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

STUDENT NUMBER/NAME: ....

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

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

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

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

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, internally, 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 $tan\alpha = \frac{1}{2}$. $m > 0$

(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 $(Px) = x^4 + 3x^3 + ax^2 - 2x - b$, 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 $(3+4x)^{12}$ 2

d) A particle is projected from a point O on level ground with velocity 20 metres per second.
Take the acceleration due to gravity as $10\ m\ per\ sec^2$

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

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

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

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

If this particle hits a target at a horizontal distance of 20 metres and a vertical height of 10 metres.

(iii) Find the values of ∝. 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 $-3\ metres\ per\ second.$ 3
Find an expression for the velocity v, in terms of the displacement, x

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

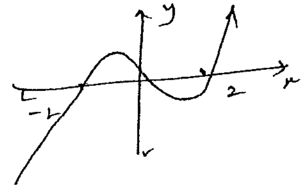
(ii Find the largest domain of the function for which the inverse function $f^{-1}(x)$ exists. Include $x = 0$ in the domain. 1

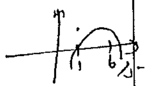
(iii Find the equation of $y = f^{-1}(x)$ 2

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

End of Task

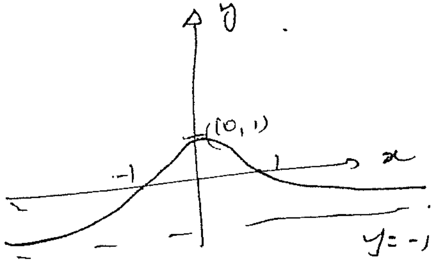
Qn	Solutions	Marks	Comments: Criteria
	Multiple choice.		
1.	$y = \sin^{-1}(x^2)$ $y' = \dfrac{(2x)}{\sqrt{1-x^4}}$ A		
2.	$\int \sin^2 3x\, dx = \frac{1}{2}\int(1-\cos 6x)\, dx$ $= \frac{1}{2}\left(x - \frac{\sin 6x}{6}\right) + c$ D.		
3.	$\int e^{\frac{3x}{2}}dx = \frac{2}{3}e^{\frac{3x}{2}} + c.$ 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.	$\cos^{-1}(\cos \frac{11\pi}{6})$ $= \cos^{-1}(\cos(2\pi - \frac{11\pi}{6}))$ $= \cos^{-1}\cos(\frac{\pi}{6})$ D $= \frac{\pi}{6}$		

Qn	Solutions	Marks	Comments: Criteria
11.	$\frac{1}{x-1} \geq 5 \quad ; \quad x \neq 1.$ $(x-1)^2 \cdot \frac{1}{x-1} \geq 5(x-1)^2$ $x-1 \geq 5(x-1)^2$ $(x-1) - 5(x-1)^2 \geq 0$ $(x-1)(1-5(x-1)) \geq 0$ $(x-1)(6-5x) \geq 0$  $1 < x \leq \frac{6}{5}$		$x \neq 1 \quad (-\frac{1}{2})$
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)	$A(1,5) \quad B(4,10)$ $k \quad\quad 1$ $(2, \frac{20}{3})$ $\frac{4k+1}{k+1} = 2$ $4k+1 = 2k+2$ $2k = 1$ $k = \frac{1}{2}$.		Ensure you take $k:1$ rather than $k:l$ for each of calculation. A number of students had the wrong formula.
	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)	$y = 3mx+1 \quad\quad y = mx$ Grad m_1 $3m$ $\quad\quad$ 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 $\therefore P(2) = 0$ $16+24+4a-4-b = 0$ $4a-b = -36$ —(1) $(x+1)$ 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) $a = -12 \quad b = -12$.		
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	
	Conside $\tan(\alpha+\beta)$ $= \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$	$\frac{1}{2}$	
	$= \frac{\frac{1}{3}+\frac{1}{5}}{1-\frac{1}{15}} = \frac{8}{14} = \frac{4}{7}$	$\frac{1}{2}$	
		$\frac{1}{2}$	
	$\therefore \tan^{-1}\frac{4}{7} = \alpha + \beta$ $= \tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{5}$	$\frac{1}{2}$	
b)	$x = 2\sin\theta$ $dx = 2\cos\theta\, d\theta$ $x = 0: \quad \theta = 0$ $x = 2 \quad \sin\theta = 1$ $\theta = \frac{\pi}{2}$		
	$\therefore \int_0^2 \sqrt{4-x^2}\,dx = \int_0^{\pi/2} \sqrt{4-4\sin^2\theta}\; 2\cos\theta\, d\theta$ $= 4\int_0^{\pi/2} \cos^2\theta\, d\theta$		2M
	$= 2\int_0^{\pi/2} (1+\cos 2\theta)\, d\theta$	$\frac{1}{2}$	

Qn	Solutions	Marks	Comments: Criteria
	$= 2\left[\theta + \frac{\sin 2\theta}{2}\right]_0^{\pi/2}$	$\frac{1}{2}$	-1 if many didn't use $\cos^2\theta = \frac{1+\cos 2\theta}{2}$.
	$= 2\left[\frac{\pi}{2}\right] = \pi$.	$\frac{1}{2}$	
c)	$\sin 2\theta = \cos\theta$ $2\sin\theta\cos\theta = \cos\theta$ $\cos\theta(2\sin\theta - 1) = 0$	1	losing $\cos\theta$. altogether. $\cancel{2\sin\theta\cos\theta = \cos\theta}$ $\cancel{2\sin\theta = 1}$ is $\frac{1\frac{1}{2}}{3}$.
	$\cos\theta = 0$ $\theta = 2n\pi \pm \frac{\pi}{2}$ $\sin\theta = \frac{1}{2}$ $\theta = n\pi + (-1)^n\frac{\pi}{6}$	1	
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 asked for the graph. If the question was excluded, find the stat. pt; a number of them would have got that point 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)	$\left(2x - \frac{1}{x^2}\right)^9$		
	$= {}^9C_0 (2x)^9 + {}^9C_1 (2x)^8\left(-\frac{1}{x^2}\right) + \dots$		
	$T_{r+1} = {}^9C_r (2x)^{9-r}\left(-\frac{1}{x^2}\right)^r$	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	
	$\therefore$ Constant term is $(-1)^3\, {}^9C_3\, 2^6 = -{}^9C_3 \cdot 2^6$	1M	
	$= -5376$		$-\frac{1}{2}$ for incorrect sign.
c)	$(3+4x)^{12} = {}^{12}C_0\, 3^{12}(4x) + {}^{12}C_1 \cdot 3^{11}(4x)^2 + \dots$		
	$t_{r+1} = {}^{12}C_r \cdot 3^{12-r}(4x)^r$		$\frac{1}{2}$ 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

$4(13-r) \geq 3r$ $\frac{1}{2}$

$52 - 4r \geq 3r$

$7r \leq 52$ $\left(\frac{52}{7} = 7\frac{3}{7}\right)$ 1

$r \leq 7$ $\frac{1}{2}$

$\therefore$ [Coeff of t_{r+1} $\cancel{\geq}$ Coeff of t_r for $r \geq 8$. (2)

Coeff of t_8 > Coeff of t_7 > ... Coeff of t_1

Also Coeff of t_{13} < Coeff of t_{12} ... < coeff of t_8.

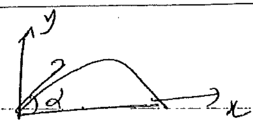
$\therefore T_8 = {}^{12}C_7 \cdot 3^5 \cdot (4x)^7$ $\frac{1}{2}$ 1

Coeff. of $T_8 = {}^{12}C_7 \cdot 3^5 \cdot 4^7$ $\frac{1}{2}$

or greatest coeff $= 3153199104$

Qn	Solutions	Marks	Comments: Criteria

13a.



The only acceleration on the particle is gravity. $\ddot{x} = 0$. 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.

$\ddot{y} = -10$

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} = $ 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)

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

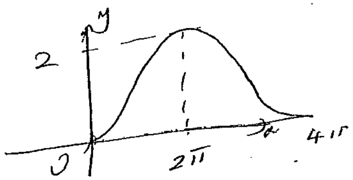
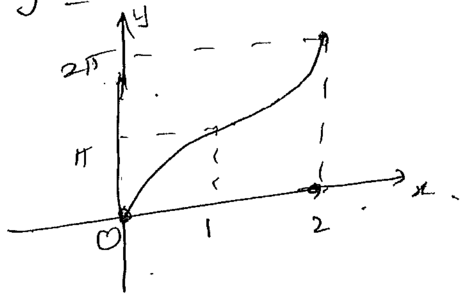
$= -\dfrac{1}{80}\sec^2\alpha \, x^2 + x\tan\alpha$

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

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

Qn	Solutions	Marks	Comments: Criteria
	if $t = \tan\alpha$	2	
	$y = xt - \frac{x^2}{80}(1+t^2)$		
	$10 = 20t - \frac{400(1+t^2)}{80}$		½ FOR CORRECT SUBSTITUTION $x=20$ $y=10$
	$10 = 20t - 5(1+t^2)$		½ FOR SIGNIFICANT SIMPLIFICATION
	$2 = 4t - 1 - t^2$		
	$t^2 - 4t + 3 = 0$		
	$(t-3)(t-1) = 0$		
	$t = 3$ $t = 1$, $\tan\alpha = 1$		
	$\tan\alpha = 3$		
	$\alpha = \tan^{-1}3$; 45° $71^\circ 34'$		
14 (b)	$x = 3\sin(2t+\alpha)$		
	$t=0$ $x = 1.5$		
(i)	$1.5 = 3\sin\alpha$. $\sin\alpha = \frac{1}{2}$, $\alpha = 30^\circ$	1	
(ii)	$\dot{x} = 6\cos(2t+\alpha)$		
	$\ddot{x} = -12\sin(2t+\alpha)$ $= -4(3\sin(2t+\alpha))$ $= -4x$ ½		

Qn	Solutions	Marks	Comments: Criteria
(iii)	$0 = 3\sin(2t+\alpha)$ ½	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)	$-12 = -12\sin(2t+\pi/6)$ ½	2	
	$\sin(2t+\frac{\pi}{6}) = 1$		
	$2t + \frac{\pi}{6} = \frac{\pi}{2}$ 1		
	$t = \frac{\pi}{6}$. $\frac{1}{2}$		
(a)	$a = 7x$. $t=0$, $x=0$, $V=3$		
	$\frac{d}{dx}(\frac{1}{2}v^2) = 7x$ 1		
	$\frac{1}{2}v^2 = \frac{7x^2}{2} + c$ ½ $x=0$, $V=3$		$V=\sqrt{7x}$ $1\frac{1}{2}/3$
	$\frac{9}{2} = c$ $\frac{1}{2}$		
	$\therefore v^2 = 7x^2+9$		
	$v = \pm\sqrt{7x^2+9}$ ½, reconcile with $x=0$: $v=3$		
	$\therefore v = \sqrt{7x^2+9}$. ½	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 $0 \le x \le 2\pi$ ($\text{OR} -2\pi \le x \le 0$)	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