Moriah College
MATHEMATICS DEPARTMENT

Year 12

Mathematics Pre-Trial 2007

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using blue or black pen
- Board-approved calculators may be used
- A table of standard integrals is provided on page and a detachable sheet is provided on page.
- All necessary working should be shown in every question

Total marks (**120**)

- Attempt Questions 1−10
- All questions are of equal value
- Use a **SEPARATE** answer sheet for each question

STUDENT NUMBER:___________________ **CLASS TEACHER:**________________

Question 1 (12 marks). Use a SEPARATE Writing Booklet.

Marks

(a) Evaluate e^{-3} correct to three significant figures. **2**

(b) Solve $|3x+2| \le 5$ **2**

(c) Fully factorise $27x^3 - 64y^3$ **2**

(d) Differentiate with respect to x:

$$y = \frac{x^2}{2} - \frac{4}{x^2}$$ **2**

(e) Find the fractional equivalent of $0\cdot 6\dot{8}$. **2**

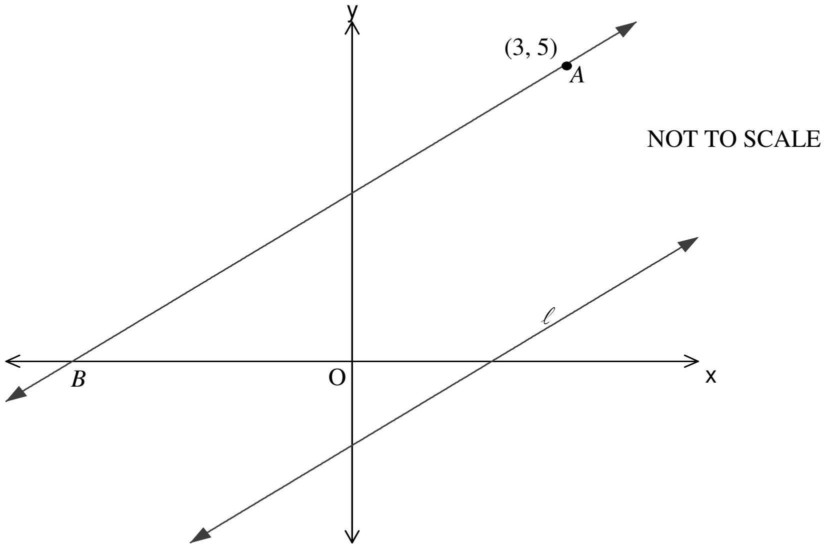
(f) Find integers a and b such that:

$$(3-\sqrt{2})^2 = a - b\sqrt{2}$$ **2**

Question 2 (12 marks). Use a SEPARATE Writing Booklet.

Marks

(a)



(a) The diagram shows the points $A(3,5)$ and B, where the line AB cuts the x-axis at B. The line ℓ has equation $3x - 5y - 8 = 0$ and is parallel to AB.

i. Find the gradient of the line AB. **1**

ii. Find the equation of the line AB. **1**

iii. Find the coordinates of point B. **1**

iv. Write down the size of $\angle ABO$ correct to the nearest degree. **1**

v. Another point $C(-2, 2)$ also lies on AB. Find the exact length of the interval AC. **1**

vi. Find the exact perpendicular distance of C from the line ℓ. **2**

vii. Find the exact area of the triangle formed by the points A, C and any point P, on the line ℓ. **1**

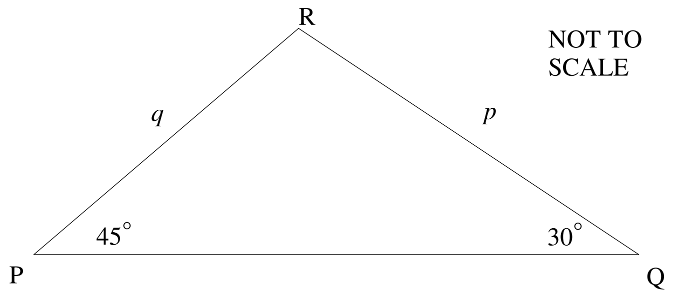
viii. Explain why the area of triangle ACP is constant, regardless of the position of P on the line ℓ. **1**

(b) Find the equation of the normal to the curve $y = 2x^2 - 5x + 1$ at the point (2, -1). **3**

Question 3 (12 marks). Use a SEPARATE Writing Booklet.

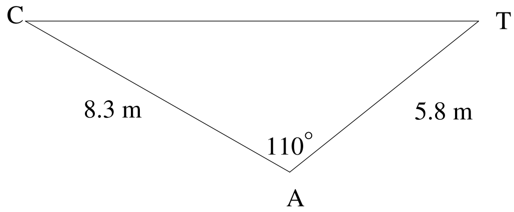
Marks

(a) In ΔPQR below, $\angle RPQ = 45°$ and $\angle RQP = 30°$. **3**



Find the exact value of $\dfrac{p}{q}$.

(b) In ΔCAT below, CA = 8·3 m, AT = 5·8 m and $\angle TAC = 110°$.



NOT TO SCALE

(i) Find the length of CT correct to one decimal place. **2**

(ii) Find the size of the smallest angle correct to the nearest degree. **2**

(c) (i) Prove that $2\cos^2 B + 3\sin^2 B - 2 = \sin^2 B$ is true for all values of B. **3**

(ii) Hence or otherwise, solve: $2\cos^2 A + 3\sin^2 A - 3 = 0$ for $0° \le A \le 360°$. **2**

Question 4 (12 marks). Use a SEPARATE Writing Booklet.

Marks

(a) Find:

$$\lim_{x \to 2} \frac{2x^2 - 3x - 2}{x - 2}$$ **2**

(b) Differentiate:

i. $y = 5\sqrt{x} - \dfrac{3}{x^4}$ **2**

ii. $f(x) = \dfrac{2x+3}{3x+2}$ **2**

(c) A function $y = f(x)$ has $\dfrac{d^2y}{dx^2} = 6x - 2$ and a stationary point at (1, 2).

Find the equation of $f(x)$. **3**

(d) Solve for x:

$$4^x - 9 \times 2^x + 8 = 0$$ **3**

Question 5 (12 marks). Use a SEPARATE Writing Booklet.

Marks

(a) The sum of the first three terms of a geometric series is 19 and the sum to infinity is 27.

Find:

i. the common ratio. **2**

ii. the first term. **1**

iii. the fifth term. **1**

(b) The first four terms of a series are 3, x, y and 192.

Find the values of x and y if the series is:

i. Arithmetic **2**

ii. Geometric **2**

(c) The sum of n terms of a certain series is given by:

$$S_n = 2n(n+1).$$

i. Find the first three terms of this sequence. **2**

ii. Which term of the sequence is 124? **2**

Question 6 (12 marks). Use a SEPARATE Writing Booklet.

Marks

(a) Consider the parabola $y = -4x^2 - 16x - 15$,

i. Find the coordinates of its vertex. **2**

ii. Find the coordinates of its focus. **2**

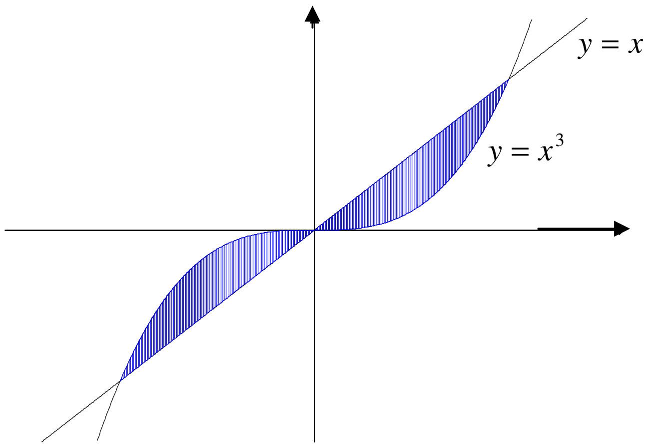
(b) α and β are the roots of the equation $2x^2 + 5x - 5 = 0$. Find the values of:

i. $\alpha + \beta$ **1**

ii. $\alpha\beta$ **1**

iii. $\alpha^{-1} + \beta^{-1}$ **2**

(c)



i. Show that $y = x^3$ is an odd function. **1**

ii. Hence, or otherwise, find the area between the curves $y = x$ and $y = x^3$. **3**

Question 7 (12 marks). Use a SEPARATE Writing Booklet.

Marks

(a) Consider the curve given by $y = 3x^2 + x^3 - 9x - 5$.

i. Find $\frac{dy}{dx}$. **1**

ii. Find the coordinates of the two stationary points. **2**

iii. Determine the nature of the stationary points. **2**

iv. Sketch the graph of the function for the domain $-5 \le x \le 3$. **2**

(b) Evaluate the following integral, giving your answer in exact form: **2**

$$\int_0^1 e^{2-3x}\,dx$$

(c) Differentiate $y = e^{-x^3}$ and hence or otherwise find $\int_1^2 x^2 e^{-x^3}\,dx$ correct to three decimal places. **3**

Question 8 (12 marks). Use a SEPARATE Writing Booklet.

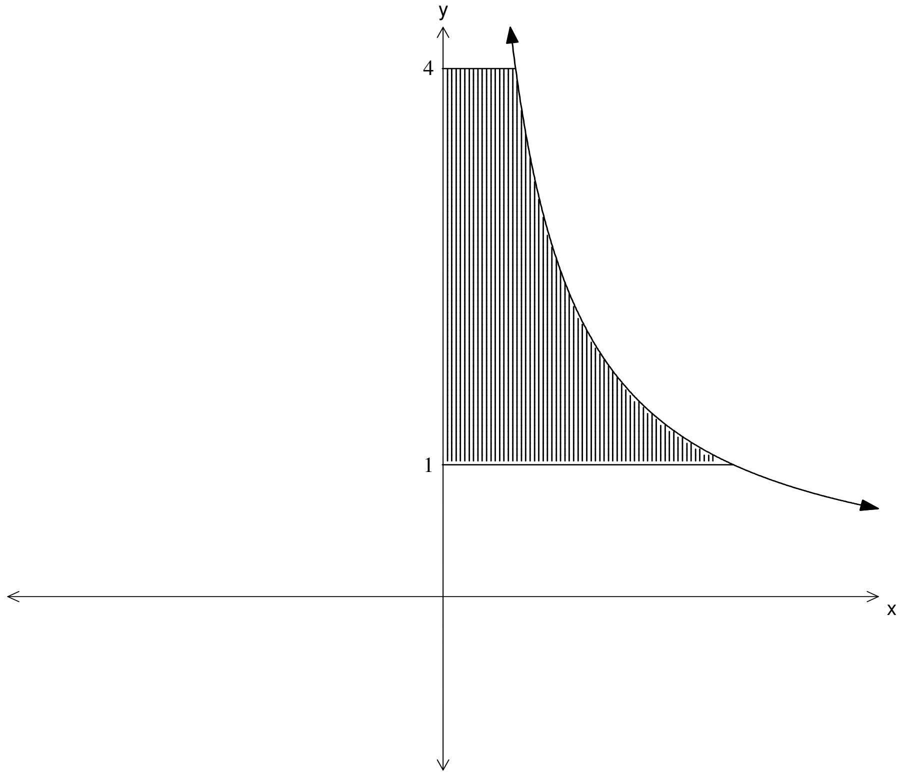
Marks

(a) A point P moves so that the distance from the point $A(-6, -2)$, is three times the distance from the point $B(2, 2)$.

i. Find the equation that describes the locus of the point P. **4**

ii. Describe this locus geometrically. **3**

(b) The area enclosed by the curve $xy = 3$, the y-axis and the lines $y = 1$ and $y = 4$, is rotated about the y-axis.



Find the volume of the solid of revolution correct to three decimal places. **5**

Question 9 (12 marks). Use a SEPARATE Writing Booklet.

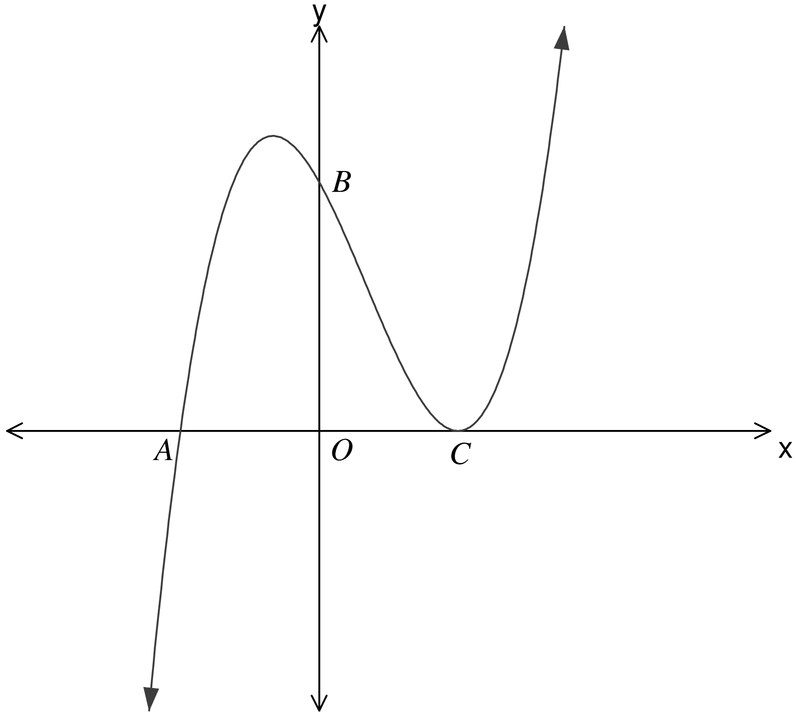
Marks

(a) Differentiate the following functions:

i. $y = (e^{4x+3} - 3)^4$ **2**

ii. $y = \dfrac{x}{e^x}$ **2**

(b) The diagram shows the sketch of $y = (x+1)(x-1)^2$.



i. Find the coordinates of the points A, B and C, the intercepts on the axes. **2**

ii. Show that OB divides the area between the curve and the line AC in the ratio of 11:5. **3**

(c) The following table gives values of $f(x) = x\log_e x$.

x	1	2	3	4	5
$f(x)$	0	1·39	3·30	5·55	8·05

Use Simpson's Rule and these five functional values in the table above to find an approximation of $\int_1^5 x \log_e x \, dx$ correct to two decimal places. **3**

Question 10 (12 marks). Use a SEPARATE Writing Booklet.

Marks

(a) Consider the function $f(x) = \frac{1}{2}(e^x + e^{-x})$

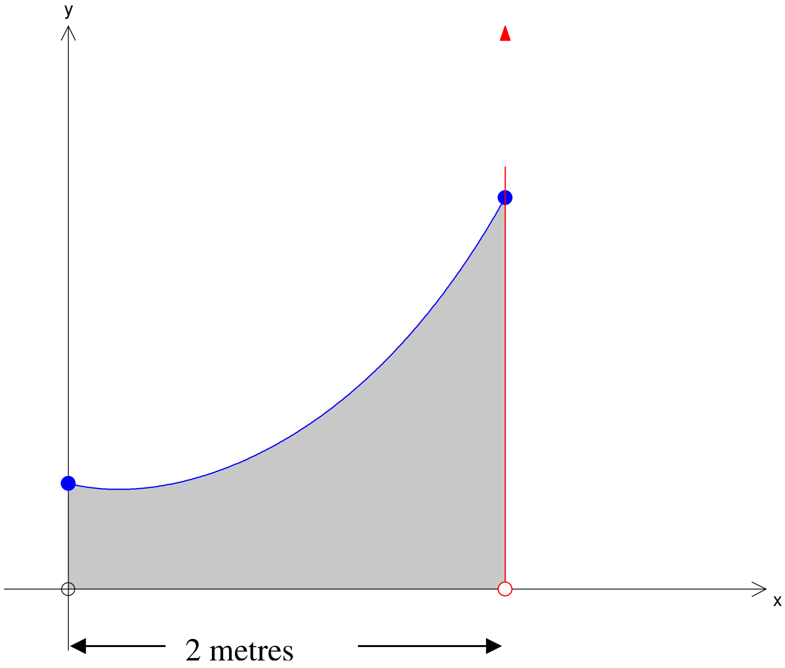
i. Show that the curve represents an even function. **1**

ii. Show that the function has only one stationary point and determine its nature. **3**

iii. Show that the function has no points of inflexion. **1**

iv. Hence sketch the curve. **1**

(b) A metal chain hangs between two walls, which stand two metres apart, as shown in the diagram below. The height of this chain above the ground, is given by the equation: $y = e^{-2x} + e^x$ (x and y are measured in metres)



Answer the following questions, giving all answers correct to 2 decimal places:

i. How far from the ground is the chain hooked to the right wall? **2**

ii. Find the area of the shaded region. **4**

END OF PAPER

MATHEMATICS PRE-TRIAL 2007

Solutions

Question 1

(a) $e^{-3} = 0.0498$ (3 significant figures)

(b)

$$-5 \le 3x + 2 \le 5$$
$$-7 \le 3x \le 3$$
$$\frac{-7}{3} \le x \le 1$$

(c)

$$(3x)^3 - (4y)^3 \quad \Rightarrow$$
$$(3x - 4y)(9x^2 + 12xy + 16y^2)$$

(d)

$$y = \frac{1}{2}x^2 - 4x^{-2} \quad \Rightarrow$$
$$y' = x + 8x^{-3}$$
$$y' = x + \frac{8}{x^3}$$

(e) Let: $x = 0.6\dot{8}$

$So: 10x = 6.\dot{8}$ [1]

$And: 100x = 68.\dot{8}$ [2]

Subtracting [1] from [2] yields:

$$90x = 62$$
$$x = \frac{62}{90} = \frac{31}{45}$$

(f)

$$\left(3 - \sqrt{2}\right)^2 = a - b\sqrt{2}$$
$$9 - 6\sqrt{2} + 2 = a - b\sqrt{2}$$
$$11 - 6\sqrt{2} = a - b\sqrt{2}$$

Comparing the rational coefficients and the irrational coefficients yields:

$$a = 11$$
$$b = 6$$

Question 2

(a)

i. Rearrange: $3x-5y-8=0$

$y=\frac{3}{5}x-\frac{8}{5}$ $\Rightarrow$

$m=\frac{3}{5}$ 1

ii. $\frac{y-5}{x-3}=\frac{3}{5}$ $\Rightarrow$

$5y-3x-16=0$ 1

$y=\frac{3}{5}x+b$
$5=\frac{3}{5}\times 3+b$
$25=9+5b$
$b=\frac{16}{5}$

$y=\frac{3}{5}x+\frac{16}{5}$

iii. Substitute y=0 in the equation of AB:

$-3x-16=0$

$x=\frac{-16}{3}$

$B:\left(\frac{-16}{3},0\right)$ $\left(-5\frac{1}{3},0\right)$ 1

iv. Let $\measuredangle ABO=\alpha$, then:

$\tan\alpha=\frac{3}{5}$ $\Rightarrow$ $\alpha=31°$ (nearest deg) 1

v. A: (3,5) and C (-2,2), so the length AB is:

$AC=\sqrt{(3+2)^2+(5-2)^2}$

$AC=\sqrt{5^2+3^2}$

$AC=\sqrt{34}$ units 1

$d=\frac{|ax+by+c|}{\sqrt{a^2+b^2}}$

vi. The distance of from the line: $3x-5y-8=0$

$\frac{|3(-2)+(-5)(2)-8|}{\sqrt{3^2+(-5)^2}}$ 1

$=\frac{24}{\sqrt{34}}=\frac{12\sqrt{34}}{17}$ 1

[2]

vii. Area:

$=\frac{1}{2}\times\sqrt{34}\times\frac{24}{\sqrt{34}}=12\,u^2$ 1

viii. The lines are parallel and, therefore, the distance between the two lines is constant. 1

(b) $y'=4x-5$ at x=2: $y'=3$ 1

$\therefore m_\perp=-\frac{1}{3}$ 1

$\therefore y=-\frac{1}{3}x+c$

$(2,-1)$: $-1=-\frac{2}{3}+c$

$c=-\frac{1}{3}$

$\therefore y=-\frac{1}{3}x-\frac{1}{3}$ 1

(OR) $3y+x+1=0$. [3]

Question 3

a) Applying the sine rule to the triangle RPQ:

$$\frac{p}{\sin 45^\circ} = \frac{q}{\sin 30^\circ} \quad 1$$

$$\frac{p}{q} = \frac{\sin 45^\circ}{\sin 30^\circ} = \frac{\frac{\sqrt{2}}{2}}{\frac{1}{2}} = \sqrt{2} \quad 1$$

$$\frac{\frac{1}{\sqrt{2}}}{\frac{1}{2}} = \frac{2}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

1

If $\frac{2}{\sqrt{2}}$ then (2)

[3]

b)

i. Applying the cosine rule to the triangle ACT:

$CT^2 = 8.3^2 + 5.8^2 - 2 \times 8.3 \times 5.8 \times \cos 110^\circ$ 1

$CT = 11.6m$ (1dp) $-\frac{1}{2}$ 1

ii. The smallest angles lies opposite the smallest side, so angle TCA is the smallest angle.

Let $\measuredangle TCA = \theta$ Applying the sine rule to the triangle TCA:

$$\frac{5.8}{\sin\theta} = \frac{11.6}{\sin 110^\circ} \Rightarrow$$

$$\frac{5.8 \times \sin 110^\circ}{11.6} = \sin\theta$$

$$0.468 = \sin\theta$$

$\theta = 28^\circ$ (nearest deg) $-\frac{1}{2}$ 1

$$\frac{\sin\theta}{5.8} = \frac{\sin 110^\circ}{11.6} \quad 1$$

[4]

$$\sin\theta = \frac{5.8 \sin 110^\circ}{11.6}$$

use the identity:
$\cos^2 B + \sin^2 B = 1$

c) (i) LHS:

$= 2\cos^2 B + 3\sin^2 B - 2$

$= 2(1 - \sin^2 B) + 3\sin^2 B - 2$ 2

$= 2 - 2\sin^2 B + 3\sin^2 B - 2$ 1

$= \sin^2 B$

So, $LHS = RHS$

(ii)

$\underbrace{2\cos^2 A + 3\sin^2 A - 2}_{\sin^2 A} - 1 = 0$ 1

$\sin^2 A - 1 = 0$

$\sin^2 A = 1$

$\sin A = \pm 1$

$\sin A = 1 \Rightarrow A = 90^\circ$

$\sin A = -1 \Rightarrow A = 270^\circ$ } 1

If no ±, then 1 mark

[5]

Question 4

(a) $\lim_{x\to 2}\frac{2x^2-3x-2}{x-2}$

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

$= \lim_{x\to 2}(2x+1) = 5$ 1

[2]

(b)

Rewrite: $y = 5x^{\frac{1}{2}} - 3x^{-4}$

$y' = \frac{5}{2}x^{-\frac{1}{2}} + 12x^{-5}$ 1

$y' = \frac{5}{2\sqrt{x}} + \frac{12}{x^5}$ 1

[2]

Let $u = 2x+3$ $\quad v = 3x+2$

$u' = 2$ $\quad v' = 3$

Use the quotient rule: Formula wrong 0

$f'(x) = \frac{u'v - v'u}{(v)^2}$

$f'(x) = \frac{2(3x+2) - 3(2x+3)}{(3x+2)^2}$ 1

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

[2]

(c) Given $f''(x) = 6x - 2$

$\Rightarrow \quad f'(x) = 3x^2 - 2x + C$ 1

Also, given stationary point: $f'(1) = 0$

$\Rightarrow \quad 0 = 3 - 2 + C$

$\Rightarrow \quad C = -1$

So, $f'(x) = 3x^2 - 2x - 1$.

Therefore: $f(x) = x^3 - x^2 - x + D$ 1

The point (1,2) lies on the graph so $f(1) = 2$. Substitute:

$2 = 1^3 - 1^2 - 1 + D$

$\Rightarrow \quad D = 3$

$f(x) = x^3 - x^2 - x + 3$ 1

[3]

(d) Let $m = 2^x$, so the equation simplifies to:

$m^2 - 9m + 8 = 0$

$(m-1)(m-8) = 0$ 1

$m = 1 \quad or \quad m = 8$

$2^x = 1$ or: $2^x = 8$

$x = 0 \quad x = 3$

1 1

[3]

Question 5

(a)

i. Given: $\begin{cases} S_3 = 19 \\ S = 27 \end{cases}$

$$\Rightarrow \begin{cases} \dfrac{a(1-r^3)}{1-r} = 19 & [I] \\ \dfrac{a}{1-r} = 27 & [II] \end{cases}$$

Dividing [I] by [II] yields:

$1 - r^3 = \dfrac{19}{27}$ and that can be simplified to:

$r^3 = \dfrac{8}{27} \Rightarrow \quad r = \dfrac{2}{3}$

ii. Put in [II] and find the value of the first term: a=9

iii. And so, for a general formula:

$$T_n = 9 \times (\frac{2}{3})^{n-1} \quad \Rightarrow$$
$$T_5 = \frac{16}{9}$$

(b) Let the sequence of numbers be:

3, x, y, 192

We know that $\begin{cases} a = 3 \\ T_4 = 192 \end{cases}$

i. If the sequence is an AP then: 192=3+3d

d=63 and then: x=66 and y=129

i. If the sequence is a GP then:

$192 = 3 \times r^3$
$64 = r^3$
$4 = r$

And so, x=12 and y=48

(c)

$S_1 = T_1 = 2 \times 2$
$\therefore T_1 = 4$

i. $S_2 = T_1 + T_2 \quad \Rightarrow$
$12 = 4 + T_2$
$\therefore T_2 = 8$

$S_3 = 24$
$S_3 = T_1 + T_2 + T_3 \quad \Rightarrow$
$24 = 4 + 8 + T_3$
$\therefore T_3 = 12$

clearly an AP emerging, for which the first term = 4 and the common difference is 4:

$T_n = 4 + 4(n-1)$
$T_n = 4n \quad \Rightarrow$

$124 = 4n$
$31 = n$

So, the 31st term of the given sequence is 124

Question 6

(a)

Rewrite the equation of the parabola:

$y = -4(x^2 + 4x + 4) + 1$

$y - 1 = -4(x+2)^2$

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

The vertex is at: (-2,1)

Comparing the parabola to: $4a(y-n) = -(x-p)^2$

We get: $4a = \frac{1}{4}$ or: $a = \frac{1}{16}$

Therefore the focus is at: $\left(-2, \frac{15}{16}\right)$

(b) $\alpha + \beta = \frac{-b}{a} = \frac{-5}{2}$

$\alpha\beta = \frac{c}{a} = \frac{-5}{2}$

$\alpha^{-1} + \beta^{-1} = \frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta} = 1$

(c)

i. Let: $f(x) = x^3$

So, $f(-x) = (-x)^3 = -x^3$

$f(-x) = -f(x)$ [Hence, odd function]

ii. Find points of intersection between $y = x^3$ and $y = x$

$x = x^2 \quad \Rightarrow \quad x^3 - x = 0$

$\Rightarrow \quad x(x^2 - 1) = 0 \quad \Rightarrow \quad x(x-1)(x+1) = 0$

Intersection at: (1,0), (-1,0) and (0,0)

Since the graph is of an odd function, it has a point symmetry and the area shaded in the first quadrant is the same as that in the fourth quadrant. Therefore, it is sufficient to

calculate: $A = 2\int_0^1 (x - x^3)dx$ $\quad A = 2 \times \left[\frac{x^2}{2} - \frac{x^4}{4}\right]_0^1 = 2 \times \frac{1}{4}$ so total area:

$2 \times \frac{1}{4} = \frac{1}{2} units^2$

Question 7

a.

i. $\dfrac{dy}{dx} = 6x + 3x^2 - 9$

ii. For stationary points, solve: $\dfrac{dy}{dx} = 0 \Rightarrow$

$0 = 6x + 3x^2 - 9$

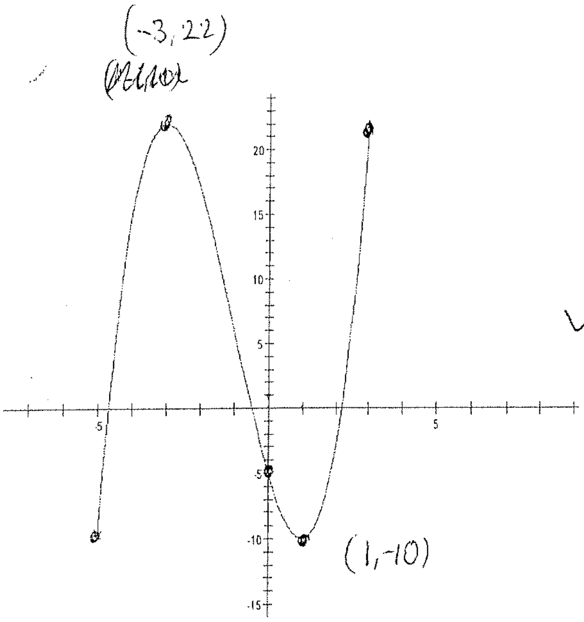
$(-3, 22) \quad or \quad (1, -10)$

iii. $\dfrac{d^2y}{dx^2} = 6 + 6x$

At x=-3 $\quad \dfrac{d^2y}{dx^2} = -12 < 0 \quad \Rightarrow Max$

At x=1 $\quad \dfrac{d^2y}{dx^2} = 12 > 0 \quad \Rightarrow Min$

iv.



6. $y' = -3x^2 e^{-x^3} \quad \Rightarrow \displaystyle\int_1^2 x^2 e^{-x^3}\,dx = \left[\frac{e^{-x^3}}{-3}\right]_1^2 = \left[\frac{(e^{-8} - e^{-1})}{-3}\right] = 0.123$

b. $\displaystyle\int_0^1 e^{2-3x}\,dx = \left[\frac{e^{2-3x}}{-3}\right]_0^1 = \frac{e^{-1} - e^2}{-3} = \frac{e^3 - 1}{3e}$

Question 8

Let P:(x, y), then: $PA=\sqrt{(x+6)^2+(y+2)^2}$

$PB=\sqrt{(x-2)^2+(y-2)^2}$

Since $PA=3PB$ $\sqrt{(x+6)^2+(y+2)^2}=3\sqrt{(x-2)^2+(y-2)^2}$ $/(\ )^2$ ✓ (1)

$(x+6)^2+(y+2)^2=9\left((x-2)^2+(y-2)^2\right)$

$x^2+12x+36+y^2+4y+4=9\left(x^2-4x+4+y^2-4y+4\right)$ ✓ (1)

$x^2+12x+y^2+4y+40=9\left(x^2-4x+y^2-4y+8\right)$

$x^2+12x+y^2+4y+40=9x^2-36x+9y^2-36y+72$

$0=8x^2-48x+8y^2-40y+32$ ✓ (1)

$0=x^2-6x+y^2-5y+4$

$0=(x-3)^2-9+(y-2.5)^2-6.25+4$ ✓ (1)

$11.25=(x-3)^2+(y-2.5)^2$

Equation of circle with centre (3, 2.5) and radius $\frac{3\sqrt{5}}{2}$ ✓ (1) ✓ (1) ✓ (1)

b. Rearrange: $x=\frac{3}{y}$ ✓ (1)

Volume generated is given by: $V=\pi\int_1^4\left(\frac{3}{y}\right)^2 dy$

$V=\pi\int_1^4\left(\frac{9}{y^2}\right)dy$ ✓ (1)

$V=\pi\int_1^4\left(9y^{-2}\right)dy$

$V=\pi\left[\frac{9y^{-1}}{-1}\right]_1^4$ ✓ (1)

$V=\pi\left[-\frac{9}{y}\right]_1^4=\pi\left(\frac{-9}{4}+9\right)=21.206u^3$ ✓ (1) ✓ (1)

c.

d.

Question 9

a.

i.
$$y' = 4(e^{4x+3} - 3)^3 \times 4e^{4x+3}$$
$$y' = 16e^{4x+3}(e^{4x+3} - 3)^3$$

ii. Rearrange: $y = xe^{-x}$ Use product rule with:

$u = x \quad v = e^{-x}$

$u' = 1 \quad v' = -e^{-x}$

$$y' = 1e^{-x} - xe^{-x}$$
$$y' = e^{-x}(1-x)$$

b. For A and C need to solve: $(x+1)(x-1)^2 = 0$

$x = -1$ *or* $x = 1$

A:(-1,0) B:(1,0)

For B, substitute x=0 in equation: $y = (0+1)(0-1)^2 = 1$

B:(0,1)

c. Rewrite: $y = x^3 - x^2 - x + 1$

$$A_1 = \int_{-1}^{0}\left(x^3 - x^2 - x + 1\right)dx \qquad A_2 = \int_{0}^{1}\left(x^3 - x^2 - x + 1\right)dx$$

$$A_1 = \left[\frac{x^4}{4} - \frac{x^3}{3} - \frac{x^2}{2} + x\right]_{-1}^{0} \qquad A_2 = \left[\frac{x^4}{4} - \frac{x^3}{3} - \frac{x^2}{2} + x\right]_{0}^{1}$$

$$A_1 = \frac{11}{12}u^2 \qquad A_2 = \frac{5}{12}u^2$$

$$\frac{A_1}{A_2} = \frac{\frac{11}{12}}{\frac{5}{12}} = \frac{11}{5}$$

b.
$$\int_1^5 x\log_e x \approx \frac{1}{3}\left(0\times1 + 1.39\times4 + 3.30\times2 + 5.55\times4 + 8.05\times1\right)$$
$$\int_1^5 x\log_e x \approx 14.14$$

c.

Question 10

a.

i. Consider: $f(x)=\frac{1}{2}\left(e^{x}+e^{-x}\right)$

Then: $f(-x)=\frac{1}{2}\left(e^{-x}+e^{x}\right)$

$\therefore f(-x)=f(x)$ The function is even.

ii. $f'(x)=\frac{1}{2}\left(e^{x}-e^{-x}\right)$

For stationary point $f'(x)=0$ $\Rightarrow$ $0=\frac{1}{2}\left(e^{x}-e^{-x}\right)$

$\Rightarrow$ $0=e^{x}-e^{-x}$

$\Rightarrow$ $e^{x}=e^{-x}$

$\Rightarrow$ $x=-x$

$\Rightarrow$ $2x=0$

$\Rightarrow$ $x=0$

At x=0 : $f(0)=\frac{1}{2}(1+1)=1$ $\Rightarrow$ $(0,1)$ stationary point

Nature of stationary point. $f''(x)=\frac{1}{2}\left(e^{x}+e^{-x}\right)$

At x=0 $f''(0)=1>0$ $\Rightarrow$ *Minimum*

iii. For inflexion, need to solve: $f''(x)=0$

$0=\frac{1}{2}\left(e^{x}+e^{-x}\right)$

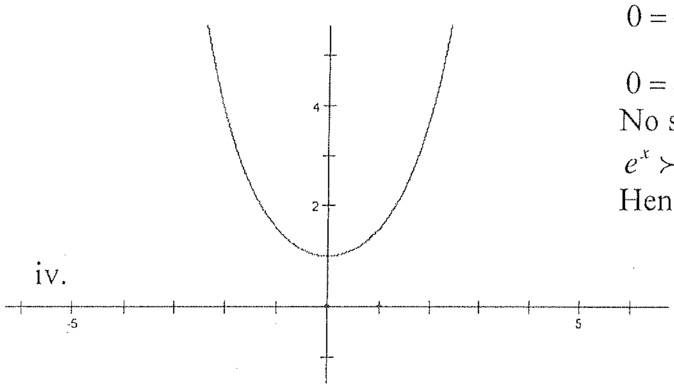
$0=e^{x}+e^{-x}$

No solutions since both

$e^{x}\succ 0$ *and* $e^{-x}\succ 0$ for all values of x

Hence no points of inflexion.

iv.



b.

i. Substitute x=*2* into the function: $y=e^{-4}+e^{2}=7.41$

ii. $A=\int_{0}^{2}\left(e^{2x}+e^{x}\right)dx$ $A=\left|\frac{e^{-2x}}{-2}+e^{x}\right|_{0}^{2}=6.880u^{2}$