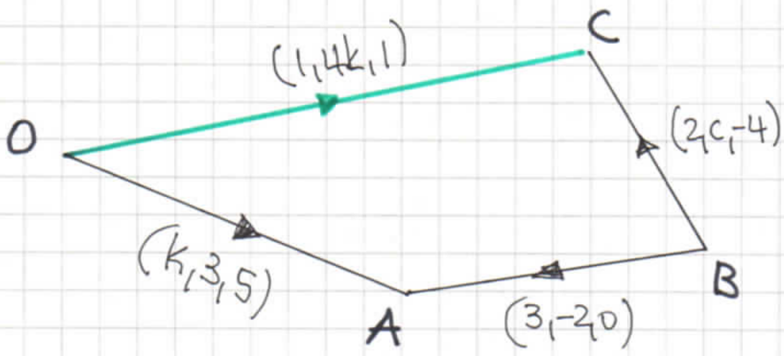
IYGB - MP2 PAPER R - QUESTION 1

STARTING WITH A VECTOR DIAGRAM



$A(k,3,5)$

$\overrightarrow{BA} = (3,-2,0)$

$\overrightarrow{BC} = (2,c,-4)$

$C(1,4k,1)$

FORMING A VECTOR EQUATION

$\Rightarrow \overrightarrow{OA} + \overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{OC}$

$\Rightarrow (k,3,5) - (3,-2,0) + (2,c,-4) = (1,4k,1)$

$\Rightarrow (k-1, c+5, 1) = (1,4k,1)$

$[i]: \quad k-1=1 \Rightarrow \underline{k=2}$

$[j]: \quad c+5 = 4k$

$c+5 = 8$

$\underline{c=3}$

FINALLY WE CAN FIND THE DISTANCE BC

$\rightarrow |\overrightarrow{BC}| = |2,3,-4|$

$\Rightarrow |\overrightarrow{BC}| = \sqrt{2^2+3^2+(-4)^2}$

$\Rightarrow |\overrightarrow{BC}| = \sqrt{4+9+16}$

$\Rightarrow |\overrightarrow{BC}| = \underline{\sqrt{29} \approx 5.39}$

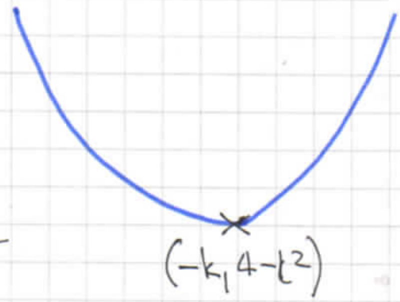
IYGB – MP2 PAPER R – QUESTION 2

a) COMPLETING THE SQUARE

$f(x) = x^2 + 2kx + 4, \quad x \in \mathbb{R}$

$f(x) = (x+k)^2 - k^2 + 4$

$f(x)$ HAS A MINIMUM VALUE OF $4 - k^2$



$f(x) \geqslant 4 - k^2$

b) $f(g(2)) = 4$

$\Rightarrow f(3 - k \times 2) = 4$

$\Rightarrow f(3 - 2k) = 4$

$\Rightarrow (3-2k)^2 + 2k(3-2k) + \cancel{4} = \cancel{4}$

$\Rightarrow 9 - 12k + \cancel{4k^2} + 6k - \cancel{4k^2} = 0$

$\Rightarrow 9 = 6k$

$\Rightarrow k = \frac{3}{2}$

IYGB - MP2 PAPER R - QUESTION 3

START FORMING EQUATIONS AS FOLLOWS

$$\begin{array}{ccccc} u_2 & & u_3 & & u_9 \\ a+d & \xrightarrow{\times r} & a+2d & \xrightarrow{\times r} & a+8d \end{array} \quad \leftarrow u_n = a+(n-1)d$$

$$\Rightarrow \begin{bmatrix} (a+d)r = a+2d \\ (a+2d)r = a+8d \end{bmatrix}$$

ELIMINATE THE COMMON RATIO r, BY DIVISION

$$\Rightarrow \frac{a+d}{a+2d} = \frac{a+2d}{a+8d}$$

$$\Rightarrow (a+d)(a+8d) = (a+2d)^2$$

$$\Rightarrow \cancel{a^2} + 8ad + ad + 8d^2 = \cancel{a^2} + 4ad + 4d^2$$

$$\Rightarrow 4d^2 + 5ad = 0$$

$$\Rightarrow d(4d+5a) = 0$$

$$\Rightarrow 5a + 4d = 0 \qquad (d \neq 0)$$

$$\Rightarrow d = -\frac{5}{4}a$$

NOW RETURNING & PICKING ONE OF THE ORIGINAL EQUATIONS WHICH CONTAIN a, d & r

$$\Rightarrow (a+d)r = a+2d$$

$$\Rightarrow \left(a - \frac{5}{4}a\right)r = a + 2\left(-\frac{5}{4}a\right)$$

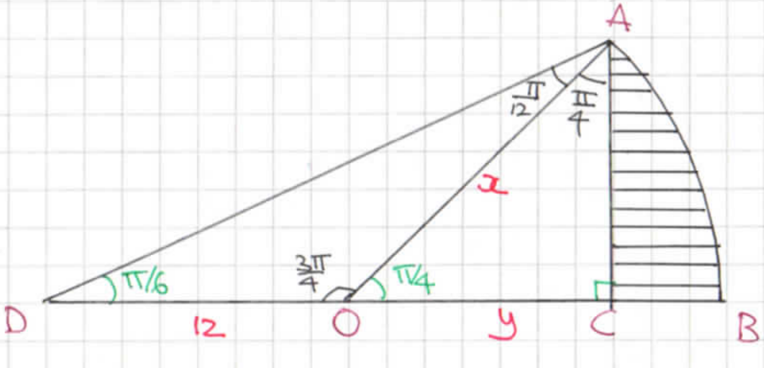
$$\Rightarrow -\frac{1}{4}ar = -\frac{3}{2}a$$

$$\Rightarrow \frac{1}{4}\cancel{a}r = \frac{3}{2}\cancel{a} \qquad a \neq 0$$

$$\Rightarrow r = 6$$

IYGB – MP2 PAPER R – QUESTION 4

a) STARTING WITH A DIAGRAM



OBTAIN SOME ANGLES

- $D\hat{O}A = \pi - \frac{\pi}{4} = \frac{3\pi}{4}$ (straight line)
- $D\hat{A}O = \pi - \left(\frac{\pi}{6} + \frac{3\pi}{4}\right) = \frac{\pi}{12}$ (triangle $\overset{\triangle}{DAO}$)
- $O\hat{A}C = \pi - \left(\frac{\pi}{2} + \frac{\pi}{4}\right) = \frac{\pi}{4}$ (triangle $\overset{\triangle}{OAC}$)

BY THE SINE RULE ON $\overset{\triangle}{AOD}$

$$\frac{|OA|}{\sin\pi/6} = \frac{|OD|}{\sin\pi/12} \Longrightarrow \frac{x}{\sin\pi/6} = \frac{12}{\sin\pi/12}$$

$$\Longrightarrow x = \frac{12\sin\pi/6}{\sin\pi/12}$$

$$\Longrightarrow x = 6\sqrt{6} + 6\sqrt{2}$$

(≈ 23.18)

b) AREA OF THE SECTOR $= \text{"}\frac{1}{2}r^2\theta^c\text{"}$

$$= \frac{1}{2}x^2 \times \frac{\pi}{4}$$

$$= \frac{1}{2}\left(6\sqrt{6} + 6\sqrt{2}\right)^2 \times \frac{\pi}{4}$$

$$= \frac{\pi}{8}\left[6\left(\sqrt{6} + \sqrt{2}\right)\right]^2$$

$$= \frac{\pi}{8} \times 6^2\left(\sqrt{6} + \sqrt{2}\right)^2$$

$$= \frac{\pi}{8} \times 36 \times \left(8 + 4\sqrt{3}\right)$$

$$= \frac{\pi}{8} \times 36 \times 4 \times \left(2 + \sqrt{3}\right)$$

$$= 18\pi\left(2 + \sqrt{3}\right)$$

≈ 211

c) NOW LOOKING AT $\overset{\triangle}{AOC}$

$$\frac{|OC|}{|OA|} = \cos\frac{\pi}{4} \Longrightarrow \frac{y}{x} = \cos\frac{\pi}{4}$$

$$\Longrightarrow y = x \times \frac{\sqrt{2}}{2}$$

$$\Longrightarrow y = \left(6\sqrt{6} + 6\sqrt{2}\right) \times \frac{\sqrt{2}}{2}$$

$$\Longrightarrow y = \left(3\sqrt{6} + 3\sqrt{2}\right) \times \sqrt{2}$$

$$\Longrightarrow y = 3\sqrt{12} + 6$$

$$\Longrightarrow y = 6 + 6\sqrt{3}$$

IYGB - MP2 PAPER R - QUESTION 4

FINALLY THE AREA OF THE TRIANGLE $\hat{OAC}$

$$\text{AREA} = \frac{1}{2}|OA||OC|\sin\frac{\pi}{4} = \frac{1}{2}xy \times \frac{\sqrt{2}}{2} = \frac{1}{4}\sqrt{2}\,xy$$

$$= \frac{1}{4}\sqrt{2}\,(6\sqrt{6}+6\sqrt{2})(6+6\sqrt{3})$$

$$= \frac{1}{4}\sqrt{2} \times 6(\sqrt{6}+\sqrt{2}) \times 6(1+\sqrt{3}) = 9\sqrt{2}(\sqrt{6}+\sqrt{2})(1+\sqrt{3})$$

$$= 9\sqrt{2}\,(2\sqrt{6}+4\sqrt{2}) = 9\sqrt{2} \times 2(\sqrt{6}+2\sqrt{2})$$

$$= 18(\sqrt{12}+4) = 18(2\sqrt{3}+4) = 36(\sqrt{3}+2)$$

THE SHADED AREA IS GIVEN BY

AREA OF SECTOR - AREA OF TRIANGLE

$$= 18\pi(2+\sqrt{3}) - 36(2+\sqrt{3})$$

$$= 18(2+\sqrt{3})\left[\pi-2\right]$$

$$= \underline{18(2+\sqrt{3})(\pi-2)}$$

IYGB - MP2 PAPER R - QUESTION 5

LOCATE THE CO-ORDINATES OF THE MINIMUM BY DIFFERENTIATION

$$f(x) = e^{nx} + ke^{-nx}$$
$$f'(x) = ne^{nx} - nke^{-nx}$$

SOLVE $f'(x) = 0$

$$\Rightarrow ne^{nx} - nke^{-nx} = 0$$
$$\Rightarrow e^{nx} - ke^{-nx} = 0 \qquad n \neq 0$$
$$\Rightarrow e^{nx} = ke^{-nx}$$
$$\Rightarrow e^{nx} = \frac{k}{e^{nx}}$$
$$\Rightarrow (e^{nx})^2 = k$$
$$\Rightarrow e^{nx} = +\sqrt{k} \qquad e^{nx} > 0$$

NEXT WE CAN FIND THE y CO-ORDINATE – WE DON'T REQUIRE x

$$\Rightarrow y = e^{nx} + ke^{-nx}$$
$$\Rightarrow y = e^{nx} + \frac{k}{e^{nx}}$$
$$\Rightarrow y = \sqrt{k} + \frac{k}{\sqrt{k}}$$
$$\Rightarrow y = \sqrt{k} + \sqrt{k}$$
$$\Rightarrow y = 2\sqrt{k}$$

$\therefore$ THE RANGE IS $f(x) \geqslant 2\sqrt{k}$

IYGB – MP2 PAPER R – QUESTION 6

a) COLLECTING ALL THE INFORMATION

$$\frac{dV}{dt} = -kV^2$$

RATE

DEPRECIATING

PROPORTIONAL

VALUE SQUARED

$V =$ value, in thousands

$t =$ time, in years

$t = 0, \ V = 12$

SOLVING BY SEPARATING VARIABLES

$$\Longrightarrow dV = -kV^2 dt$$

$$\Longrightarrow -\frac{1}{V^2}\,dV = k\,dt$$

$$\Longrightarrow \int -\frac{1}{V^2}\,dV = \int k\,dt$$

$$\Longrightarrow \boxed{\frac{1}{V} = kt + C}$$

APPLY CONDITION $t=0, \ V=12$

$$\Longrightarrow \frac{1}{12} = C$$

$$\Longrightarrow \frac{1}{V} = kt + \frac{1}{12}$$

$$\Longrightarrow V = \frac{1}{kt + \frac{1}{12}}$$

MULTIPLY TOP & BOTTOM OF THE FRACTION IN THE R.H.S BY 12

$$\Longrightarrow V = \frac{12}{12kt + 1}$$

$$\Longrightarrow \boxed{V = \frac{12}{at + 1}}$$

AS REQUIRED

IYGB - MP2 PAPER R - QUESTION 6

b) USING THE FINAL CONDITION

$t=0 \quad V=8 \leftarrow £12000 - £4000$

$\Rightarrow 8 = \dfrac{12}{2a+1}$

$\Rightarrow 16a + 8 = 12$

$\Rightarrow 16a = 4$

$\Rightarrow a = \frac{1}{4}$

REWRITING THE FORMULA

$\Rightarrow V = \dfrac{12}{\frac{1}{4}t+1}$

$\Rightarrow V = \dfrac{12}{\frac{1}{4}\times 12+1}$ (A FURTHER PERIOD ....)

$\Rightarrow V = 3$

$\therefore$ £3000

IYGB – MP2 PAPER R – QUESTION 7

a) FILL IN THE TABLE

x	$\frac{\pi}{6}$	$\frac{5\pi}{24}$	$\frac{\pi}{4}$	$\frac{7\pi}{24}$	$\frac{\pi}{3}$
y	3	4.1120	5.8284	8.6784	13.9282

BY THE TRAPEZIUM RULE

$$\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{(1+\sin x)^2}{\cos^2 x}\,dx \simeq \frac{\text{"THICKNESS"}}{2}\left[\text{FIRST} + \text{LAST} + 2\times(\text{SUM OF REST})\right]$$

$$\simeq \frac{\pi/24}{2}\left[3 + 13.9282 + 2(4.1120 + 5.8284 + 8.6784)\right]$$

$$\simeq 3.545$$

b) PROCEED BY DIRECT INTEGRATION

$$\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{(1+\sin x)^2}{\cos^2 x}\,dx = \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{1+2\sin x+\sin^2 x}{\cos^2 x}\,dx$$

$$= \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{1}{\cos^2 x} + \frac{2\sin x}{\cos^2 x} + \frac{\sin^2 x}{\cos^2 x}\,dx = \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \sec^2 x + \frac{2\sin x}{\cos x}\times\frac{1}{\cos x} + \tan^2 x\,dx$$

$$= \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \sec^2 x + 2\tan x\sec x + (\sec^2 x - 1)\,dx$$

$$= \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} 2\sec^2 x + 2\tan x\sec x - 1\,dx$$

IYGB - MP2 PAPER R - QUESTION 7

NOW WE NOTE THAT

$$\frac{d}{dx}(\tan x) = \sec^2 x \quad \& \quad \frac{d}{dx}(\sec x) = \sec x \tan x$$

HENCE WE FINALLY HAVE

$$\ldots = \Big[2\tan x + 2\sec x - x\Big]_{\frac{\pi}{6}}^{\frac{\pi}{3}}$$

$$= \left(2\tan\frac{\pi}{3} + 2\sec\frac{\pi}{3} - \frac{\pi}{3}\right) - \left(2\tan\frac{\pi}{6} + 2\sec\frac{\pi}{6} - \frac{\pi}{6}\right)$$

$$= \left(2\sqrt{3} + 4 - \frac{\pi}{3}\right) - \left(\frac{2}{\sqrt{3}} + \frac{4}{\sqrt{3}} - \frac{\pi}{6}\right)$$

$$= \left(2\sqrt{3} + 4 - \frac{\pi}{3}\right) - \left(\frac{6}{\sqrt{3}} - \frac{\pi}{6}\right)$$

$$= \left(\cancel{2\sqrt{3}} + 4 - \frac{\pi}{3}\right) - \left(\cancel{2\sqrt{3}} - \frac{\pi}{6}\right)$$

$$= 4 - \frac{\pi}{6}$$

IYGB - MP2 PAPER R - QUESTION 8

a) START BY REARRANGING THE EQUATION FOR x - THEN DIFFERENTIATE

$$\Rightarrow y = \frac{x}{y + \ln y}$$

$$\Rightarrow y^2 + y\ln y = x$$

$$\Rightarrow x = y^2 + y\ln y$$

$$\Rightarrow \frac{dx}{dx} = 2y + 1 \times \ln y + y \times \frac{1}{y}$$

$$\Rightarrow \frac{dx}{dy} = 2y + \ln y + 1$$

$$\Rightarrow \frac{dy}{dx} = \frac{1}{2y + \ln y + 1}$$

SOLVING $\frac{dy}{dx} = 2$ YIELDS

$$\Rightarrow 2 = \frac{1}{2y + \ln y + 1}$$

$$\Rightarrow 4y + 2\ln y + 2 = 1$$

$$\Rightarrow 4y + 2\ln y + 1 = 0$$

$$\Rightarrow 2\ln y = -1 - 4y$$

$$\Rightarrow \ln y = -\frac{1}{2} - 2y$$

$$\Rightarrow \ln y = -\frac{1}{2}(4y + 1) \qquad \therefore y = e^{-\frac{1}{2}(4y+1)}$$

AS REQUIRED

b) USING THE ITERATIVE FORMULA $y = e^{-\frac{1}{2}(4y+1)}$

STARTING WITH $y_1 = 0.3$

$y_2 = 0.33287\ldots$

$y_3 = 0.311691\ldots$

$y_4 = 0.325178\ldots$

IYGB - MP2 PAPER R - QUESTION 8

THE CONVERGENCE IS BY OSCILLATION BUT VERY SLOW

$y_5 = 0.316524\ldots$

$y_6 = 0.32205\ldots$

$y_7 = 0.31851\ldots$

$y_8 = 0.32077\ldots$

$y_9 = 0.31932\ldots$

$y_{10} = 0.32025\ldots$

$y_{11} = 0.31965\ldots$

$y_{12} = 0.32003\ldots$

$y_{13} = 0.31979\ldots$

$y_{14} = 0.31995\ldots$

$y_{15} = 0.31985\ldots$

$\therefore y = 0.320$ (CORRECT TO 3 d.p)

USING $y = 0.3199$ IN $x = y^2 + y\ln y$ WE OBTAIN $x = -0.262$

$\therefore P(-0.262, 0.320)$

IYGB – MP2 PAPER R – QUESTION 9

a) $f(x) \equiv \dfrac{16x^2+3x-2}{x^2(3x-2)} \equiv \dfrac{A}{x^2} + \dfrac{B}{x} + \dfrac{C}{3x-2}$

$16x^2+3x-2 \equiv A(3x-2) + Bx(3x-2) + Cx^2$

- IF $x=0$

$-2 = -2A$

$A = 1$

- IF $x = 2/3$

$\frac{64}{9} \cancel{+2} \cancel{-2} = C \times \frac{4}{9}$

$C = 16$

- IF $x = 1$

$17 = A + B + C$

$17 = 1 + B + 16$

$B = 0$

b) $\dfrac{1}{3x-2} = -\dfrac{1}{2-3x} = -(2-3x)^{-1} = -(2)^{-1}\left[1-\frac{3}{2}x\right]^{-1}$

$= -\frac{1}{2}\left(1-\frac{3}{2}x\right)^{-1}$

$= -\frac{1}{2}\left[1 + \frac{-1}{1}\left(-\frac{3}{2}x\right)^1 + \frac{-1(-2)}{1\times 2}\left(-\frac{3}{2}x\right)^2 + \frac{(-1)(-2)(-3)}{1\times 2\times 3}\left(-\frac{3}{2}x\right)^3 + \dots\right]$

$= -\frac{1}{2}\left[1 + \frac{3}{2}x + \frac{9}{4}x^2 + \frac{27}{8}x^3 + \dots\right]$

$= -\frac{1}{2} - \frac{3}{4}x - \frac{9}{8}x^2 - \frac{27}{16}x^3 - \dots$

c) METHOD A (ONLY UP TO x^3 IS DIRECTLY AVAILABLE)

$\dfrac{16x^2+3x-2}{3x-2} = (-2+3x+16x^2)\left[-\frac{1}{2} - \frac{3}{4}x - \frac{9}{8}x^2 - \frac{27}{16}x^3 + \dots\right]$

$$
\begin{aligned}
= 1 &+ \cancel{\tfrac{3}{2}x} + \cancel{\tfrac{9}{4}x^2} + \cancel{\tfrac{27}{8}x^3} + \dots \\
&\cancel{-\tfrac{3}{2}x} \cancel{-\tfrac{9}{4}x^2} \cancel{-\tfrac{27}{8}x^3} + \dots \\
&\qquad -8x^2 - 12x^3 + \dots
\end{aligned}
$$

$= 1 - 8x^2 - 12x^3 + \dots$

IYGB - MP2 PAPER R - QUESTION 9

METHOD B (USING PREVIOUS PARTS)

$$\frac{16x^2+3x-2}{x^2(3x-2)} = \frac{1}{x^2} + \frac{16}{3x-2}$$

$$\frac{1}{x^2}\left(\frac{16x^2+3x-2}{3x-2}\right) = \frac{1}{x^2} + 16\left(\frac{1}{3x-2}\right)$$

$$\frac{16x^2+3x-2}{3x-2} = 1 + 16x^2\left(\frac{1}{3x-2}\right)$$

$$\frac{16x^2+3x-2}{3x-2} = 1 + 16x^2\left[-\frac{1}{2} - \frac{3}{4}x - \frac{9}{8}x^2 - \frac{27}{16}x^3 + O(x^4)\right]$$

$$\frac{16x^2+3x-2}{3x-2} = 1 - 8x^2 - 12x^3 - 18x^4 - 27x^5 + O(x^6)$$

IYGB - MP2 PAPER R - QUESTION 10

a) STARTING FROM THE L.H.S

$$\text{LHS} = \sin 3\theta$$
$$= \sin(2\theta + \theta)$$
$$= \sin 2\theta \cos\theta + \cos 2\theta \sin\theta$$

sin(A+B) ≡ sinAcosB + cosAsinB

$$= (2\sin\theta\cos\theta)\cos\theta + (1 - 2\sin^2\theta)\sin\theta$$
$$= 2\sin\theta\cos^2\theta + \sin\theta + 2\sin^3\theta$$
$$= 2\sin\theta(1 - \sin^2\theta) + \sin\theta + 2\sin^3\theta$$
$$= 2\sin\theta - 2\sin^3\theta + \sin\theta + 2\sin^3\theta$$
$$= 3\sin\theta - 4\sin^3\theta$$
$$= \text{RHS}$$

AS REQUIRED

b) DIFFERENTIATING THE IDENTITY W.R.T θ

$$\frac{d}{d\theta}\left[\sin 3\theta\right] = \frac{d}{d\theta}\left[3\sin\theta - 4\sin^3\theta\right]$$

$$3\cos 3\theta = 3\cos\theta - 12\sin^2\theta \times \cos\theta$$

$\div 3$

$$\cos 3\theta = \cos\theta - 4\cos\theta\sin^2\theta$$
$$\cos 3\theta = \cos\theta - 4\cos\theta(1 - \cos^2\theta)$$
$$\cos 3\theta = \cos\theta - 4\cos\theta + 4\cos^3\theta$$
$$\cos 3\theta = 4\cos^3\theta - 3\cos\theta$$

AS REQUIRED

c) PROCEED AS FOLLOWS

$$\tan 3\theta = \frac{\sin 3\theta}{\cos 3\theta} = \frac{3\sin\theta - 4\sin^3\theta}{4\cos^3\theta - 3\cos\theta} = \frac{\frac{3\sin\theta}{\cos^3\theta} - \frac{4\sin^3\theta}{\cos^3\theta}}{\frac{4\cos^3\theta}{\cos^3\theta} - \frac{3\cos\theta}{\cos^3\theta}}$$

$$= \frac{\frac{3\sin\theta}{\cos\theta} \times \frac{1}{\cos^2\theta} - 4\tan^3\theta}{4 - \frac{3}{\cos^2\theta}} = \frac{3\tan\theta\sec^2\theta - 4\tan^3\theta}{4 - 3\sec^2\theta}$$

AS REQUIRED

IYGB - MP2 PAPER R - QUESTION 10

d) USING THE IDENTITY $1+\tan^2\theta \equiv \sec^2\theta$ WE HAVE

$$\tan 3\theta = \frac{3\tan\theta\sec^2\theta - 4\tan^3\theta}{4-3\sec^2\theta} = \frac{3\tan\theta(1+\tan^2\theta)-4\tan^3\theta}{4-3(1+\tan^2\theta)}$$

$$= \frac{3\tan\theta+3\tan^3\theta-4\tan^3\theta}{4-3-3\tan^2\theta} = \frac{3\tan\theta-\tan^3\theta}{1-3\tan^2\theta}$$

AS REQUIRED

IYGB - MP2 PAPER R - QUESTION 11

a) OBTAIN THE GRADIENT FUNCTION IN PARAMETRIC

- $\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{3\sin^2 t \cos t}{3\cos^2 t(-\sin t)} = -\frac{\cancel{3}\sin^{\cancel{2}} t \cancel{\cos t}}{\cancel{3}\cancel{\sin t}\cos^{\cancel{2}} t} = -\frac{\sin t}{\cos t}$
- $\left.\frac{dy}{dx}\right|_{t=\theta} = -\frac{\sin\theta}{\cos\theta}$

EQUATION OF NORMAL AT $(\cos^3\theta, \sin^3\theta)$ WITH GRADIENT $+\frac{\cos\theta}{\sin\theta}$

$$\Rightarrow y - y_0 = m(x - x_0)$$
$$\Rightarrow y - \sin^3\theta = \frac{\cos\theta}{\sin\theta}(x - \cos^3\theta)$$
$$\Rightarrow y\sin\theta - \sin^4\theta = x\cos\theta - \cos^4\theta$$
$$\Rightarrow \cos^4\theta - \sin^4\theta = x\cos\theta - y\sin\theta$$
$$\Rightarrow \underbrace{(\cos^2\theta - \sin^2\theta)}_{\cos 2\theta}\underbrace{(\cos^2\theta + \sin^2\theta)}_{1} = x\cos\theta - y\sin\theta$$
$$\Rightarrow x\cos\theta - y\sin\theta = \cos 2\theta$$

AS REQUIRED

b) WHEN $x=0$

$-y\sin\theta = \cos 2\theta$

$y = -\frac{\cos 2\theta}{\sin\theta}$

WHEN $y=0$

$x\cos\theta = \cos 2\theta$

$x = \frac{\cos 2\theta}{\cos\theta}$

AREA IS GIVEN BY

$$\frac{1}{2}\left|-\frac{\cos 2\theta}{\sin\theta} \times \frac{\cos 2\theta}{\cos\theta}\right| = \frac{\cos 2\theta \cos 2\theta}{2\sin\theta\cos\theta} = \frac{\cos 2\theta \cos 2\theta}{\sin 2\theta}$$

$$= \cot 2\theta \cos 2\theta$$