Caringbah High School

2011
Trial Higher School Certificate Examination

Mathematics

General Instructions

- Reading time - 5 minutes
- Working time - 3 hours
- Write using black or blue pen
- Board approved calculators may be used
- A table of standard integrals is provided at the back of this paper
- All necessary working should be shown in every question

Total marks - 120

- Attempt Questions 1 -10
- All questions are of equal value

Total marks – 120
Attempt Questions 1–10
All questions are of equal value

Start each question in a SEPARATE booklet. Extra booklets are available.

Marks

Question 1 (12 marks) Use a SEPARATE writing booklet.

(a) Evaluate $\sqrt{\frac{4^2+11^2}{321-11^2}}$ correct to three significant figures. **2**

(b) Find a primitive of $4+\sec^2 x$. **2**

(c) Factorise x^3+27. **2**

(d) Solve $|x-5|=8$. **2**

(e) Simplify $\frac{x}{x^2-9}+\frac{3}{x+3}$. **2**

(f) Solve $4x=x^2$. **2**

Question 2 (12 marks) Use a SEPARATE writing booklet.

(a) Differentiate with respect to x:

(i) x^5+7 **2**

(ii) $\frac{x^2}{x+1}$ **2**

(iii) $x\cos x$ **2**

Question 2 (continued)

(b) Find

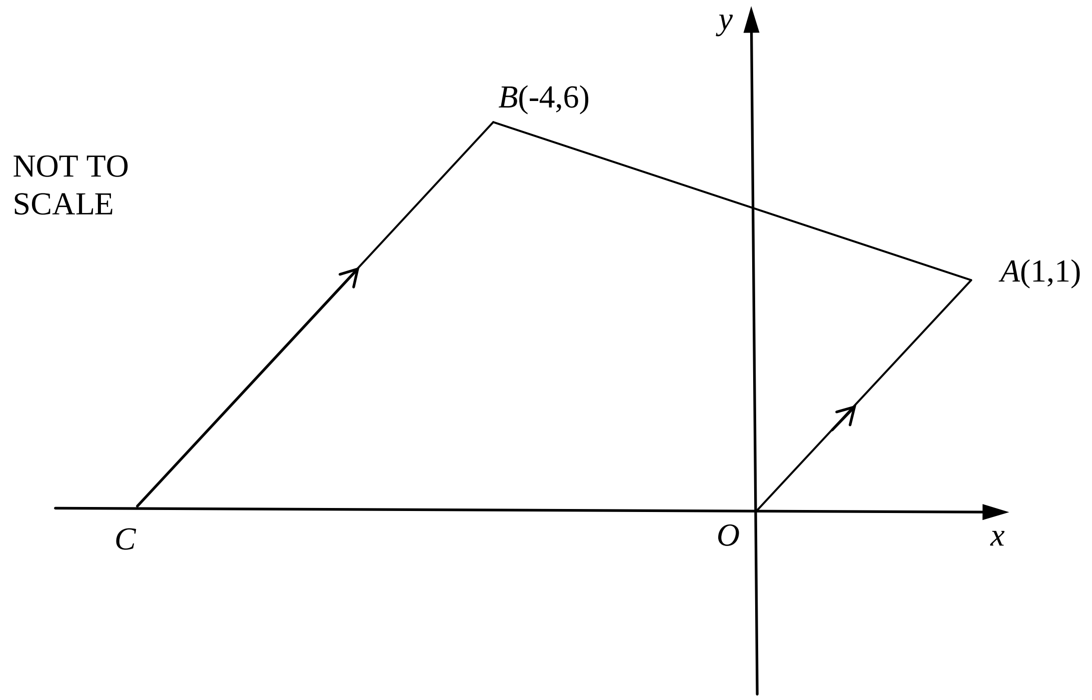
(i) $\int \frac{12x^3}{x^4+2}dx$ **2**

(ii) $\int_0^1 (e^{5x} - 1)dx$ **2**

(c) Find the equation of the tangent to $y = e^{2x}$ at the point $(2, e^4)$. **2**

Question 3 (12 marks) Use a SEPARATE writing booklet.

(a)



In the diagram, *OABC* is a trapezium with *OA*||*CB*. The coordinates of *O*, *A* and *B* are (0,0), (1,1) and (-4,6) respectively.

(i) Calculate the length *OA*. **1**

(ii) Write down the gradient of line OA. **1**

(iii) What is the size of $\angle AOC$? **1**

(iv) Find the equation of the line *BC*, and hence find the coordinates of *C*. **2**

(v) Show that the perpendicular distance from *O* to the line *BC* is $5\sqrt{2}$. **2**

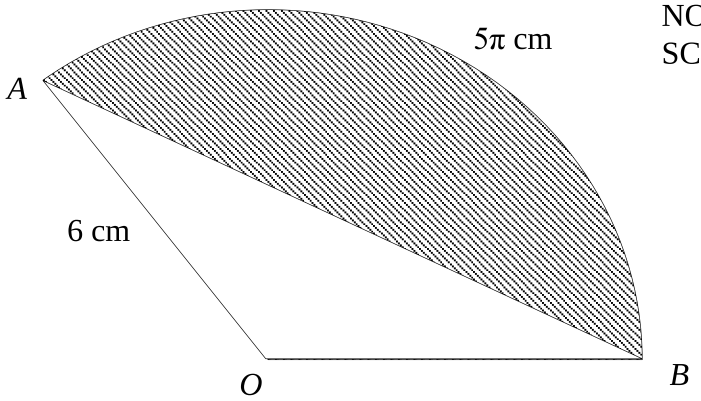
(vi) Hence, or otherwise, calculate the area of the trapezium *OABC*. **2**

(b) The lengths of the sides of a triangle are 8 cm, 9 cm and 14 cm. Find the size of the angle opposite the smallest side. **2**

(c) Evaluate $\sum_{n=2}^{4}(1-3n)$ **1**

Question 4 (12 marks) Use a SEPARATE writing booklet.

(a)



AOB is a sector of a circle, centre *O* and radius 6 cm. The length of the arc *AB* is 5π cm.

(i) Find the exact size of $\angle AOB$ **1**

(ii) Calculate the exact area of the shaded segment. **2**

(b) Consider the function $f(x) = 3x^2 - x^3$.

(i) Find the coordinates of the stationary points of the curve $y = f(x)$ and determine their nature. **3**

(ii) Sketch the curve showing where it meets the axes. **2**

(iii) Find the values for which the curve is concave down. **2**

(c) Sally invests \$3000 in a term deposit that earns 6·5% per annum compounded annually. What is the value of her investment at the end of 15 years? **2**

Question 5 (12 marks) Use a SEPARATE writing booklet.

(a) Madison is learning to drive. Her first lesson is 10 minutes long. Her second lesson is 15 minutes long. Each subsequent lesson is 5 minutes longer than the previous lesson.

(i) How long will Madison's fifteenth lesson be? **1**

(ii) How many hours of lessons will Madison have completed after her fifteenth lesson? **2**

(iii) During which lesson will Madison have completed a total of 40 hours of driving lessons? **2**

(b) Find the values of m for which the expression below is always positive. **2**

$$x^2 + 2mx + (3m - 2)$$

(c) Find the amplitude and period if $y = -3\cos \pi x$. **2**

(d) (i) Differentiate $\log_e(\sin x)$ **1**

(ii) Hence, or otherwise, find the exact value of $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \cot x.dx$ **2**

Question 6 (12 marks) Use a SEPARATE writing booklet.

(a) Find all values of , where $0° \leq \theta \leq 360°$, that satisfy the equation .

$$\cos\theta - \frac{2}{5} = 0$$ **2**

Give your answer(s) to the nearest degree.

(b) Solve $|x - 2| > 5$ and graph your solution on the number line. **2**

Question 6 (continued)

(c) (i) Find the limiting sum of the geometric series **2**

$$3+\frac{3}{\sqrt{3}+1}+\frac{3}{(\sqrt{3}+1)^2}+\ldots$$

(ii) Explain why the geometric series **1**

$$3+\frac{3}{\sqrt{3}-1}+\frac{3}{(\sqrt{3}-1)^2}+\ldots$$

does NOT have a limiting sum.

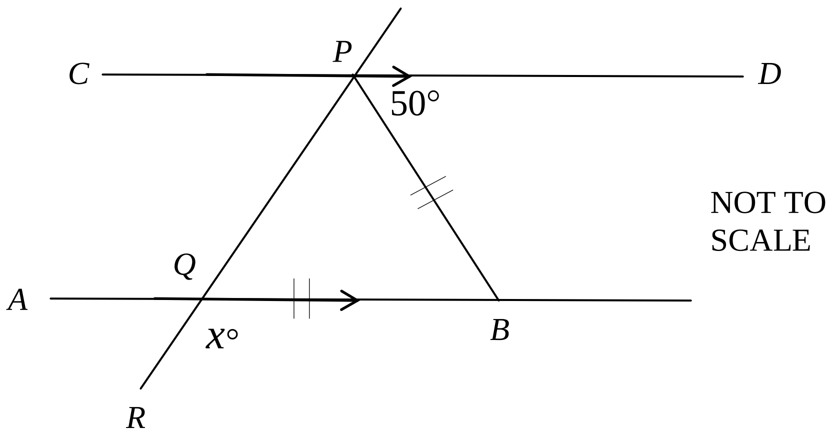
(d) A council worker accidently spread a toxic chemical on a local soccer field. The concentration of the chemical in the soil was initially measured at 4 kg/ha. One year later the concentration was found to be 2·6 kg/ha. It is known that the concentration, *C*, is given by $C = C_0e^{-kt}$, where C_0 and *k* are constants, and *t* is measured in years.

(i) Evaluate C_0 and *k*. **3**

(ii) It is safe to use the soccer field when the concentration is below 0·1 kg/ha. How long must the soccer players wait after the accident before the soccer field can be used? Give your answer in years, correct to one decimal place. **2**

Question 7 (12 marks) Use a SEPARATE writing booklet.

(a)



3

In the diagram, *CD* is parallel to *AB*, *PB* = *QB*, $\angle BPD = 50°$ and $\angle BQR = x°$. Copy or trace this diagram.

Find the value of *x*, giving complete reasons.

Question 7 (continued)

(b) Let α and β be the roots of the equation

$$x^2 - 5x + 2 = 0$$

Find the values of;

(b) (i) $\alpha + \beta$ **1**

(ii) $\alpha\beta$ **1**

(iii) $(\alpha + 1)(\beta + 1)$ **2**

(c) The equation of a parabola is $y = \dfrac{x^2}{8} - 3$

(i) Find the coordinates of the vertex of the parabola. **2**

(ii) Find the equation of the directrix of the parabola. **1**

(iii) Sketch the curve clearly labelling the vertex and directrix. **2**

Question 8 (12 marks) Use a SEPARATE writing booklet.

(a) Use Simpson's rule, with three function values to find an approximation for $\int_{0\cdot5}^{1\cdot5} (\log_e x)^3 \, dx$. **2**

Give your answer correct to three decimal places.

(b) (i) Write down the discriminant of $2x^2 + (k-2)x + 8$, where k is a constant. **1**

(ii) Hence, or otherwise, find the values of k for which the parabola $y = 2x^2 + kx + 9$ does not intersect the line $y = 2x + 1$. **2**

Question 8 (continued)

(c) During a storm, water flows into a 7000 litre tank at a rate of $\frac{dV}{dt}$ litres per minute, where $\frac{dV}{dt} = 120 + 26t - t^2$ and t is the time in minutes since the storm began.

(i) At what time is the tank filling at twice the initial rate? **2**

(ii) Find the volume of water that has flowed into the tank since the start of the storm as a function of t. **1**

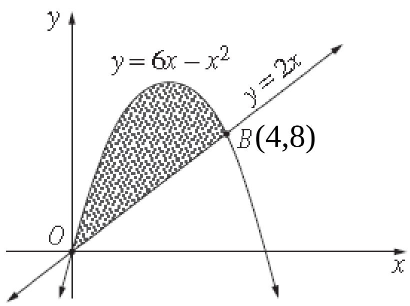
(iii) Initially, the tank contains 1500 litres of water. When the storm finishes, 30 minutes after it began, the tank is overflowing. **2**

How many litres of water have been lost?

(d) Solve the equation $2\ln x = \ln(7x - 12)$ **2**

Question 9 (12 marks) Use a SEPARATE writing booklet.

(a) **3**



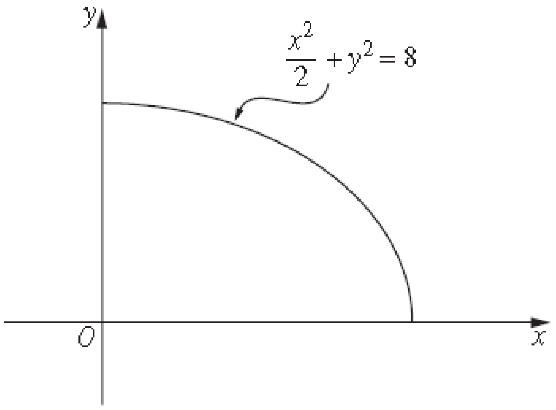
NOT TO SCALE

The graphs of $y = 2x$ and $y = 6x - x^2$ intersect at the origin and point $B(4,8)$.

Find the shaded area bounded by $y = 2x$ and $y = 6x - x^2$.

Question 9 (continued)

(b)



The part of the curve $\frac{x^2}{2}+y^2=8$ that lies in the first quadrant is rotated about the x-axis. Find the volume of the solid of revolution. **3**

(c) Mr Smith borrows \$80 000 to purchase a new car. The interest rate is calculated monthly at the rate of 1% per month, and is compounded each month.

Mr Smith intends to repay the loan, with interest, in two equal annual instalments of \$*M* at the end of the first and second years.

(i) How much does Mr Smith owe at the end of the first month? **1**

(ii) Write an expression involving *M* for the total amount owed by Mr Smith after 12 months, just after the first instalment of \$*M* has been paid. **2**

(iii) Find an expression for the amount owed at the end of the second year and deduce that **2**

$$M=\frac{80000\times(1\cdot 01)^{24}}{(1\cdot 01)^{12}+1}$$

(iv) What is the total interest over the two-year period? **1**

Question 10 (12 marks) Use a SEPARATE writing booklet.

(a) Solve the following equation for x : **2**

$$2e^{2x} - e^{x} = 0$$

(b) Show that $f(x) = \dfrac{x^4 - 8}{x^3}$ is an odd function. **1**

(c) Let $f(x) = \sqrt{25 - x^2}$

(i) Copy the following table of values into your writing booklet and supply the missing values. **1**

x	0	1	2	3	4	5
$f(x)$	5·000		4·583			0·000

(ii) Use these six values of the function and the trapezoidal rule to find the approximate value of **2**

$$\int_0^5 \sqrt{25 - x^2}\, dx$$

(iii) Draw the graph of $x^2 + y^2 = 25$ and shade the region whose area is represented by the integral **2**

$$\int_0^5 \sqrt{25 - x^2}\, dx$$

(iv) Use your answer to part (iii) to explain why the exact value of the integral is $\dfrac{25\pi}{4}$. **2**

(v) Use your answers to part (ii) and part (iv) to find an approximate value of π. **2**

End of Examination

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

Q1

(a) 0.828

(b) $4x + \tan x + c$

(c) $(x+3)(x^2 - 3x + 9)$

(d) $x = -3$ or 13

(e) $\frac{x}{(x-3)(x+3)} + \frac{3(x-3)}{(x+3)(x-3)} = \frac{4x-9}{(x-3)(x+3)}$

(f) $x^2 - 4x = 0$

$x(x-4) = 0 \Rightarrow x = 0$ or 4

Q2 (a) (i) $5x^4$

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

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

(iii) $\cos x - x.\sin x$

(b) (i) $3\int \frac{4x^3}{x^4+2}dx = 3\ln(x^4+2) + c$

(ii) $\left[\frac{e^{5x}}{5} - x\right]_0^1 = \frac{e^5}{5} - 1 - \left(\frac{1}{5} - 0\right)$

$= \frac{e^5}{5} - \frac{6}{5}$

$= \frac{e^5 - 6}{5}$

(c) $y' = 2e^{2x} \Rightarrow m_T(2) = 2e^4$

$\therefore y - e^4 = 2e^4(x-2)$

$y = 2e^4.x - 4e^4 + e^4$

$\therefore$ Tangent is $y = 2e^4.x - 3e^4$

Q3 (a) (i) $OA = \sqrt{(1-0)^2 + (1-0)^2} = \sqrt{2}$

(ii) $m_{OA} = \frac{1-0}{1-0}$

$= 1$

(iii) $\angle AOC = 135^\circ$

(iv) $m_{BC} = 1 \quad B \equiv (-4, 6)$

$y - 6 = 1(x - -4)$

$y = x + 4 + 6$

line $BC \equiv y = x + 10$

at C $y = 0 \therefore x = -10$

(v) line $BC \equiv x - y + 10 = 0$

$\therefore D_\perp = \frac{|0.1 - 0.1 + 10|}{\sqrt{1^2+1^2}}$

$= \frac{|10|}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$

$= \frac{10\sqrt{2}}{2}$

$= 5\sqrt{2}$

(vi) Need $d_{BC} = \sqrt{(-10 - -4)^2 + (6-0)^2}$

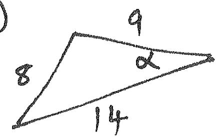
$= \sqrt{36+36}$

$= 6\sqrt{2}$

$\therefore \text{Area}_{OABC} = \frac{1}{2} \cdot 5\sqrt{2} \cdot (6\sqrt{2} + \sqrt{2})$

$= 35 u^2$

(b)



$\cos\alpha = \frac{9^2 + 14^2 - 8^2}{2.9.14}$

$\therefore \alpha \doteq 32.3025^\circ$

$\doteq 32^\circ 18'$

(c) $\text{Sum} = (1-12) + (1-9) + (1-6)$

$= -11 - 8 - 5$

$= -24$

Q4 (a) (i) $l = r\theta$

$5\pi = 6\theta$

$\theta = \frac{5\pi}{6}^c$

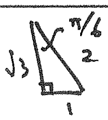
(ii) $\text{Area} = \frac{1}{2}6^2\left(\frac{5\pi}{6} - \sin\frac{5\pi}{6}\right)$

$= 15\pi - 18 \sin \pi/6$

Q4 (a)(ii) (cont'd)

$= 15\pi - 18\cdot\frac{1}{2}$

$= 15\pi - 9\ u^2$



(b)

(i) $f'(x) = 6x - 3x^2$

$= 3x(2-x) = 0$

when $x = 0$ or 2

If $x=0, y=0 \Rightarrow (0,0)$

If $x=2, y=4 \Rightarrow (2,4)$

To get nature consider $f''(x)$

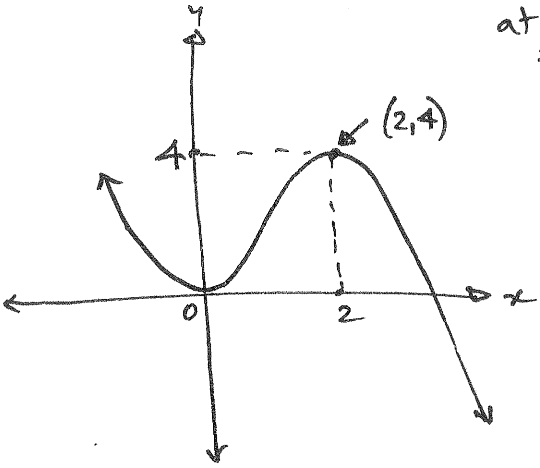
$f''(x) = 6 - 6x$

$= 6(1-x)$

$f''(0) = 6 > 0 \Rightarrow \cup \Rightarrow$ MINIMUM turning point at $(0,0)$

$f''(2) = -6 < 0 \Rightarrow \cap \Rightarrow$ MAXIMUM turning point at $(2,4)$

(ii)



(iii) concave down $\Rightarrow f''(x) < 0 \Rightarrow 6 - 6x < 0$

$6x > 6$

$x > 1$

(c) Use $A = P(1+r)^n$

$= \$3000(1\cdot065)^{15}$

$= \$7\,715\cdot52$

Q5 (a)(i) $a = 10 \quad d = 5, \ T_{15} = ?$

Use $T_n = a + (n-1)d$

$T_{15} = 10 + 14 \times 5$

$= 80$ minutes

(ii) $S_{15} = ?$ Use $S_n = \frac{n}{2}\{a + l\}$

$= \frac{15}{2}(10 + 80)$

$= 675$ minutes

$= 11\cdot25$ hours.

(iii) $S_n = 40 \times 60, \ n = ?$

Use $S_n = \frac{n}{2}(2a + (n-1)d)$

$40 \times 60 = \frac{n}{2}(20 + 5n - 5)$

$4800 = 15n + 5n^2$

$n^2 + 3n - 960 = 0$

$n = \frac{-3 \pm \sqrt{9 + 4 \times 960}}{2}$

$n = 29\cdot5$

$\therefore$ During the 30th lesson

(b) Always positive $\Rightarrow \Delta > 0$

$\therefore b^2 - 4ac = (2m)^2 - 4(3m-2) > 0$

$4m^2 - 12m + 8 > 0$

$m^2 - 3m + 2 > 0$

$(m-2)(m-1) > 0$

$\therefore m < 1$ or $m > 2$

(c) amplitude $= 3$

period $= \frac{2\pi}{\pi}$

$= 2$

(d)(i) $\frac{\cos x}{\sin x} = \cot x$

(ii) $\left[\ln(\sin x)\right]_{\pi/4}^{\pi/2}$

$= \ln\left(\sin\frac{\pi}{2}\right) - \ln\left(\sin\frac{\pi}{4}\right)$

$= \ln(1) - \ln\left(\frac{1}{\sqrt{2}}\right)$

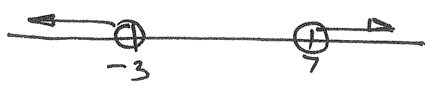
$= \ln\sqrt{2}$

Q6 (a) $\cos\theta = \frac{2}{5}$

$\theta = 66^\circ$ or 294°

(b) $x - 2 > 5$ or $-(x-2) > 5$

$x > 7 \qquad x < -3$



(c)(i) $a = 3 \quad r = \frac{1}{\sqrt{3}+1}$

$S_\infty = \frac{3}{1 - \frac{1}{\sqrt{3}+1}}$

$$= \frac{3(\sqrt{3}+1)}{\sqrt{3}+1-1}\cdot\frac{\sqrt{3}}{\sqrt{3}}$$

$$= \sqrt{3}(\sqrt{3}+1)$$

$$= \underline{3+\sqrt{3}}$$

(ii) $r = \frac{1}{(\sqrt{3}-1)}\cdot\frac{(\sqrt{3}+1)}{(\sqrt{3}+1)}$

$$= \frac{\sqrt{3}+1}{3-1}$$

$$= \tfrac{1}{2}(1+\sqrt{3})$$

$\doteq 1.366 > 1 \Rightarrow$ no limiting sum

(d)(i) $C_0 = 4$

and $2.6 = 4\times e^{-k\times 1}$

$$\frac{2.6}{4} = e^{-k}$$

$$\underline{k = -\ln\left(\frac{2.6}{4}\right) \doteq 0.4307829161}$$

(ii) $0.1 = 4\times e^{-kt}$

$$e^{-kt} = \frac{0.1}{4}$$

$$-kt = \ln\left(\frac{0.1}{4}\right)$$

$$t = -\frac{\ln\left(\frac{0.1}{4}\right)}{k}$$

$\doteq 8.563198113$ yrs

$\doteq \underline{8.6 \text{ yrs}}$

Q7 (a) $\triangle BPQ$ is isosceles $(BP = BQ)$

$\angle BQP = 180° - x$ (angle sum straight angle RQP)

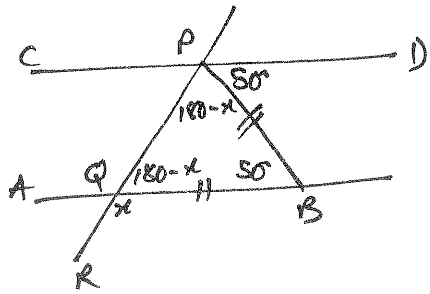
$\angle BPQ = \angle PQB$ (base angles isosceles triangle BPQ)

$= 180° - x$

$\angle QBP = \angle BPD = 50°$ (alternate angles, $PD \parallel QB$)

$\therefore 180 - x + 180 - x + 50 = 180°$ (angle sum, $\triangle BPQ$)

$\therefore \underline{x = 115°}$



(b) (i) $\alpha+\beta = \frac{-b}{a} = \underline{5}$

(ii) $\alpha\beta = \frac{c}{a} = \underline{2}$

(iii) $(\alpha+1)(\beta+1) = \alpha\beta + \alpha + \beta + 1$

$$= 2+5+1$$

$$= \underline{8}$$

(c)(i) $8y = x^2 - 24$

$$x^2 = 8y + 24$$

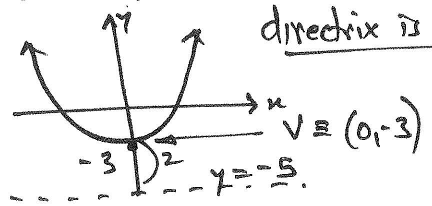
$$= 8(y+3)$$

$$(x-0)^2 = 4\times 2\times(y+3)$$

$\therefore$ Vertex $= \underline{(0,-3)}$

(ii) $a=2$ directrix is $\underline{y=-5}$

(iii)



Q8 (a)

$$\int_{0.5}^{1.5} (\log_e x)^3\,dx \doteq \frac{1}{6}\left\{(\ln(0.5))^3 + 4(\ln(1))^3 + (\ln(1.5))^3\right\}$$

$$\doteq \underline{-0.044}$$

(b)(i) $\Delta \equiv (k-2)^2 - 4.2.8$

$$= k^2 - 4k - 60$$

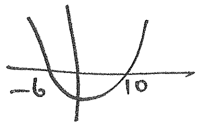
$$= (k-10)(k+6)$$

(ii) $2x^2 + kx + 9 = 2x + 1$

$$2x^2 + (k-2)x + 8 = 0$$

no solutions $\Rightarrow$ no intersections $\Rightarrow \Delta < 0$

$\therefore (k-10)(k+6)<0$



$\therefore \underline{-6<k<10}$

(c) (i) initial rate $\Rightarrow t=0$

$\therefore \frac{dv}{dt} = 120+0-0 = 120\,L/min$

$\therefore 240 = 120 + 26t - t^2$

$t^2 - 26t + 120 = 0$

$(t-6)(t-20)=0$

$\therefore \underline{t = 6 \text{ or } 20}$ min

(ii) $V = \int (120 + 260t - t^2)\,dt$

$\underline{V = 120t + 13t^2 - \frac{t^3}{3} + c}$

(iii) $t=0,\ V=1500$

$\therefore 1500 = 0+0-0+c$

$\therefore V = 1500 + 120t + 13t^2 - \frac{t^3}{3}$

$V(30) = 1500 + 120\times 30 + 13\times 30^2 - \frac{30^3}{3}$

$= 7800 \Rightarrow \underline{800L \text{ lost}}$

(d) $\ln(x^2) = \ln(7x-12)$

$\therefore x^2 = 7x-12$

$x^2 - 7x + 12 = 0$

$(x-3)(x-4)=0$

$\therefore \underline{x = 3 \text{ or } 4}$

Q9 (a) Area $= \int_0^4 (6x - x^2 - 2x)\,dx$

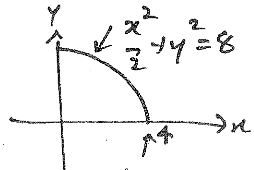
$= \int_0^4 (4x - x^2)\,dx$

$= \left[2x^2 - \frac{x^3}{3}\right]_0^4$

$= 32 - \frac{64}{3} - (0-0)$

$= \underline{\frac{32}{3}\,u^3}$

(b) $V_x = \pi \int_0^4 \left(8 - \frac{x^2}{2}\right) dx$



$y=0$

$\therefore x^2 = 16$

$\underline{x=4}$

$= \pi \left[8x - \frac{x^3}{6}\right]_0^4$

$= \pi\left(32 - \frac{64}{6} - (0-0)\right)$

$= \underline{\frac{64\pi}{3}\,u^3}$

(c) let Amount owing after n months be AO_n

(i) $\therefore AO_1 = \$80000 + 1\%$ of $\$80000$

$= \underline{1.01 \times \$80000}$

(ii) $AO_2 = 1.01 \times AO_1$

$= 1.01^2 \times \$80000$

$= 1.01$

$\therefore AO_{12} = \underline{1.01^{12} \times \$80000 - \$M = Y1}$

(iii) $AO_{13} = 1.01 \times Y_1$

$AO_{14} = 1.01^2 \times Y_1$

$AO_{24} = 1.01^{12} \times Y1 - \$M.$

$= 1.01^{12}(1.012^{12} \times \$80000 - \$M) - \$M$

as $AO_{24} = 0$

then $1.01^{24} \times \$80000 = 1.01^{12}M + M$

$= M(1 + 1.01^{12})$

$\therefore \underline{M = \frac{1.01^{24} \times \$80000}{1 + 1.01^{12}}}$

(iv) $\therefore M = \$\,47,760.756$

$\therefore$ total paid back $= \$95,521.51$

$\therefore$ total interest $= \underline{\$15,521.51}$

Q10 (a) let $U = e^x$, $\therefore$ solve $2U^2 - U = 0$

$U(2U-1) = 0$

$U = 0$ or $U = \frac{1}{2}$

$e^x \neq 0 \ \therefore e^x = \frac{1}{2}$

$\therefore \underline{x = \ln(0.5)}$

(b) $f(-x) = \dfrac{(-x)^4 - 8}{(-x)^3}$

$= \dfrac{x^4 - 8}{-x^3}$

$= -\left(\dfrac{x^4 - 8}{x^3}\right)$

$= -f(x) \Rightarrow f(x)$ is an odd function

(c)

(i)

x	0	1	2	3	4	5
$f(x)$	5	$\sqrt{24}$	4.583	4	3	0

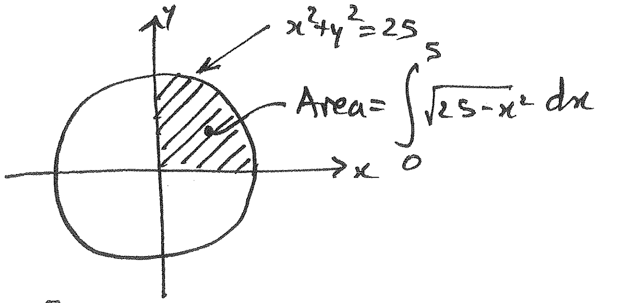
$\sqrt{24} \doteq 4.899$

(ii)

$$\int_0^5 \sqrt{25-x^2}\,dx \doteq \frac{1}{2}\left\{5 + 2\times\left(\sqrt{24} + 4.583 + 4 + 3\right) + 0\right\}.$$

$\doteq 18.98197949$

(iii)



(iv) $\int_0^5 \sqrt{25-x^2}\,dx$ = area of $\frac{1}{4}$ of a circle centre (0,0), radius 5 units

$= \dfrac{\pi . 5^2}{4}$

$= \dfrac{25\pi}{4}\ u^2$

(v) $\therefore \dfrac{25\pi}{4} \doteq 18.98\ldots.$

$\therefore \pi \doteq \dfrac{4}{25} \times 18.98\ldots.$

$\doteq 3.037116718$