St George Girls High School

Trial Higher School Certificate Examination

2012

Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using blue or black pen
- Begin each question in a new booklet
- Write your student number on each booklet.
- Board-approved calculators may be used.
- A table of standard integrals is provided at the back of this paper. Detach.
- Multiple choice Answer sheet is at the back of this paper. Detach.
- Show all necessary working in Questions 11 – 16.
- Diagrams are not to scale.
- The mark allocated for each question is listed at the side of the question.

Total Marks – 100

Section I – Pages 2 – 4
10 marks

- Attempt Questions 1 – 10
- Allow about 15 minutes for this section

Section II – Pages 5 – 12
90 marks

- Attempt Questions 11 – 16
- Allow about 2 hours 45 minutes for this section

Students are advised that this is a Trial Examination only and does not necessarily reflect the content or format of the Higher School Certificate Examination.

Section I – (10 marks) Marks

Answer this section on the answer sheet provided at the back of this paper.
Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

1. The angle which the straight line $3x + 5y + 2 = 0$ makes with the positive direction of the x-axis is closest to:

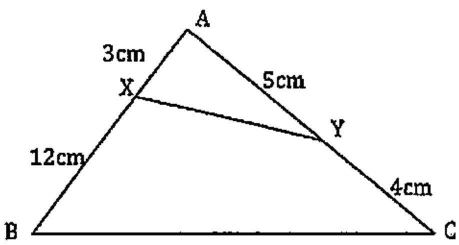
   A. 31° B. 59° C. 121° D. 149°

2. Janet works out the sum of n terms of a given arithmetic series. Her answer, which is correct, could be:

   A. $S_n = 2(2^n - 1)$
   B. $S_n = 9 - 2n$
   C. $S_n = 8n - n^2$
   D. $S_n = 7 \times 2^{n-1}$

3. The values of x for which $y = 2x^3 - 12x^2 + 18x + 7$ is increasing are:

   A. $x < 2$ B. $x > 2$ C. $1 < x < 3$ D. $x < 1$ or $x > 3$

4. 

   If ΔABC has area 36 cm² then the area of ΔAXY is:

   A. 4 cm² B. 8 cm² C. 12 cm² D. 16 cm²

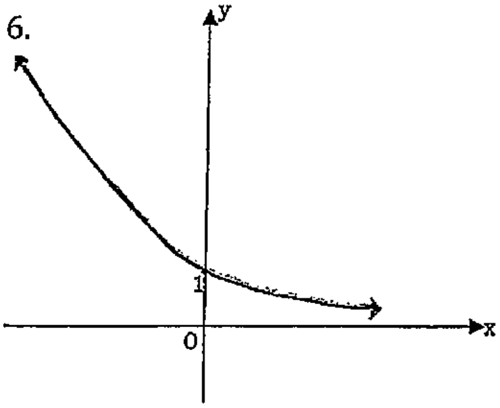
5. When the curve of equation $y = e^x$ is rotated about the x-axis between $x = -2$ and $x = 2$ the volume of the solid generated is given by:

   A. $\pi \int_{-2}^{2} e^x \, dx$ B. $2\pi \int_{0}^{2} e^{x^2} \, dx$

   C. $\pi \int_{-2}^{2} e^{x^2} \, dx$ D. $\pi \int_{-2}^{2} e^{2x} \, dx$

Section I (cont'd) **Marks**

6.



The graph illustrated could be:

A. $y = 2^x$

B. $y = (-2)^x$

C. $y = \left(\frac{1}{2}\right)^x$

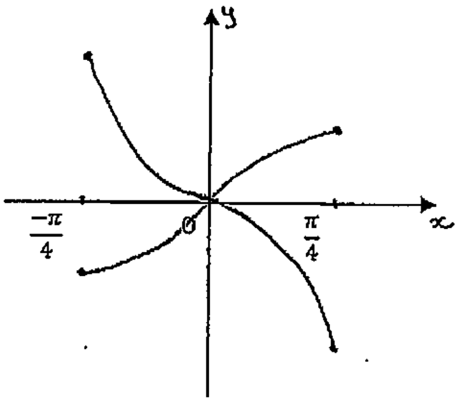
D. $y = \left(-\frac{1}{2}\right)^x$

7. The quadratic function, $Q(x) = 5x^2 - 4x + 3$, has roots for $Q(x) = 0$ of α and β. Hence, $\alpha^2 + \beta^2 =$

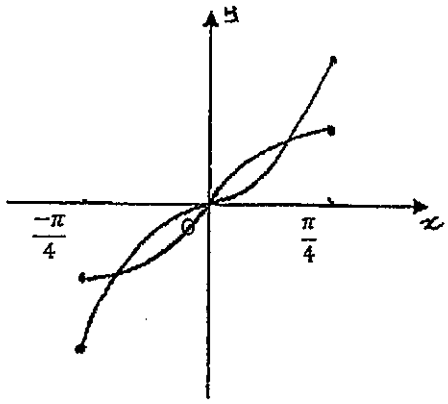
A. $\frac{46}{25}$ B. $\frac{29}{25}$ C. $\frac{-11}{25}$ D. $\frac{-14}{25}$

8. The graphs of $y = \sin x$ and $y = \tan x$ for $\frac{-\pi}{4} \leq x \leq \frac{\pi}{4}$ are represented in:

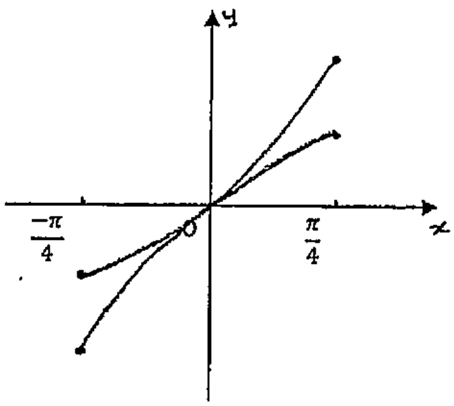
A.



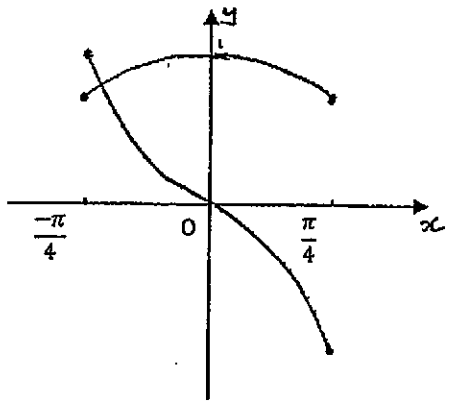
B.



C.

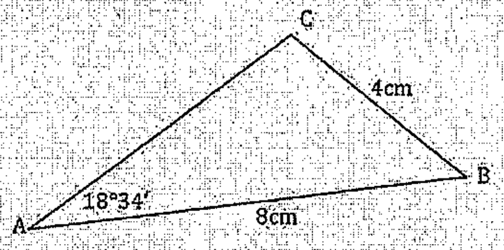


D.



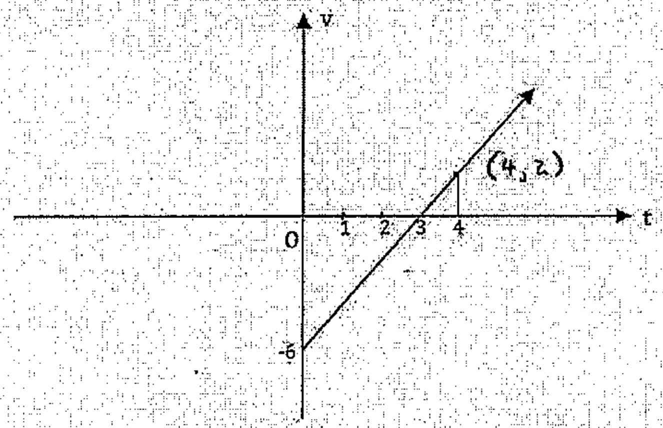
Section I (cont'd) **Marks**

9. A possible answer to the size of $\angle C$ in the triangle below is:



A. 140°27′ B. 0°10′ C. 37°8′ D. None of these answers

10.



The graph shows velocity expressed as a function of time. The distance travelled by the particle in the first 4 seconds is:

A. 8 units B. 10 units C. $4\sqrt{5}$ units D. 12 units

Section II – Show all working

Question 11 – Start A New Booklet – (15 marks) Marks

a) Write the answer to $\sqrt{\frac{4.83\times10.86}{17.83-5.92}}$ correct to 3 significant figures. 2

b) Solve $|2x-3|\le 5$ 2

c) If $\log_a 2 = 0.36$ and $\log_a 5 = 0.83$ evaluate $\log_a\sqrt{10}$ 2

d) Differentiate each of the following with respect to x

(i) $\cos 7x$ 1

(ii) $\sqrt{e^{2x}+4}$ 2

(iii) $x\ln x$ 2

e) Find:

(i) $\int (3-2x)^4\ dx$ 1

(ii) $\int \frac{1}{\sqrt{x}}\ dx$ 1

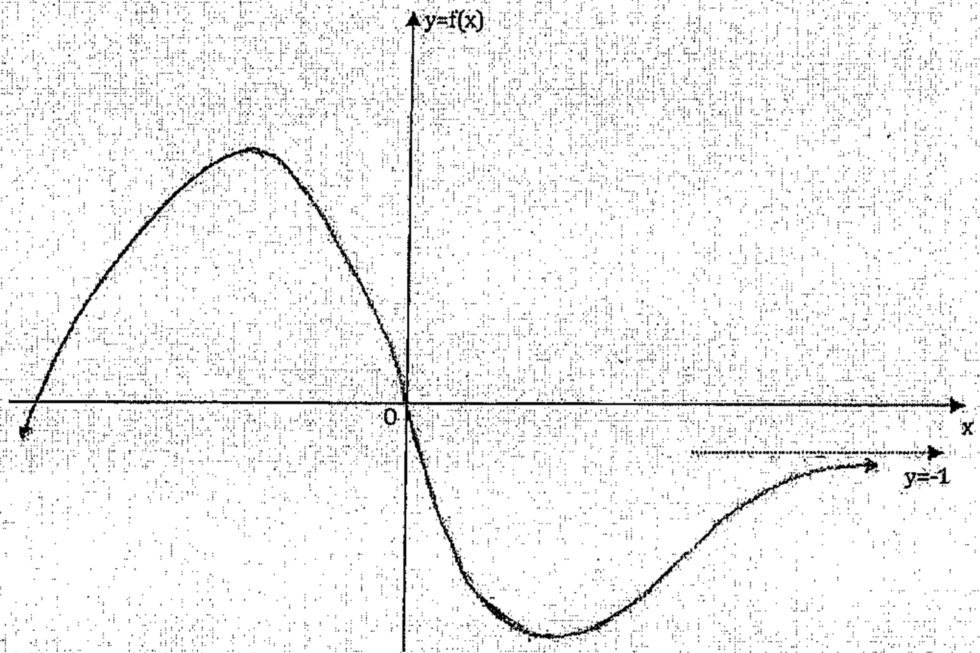
(iii) $\int \cos x^\circ\ dx$ 2

Question 12 – Start A New Booklet – (15 marks) **Marks**

a) Graph the region on the number plane given by $y > \log_e(x-1)$ 2

b) Copy this graph carefully onto your own paper. The graph shows $y = f(x)$.

On your graph draw the graph of $y = f'(x)$ making it clear which graph is your answer. 2

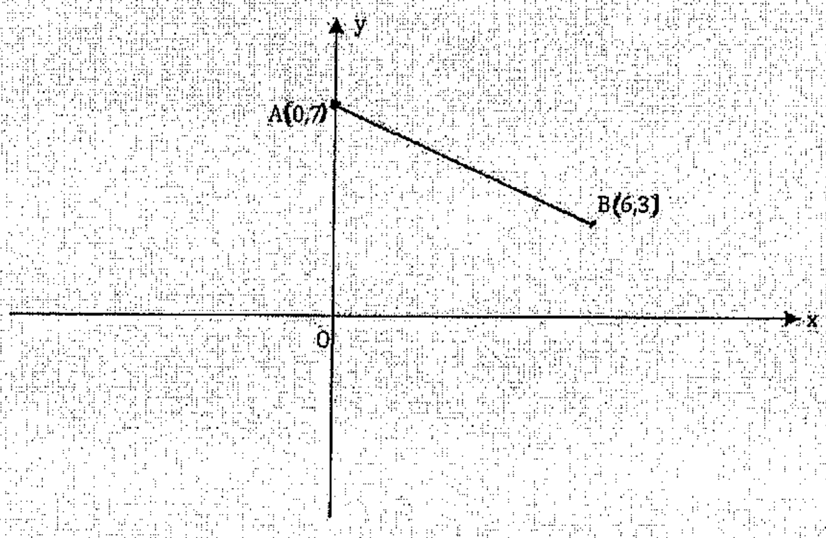


c) Initially a particle, travelling in straight line, is at rest at the origin. It is given an acceleration of $(6t+4)$ cm/sec². 3

Find the motion equation for displacement.

Question 12 – (cont'd) Marks

d)



$A(0,7)$ and $B(6,3)$ are points on the number plane and the equation of AB is $2x+3y-21=0$

(i) Find the length of AB 1

(ii) Find the gradient of AB 1

(iii) Show that the equation of the perpendicular from $D(-2,0)$ to AB is $3x-2y+6=0$ 2

(iv) Find the perpendicular distance from D to AB. 2

(v) Find the coordinates of C such that $ABCD$ is a parallelogram. 1

(vi) Find the area of parallelogram $ABCD$. 1

Question 13 – Start A New Booklet – (15 marks)

Marks

a) $20 + 10 + 5 + \cdots$ is a geometric series. Find which term of the series will be just less than 0.0001. 3

b) If $\cos\theta = \dfrac{-8}{17}$ and $\tan\theta < 0$, find the exact value for $\sin\theta$. 2

c) Sketch the graph of $y = -3\ \sin 2x$ for $0 \leq x \leq 2\pi$ 3

d) Copy the table of values into your writing booklet and supply the missing numbers, for $f(x) = x\sin x$, writing each correct to 3 decimal places. 3

x	1	1.5	2	2.5	3
$f(x) = x \sin x$	0.841				

Use Simpson's Rule with 5 function values to find an approximation for

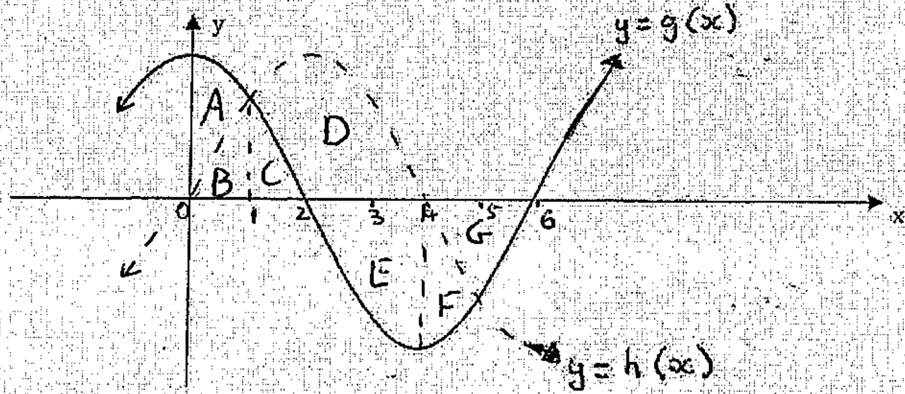
$$\int_1^3 x\sin x\, dx$$

e) Find the volume formed when the area enclosed between $y = x^2$ and $y = 4x - x^2$ is rotated about the x-axis. 4

Question 14 – Start A New Booklet – (15 marks)

Marks

a)



A, B, C, D, E, F and G are the areas of the regions in which they are given.

Using these letters, write an expression for:

(i) $\int_0^4 h(x)\,dx$ (ii) $\int_1^4 g(x)\,dx$ 1,2

b) Solve $\tan 3\theta = 1$ for $0 \le \theta \le 2\pi$ 3

c) Find the equation of the parabola with vertex $(-1, 1)$ and focus $(-3, 1)$ 3

d) (i) Differentiate 2

$$y = \log_e\left(\frac{x-1}{x+1}\right)$$

(ii) Hence, or otherwise , find 1

$$\int \frac{1}{x^2 - 1}\,dx$$

e) Given $y = -4x - 20$ is the equation of a tangent to $y = x^3 - 4x^2 - 7x + 10$ and $x > 0$, find the coordinates of the point of contact. 3

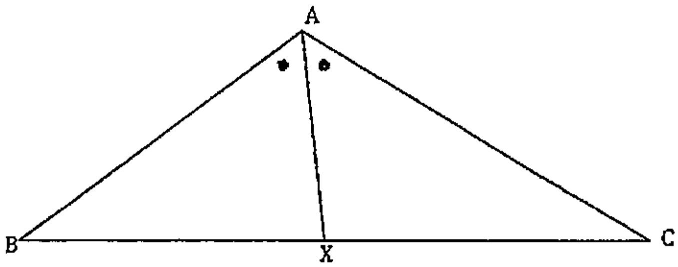
Question 15 – Start A New Booklet – (15 marks)

Marks

a) Simplify: 2

$$\frac{\sin^2\theta}{\tan\theta\,\sin(90-\theta)}$$

b)



Copy the diagram carefully onto your paper.

X is a point on the side BC of ΔABC and AX bisects $\angle BAC$.

(i) Draw the line through X parallel to BA to meet AC at L.

This construction gives $\frac{BX}{XC}=\frac{AL}{LC}$ 1

(ii) Prove that ΔALX is isosceles. 2

(iii) Given that $\Delta CAB\,|||\,\Delta CLX$ (Do not prove this) prove that $\frac{BX}{XC}=\frac{AB}{AC}$ 2

c) The equation of motion of a particle is $x=te^{-t}$
where x is in centimetres
t is in seconds.

(i) Find the time when the particle is at rest. 3

(ii) Find the equation of motion for acceleration and the acceleration when $v=0$. 2

(iii) Find the time when acceleration is zero. 1

(iv) Using the answers from parts (i) to (iii) and other necessary information, sketch the displacement-time function $x=te^{-t}$. Show all important features clearly. 2

Question 16 – Start A New Booklet – (15 marks)

Marks

a) An open cone, of radius r cm, and height, h cm is made from a sector of a circle. The area of the sector used is 300 cm².

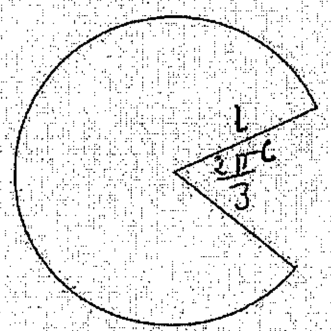


Fig I

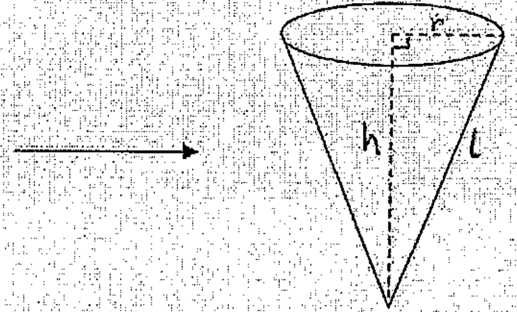


Fig II

(i) Show from Figure I that slant height l is given by $l^2 = \frac{450}{\pi}$ **2**

(ii) Show from Figure II that $h = \sqrt{l^2 - r^2}$ **1**

(iii) Hence or otherwise show that the volume of the cone is given by **1**

$$V = \frac{1}{3}r^2\sqrt{450\pi - \pi^2 r^2}$$

(iv) Show that $\frac{dv}{dr} = \frac{300\pi r - \pi^2 r^3}{\sqrt{450\pi - \pi^2 r^2}}$ **2**

(v) Find the value of r for the volume of the cone to be a maximum. **2**

Question 16 – (cont'd) **Marks**

b) Kando, the mathematical kangaroo always hops (i.e. jumps) according to mathematical rules. One day, Kando decides to go hopping according to the following rules:

- The length of odd number hops (1st, 3rd, 5th hop etc), in metres, is given by the arithmetic series $t_n = 4 - (n - 1)$, where $n = 1, 3, 5, \ldots$ is an odd number;
- The length of even number hops (2nd, 4th, 6th hop etc), in metres, is given by the geometric series $T_N = \frac{192}{63}\left(\frac{1}{2}\right)^{\frac{N-2}{2}}$, where $N = 2, 4, 6, \ldots$ is an even number;
- If the length of a hop is negative according to the relevant series, Kando hops the prescribed distance *backwards*.

(i) Write down the first term and common difference for the series t_n. 1

(ii) Write down the first term and common ratio for the series T_n. 1

(iii) Find where Kando is relative to her starting point after 12 hops. 3

(iv) Find the total distance travelled backwards in the first 16 hops. 2

End of Paper

TABLE OF 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 $\ln x = \log_e x, \quad x > 0$

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Mathematics Trial 2012 Solutions

Multiple Choice

1.	D	6.	C
2.	C	7.	D
3.	D	8.	C
4.	A	9.	A
5.	D	10.	B

Question 11

(a) $\sqrt{\dfrac{4.83\times10.86}{17.83-5.92}} = 2.0986$

$= 2.10$

(b) $|2x-3|\le 5$

$-5\le 2x-3\le 5$

$-2\le 2x\le 8$

$-1\le x\le 4$

(c) $\log_a\sqrt{10} = \log_a 10^{\frac{1}{2}}$

$= \frac{1}{2}\log_a 10$

$= \frac{1}{2}(\log_a 5 + \log_a 2)$

$= \frac{1}{2}(0.83 + 0.36)$

$= 0.595$

(d) (i) $y = \cos 7x$

$y' = -7\sin 7x$

(ii) $y = \sqrt{e^{2x}+4}$

$y = (e^{2x}+4)^{\frac{1}{2}}$

$y' = \frac{1}{2}(e^{2x}+4)^{-\frac{1}{2}}\times 2e^{2x}$

$= e^{2x}(e^{2x}+4)^{-\frac{1}{2}}$

(iii) $y = x\ln x$

$y' = 1.\ln x + x.\frac{1}{x}$

$= \ln x + 1$

(e) (i) $\int(3-2x)^4\,dx = \dfrac{(3-2x)^5}{-2\times5} + C$

$= -\frac{1}{10}(3-2x)^5 + C$

(ii) $\int\frac{1}{\sqrt{x}}\,dx = \int x^{-\frac{1}{2}}\,dx$

$= \dfrac{x^{\frac{1}{2}}}{\frac{1}{2}} + C$

$= 2\sqrt{x} + C$

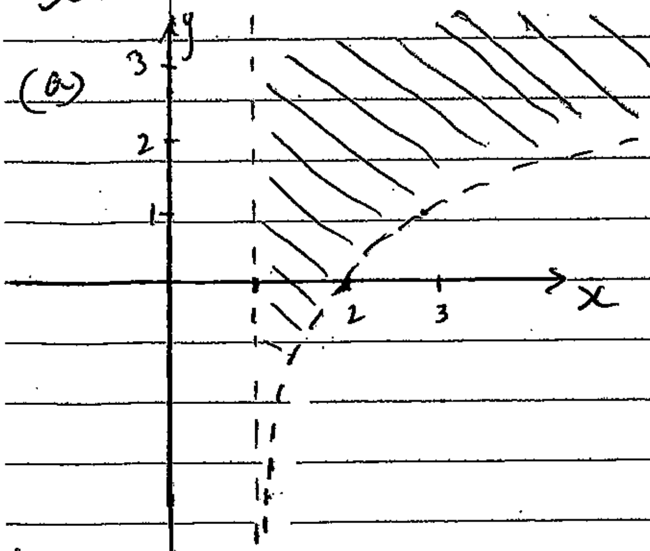
(iii) $\int\cos x^\circ\,dx = \int\cos\frac{\pi x}{180}\,dx$

$= \dfrac{1}{\frac{\pi}{180}}\sin\frac{\pi x}{180} + C$

$= \frac{180}{\pi}\sin\frac{\pi x}{180} + C$

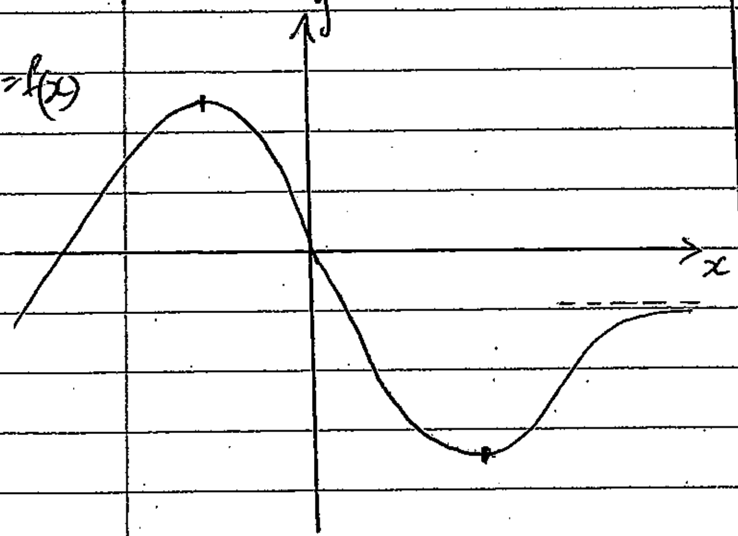
Question 12

(a)

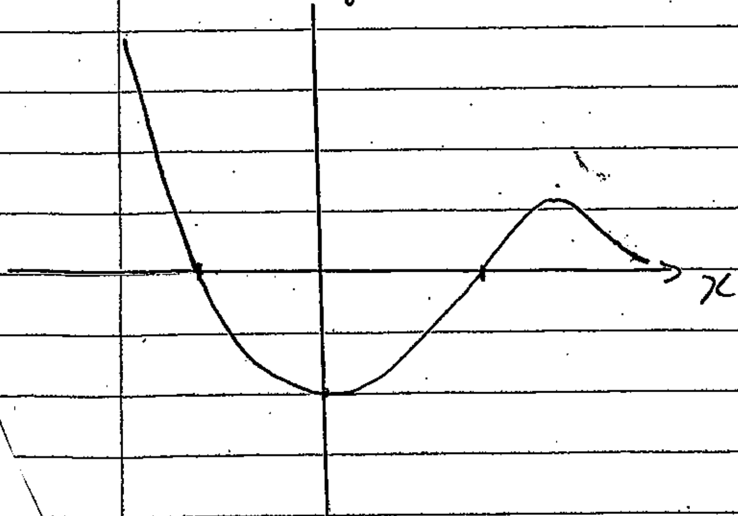


(b)

y = f(x)



y = f'(x)



(c) $t=0 \quad v=0 \quad x=0 \quad \therefore c=0$

$a = 6t+4$

$v = \int 6t+4 \, dt$

$v = 3t^2 + 4t$

$x = \int 3t^2+4t \, dt$

$x = t^3 + 2t^2$

(d) (i) $d = \sqrt{(6-0)^2 + (3-7)^2}$

$= \sqrt{36+16}$

$= \sqrt{52}$

(ii) $m = \dfrac{3-7}{6-0}$

$= -\dfrac{2}{3}$

(iii) $m = \dfrac{3}{2} \quad (-2, 0)$

$y - 0 = \dfrac{3}{2}(x+2)$

$2y = 3x+6$

$3x - 2y + 6 = 0$

(iv) $d = \dfrac{|2x_1 + 3y_1 - 21|}{\sqrt{2^2+3^2}}$

$= \dfrac{|2.-2 + 3.0 - 21|}{\sqrt{13}}$

$= \dfrac{25}{\sqrt{13}}$

(v) $C = (4 \; -4)$

(vi) Area = base × height

$= \sqrt{52} \times \dfrac{25}{\sqrt{13}}$

$= \sqrt{4} \times 25$

$= 50$ sq units.

Question 13

i) $a = 20 \quad r = 0.5$

$T_n = ar^{n-1}$

$= 20(0.5)^{n-1}$

$20(0.5)^{n-1} < 0.0001$

$(0.5)^{n-1} < 0.000005$

$(n-1)\log(0.5) < \log(0.000005)$

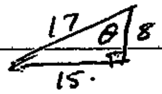
$(n-1) > \dfrac{\log(0.000005)}{\log(0.5)}$

$n-1 > 17.6$

$n > 18.6$

$\therefore$ 19th term

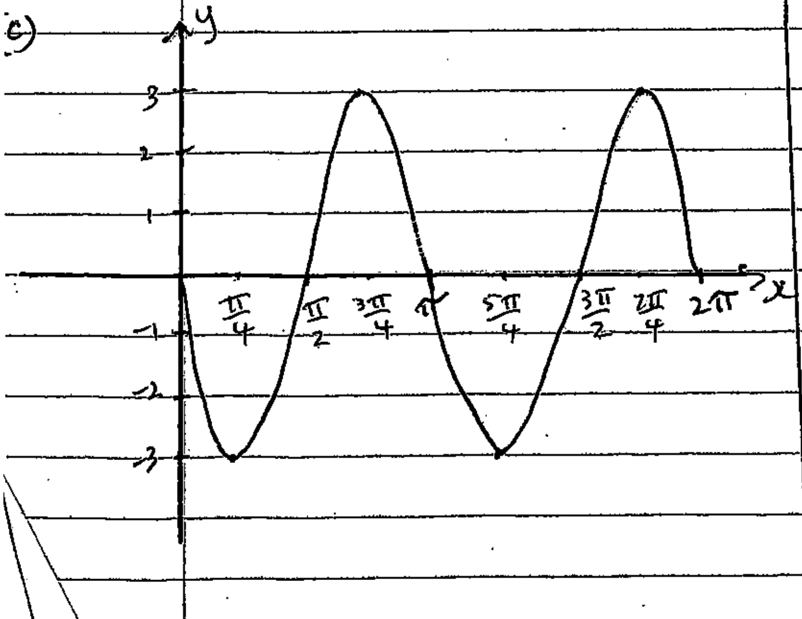
(b) $\cos\theta = \dfrac{-8}{17}$



2nd Quadrat.

$\therefore \sin\theta = \dfrac{15}{17}$

(c)



1	1.5	2	2.5	3
0.841	1.496	1.819	1.496	0.423

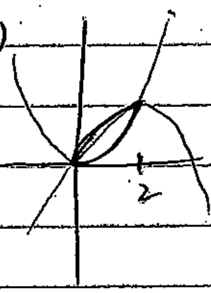
$h = 0.5$

$\int_1^3 x\sin x\,dx \approx \dfrac{0.5}{3}\{0.841 + 4\times1.496 + 1.819\}$

$+ \dfrac{0.5}{3}\{1.819 + 4\times1.496 + 0.42\}$

≈ 2.812

(e)



$x^2 = 4x - x^2$

$0 = 4x - 2x^2$

$0 = 2x - x^2$

$0 = x(2-x)$.

$x = 0, 2.$

$Vol = \pi\int_0^2 (4x-x^2)^2\,dx - \pi\int_0^2 (x^2)^2\,dx$.

$= \pi\int_0^2 16x^2 - 8x^3 + x^4\,dx - \pi\int_0^2 x^4\,dx$

$= \pi\int_0^2 16x^2 - 8x^3 + x^4 - x^4\,dx$.

$= \pi\int_0^2 16x^2 - 8x^3\,dx$

$= \pi\left[\dfrac{16x^3}{3} - \dfrac{8x^4}{4}\right]_0^2$

$= \pi\left[\left(\dfrac{16\cdot2^3}{3} - \dfrac{8\cdot2^4}{4}\right) - (0)\right]$

$= \pi\cdot\dfrac{32}{3}$

$= \dfrac{32\pi}{3}$

Question 14.

(a) (i) $\int_0^4 h(x)\,dx = B + C + D$

(ii) $\int_1^4 g(x)\,dx = C - E$

b) $\tan 3\theta = 1$ $\quad 0 \leq \theta \leq 2\pi$

$0 \leq 3\theta \leq 6\pi$

Q_1 & Q_3

$3\theta = \frac{\pi}{4}, \frac{5\pi}{4}, \frac{9\pi}{4}, \frac{13\pi}{4}, \frac{17\pi}{4}, \frac{21\pi}{4}$

$\theta = \frac{\pi}{12}, \frac{5\pi}{12}, \frac{9\pi}{12}, \frac{13\pi}{12}, \frac{17\pi}{12}, \frac{21\pi}{12}$

(c) Vertex $= (-1, 1)$ focus $= (-3, 1)$

$a = -2$ $\quad (y-k)^2 = 4a(x-h)$

$(y-1)^2 = 8(x+3)$

d) (i) $y = \ln\frac{(x-1)}{(x+1)}$

$y = \ln(x-1) - \ln(x+1)$

$y' = \frac{1}{x-1}\cdot 1 - \frac{1}{x+1}\cdot 1$

$y' = \frac{1}{x-1} - \frac{1}{x+1}$

$= \frac{2}{} = \frac{x+1-(x-1)}{(x-1)(x+1)}$

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

(ii) $\int \frac{1}{x^2-1}\,dx = \frac{1}{2}\int \frac{2}{x^2-1}\,dx$

$= \frac{1}{2}\ln\frac{(x-1)}{(x+1)} + C$

(e) $y = x^3 - 4x^2 - 7x + 10$

$y' = 3x^2 - 8x - 7$

$m = -4$

$\therefore -4 = 3x^2 - 8x - 7$

$0 = 3x^2 - 8x - 3$

$(3x+1)(x-3)$

$x > 0 \quad \therefore x = 3$

$y = 3^3 - 4.3^2 - 7.3 + 10$

$= -20$

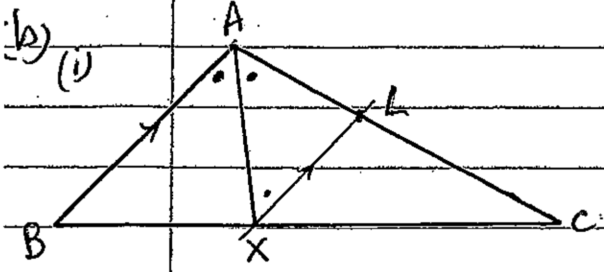
$\therefore (3, -20)$ is the point of contact

Question 15

a)

$$\frac{\sin^2\theta}{\tan\theta\sin(90-\theta)} = \frac{\sin^2\theta}{\frac{\sin\theta}{\cos\theta}\cdot\cos\theta} = \frac{\sin^2\theta}{\sin\theta} = \sin\theta$$ ②

b) (i)



①

ii) $B\hat{A}X = A\hat{X}L$ (alternate angles on parallel lines)

$\therefore \triangle ALX$ isosceles (base angles equal)

$\therefore AL = LX$ ②

ii) $\triangle CAB \parallel\!\mid \triangle CLX$

$\therefore \frac{AB}{LX} = \frac{AC}{LC}$

$\frac{AB}{AC} = \frac{LX}{LC}$

$\therefore \frac{AB}{AC} = \frac{AL}{LC}$ $(AL = LX)$

but $\frac{AL}{LC} = \frac{BX}{XC}$ (given)

$\therefore \frac{AB}{AC} = \frac{BX}{XC}$ ②

(c) $x = te^{-t}$

$\dot{x} = 1.e^{-t} + t.e^{-t}$

$= e^{-t}(1-t)$

(i) $\dot{x} = 0$

$(1-t)e^{-t} = 0$

$1-t=0$

$t=1$ ③

(ii) $\ddot{x} = -e^{-t}(1-t) + -1.e^{-t}$

$= e^{-t}(-(1-t)-1)$

$= (t-2)e^{-t}$

$t=1$ $\quad \ddot{x} = (1-2)e^{-1}$

$= -e^{-1}$

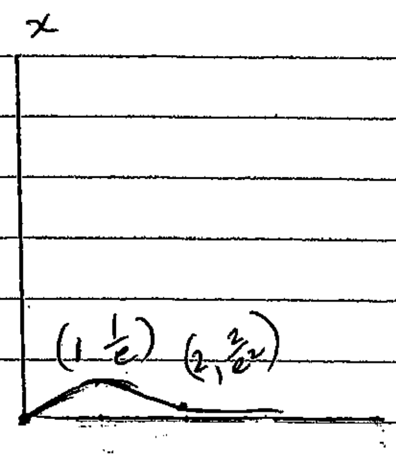
$= -\frac{1}{e}$ ②

(iii) $\ddot{x} = 0$

$(t-2)e^{-t} = 0$

$t = 2$ ①

(iv)



②

Question 16

(a)

(i) $A = \frac{1}{2}r^2\theta$ $\qquad \theta = 2\pi - \frac{2\pi}{3} = \frac{4\pi}{3}$

$\therefore 300 = \frac{1}{2}l^2\frac{4\pi}{3}$

$900 = 2\pi l^2$

$\frac{450}{\pi} = l^2$

(ii) $r^2 + h^2 = l^2$

$h^2 = l^2 - r^2$

$h = \sqrt{l^2 - r^2}$

(iii) $V = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi r^2\sqrt{l^2 - r^2}$

$= \frac{1}{3}\pi r^2\sqrt{\frac{450}{\pi} - r^2}$

$= \frac{1}{3}r^2\sqrt{\pi^2\left(\frac{450}{\pi} - r^2\right)}$

$= \frac{1}{3}r^2\sqrt{450\pi - \pi^2r^2}$

(iv) $V = \frac{1}{3}r^2\left(450\pi - \pi^2r^2\right)^{\frac{1}{2}}$

$V' = \frac{2}{3}r\left(450\pi - \pi^2r^2\right)^{\frac{1}{2}} + \frac{1}{2}\left(450\pi - \pi^2r^2\right)^{-\frac{1}{2}} \cdot -2\pi^2 r \cdot \frac{1}{3}r^2$

$= \frac{2}{3}r\left(450\pi - \pi^2r^2\right)^{\frac{1}{2}} - \frac{\pi^2}{3}r^3\left(450\pi - \pi^2r^2\right)^{-\frac{1}{2}}$

$= \frac{\frac{2}{3}r\left(450\pi - \pi^2r^2\right)}{\left(450\pi - \pi^2r^2\right)^{\frac{1}{2}}} - \frac{\frac{\pi^2}{3}r^3}{\left(450\pi - \pi^2r^2\right)^{\frac{1}{2}}}$

$= \frac{300r\pi - \frac{2}{3}\pi^2r^3 - \frac{1}{3}\pi^2r^3}{\left(450\pi - \pi^2r^2\right)^{\frac{1}{2}}}$

$= \frac{300\pi r - \pi^2r^3}{\sqrt{450\pi - \pi^2r^2}}$

(v) $V' = 0$

$\frac{300\pi r - \pi^2r^3}{\sqrt{450\pi - \pi^2r^2}} = 0$

$300\pi r - \pi^2r^3 = 0$

$300r - \pi r^3 = 0$

$r(300 - \pi r^2) = 0$

$r(\sqrt{300} + \sqrt{\pi}r)(\sqrt{300} - \sqrt{\pi}r) =$

$\therefore r = 0, -\sqrt{\frac{300}{\pi}}, \sqrt{\frac{300}{\pi}}$

$0, -\sqrt{\frac{300}{\pi}}$ are not valid solutions

$\therefore r = \sqrt{\frac{300}{\pi}}$

r	9	$\sqrt{\frac{300}{\pi}}$	10
V'	37.8	0	-13.4
	+	0	−

$\therefore r = \sqrt{\frac{300}{\pi}}$ gives max. volume.

Question 16.

b) (i) $T_n = 4-(n-1)$

$T_1 = 4$ $\therefore a = 4$

$T_2 = 2$ $d = -2$

$T_3 = 0$

(ii) $T_N = \frac{192}{63}\left(\frac{1}{2}\right)^{\frac{N-2}{2}}$

$T_1 = \frac{192}{63}\cdot\left(\frac{1}{2}\right)^0$

$= \frac{192}{63}$

$T_2 = \frac{192}{63}\cdot\left(\frac{1}{2}\right)^1$

$= \frac{192}{63}\cdot\frac{1}{2}$

$T_3 = \frac{192}{63}\cdot\left(\frac{1}{2}\right)^2$

$\therefore a = \frac{192}{63}$ $r = \frac{1}{2}$

(iii) $S_n + S_N$ $n=6$ $N=6$

$a=4$ $d=-2$

$S_6 = \frac{6}{2}(2\times4+5\times-2)$

$= 3(8-10)$

$= -6$

$a = \frac{192}{63}$ $r = \frac{1}{2}$ $S_n = \frac{a(1-r^n)}{1-r}$

$S_6 = \frac{\frac{192}{63}\cdot\left(1-\frac{1}{2}^6\right)}{1-\frac{1}{2}}$

$= \frac{\frac{192}{63}\cdot\left(1-\frac{1}{2^6}\right)}{\frac{1}{2}}$

$= \frac{384}{63}\left(1-\frac{1}{64}\right)$

$= \frac{384}{63}\cdot\frac{63}{64}$

$= \frac{384}{64}$

$= 6.$

$S_n + S_N$

$= -6+6$

$= 0$

$\therefore$ Kando is at the starting point.

(iv) Total distance backwards.

is $-2-4-6-8-10 = -30$

$\therefore$ 30 metres backwards.