2006. HSC Mathematics
Half-Yearly

QUESTION 1 (12 marks)

(a) Differentiate i) $y = 3x^2 - \dfrac{1}{x}$. [2]

ii) $f(x) = (2 - 4x)^{\frac{1}{2}}$ [2]

iii) $y = \dfrac{1 - x}{x^2 + 1}$ [2]

(b) If $\dfrac{dy}{dx} = 12x^2 + 1$ and $y = 10$ when $x = 1$, find y when $x = 2$ [3]

(c) Find the value of m if $\displaystyle\int_m^{m+2} (2x)\ dx = 16$ [3]

QUESTION 2 (12 marks) START A NEW PAGE

(a) For the curve $y = 2x^3 - 3x^2 - 36x + 2$

i.) find the coordinates of any stationary points and determine their nature [3]

ii.) find any points of inflexion [2]

iii.) sketch the curve [2]

iv.) state the domain for which this curve is decreasing [1]

(b) If α and β are the roots of the equation $2x^2 - 8x - 25 = 0$ [4]

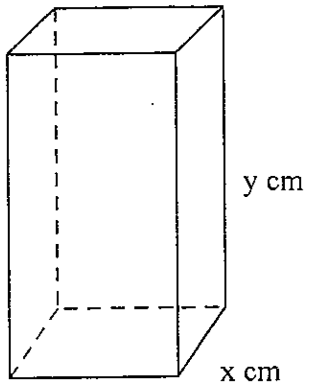
find i) $\alpha + \beta$

ii) $\alpha\beta$

iii) $\alpha^2 + \beta^2$

QUESTION 3 (12 marks) START A NEW PAGE

(a) A box , open at the top, is to be made from cardboard.
The base of the box is a square of side x cm and its height is y cm, as shown in the diagram.



i) If the volume of the box is 32 cm^2, show that $y = \frac{32}{x^2}$ [1]

ii) Show that the area of cardboard needed will be given by $A = x^2 + \frac{128}{x} cm^2$ [1]

iii) Find the dimensions of the box if this area is to be a minimum. [4]

(b) A parabola **T** has equation $x^2 = 4(2 - y)$.

i) Write this equation in the form $(x - h)^2 = 4a(y - k)$ and hence find the coordinates of its vertex and focus [2]

ii) Draw a sketch of **T**, clearly indicating the coordinates of the vertex and focus [1]

iii) Find the equation of the normal to the parabola T at the point (2,1) [3]

QUESTION 4 (12 marks) START A NEW PAGE

(a) Find i) $\int_2^4 \left(\frac{x^3 - 1}{x^2}\right) dx$ [3]

ii) $\int \sqrt{2x + 3}\ dx$ [3]

(b) Sketch the continuous curve $y = f(x)$ having all the following properties [3]

$f(-3) = 12,\ f(3) = -6,\ f(0) = 6$

and $f'(-3) = f'(3) = 0$

and $f'(x) < 0$ for $-3 < x < 3$, $f'(x) > 0$ for $x > 3$ or $x < -3$

and $f''(x) < 0$ for $x < 0$, $f''(x) > 0$ for $x > 0$

(c) i) Express $x^2 + 4x - 12$ in the form $(x + B)^2 + C$ [1]

1. Hence or otherwise, state the minimum value of $x^2 + 4x - 12$ and where it occurs [2]
2.

Question 5 (12 marks) START A NEW PAGE

(a) Given the parabola $y = 2x - x^2$ and the straight line $y = 2 - x$, find

i) The coordinates of the points of intersection of the parabola and the line [2]

ii) The area enclosed between the parabola and the line. [3]

(b) Let A and B be the fixed points (-1,0) ands (2,0) and let P be the variable point (x,y).

i) Write down expressions for PA and PB in terms of x and y [2]

ii) Suppose that P moves so that PA=2PB. [3]
Prove that P moves on a circle.

iii) Find the centre and radius of this circle [2]

Question 6 (12 marks) START A NEW PAGE

(a) Find the area bounded by the graph of $f(x) = x(x-2)(x+1)$ and the x-axis [4]

(b) Prove that the line $x + 2y - 4 = 0$ is a tangent to the circle $(x-4)^2 + (y-5)^2 = 20$ [4]

(c) Find the area bounded by the curve $y = x^3 + 1$, the y-axis and the lines $y = 1$ and $y = 9$ [4]

Question 7 (12 Marks) **START A NEW PAGE**

(a) i) Copy and complete the table of values below for the function $y = \frac{1}{x}$ [1]

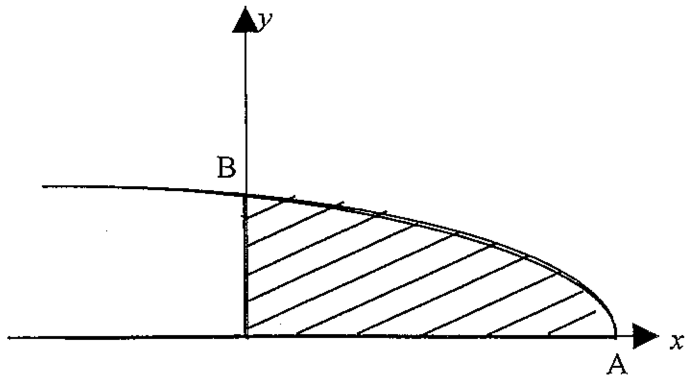
$$y = \frac{1}{x}$$

x	1	1.5	2	2.5	3
$f(x)$					

ii) Using the five function values in the table and the Trapezoidal Rule,

find an approximate value for $\int_1^3 \frac{1}{x}\,dx$, correct to 2 decimal places [3]

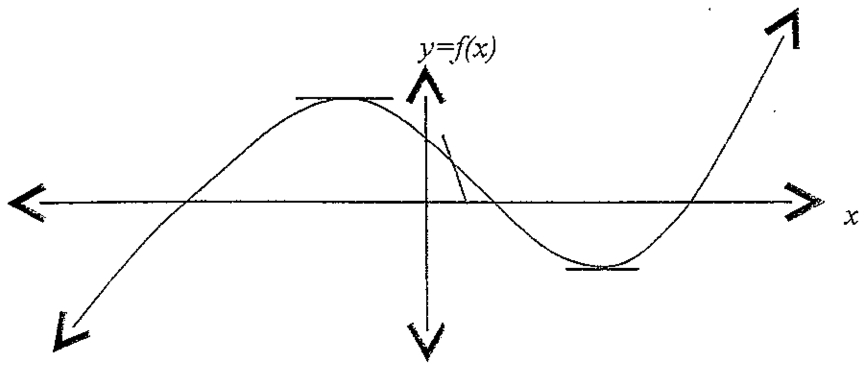
(b) This sketch represents the curve $y = \sqrt{9 - x}$



Write down the coordinates of A and B,
the points where the curve cuts the x and y axes [2]

Find the volume of the solid formed when the shaded region
is rotated about the x axis [4]

(c) Sketch the gradient function , $y = f'(x)$, for the given function $y = f(x)$. [2]



SOLUTIONS TO 2006 MID YEAR ~~HSC MATHEMATICS~~

Q1(a)

RULE

(i) $y = 3x^2 - \frac{1}{x}$

$y = 3x^2 - x^{-1}$

$\frac{dy}{dx} = 6x + x^{-2}$

$= 6x + \frac{1}{x^2}$ 2

- $f(x) = ax^n$

$\therefore f'(x) = anx^{n-1}$

(ii) $f(x) = (2-4x)^{\frac{1}{2}}$

$f'(x) = \frac{1}{2}(2-4x)^{-\frac{1}{2}}(-4)$

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

- function of a function
- chain rule

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

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

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

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

- Quotient rule

$y = \frac{u}{v}$

$\frac{dy}{dx} = \frac{vu' - uv'}{v^2}$

1(b) $\frac{dy}{dx} = 12x^2 + 1$

$\therefore y = \int (12x^2 + 1)\, dx$ · indefinite integral

$y = \frac{12x^3}{3} + x + C$

$y = 4x^3 + x + C$

but $y = 10$ when $x = 1$

$\therefore 10 = 4(1)^3 + 1 + C$ · to find C

$10 = 4 + 1 + C$

$C = 5$

$\therefore y = 4x^3 + x + 5$

let $x = 2$

$y = 4(2)^3 + 2 + 5$

$y = 4 \times 8 + 2 + 5$

$y = 32 + 7$

$y = 39$ 3

(c) $\int_m^{m+2} (2x)\, dx = 16$ · definite integral

$\left[x^2\right]_m^{m+2} = 16$

$(m+2)^2 - m^2 = 16$

$m^2 + 4m + 4 - m^2 = 16$

$4m + 4 = 16$

$4m = 12$

$\therefore m = 3$ 3

Question 2:

(a) $y = 2x^3 - 3x^2 - 36x + 2$

(i) Stationary points occur when $\frac{dy}{dx} = 0$

$$\therefore 6x^2 - 6x - 36 = 0$$
$$6(x^2 - x - 6) = 0$$
$$(x-3)(x+2) = 0$$
$$\therefore x = 3, -2$$

When $x = -2$

$$\frac{d^2y}{dx^2} = 12x - 6$$
$$= 12(-2) - 6$$
$$= -30$$
$$< 0 \quad \text{concave down}$$

$$y = 2(-8) - 3(4) - 36(-2) + 2$$
$$= 46$$

$\therefore$ At $(-2, 46)$ a relative maximum stationary point occurs.

when $x = 3$

$$\frac{d^2y}{dx^2} = 12x - 6$$
$$= 12(3) - 6$$
$$= 30$$
$$> 0 \quad \text{concave up.}$$

$$y = 2(27) - 27 - 36 \times 3 + 2$$
$$= -79$$

$\therefore$ At $(3, -79)$ a relative minimum stationary point occurs

1 mark $x = -2, 3$ OR $\frac{dy}{dx} = 6x^2 - 6x - 36$, $\frac{d^2y}{dx^2} = 12x - 6$

1 mark $(-2, 46)$ rel min

1 mark $(3, -79)$ rel max

Section very well done.
Careless errors cost marks
especially omitting $(-,-)$.

(a) (ii) Possible points of inflexion occur when $\frac{d^2y}{dx^2} = 0$

$$\frac{d^2y}{dx^2} = 12x - 6$$
$$0 = 6(2x-1)$$
$$x = \tfrac{1}{2}$$

$$\left.\begin{array}{llll} \text{when } x < \frac{1}{2} & \frac{d^2y}{dx^2} < 0 & (\text{TEST } x = 0) \\ x > \frac{1}{2} & \frac{d^2y}{dx^2} > 0 & (\text{TEST } x = 1) \end{array}\right\} \text{ 1 mark}$$

$\therefore$ Concavity changes either side of $x = \frac{1}{2}$.

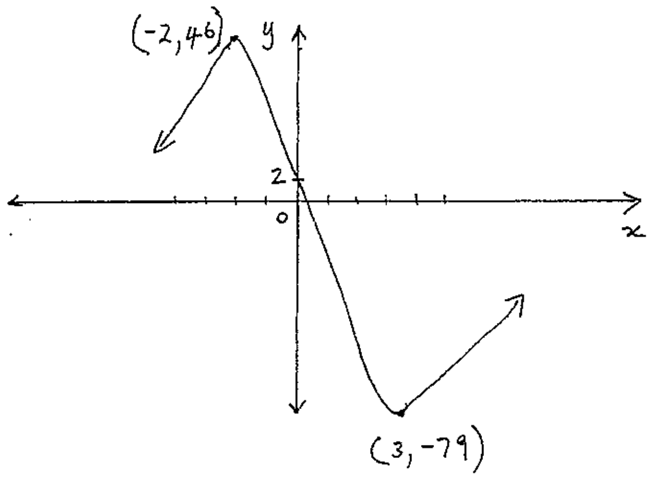
When $x = \frac{1}{2}$

$$y = 2x^3 - 3x^2 - 36x + 2$$
$$= \frac{2}{8} - \frac{3}{4} - 18 + 2$$
$$= -16\tfrac{1}{2}$$

Many students did not indicate the purpose of the 2ND derivative test. You WILL lose a mark NEXT TIME

$\therefore$ Point of inflexion occurs at $\left(\frac{1}{2}, -16\frac{1}{2}\right)$ ← 1 mark

(iii)



1 mark y-intercept clearly shown

1 mark basic sketch of a cubic fn with max, min and axes labelled

(iv) The function is decreasing in the domain $-2 < x < 3$ 1 mark

Some students misread the question.
A fn is decreasing where $\frac{dy}{dx} < 0$

(b) $2x^2 - 8x - 25 = 0$

If α, β are the roots then

$$(x-\alpha)(x-\beta) = 0$$

$$x^2 - (\alpha+\beta)x + \alpha\beta = 0$$

cf $$x^2 - \frac{8}{2}x - \frac{25}{2} = 0$$

$$x^2 - 4x - \frac{25}{2} = 0$$

(i) $\alpha + \beta = -(-4)$

$= 4$ ———— 1 mark

(ii) $\alpha\beta = -\frac{25}{2} \quad (-12\frac{1}{2})$ ———— 1 mark

(iii) $\alpha^2+\beta^2 = (\alpha+\beta)^2 - 2\alpha\beta$ ———— 1 mark

$= 4^2 - 2(-\frac{25}{2})$

$= 41$ ———— 1 mark

IN General, question well done.

Students lost marks in part (iii) if they demonstrated poor understanding. eg. a real number squared is always positive. The sum of two positive numbers can only be positive.

A significant number of students obtained a negative solution. IMPOSSIBLE for real numbers.

No marks awarded when solution defies logic.

Question 3. (12 marks). Y12. (HY) 2006

(a) (i) $V = x^2 y = 32$

$\therefore y = \frac{32}{x^2}$ ① mark.

(ii) $A = x^2 + 4xy$

$= x^2 + 4x\left(\frac{32}{x^2}\right)$ ①

$= x^2 + \frac{128}{x}$

For Areas, etc You MUST wri[te] $\frac{dA}{dx} = 0$ or A'(... A' is NOT acceptable

(iii) $A = x^2 + 128x^{-1}$

$\frac{dA}{dx} = 2x - 128x^{-2}$

$\frac{d^2A}{dx^2} = 2x + 256x^{-3}$ ①

For max/min value $\frac{dA}{dx} = 0$

← Must write th[is] statement

$\therefore 2x - \frac{128}{x^2} = 0.$

$\therefore x = 4.$

If $x = 4$, $\frac{d^2A}{dx^2} > 0$ ①

$\therefore$ Dimensions are 4cm × 4cm × 2cm.

you MUST tes[t] the value

It's volume, so you must write 3 dimensions. (... NOT area).

(b) (i) $x^2 = 4(2-y)$

$x^2 = 8 - 4y$

$x^2 = -4y + 8$

$x^2 = -4(y-2)$. ①

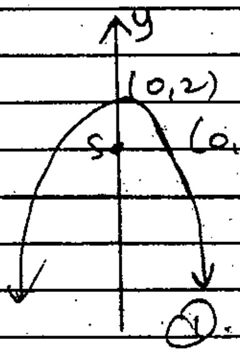
$\therefore$ Vertex is $(0,2)$

$\therefore a = |-1|$

$\therefore a = 1.$

$\therefore$ Focus is $(0,1)$ ①

(ii)



①.

→ This question se[eks] to confuse. You need to factorise [the] negative out. The graph shou[ld] represent you[r] answers in (a).

(iii) $x^2 = -4y + 8$

$4y = -x^2 + 8$

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

$\frac{dy}{dx} = -\frac{x}{2}$ ①

At $x = 2$, $\frac{dy}{dx} = -1$ (m_1)

$m_2 = 1$ ①.

Equation of normal is $y - 1 = 1(x - 2)$

$y = x - 1.$ ①

You must make y the subject [and] differentiate.

Question 4 $\quad \frac{}{12}$

a) (i) $\int_2^4 \left(\frac{x^3-1}{x^2}\right) dx = \int_2^4 \left(\frac{x^3}{x^2} - \frac{1}{x^2}\right) dx$

$= \int_2^4 (x - x^{-2})\, dx$ ① simplifying the expression to be integrated

$= \left[\frac{x^2}{2} - \frac{x^{-1}}{-1}\right]_2^4$

$= \left[\frac{x^2}{2} + \frac{1}{x}\right]_2^4$ ① integrating

$= \left(\frac{16}{2} + \frac{1}{4}\right) - \left(\frac{4}{2} + \frac{1}{2}\right)$

$= 8\frac{1}{4} - 2\frac{1}{2}$

$= 5\frac{3}{4}$. ① sub. and simplif

3

Note: * You cannot integrate a product (or a quotient at the moment)
* Many students need to take care with notation.

(ii) $\int \sqrt{2x+3}\, dx = \int (2x+3)^{\frac{1}{2}} dx$

$= \frac{(2x+3)^{\frac{3}{2}}}{\frac{3}{2} \times 2} + C$ ① constant of integration ① integrating

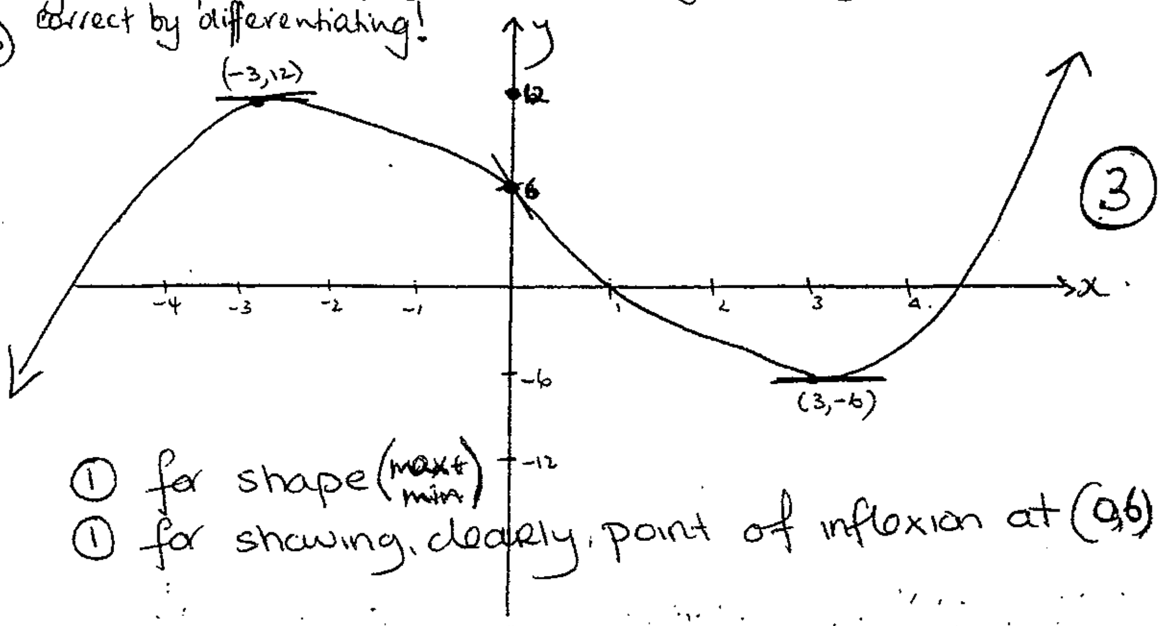
$= \frac{\sqrt{(2x+3)^3}}{3} + C$

① simplifying / correct form!

3

Notes:
* Indefinite integrals (with no limits) require a constant of integration, 'C'.
* Always check primitives are correct by differentiating!

(b)



3

① for shape (max + min)
① for showing, clearly, point of inflexion at (0,6)

① Smooth curve / scale

Q4 continued.

c) (i) $x^2+4x-12 = (x^2+4x+4)-12-4$
$= (x+2)^2 - 16$. (1)

(ii) $\therefore$ minimum value is -16 when $x = -2$.
(1) (1).

Note: * The 'hence' in part(ii) means use (i) to solve part(ii)!

(3)

OR $x = \frac{-b}{2a}$, $b=4$, $a=1$

$\therefore x = \frac{-4}{2}$
$= -2$

i.e. vertex occurs at $x=-2$ on parabola $y = x^2+4x-12$ (where $a=1$ ie has minimum turning point) (1)

$f(-2) = (-2)^2+4(-2)-12$
$= 4-8-12$
$= -16$ $\therefore$ minimum of -16 at $x=-2$ (1)

Note: $(x+2)^2 \geq 0$ for all x
$\therefore (x+2)^2-16$ is at least -16 (when $x=-2$)

OR Let $y = x^2+4x-12$

For min. value, $\frac{dy}{dx} = 0$, $\frac{d^2y}{dx^2} > 0$

$\frac{dy}{dx} = 2x+4$

ie $0 = 2x+4$

$\therefore x = -2$

$\frac{d^2y}{dx^2} = 2 > 0$ for all x-values

$\therefore$ min. at $x=-2$

(or use 1st derivative test!)

At $x = -2$
$y = (-2)^2+(4)(-2)-12$
$= -16$

$\therefore$ minimum of -16 at $x=-2$! (1)

$f(x)$ y-value

For (1) mark?

Note: * Stating the coordinates of the minimum value is not enough for full marks.
* You had to interpret the coordinates
→ know that the minimum is the y-value!

Solutions for Mathematics Half Yearly 2006 Year 12

Question 5

a) i) $y = 2x - x^2$, $y = 2 - x$

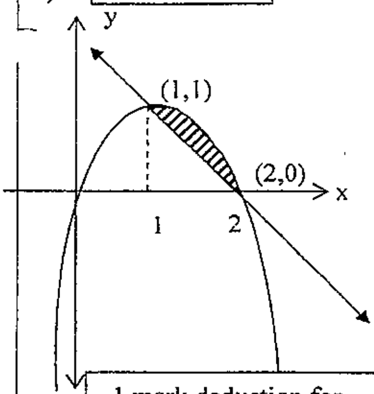
equating the two equations

$$2x - x^2 = 2 - x$$
$$x^2 - 3x + 2 = 0$$
$$(x-2)(x-1) = 0$$
$$x = 1,2 \quad \boxed{\text{1 mark}}$$

$\therefore$ points of intersection are $(1,1)$ and $(2,0)$ $\boxed{\text{1 mark}}$

- The question asked for the coordinates of the points of intersection, so you needed to write answers as ordered pairs of numbers

ii) Write Area=

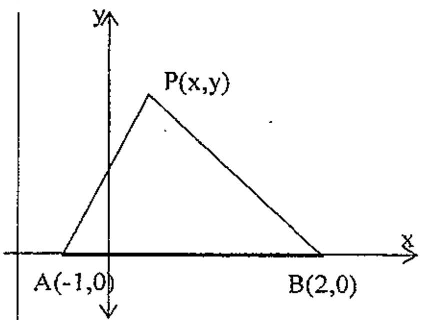


$$\text{Area} = \int_1^2 \left|(2x - x^2) - (2 - x)\right| dx \quad \boxed{\text{1 mark}}$$
$$= \int_1^2 \left(3x - x^2 - 2\right) dx$$
$$= \left[\frac{3x^2}{2} - \frac{x^3}{3} - 2x\right]_1^2 \quad \boxed{\text{1 mark}}$$
$$= \left(\frac{12}{2} - \frac{8}{3} - 4\right) - \left(\frac{3}{2} - \frac{1}{3} - 2\right)$$
$$= \frac{-2}{3} - -\frac{5}{6}$$
$$= \frac{1}{6} \text{ units}^2 \quad \boxed{\text{1 mark}}$$

1 mark deduction for leaving off units

- Always simplify the expression before integrating by collecting like terms
- You must write the subject of the equation. AREA=
- There is generally a poor use of notation. Once you have integrated, $\int$ and the dx are no longer written
- Many students use absolute value signs incorrectly. They should appear at the beginning and not taken off until the very last step

b)



i) $PA = \sqrt{(x+1)^2 + y^2}$

$PB = \sqrt{(x-2)^2 + y^2}$ $\boxed{\text{1 mark each}}$

ii)
$$PA = 2PB$$
$$\sqrt{(x+1)^2 + y^2} = 2\sqrt{(x-2)^2 + y^2} \quad \boxed{\text{1 mark}}$$
$$x^2 + 2x + 1 + y^2 = 4x^2 - 16x + 16 + 4y^2$$
$$3x^2 - 18x + 3y^2 + 15 = 0$$
$$x^2 - 6x + y^2 + 5 = 0 \quad \boxed{\text{1 mark}}$$
$$(x^2 - 6x + 9) + y^2 + 5 + 9 = 0$$
$$(x-3)^2 + y^2 = 4 \quad \boxed{\text{1 mark}}$$

which is a circle of the form

$$(x-h)^2 + (y-k)^2 = r^2$$

iii) Centre $(3,0)$

Radius= 2 units $\boxed{\text{1 mark each}}$

- Read the question carefully. You were asked to find PA and PB NOT PA^2 and PB^2. You lost a mark for going on and doing some strange simplification as you cannot have 2 answers for the one question
- Many students forgot to square the 2 when squaring both sides
- To show it is a circle you should compare your answer to the general form. Not just say it is a circle

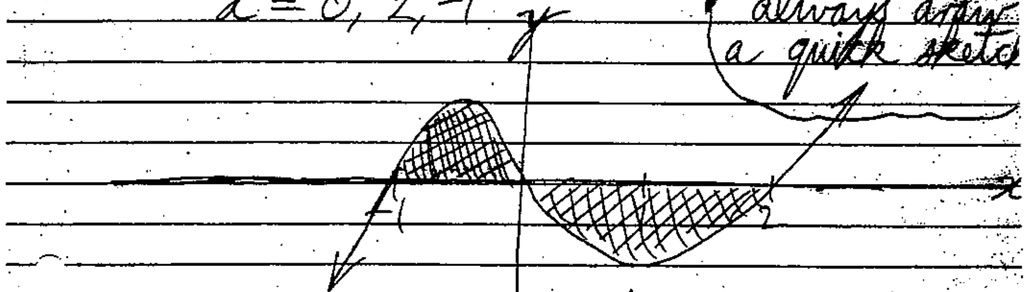
Q6. $f(x) = x(x-2)(x+1) = x(x^2-x-2)$

(a) let $f(x) = 0$ $\quad = x^3-x^2-2x$

$0 = x(x-2)(x+1)$

$x = 0, 2, -1$

• always draw a quick sketch



$$A = \int_{-1}^{0} (x^3-x^2-2x)\,dx + \left| \int_{0}^{2} (x^3-x^2-2x)\,dx \right|$$

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

$$A = (0-0-0) - \left(\frac{1}{4} + \frac{1}{3} - 1\right) + \left| \left(4 - \frac{8}{3} - 4\right) - 0 \right|$$

$$A = \frac{5}{12} + \left| -2\frac{2}{3} \right|$$

$$A = \frac{5}{12} + 2\frac{2}{3}$$

$$A = 3\frac{1}{12} \text{ units}^2$$

• always take the absolute value because we cant have a negative area.

4

6(b) $(x-4)^2+(y-5)^2=20$
centre $(4,5)$, radius $=\sqrt{20}$
$r = 2\sqrt{5}$ units

Find the perp. dist. from $(4,5)$ to the line $x+2y-4=0$

$$d = \left| \frac{ax_1+by_1+c}{\sqrt{a^2+b^2}} \right|$$

• the perp. distance formula

$$d = \left| \frac{4+10-4}{\sqrt{1^2+2^2}} \right|$$

$$d = \frac{10}{\sqrt{5}} \text{ units}$$

$$d = \frac{10}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$$

$$d = \frac{10\sqrt{5}}{5}$$

$$d = 2\sqrt{5} \text{ units}$$

4

Now, $d = 2\sqrt{5}$ and the radius is $2\sqrt{5}$ so, the line $x+2y-4=0$ must be a tangent to the circle.

• you must write your conclusion ie the reason why the line is a tangent

6(b) $(x-4)^2+(y-5)^2=20$ —— ①

$x+2y-4=0$ —— ②

• simultaneous equations

From ② $x=4-2y$

Subst. from ② into ①

$(4-2y-4)^2+(y-5)^2=20$

$(2y)^2+y^2-10y+25=20$

$4y^2+y^2-10y+5=0$

$5y^2-10y+5=0$

$y^2-2y+1=0$

$(y-1)(y-1)=0$

$y=1,\ y=1$

• must write your conclusion.

Subst. into $x=4-2y$

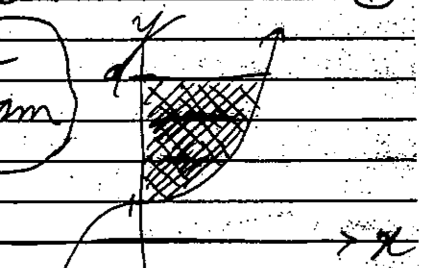
let $y=1$, $x=4-2$

$x=2$

∴ (2,1) is the only point of intersection so the line $x+2y-4=0$ is a tangent to the circle. ④

(c) $A=\int_c^d x\,dy$

• draw a diagram



$y=x^3+1$

$x^3=y-1$

$x=(y-1)^{\frac{1}{3}}$

$A=\int_1^9 (y-1)^{\frac{1}{3}}\,dy$

$A=\left[\frac{3}{4}(y-1)^{\frac{4}{3}}\right]_1^9$

$A=\left[\frac{3}{4}(8)^{\frac{4}{3}}-0\right]$

$A=\frac{3}{4}(16)$

$A=12$ units^2 ④

Question 7

a)

x	1	1.5	2	2.5	3
f(x)	1	$\frac{2}{3}$ *or* $0.\dot{6}$	$\frac{1}{2}$ or 0.5	$\frac{2}{5}$ or 0.4	$\frac{1}{3}$ or $0.\dot{3}$

1 mark

b) For one application trapezoidal rule says

$$\text{Area} \approx \frac{h}{2}\left(f(a)+f(b)\right)$$

Here there are 4 applications so h$=\frac{3-1}{4}=\frac{1}{2}$ 1 mark

$$\therefore \int_1^3 \frac{1}{x}dx \approx \frac{\frac{1}{2}}{2}\left(1+\frac{2}{3}\right)+\frac{1}{4}\left(\frac{2}{3}+\frac{1}{2}\right)+\frac{1}{4}\left(\frac{1}{2}+\frac{2}{5}\right)+\frac{1}{4}\left(\frac{2}{5}+\frac{1}{3}\right)$$

1 mark

$$\approx \frac{1}{4}\times 4\frac{7}{15}$$
$$\approx 1.11666.....$$
$$=1.12 \text{ (to 2 d.p.)}$$

1 mark

OR in table form

x	f(x)$=\frac{1}{x}$	Weighting factor	WF$\times$f(x)
1	1	1	1
$1\frac{1}{2}$	$\frac{2}{3}$	2	$\frac{4}{3}$
2	$\frac{1}{2}$	2	1
$2\frac{1}{2}$	$\frac{2}{5}$	2	$\frac{4}{5}$
3	$\frac{1}{3}$	1	$\frac{1}{3}$

1 mark

Sum$=4\frac{7}{15}$

1 mark

4 applications

width of each application $=\frac{1}{2}$ 1 mark

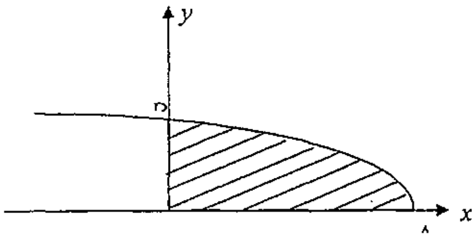
$$\int_1^3 \frac{1}{x}dx \approx \frac{1}{2}\times \text{ width of application } \times \text{sum}$$

$$\approx \frac{1}{4}\times 4\frac{7}{15}$$
$$\approx 1.11666.....$$
$$=1.12 \text{ (to 2 d.p.)}$$

1 mark

- You should be working with exact values until the last step as you create rounding errors as you work through the question
- When you have to complete a table , you actually need to find the values , by simplifying your substitutions
- This was done poorly as many students learn a long formula but don't actually recognize how many applications of the rule they are doing. You should show the number of applications
- Here there are 4 applications and each one has a width of ½. So h=½
- This is not an area question and so there should be no units on the answer
- The subject of the equations should be $\therefore \int_1^3 \frac{1}{x}dx \approx$ and as it is an approximate method you must use approximately equal to signs NOT =
- There was a mark penalty for incorrect use of units and approx equal signs
- Be careful not to confuse Simpson's rule and the trapezoidal rule

b) $y = \sqrt{9-x}$



i) When x=0, y=3
So B is (0,3) ← 1 mark

$$0 = \sqrt{9-x}$$

When y=0, $0^2 = 9 - x$

$$x = 9$$

So A is (9,0) ← 1 mark

$$\pi\int_0^9 \left(\sqrt{9-x}\right)^2 dx$$ ← 1 mark for setting up the volume question

$$= \pi\int_0^9 (9-x)dx$$

ii)Volume= $= \pi\left[9x - \frac{x^2}{2}\right]_0^9$ ← 1 mark for correct integration

$$= \pi\left[81 - \frac{81}{2} - 0\right]$$

$$= \frac{81\pi}{2} units^3$$ ← 1 mark for units

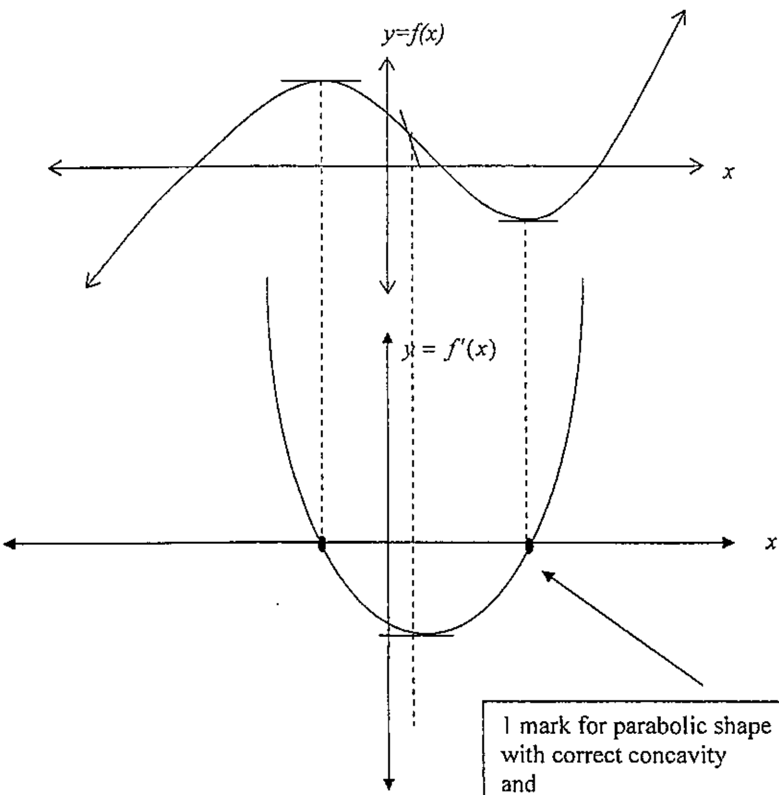
1 mark for answer. It is best left in exact form ie. In terms of pi

- The question required coordinates. You received 1 mark only for x=9 and y=3

- This was a volume around the x-axis, but many students did not read the question and went around the y-axis. Many also found area instead of volume
- Again you need a subject for your equation Volume=

- Don't forget units cubed for volume
- Many students forgot to square the function and so created problems for the integration

Question 7 c)



1 mark for parabolic shape with correct concavity
and
1 mark for roots and vertex in correct position

- When drawing a derivative function, you must redraw the original function and clearly show where the critical points line up
- Most students didn't bother drawing the first function and so as a marker I cant check whether or not you have your roots and turning point in the right place.
- PLEASE use a ruler when drawing diagrams and make them big