1}{3}} \times \left(\frac{3t}{8\pi}\right)^{-\frac{2}{3}}$ $= \left(\frac{3t}{8\pi}\right)^{-\frac{1}{3}}$ when $t = 8$ $\frac{dA}{dt} = \left(\frac{24}{8\pi}\right)^{-\frac{1}{3}}$ $= \left(\frac{3}{\pi}\right)^{-\frac{1}{3}}$ $= \left(\frac{\pi}{3}\right)^{\frac{1}{3}}$			

Question 7		Trial HSC Examination - Mathematics Extension 1	2010
Part	Solution	Marks	Comment
c) (iii)	$4\pi r^2 = 200$ $r^2 = \frac{50}{\pi}$ $r = \sqrt{\frac{50}{\pi}}$ $r = \sqrt[3]{\frac{3t}{8\pi}}$ $\sqrt{\frac{50}{\pi}} = \sqrt[3]{\frac{3t}{8\pi}}$ $\left(\sqrt{\frac{50}{\pi}}\right)^6 = \left(\sqrt[3]{\frac{3t}{8\pi}}\right)^6$ $\frac{125000}{\pi^3} = \frac{9t^2}{64\pi^2}$ $t^2 = \frac{125000}{\pi^3} \cdot \frac{64\pi^2}{9}$ $= \frac{8000000}{9\pi}$ $= 282\,942$ $t = 532 \text{ seconds}$ $t = 8 \text{ minutes and } 52 \text{ seconds}$	1	1 mark for answer in seconds or minutes and seconds or in unsimplified form.
		/12	