Student Number

St. Catherine's School, Waverley

2014

TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Extension 1

General Instructions

- Reading Time – 5 minutes
- Working Time – 2 hours
- Write using black or blue pen
  Black pen is preferred
- Board-approved calculators may be used
- A table of standard integrals is provided at the back of this paper
- In Questions 11-14, show relevant mathematical reasoning and/or calculations
- Task weighting – 40%

Section I **Pages 3-6**

10 marks

- Attempt Questions 1 – 10
- Allow about 15 minutes for this section
- Answer on the multiple choice answer sheet provided.

Section II **Pages 7-13**

60 marks

- Attempt Questions 11-14
- Allow about 1hour and 45 minutes for this section
- Answer each question in the booklet provided.

Total Marks – 70

Extension 1 trials.

1 $If\ y = sin^{-1}(x^2),$ then $\frac{dy}{dx}$=

A $\dfrac{2x}{\sqrt{1-x^4}}$

B $\dfrac{2x}{\sqrt{1-x^2}}$

C $2xcos^{-1}(x^2)$

D $\dfrac{2x}{1-x^4}$

2 $\int sin^2 3x\ dx$ is

A $cos^2 3x + C$

B $2 \sin 3x \cos 3x + C$

C $\frac{1}{2}\left(x - \frac{cos6x}{6}\right)$+C

D $\frac{1}{2}\left(x - \frac{sin6x}{6}\right)$+C

3 The primitive of $\sqrt{e^{3x}}$ is given by

A $\dfrac{3}{2\sqrt{e^{3x}}} + C$

B $\dfrac{3}{2}e^{\frac{3x}{2}} + C$

C $\dfrac{2}{3}e^{\frac{3x}{2}} + C$

D $\dfrac{1}{2}e^{3x} + C$

4 $\int \frac{dx}{\sqrt{1-4x^2}}$ is given by

A $sin^{-1}2x + C$

B $sin^{-1}\frac{x}{2} + C$

C $4\,sin^{-1}2x + C$

D $\frac{1}{2}sin^{-1}2x + C$

5 The equation of motion of a particle moving in Simple harmonic Motion is given by

$\ddot{x}\ = 1 - 3x$, which of the following statements is true?

A The period of motion is $\frac{2\pi}{3}$ and the centre is x=$\frac{1}{3}$

B The period of motion is $\frac{-2\pi}{3}$ and the centre is x=3

C The period of motion is $\frac{2\pi}{3}$ and the centre is x=3

D The period of motion is $\frac{2\pi}{\sqrt{3}}$ and the centre is x=$\frac{1}{3}$

6 Given that $\frac{f'(x)}{f(x)} = 1$, which of the following statements is true?

(note: C is a constant in each case)

A $f(x) = lnx + C$

B $f(x) = e^x + C$

C $f(x) = C\ e^x$

D $f(x) = C\ lnx$

7 Consider the graph of the function $y = \frac{x^2+1}{x}$. The equations of the asymptotes are

A $x = 0\ and\ x = 1$

B $x = 0\ and\ y = x$

C $x = -1\ and\ x = 1$

D No asymptotes

8 The solution to the inequality $x(x^2 - 4) > 0\ is$

A $-2 < x < 0\ or\ x > 2$

B $-2 < x < 2$

C $x < -2\ or\ x > 2$

D $x < -2\ or\ 0 < x < 2$

9 Surface area S of a spherical balloon is given by the formula $S = 4\pi r^2$,

$where\ r\ is\ the\ radius.$

A spherical balloon is being inflated so that, $\frac{dr}{dt} = 2$ cm/sec.

The value of $\frac{dS}{dt}$, when the surface area is $16\pi\ cm^2$ is given by

A 32π

B $\frac{16}{\pi}$

C $256\ \pi^2$

D No sufficient information

10 $cos^{-1}\left(cos\frac{11\pi}{6}\right) is$

A $\frac{11\pi}{6}$

B $\frac{\sqrt{3}}{2}$

C $\frac{7\pi}{6}$

D $\frac{\pi}{6}$

Question 11 Start a new page

a) Solve for x: $\frac{1}{x-1} \geq 5$ 3

b) Find the value of k: $x^{3k+4} = e^{8\ln x}$ 2

c) Find the ratio in which P divides the interval AB, where P is $(2, \frac{20}{3})$ $A\ is\ (1, 5) and\ B\ is\ (4, 10)$. 3

d The lines $y = 3mx + 1$ and $y = mx$ are inclined at an angle of α, where $tan\alpha = \frac{1}{2}$.

(i) Show that $3m^2 - 4m + 1 = 0$ 2

(ii) Hence find the possible values of *m*. 1

e If $x^2 - x - 2$ is a factor of the polynomial $x^4 + 3x^3 + ax^2 - 2x - b$, find the values of a and b. 4

Question 12 Start a new page

a Show that $tan^{-1}\frac{1}{3} + tan^{-1}\frac{1}{5} = tan^{-1}\frac{4}{7}$ 3

b Use the substitution $x = 2\sin\theta$, to evaluate $\int_0^2 \sqrt{4-x^2}\ dx$ 4

c Find the general solution to the equation $\sin 2\theta = cos\ \theta$ 3

d (i) Show that $\frac{1-x^2}{1+x^2} = -1 + \frac{2}{x^2+1}$ 1

(ii) Hence or otherwise clearly sketch the graph of the function 4

$y = \frac{1-x^2}{1+x^2}$, locating any stationary points and equations of asymptotes.

(Use at least one third of a page)

Question 13 Start a new page

a Find $\int \frac{5}{1+16x^2}\,dx$ 2

b Find the constant term in the expansion of $(2x - \frac{1}{x^2})^9$ 3

c Consider the expansion of $(3 + 4x)^{12}$ in ascending powers of x.

(i) Show that $\frac{coefficient\ of\ t_{r+1}}{coefficient\ of\ t_r} = \frac{4(13-r)}{3r}$, where $t_r\ is\ the\ r^{th}\ term.$ 2

(ii) Hence or otherwise find the greatest coefficient in the expansion of 2

$(3 + 4x)^{12}$

d A particle is projected with velocity 20 metres per second.
This hits a target at a horizontal distance of 20 metres and a vertical height of 10 metres. Take the acceleration due to gravity as $10\ m\ per\ sec^2$

(i) Show that the equations of motion are given by 2

$x = 20 \cos\alpha\, t$ and $y = -5t^2 + 20 \sin\alpha\ t$, where α, is the angle of projection.

(ii) Show that the Cartesian equation of the motion is 2

$$y = x\,tan \propto - \frac{x^2}{80} sec^2 \propto$$

(iii) Hence find the values of $\propto$ 2

Question 14 Start a new page

a A particle moves with an acceleration given by the expression $a = 7x$ Initially the particle start from the origin with a velocity of $-3\ metres\ pe\ second$. Find an expression for the velocity in terms of the displacement 3

b The displacement of a particle (in cm) from a point O on a line after t seconds is given by $x = 3\sin(2t + \alpha)$. Initially the particle is at $x = 1.5$

(i) Find the value of ∝ 1

(ii) Find the acceleration $\ddot{x}$ in terms of the displacement x 1

(iii) Find the time the particle takes to reach the point $x = 0$, for the first time 2

(iii) Find the time it takes to reach an acceleration of $-12\ cm\ per\ sec^2$, for the first time. 2

c A function is defined as $f(x) = 1 - cos\frac{x}{2}$

(i) Stae the period of this function 1

(ii) Find the largest domain of the function for which the inverse function $f^{-1}(x)$ exists. Include $x = 0$ in the domain. 1

(iii) Find the equation of $y = f^{-1}(x)$ 2

(iv) Sketch $y = f^{-1}(x)$ 2

End of Task

The following list of standard integrals may be used:

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

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

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

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

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

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

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

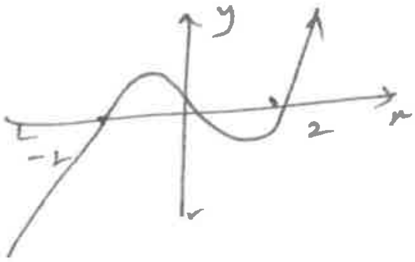
□ $$\int \frac{1}{a^2 + x^2} \; dx = \frac{1}{a} \tan^{-1} \frac{x}{a}, \; a \neq 0$$

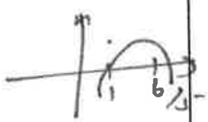
□ $$\int \frac{1}{\sqrt{a^2 - x^2}} \; dx = \sin^{-1} \frac{x}{a}, \; a > 0, \, -a < x < a$$

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

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

Qn	Solutions	Marks	Comments: Criteria
.	Multiple choice.		
1.	$y = \sin^{-1}(x^2)$ $y' = \frac{(2x)}{\sqrt{1-x^4}}$ A		
2.	$\int \sin^2 3x \, dx = \frac{1}{2}\int (1-\cos 6x)\, dx$ $= \frac{1}{2}\left(x - \frac{\sin 6x}{6}\right) + c$ D.		
3.	$\int e^{\frac{3x}{2}} dx = \frac{2}{3} e^{\frac{3x}{2}} + c.$ (C)		
4.	$\int \frac{dx}{\sqrt{1-4x^2}} = \int \frac{dx}{\sqrt{4(\frac{1}{4}-x^2)}}$ $= \frac{1}{2} \cdot \sin^{-1} 2x + c.$ (D)		
5.	$\ddot{x} = 1 - 3x$ $= -3(x - \frac{1}{3})$ centre $x = \frac{1}{3}$. (D) $\frac{2\pi}{\sqrt{3}}$		
6	$\int \frac{f'(x)}{f(x)} dx = \int 1 \, dx$ $\ln f(x) = x + c.$ $f(x) = e^{x+c}$ $= Ae^x$ or Ce^x (C)		

Qn	Solutions	Marks	Comments: Criteria
7.	$y = \frac{x^2+1}{x}$ $= x + \frac{1}{x}$. $x \neq 0$ $y \neq x$. (B).		
8.	$x(x-2)(x+2) > 0$ $-2 < x < 0$ or $x > 2$  (A).		
9.	$S = 4\pi r^2$ $\frac{dS}{dt} = 8\pi r \frac{dr}{dt}$. $= 8 \times \pi \times 2 \times 2$ $= 32\pi$. $16\pi = 4\pi r^2$ $4 = r^2$ $2 = r$ (A).		
10.	$\cos^{-1}\left(\cos \frac{11\pi}{6}\right)$ $= \cos^{-1}\left(\cos\left(2\pi - \pi/6\right)\right)$ $= \cos^{-1} \cos(\pi/6)$ $= \frac{\pi}{6}$ (D)		

Qn	Solutions	Marks	Comments: Criteria
11.	$\frac{1}{x-1} \geq 5$; $x \neq 1$. $(x-1)^2 \cdot \frac{1}{x-1} \geq 5(x-1)^2$ $x-1 \geq 5(x-1)^2$ $(x-1) - 5(x-1)^2 \geq 0$ $(x-1)(1-5(x-1)) \geq 0$ $(x-1)(6-5x) \geq 0$  $1 < x \leq \frac{6}{5}$		$x \neq 1$ $(-\frac{1}{2})$
b)	$x^{3k+4} = e^{8\ln x}$ $x^{3k+4} = e^{\ln x^8}$ $x^{3k+4} = x^8$ $\therefore 3k+4 = 8$ $3k = 4$ $k = \frac{4}{3}$	1 1	Taking logs on both sides. (1) sol (1)
c)	A(1,5) B(4,10) k 1 $(2, \frac{20}{3})$ $\frac{4k+1}{k+1} = 2$ $4k+1 = 2k+2$ $2k = 1$ $k = \frac{1}{2}$		Ensure you take k : 1 rather than k : l for each of calculation A number of students had the wrong formula.

Qn	Solutions	Marks	Comments: Criteria
	Note : works for y. coordinate no need to do this as well.		
	$\frac{10k+5}{k+1} = \frac{20}{3}$		
	$30k+15 = 20k+20$		
	$5 = 10k$		
	$k = \frac{1}{2}$.		
d)	$y = 3mx+1$ $y = mx$		
	grad m_1 $3m$ grad $m_2 = m$		
	$\tan\alpha = \frac{\lvert 3m-m \rvert}{1+3m^2}$		
	$\frac{1}{2} = \frac{2m}{1+3m^2}$		
	$3m^2+1 = 4m$		
	$3m^2-4m+1 = 0$		
	$(3m-1)(m-1) = 0$		
	$m = 1$.		
	$m = \frac{1}{3}$		
e)	$(x-2)(x+1)$ is a factor of $P(x)$		
	$\therefore (x-2)$ is a factor		
	$P(2) = 0$		
	$\therefore 16+24+4a-4-b = 0$ — (1)		
	$4a-b = -36$		
	$(x+1)$ is a factor : $P(-1) = 0$.		
	$1-3+a+2-b = 0$ — (2)		
	$a-b = 0$		

Qn	Solutions	Marks	Comments: Criteria
	$3a = -36$ solve (1) & (2)		
	$a = -12$ $b = -12$.		
Q.12	$\tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{5} = \tan^{-1}\frac{4}{7}$.		
	Let. $\alpha = \tan^{-1}\frac{1}{3}$ $\beta = \tan^{-1}\frac{1}{5}$		
	$\tan\alpha = \frac{1}{3}$ $\tan\beta = \frac{1}{5}$	1	
	Consider $\tan(\alpha+\beta)$	$\frac{1}{2}$	
	$= \dfrac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$		
	$= \dfrac{\frac{1}{3}+\frac{1}{5}}{1-\frac{1}{15}} = \frac{8}{14} = \frac{4}{7}$	$\frac{1}{2}$	
	$\therefore \tan^{-1}\frac{4}{7} = \alpha + \beta$	$\frac{1}{2}$	
	$= \tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{5}$	$\frac{1}{2}$	
b)	$x = 2\sin\theta$		
	$dx = 2\cos\theta\, d\theta$		
	$x = 0$: $\theta = 0$		
	$x = 2$ $\sin\theta = 1$, $\theta = \frac{\pi}{2}$		
	$\therefore \int_0^2 \sqrt{4-x^2}\,dx = \int_0^{\pi/2} \sqrt{4-4\sin^2\theta}\; 2\cos\theta\, d\theta$		(2M)
	$= 4\int_0^{\pi/2} \cos^2\theta\, d\theta$		
	$= 2\int_0^{\pi/2} (1+\cos 2\theta)\, d\theta$	$\frac{1}{2}$	

5

Qn	Solutions	Marks	Comments: Criteria
	$= 2\left[\theta + \frac{\sin 2\theta}{2}\right]_0^{\pi/2}$	½	(−1) if they didn't use $\cos^2\theta = \frac{1+\cos 2\theta}{2}$
	$= 2\left[\frac{\pi}{2}\right] = \pi$.	½	
c)	$\sin 2\theta = \cos\theta$ $2\sin\theta\cos\theta = \cos\theta$ $\cos\theta(2\sin\theta - 1) = 0$ $\cos\theta = 0$, $\theta = 2n\pi \pm \frac{\pi}{2}$ $\sin\theta = \frac{1}{2}$, $\theta = n\pi + (-1)^n \cdot \frac{\pi}{6}$	1 1	losing $\cos\theta$ altogether. $2\sin\theta\cos\theta = \cos\theta$, $2\sin\theta = 1$ is $1\frac{1}{2}/3$
d)	$\frac{1-x^2}{1+x^2} = -1 + \frac{2}{x^2+1}$ $-1 + \frac{2}{x^2+1} = \frac{-x^2-1+2}{x^2+1} = \frac{1-x^2}{1+x^2}$. $y = -1 + \frac{2}{x^2+1}$. $y' = \frac{-4x}{(x^2+1)^2}$ At stat pts: $y' = 0$, $x = 0$, $y = 1$. $(0,1)$ is a stat. pt.		A number of them had wrong information but correct graph. Marks were awarded for the question was asking for the graph. If the question concluded, find the stat. pt; a number of them would have got that part wrong.

Qn	Solutions	Marks	Comments: Criteria

x	0^-	0	0^+
y'	>0	0	<0

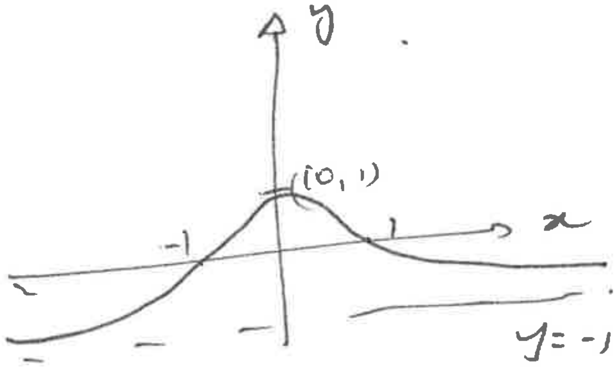
$\therefore$ $(0,1)$ is a ~~stat.~~ max. t. pt.

$y = 0$: $x = \pm 1$

$x = 0$: $y = 1$

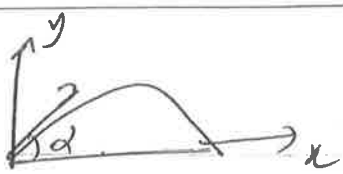
$$y = -1 + \frac{2}{x^2+1}$$

$\frac{2}{x^2+1} \neq 0$ $\therefore$ $y = -1$ is an asymptote



Qn	Solutions	Marks	Comments: Criteria
	Q.13		
a)	$\int \frac{5}{1+16x^2}\,dx$	2	1 FOR $\tan^{-1}(4x)+C$
	$= \frac{5}{16}\int \frac{1}{\frac{1}{16}+x^2}\,dx$	1	
	$= \frac{5}{16}\left[4\tan^{-1}4x + c\right]$		
	$= \frac{5}{4}\tan^{-1}(4x)+C$		
b)	$\left(2x - \frac{1}{x^2}\right)^9$		
	$= {}^9C_0\,(2x)^9 + {}^9C_1\,(2x)^8\left(-\frac{1}{x^2}\right) + \cdots$		
	$T_{r+1} = {}^9C_r\,(2x)^{9-r}\left(-\frac{1}{x^2}\right)^r$	1M	
	when T_{r+1} is a const:	3	
	$T_{r+1} = {}^9C_r \cdot 2^{9-r}\,(-1)^r \cdot x^{9-r-2r}$		
	T_{r+1} is a const. for $9-3r=0$, $r=3$.	1M	
	∴ Constant term is $(-1)^3\,{}^9C_3\,2^6 = -{}^9C_3 \cdot 2^6$	1M	
	$= -5376$		$-\frac{1}{2}$ for incorrect sign.
c)	$(3+4x)^{12} = {}^{12}C_0\,3^{12}(4x) + {}^{12}C_1 \cdot 3^{11}(4x)^2 + \cdots$	2	
	$t_{r+1} = {}^{12}C_r \cdot 3^{12-r}(4x)^r$		$\frac{1}{2}$ FOR CORRECT EXPRESSIONS FOR t_{R+1} AND t_R
	$t_r = {}^{12}C_{r-1} \cdot 3^{12-(r-1)}\,(4x)^{r-1}$.		

Qn	Solutions	Marks	Comments: Criteria
	$\dfrac{\text{Coeff of } t_{r+1}}{\text{Coeff of } t_r} = \dfrac{{}^{12}C_r}{{}^{12}C_{r-1}} \cdot \dfrac{3^{12-r}}{3^{13-r}} \cdot \dfrac{4^r}{4^{r-1}}$		1 for $\dfrac{{}^{12}C_k}{{}^{12}C_{k-1}} \cdot \dfrac{4}{3}$
	$= \dfrac{12!}{r!(12-r)!} \cdot \dfrac{(r-1)!(13-r)!}{12!} \cdot \dfrac{4}{3}$	1	
		(2)	
	$= \dfrac{13-r}{r} \cdot \dfrac{4}{3}$		
	Coeff of $t_{r+1} \geq$ Coeff of t_r $\frac{1}{2}$		
	$4(13-r) \geq 3r$		
	$52 - 4r \geq 3r$		
	$7r \leq 52$ $\left(\frac{52}{7} = 7\frac{3}{7}\right)$	1	
	$r \leq 7$ $\frac{1}{2}$		
	$\therefore$ [Coeff of t_{r+1} < Coeff of t_r for $r \geq 8$.		(2)
	Coeff of t_8 > Coeff of t_7 > ... Coeff of t_1		
	Coeff of t_8 > Coeff of t_{12} ... > Coeff of t_8.		
	[also Coeff of t_{13} < Coeff of t_{12}		
	$\therefore$ $T_8 = {}^{12}C_7 \cdot 3^5 \cdot (4x)^7$ $\frac{1}{2}$	1	
	Coeff of T_8 $= {}^{12}C_7 \cdot 3^5 \cdot 4^7$. $\frac{1}{2}$		
	or greatest coeff $= 3\,153\,199\,104$		

Qn	Solutions	Marks	Comments: Criteria
13d.	 	2	$-\frac{1}{2}$ PER ERROR $-\frac{1}{2}$ if didn't start from $\ddot{x}=0, \ddot{y}=-10$ $-\frac{1}{2}$ IF NO +C.

The only acceleration on the particle is gravity.

$\ddot{x} = 0$

$\ddot{y} = -10$

Initially $t=0$: $\dot{x} = 20\cos\alpha$, $\dot{y} = 20\sin\alpha$, $x = 0$, $y = 0$.

$\ddot{y} = -10$

$\dot{y} = -10t + c$

$20\sin\alpha = -10\times 0 + c$

$\therefore \dot{y} = -10t + 20\sin\alpha$

$y = -5t^2 + (20\sin\alpha)t + c$

$t=0$, $y=0$ $\therefore c = 0$

$y = -5t^2 + 20t\sin\alpha$ — (2)

$\ddot{x} = 0$

$\dot{x} = \text{const}.$

$\dot{x} = 20\cos\alpha$

$x = 20t\cos\alpha + C$

$t=0: x=0 \therefore C=0$

$x = 20t\cos\alpha$ — (1)

eliminate t in (1) & (2) to get the Cartesian equation.

(1) $t = \dfrac{x}{20\cos\alpha}$

Sub in (2)

$$y = -\frac{5x^2}{400\cos^2\alpha} + 20 \cdot \frac{x}{20\cos\alpha} \cdot \sin\alpha$$

$$= -\frac{1}{80}\sec^2\alpha \, x^2 + x\tan\alpha$$

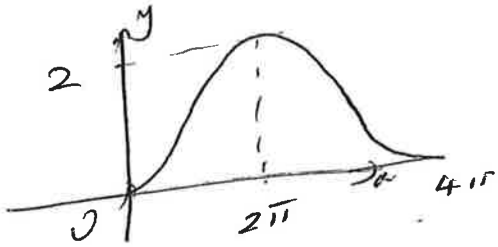
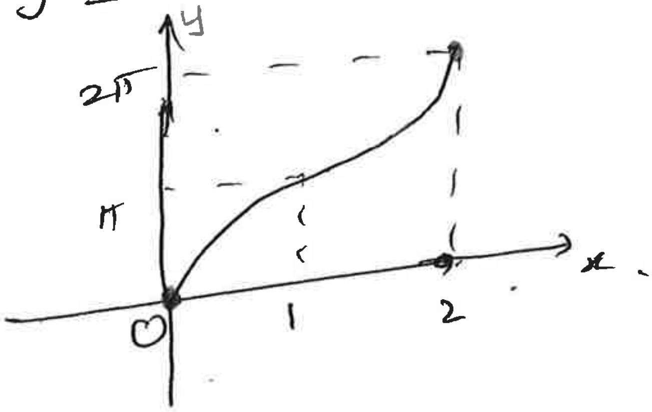
$$= -\frac{1}{80}(1+\tan^2\alpha)x^2 + x\tan\alpha.$$

$$= x\tan\alpha - \frac{x^2}{80}\sec^2\alpha.$$

2

Qn	Solutions	Marks	Comments: Criteria
	if $t = \tan\alpha$	2	
	$y = xt - \frac{x^2}{80}(1+t^2)$.		
	$10 = 20t - \frac{400(1+t^2)}{80}$		$\frac{1}{2}$ FOR CORRECT SUBSTITUTION $x=20$ $y=10$
	$10 = 20t - 5(1+t^2)$		$\frac{1}{2}$ FOR SIGNIFICANT SIMPLIFICATION
	$2 = 4t - 1 - t^2$		
	$t^2 - 4t + 3 = 0$		
	$(t-3)(t-1) = 0$		
	$t = 3$ $\quad$ $t = 1$		
	$\tan\alpha = 3$ $\quad$ $\tan\alpha = 1$		
	$\alpha = \tan^{-1}3$; 45°.		
	$71^\circ 34'$		
14 (b)	$x = 3\sin(2t+\alpha)$		
	$t=0$ $\quad$ $x = 1.5$		
(i).	$1.5 = 3\sin\alpha$. $\quad$ $\sin\alpha = \frac{1}{2}$ $\quad$ $\alpha = 30^\circ$	1	
(ii).	$\dot{x} = 6\cos(2t+\alpha)$		
	$\ddot{x} = -12\sin(2t+\alpha)$		
	$= -4(3\sin(2t+\alpha))$		
	$= -4x$	$\frac{1}{2}$	

Qn	Solutions	Marks	Comments: Criteria
(iii)	$0 = 3\sin(2t+\alpha)$ $\frac{1}{2}$	(2)	
	$\therefore\ 2t+\alpha = 0,\ \pi,\ 2\pi,$		
	$2t+\frac{\pi}{6} = \pi$ 1		
	$2t = \frac{5\pi}{6}$		
	$t = \frac{5\pi}{12}$ $\frac{1}{2}$		
(iv)	$-12 = -12\sin(2t+\pi/6)$ $\frac{1}{2}$	(2)	
	$\sin(2t+\frac{\pi}{6}) = 1$		
	$2t+\frac{\pi}{6} = \frac{\pi}{2}$ 1		
	$t = \frac{\pi}{6}$ $\frac{1}{2}$		
(a)	$a = 7x$ $t=0$, $x=0$, $v=3$		
	$\frac{d}{dx}\left(\frac{1}{2}v^2\right) = 7x$ 1		
	$\frac{1}{2}v^2 = \frac{7x^2}{2}+C$ $\frac{1}{2}$ $x=0$, $v=-3$		$v=\sqrt{7x}$ $1\frac{1}{2}/3$
	$\frac{9}{2} = C$ $\frac{1}{2}$		
	$\therefore\ v^2 = 7x^2+9$		
	$v = \pm\sqrt{7x^2+9}$ $\frac{1}{2}$; reconcile with $x=0$: $v=-3$		
	$\therefore\ v = -\sqrt{7x^2+9}$	1/2 (3)	

Qn	Solutions	Marks	Comments: Criteria
14c.	$f(x) = 1 - \cos\frac{x}{2}$		
	$T = \frac{2\pi}{1/2} = 4\pi$	(1)	
			
	$f^{-1}(x)$ exists $0 \le x \le 2\pi$ (or $-2\pi \le x \le 0$)	(1)	
	$y = 1 - \cos\frac{x}{2}$		
	$x = 1 - \cos\frac{y}{2}$	1	
	$\cos\frac{y}{2} = 1 - x$	$\frac{1}{2}$	
	$\frac{y}{2} = \cos^{-1}(1-x)$	$\frac{1}{2}$	
	$y = 2\cos^{-1}(1-x)$		
		(2)	1 SHAPE 1 CORRECT DOMAIN/RANGE $-\frac{1}{2}$ no endpoints