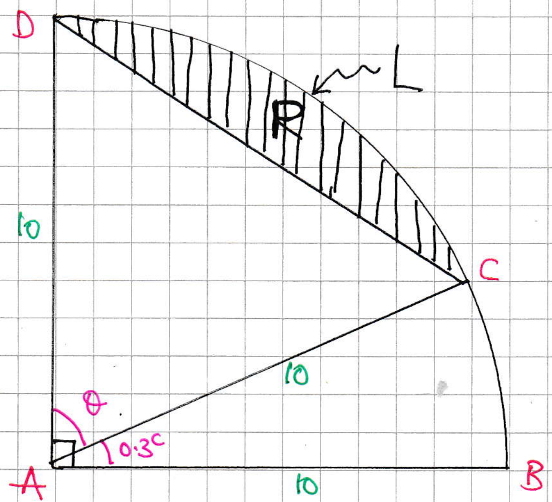
IYGB - MP2 PAPER P - QUESTION 1

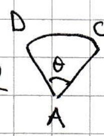
a) LOOKING AT THE PICTURE OPPOSITE



$\theta = \frac{\pi}{2} - 0.3^c$

$\theta = 1.2708^c...$

- AREA OF SECTOR "$=\frac{1}{2}r^2\theta^c$"



$= \frac{1}{2}\times 10^2 \times 1.2708...$

$= \underline{\underline{63.5398}}$

- AREA OF $\overset{\Delta}{ACD} = \frac{1}{2}|AD||AC|\sin\theta$

$= \frac{1}{2}\times 10\times 10\times \sin(1.2708...^c)$

$= \underline{\underline{47.7668...}}$

- AREA OF $R = 63.5398... - 47.7668...$

$\approx \underline{15.8 \text{ cm}^2}$

b) BY THE COSINE RULE ON $\overset{\Delta}{ACD}$

$|DC|^2 = |DA|^2 + |AC|^2 - 2|DA||AC|\cos\theta$

$|DC|^2 = 10^2 + 10^2 - 2\times 10\times 10\times \cos(1.2708...^c)$

$|DC|^2 = 200 - 200\cos(1.2708...^c)$

$|DC|^2 = 140.89666...$

$|DC| = 11.869...$

USING THE ARCLENGTH FORMULA

"$L = r\theta^c$"

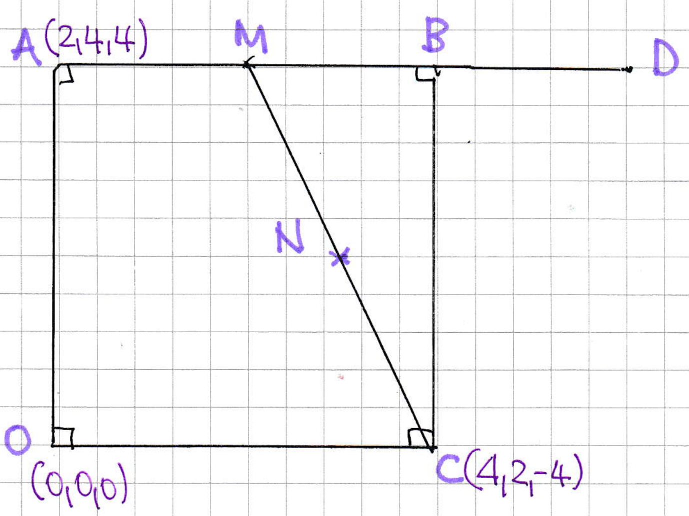
$L = 10\times 1.2708^c...$

$L = 12.708...$

HENCE THE PERIMETER OF R IS $11.869... + 12.708... \simeq \underline{24.6 \text{ cm}}$

IYGB – MP2 PAPER P – QUESTION 2

a) STARTING WITH A DIAGRAM FOR THE SQUARE



- $\overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB}$

$\overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{OC}$

$\overrightarrow{OB} = (2,4,4) + (4,2,-4)$

$\overrightarrow{OB} = (6,6,0)$

$\therefore \underline{b} = 6\underline{i} + 6\underline{j}$

- $\overrightarrow{OD} = \overrightarrow{OA} + \overrightarrow{AD}$

$\overrightarrow{OD} = \overrightarrow{OA} + \frac{3}{2}\overrightarrow{AB}$

$\overrightarrow{OD} = \overrightarrow{OA} + \frac{3}{2}\overrightarrow{OC}$

$\overrightarrow{OD} = (2,4,4) + \frac{3}{2}(4,2,-4)$

$\overrightarrow{OD} = (8,7,-2)$

$\therefore \underline{d} = 8\underline{i} + 7\underline{j} - 2\underline{k}$

- $\overrightarrow{ON} = \overrightarrow{OC} + \frac{1}{2}\overrightarrow{CM}$

$\overrightarrow{ON} = \overrightarrow{OC} + \frac{1}{2}\left[\overrightarrow{CO} + \overrightarrow{OA} + \frac{1}{2}\overrightarrow{AB}\right]$

$\overrightarrow{ON} = \overrightarrow{OC} + \frac{1}{2}\overrightarrow{CO} + \frac{1}{2}\overrightarrow{OA} + \frac{1}{4}\overrightarrow{AB}$

$\overrightarrow{ON} = (4,2,-4) + \frac{1}{2}(-4,-2,+4) + \frac{1}{2}(2,4,4) + \frac{1}{4}\overrightarrow{OC}$

$\overrightarrow{ON} = (4,2,-4) + (-2,-1,2) + (1,2,2) + \frac{1}{4}(4,2,-4)$

IYGB - MP2 PAPER P - QUESTION 2

$\overrightarrow{ON} = (3,3,0) + (1,\tfrac{1}{2},-1)$

$\overrightarrow{ON} = (4,\tfrac{7}{2},-1)$

$\therefore \quad \underline{n} = 4\underline{i} + \tfrac{7}{2}\underline{j} - \underline{k}$

b) COMPARING VECTORS FOUND EARLIER

$\overrightarrow{OD} = 8\underline{i} + 7\underline{j} - 2\underline{k}$

$\overrightarrow{OD} = 2(4\underline{i} + \tfrac{7}{2}\underline{j} - \underline{k})$

$\overrightarrow{OD} = 2\overrightarrow{ON}$

$\therefore$ O, N, D ARE COLLINEAR

IYGB - MP2 PAPER P - QUESTION 3

$$|2x+1| + 9 < 4x$$

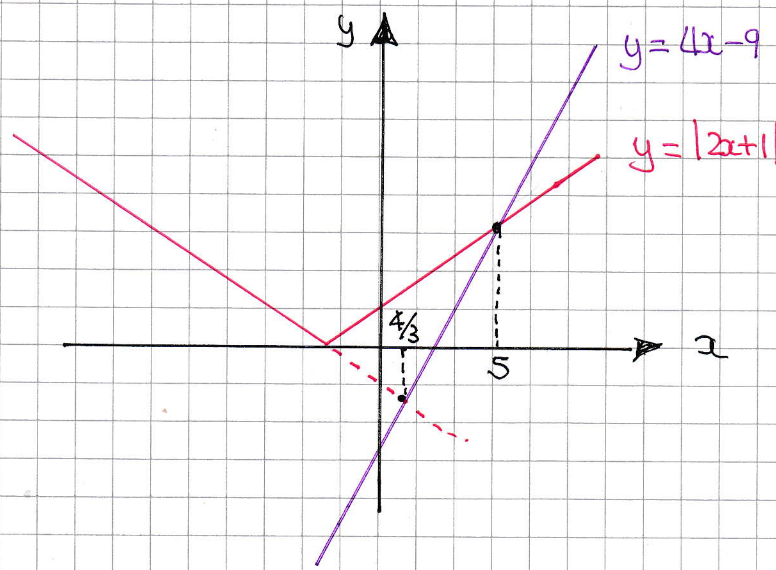
REWRITE AS

$$|2x+1| + 9 < 4x$$
$$|2x+1| < 4x - 9$$

SOLVE THE CORRESPONDING EQUATION TO FIND CRITICAL VALUES

$$2x+1 = 4x-9 \qquad\qquad 2x+1 = -4x+9$$
$$10 = 2x \qquad\qquad 6x = 8$$
$$x = 5 \qquad\qquad x = \frac{4}{3}$$

SKETCHING $y=|2x+1|$ & $y=4x-9$ IN THE SAME AXIS



FROM THE GRAPH WE OBTAIN $x>5$ (BY LOOKING AT $|2x+1|<4x-9$)

IYGB – MP2 PAPER P – QUESTION 4

a) FORMING THE DIFFERENTIAL EQUATION FROM THE INFORMATION GIVEN

$$\frac{dH}{dt} = +k(12 - H)$$

MAX HEIGHT
RATE
INCREASE
PROPORTIONAL
HEIGHT

H = height of tree (m)
t = time (months)
$H_{MAX} = 12$ m
$t=0$ $H=1$ $\left.\frac{dH}{dt}\right\vert_{t=0, H=1} = 0.1$

- APPLY CONDITION $\left.\frac{dH}{dt}\right|_{H=1} = 0.1$

$$0.1 = k(12-1)$$
$$k = \frac{1}{110}$$

- $\frac{dH}{dt} = \frac{1}{110}(12-H)$

$$110\frac{dH}{dt} = 12 - H$$

AS REQUIRED

b) SOLVING THE O.D.E. BY SEPARATING VARIABLES

$$\Rightarrow 110\, dH = (12-H)\, dt$$

$$\Rightarrow \frac{110}{12-H}\, dH = 1\, dt$$

$$\Rightarrow \int \frac{110}{12-H}\, dH = \int 1\, dt$$

$$\Rightarrow -110\ln|12-H| = t + C$$

$$\Rightarrow \ln|12-H| = -\frac{1}{110}t + C$$

$$\Rightarrow 12 - H = e^{-\frac{1}{110}t + C}$$

IYGB - MP2 PAPER P - QUESTION 4

$$\Rightarrow 12 - H = e^{-\frac{1}{110}t} \times e^{c}$$

$$\Rightarrow 12 - H = Ae^{-\frac{1}{110}t} \qquad (A = e^{c})$$

$$\Rightarrow H = 12 + Ae^{-\frac{1}{110}t}$$

APPLY THE CONDITION $t=0$ $H=1$

$$\Rightarrow 1 = 12 + A$$

$$\Rightarrow A = -11$$

$$\therefore H = 12 - 11e^{-\frac{1}{110}t}$$

c) WHEN $t=60$ (5 YEARS = 60 MONTHS)

$$\Rightarrow H = 12 - 11e^{-\frac{1}{110}\times 60}$$

$$\Rightarrow H = 12 - 11e^{-\frac{6}{11}}$$

$$\Rightarrow H \simeq 5.62\text{ m}$$

d) WHEN $H=11$

$$\Rightarrow 11 = 12 - 11e^{-\frac{1}{110}t}$$

$$\Rightarrow 11e^{-\frac{1}{110}t} = 1$$

$$\Rightarrow e^{-\frac{1}{110}t} = \frac{1}{11}$$

$$\Rightarrow e^{\frac{1}{110}t} = 11$$

$$\Rightarrow \frac{1}{110}t = \ln 11$$

$$\Rightarrow t = 110\ln 11 \approx 263.76\ldots\text{ months} \xrightarrow{\div 12} \approx 22\text{ YEARS}$$

IYGB - MP2 PAPER P - QUESTION 5

a) FORMING TWO EQUATIONS FROM THE INFORMATION GIVEN

- $S_2 = 40$

$\Rightarrow a + (a+d) = 40$

$\Rightarrow 2a + d = 40$

- $S_4 = 130$

$\Rightarrow a + (a+d) + (a+2d) + (a+3d) = 130$

$\Rightarrow 4a + 6d = 130$

$\Rightarrow 2a + 3d = 65$

SUBTRACTING

$$\begin{aligned} 2a + 3d &= 65 \\ 2a + d &= 40 \\ \hline 2d &= 25 \\ d &= 12.5 \end{aligned}$$

&

$$\begin{aligned} 2a + d &= 40 \\ 2a + 12.5 &= 40 \\ 2a &= 27.5 \\ a &= 13.75 \end{aligned}$$

$\therefore$ USING $S_n = \frac{n}{2}\left[2a + (n-1)d\right]$

$S_5 = \frac{5}{2}\left[2 \times 13.75 + 4 \times 12.5\right]$

$S_5 = 193.75$

b) REPEATING BUT FOR A GEOMETRIC PROGRESSION NOTING $S_n = \frac{a(r^n - 1)}{r-1}$

- $S_2 = 40$

$\Rightarrow a + ar = 40$

$\Rightarrow \underbrace{a(1+r) = 40}$

- $S_4 = 130$

$\Rightarrow \frac{a(r^4 - 1)}{r-1} = 130$

$\Rightarrow \frac{a(r^2-1)(r^2+1)}{r-1} = 130$

$\Rightarrow \frac{a(r+1)(r-1)(r^2+1)}{(r-1)} = 130$

AS $r - 1 \neq 0$ WE MAY CANCEL

$\Rightarrow a(r+1)(r^2+1) = 130$

$\Rightarrow 40(r^2+1) = 130$

IYGB - MP2 PAPER P - QUESTION 5

$\Rightarrow \quad r^2 + 1 = \frac{13}{4}$

$\Rightarrow \quad r^2 = \frac{9}{4}$

$\Rightarrow \quad r = \begin{cases} \frac{3}{2} \\ -\frac{3}{2} \end{cases}$

NOW IF $r = \frac{3}{2}$

$a = \frac{40}{1+r}$

$a = \frac{40}{1+\frac{3}{2}}$

$a = \frac{40}{2.5}$

$a = 16$

$S_5 = \frac{16(1.5^5 - 1)}{1.5 - 1}$

$S_5 = 211$

AND IF $r = -\frac{3}{2}$

$a = \frac{40}{1+r}$

$a = \frac{40}{1-\frac{3}{2}}$

$a = \frac{40}{-0.5}$

$a = -80$

$S_5 = \frac{-80((-1.5)^5 - 1)}{-1.5 - 1}$

$S_5 = -275$

IYGB – MP2 PAPER P – QUESTION 6

a) START BY DIFFERENTIATION

$$y = \frac{x+1}{x^3+2x+1} \implies \frac{dy}{dx} = \frac{(x^3+2x+1)\times 1 - (x+1)(3x^2+2)}{(x^3+2x+1)^2}$$

$$\implies \frac{dy}{dx} = \frac{x^3+\cancel{2x}+1-(3x^3+3x^2+\cancel{2x}+2)}{(x^3+2x+1)^2}$$

$$\implies \frac{dy}{dx} = \frac{-2x^3-3x^2-1}{(x^3+2x+1)^2}$$

SOLVING FOR ZERO TO SEARCH FOR STATIONARY POINTS

$$\implies -2x^3-3x^2-1=0$$

$$\implies -3x^2-1=2x^3$$

$$\implies -\frac{3x^2+1}{2x^2}=x$$

AS REQUIRED

b) USING THE ABOVE FORMULA AS A RECURRENCE RELATION

$$x_{n+1} = -\frac{3x_n^2+1}{2x_n^2}, \quad x_1 = -1.7$$

$x_2 = -1.67301\ldots$

$x_3 = -1.67864\ldots$

$x_4 = -1.67744\ldots$

$x_5 = -1.67769$

$x_6 = -1.67764$

$x_7 = -1.67765$

IYGB - MP2 PAPER P - QUESTION 6

NOW USING $x_7 = -1.67765...$ WE OBTAIN

$$y = \frac{x_7+1}{(x_7)^3+2x_7+1} = 0.095753...$$

$\therefore$ $M(-1.678, 0.096)$ 3 d.p

c) AS CONVERGENCE TAKES PLACE BY OSCILLATIONS, WE HAVE A "COBWEB" TYPE DIAGRAM

IYGB - MP2 PAPER P - QUESTION 7

$$f(x) = \frac{e^{\sqrt[4]{x}}}{\sqrt{x}}, \quad x > 0$$

USING THE SUBSTITUTION GIVEN WE HAVE

$$u = \sqrt[4]{x} = x^{\frac{1}{4}}$$
$$u^2 = \sqrt{x} = x^{\frac{1}{2}}$$
$$u^4 = x$$

$$\frac{dx}{du} = 4u^3$$

&

$x = 0 \longmapsto 0$

$x = 1 \longmapsto 1$

TRANSFORMING THE INTEGRAL WE HAVE

$$\int_0^1 \frac{e^{\sqrt[4]{x}}}{\sqrt{x}}\,dx = \int_0^1 \frac{e^u}{u^2}(4u^3) = \int_0^1 4ue^u\,du$$

INTEGRATION BY PARTS FOLLOWS (IGNORING LIMITS)

$4u$	4
e^u	e^u

$$\Rightarrow \int 4ue^u\,du = 4ue^u - \int 4e^u\,du$$
$$= 4ue^u - 4e^u + C$$
$$= 4e^u(u-1) + C$$

INSERTING THE LIMITS AND EVALUATING

$$\int_0^1 4ue^u\,du = \left[4e^u(u-1)\right]_0^1 = \cancel{4e^1(1-1)} - 4e^0(0-1)$$
$$= 4$$

IYGB – MP2 PAPER P – QUESTION 8

a) CREATE A "ONE" AND "EXPAND"

$$\left(\tfrac{1}{4}-x\right)^{-\frac{3}{2}} = \left(\tfrac{1}{4}\right)^{-\frac{3}{2}}(1-4x)^{-\frac{3}{2}} = 4^{\frac{3}{2}}(1-4x)^{-\frac{3}{2}}$$

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

$$= 8\left[1 + \frac{-\frac{3}{2}}{1!}(-4x)^1 + \frac{-\frac{3}{2}\left(-\frac{5}{2}\right)}{2!}(-4x)^2 + \frac{\left(-\frac{3}{2}\right)\left(-\frac{5}{2}\right)\left(-\frac{7}{2}\right)}{3!}(-4x)^3 + \ldots\right]$$

$$= 8\left[1 + 6x + 30x^2 + 140x^3 + \ldots\right]$$

$$= \underline{\underline{8 + 48x + 240x^2 + 1120x^3 + \ldots}}$$

b) PROCEED AS FOLLOWS

$$\sqrt{\tfrac{1}{4}-x} = \left(\tfrac{1}{4}-x\right)^{\frac{1}{2}} = \left(\tfrac{1}{4}-x\right)^2\left(\tfrac{1}{4}-x\right)^{-\frac{3}{2}}$$

$$= \left(\tfrac{1}{16}-\tfrac{1}{2}x+x^2\right)\left(8+48x+240x^2+1120x^3+\ldots\right)$$

$$\begin{aligned} = \tfrac{1}{2} &+ 3x + 15x^2 + 70x^3 + \ldots \\ &- 4x - 24x^2 - 120x^3 + \ldots \\ &\qquad\quad\;\; 8x^2 + 48x^3 + \ldots \end{aligned}$$

$$= \underline{\underline{\tfrac{1}{2} - x - x^2 - 2x^3 + \ldots}}$$

IYGB - MP2 PAPER P - QUESTION 9

START BY RELATING DERIVATIVES

$$\Rightarrow \frac{dh}{dt} = \frac{dh}{dV} \times \frac{dV}{dt}$$

$$\Rightarrow \frac{dh}{dt} = \frac{dh}{dV} \times 5$$

WE NEED TO DIFFERENTIATE A FORMULA WHICH CONNECT h & V

$$\Rightarrow V = -2 + (2h^3+3h+8)^{\frac{1}{2}}$$

$$\Rightarrow \frac{dV}{dh} = 0 + \tfrac{1}{2}(2h^3+3h+8)^{-\frac{1}{2}} \times (6h^2+3)$$

$$\Rightarrow \frac{dV}{dh} = \frac{6h^2+3}{2(2h^3+3h+8)^{\frac{1}{2}}}$$

$$\Rightarrow \frac{dh}{dV} = \frac{2(2h^3+3h+8)^{\frac{1}{2}}}{6h^2+3}$$

RETURNING TO THE "MAIN LINE"

$$\Rightarrow \frac{dh}{dt} = \frac{2(2h^3+3h+8)^{\frac{1}{2}}}{6h^2+3} \times 5$$

$$\Rightarrow \left.\frac{dh}{dt}\right|_{h=11} = \frac{10(2\times11^3+3\times11+8)^{\frac{1}{2}}}{6\times11^2+3}$$

$$\Rightarrow \left.\frac{dh}{dt}\right|_{h=11} = 0.713173988\ldots \simeq 0.713 \text{ cm s}^{-1}$$

IYGB - MP2 PAPER P - QUESTION 10

START BY REARRANGING THE RELATIONSHIP

$$\Rightarrow \tan 3y = 3\tan x$$

$$\Rightarrow 3y = \arctan(3\tan x) \pm n\pi \qquad n = 0,1,2,3,\ldots$$

$$\Rightarrow y = \frac{1}{3}\arctan(3\tan x) \pm \frac{n\pi}{3}$$

USING THE GIVEN RESULT $\frac{d}{dx}(\arctan x) = \frac{1}{x^2+1}$ WE OBTAIN

$$\Rightarrow \frac{dy}{dx} = \frac{1}{3} \times \frac{1}{(3\tan x)^2+1} \times \frac{d}{dx}(3\tan x)$$

$$\Rightarrow \frac{dy}{dx} = \cancel{\frac{1}{3}} \times \frac{1}{9\tan^2 x+1} \times \cancel{3}\sec^2 x$$

$$\Rightarrow \frac{dy}{dx} = \frac{\sec^2 x}{9\tan^2 x+1}$$

$$\Rightarrow \frac{dy}{dx} = \frac{\frac{1}{\cos^2 x}}{\frac{9\sin^2 x}{\cos^2 x}+1}$$

MULTIPLY "TOP & BOTTOM" OF THE FRACTION BY $\cos^2 x$

$$\Rightarrow \frac{dy}{dx} = \frac{1}{9\sin^2 x+\cos^2 x}$$

$$\Rightarrow \frac{dy}{dx} = \frac{1}{8\sin^2 x+(\sin^2 x+\cos^2 x)}$$

$$= \frac{1}{8\sin^2 x+1}$$

// AS REQUIRED

IYGB - MP2 PAPER P - QUESTION 10

ALTERNATIVE BY IMPLICIT DIFFERENTIATION

$$\Rightarrow \tan 3y = 3\tan x$$

$$\Rightarrow \frac{d}{dx}(\tan 3y) = \frac{d}{dx}(3\tan x)$$

$$\Rightarrow \cancel{3}\sec^2 3y \frac{dy}{dx} = \cancel{3}\sec^2 x$$

$$\Rightarrow \frac{dy}{dx} = \frac{\sec^2 x}{\sec^2 3y}$$

ELIMINATE y IN THE R.H.S BY USING $1+\tan^2 3y \equiv \sec^2$

$$\Rightarrow \frac{dy}{dx} = \frac{\sec^2 x}{1+\tan^2 3y}$$

$$\Rightarrow \frac{dy}{dx} = \frac{\sec^2 x}{1+(3\tan x)^2}$$

& THE SOLUTION MERGES WITH THE METHOD PREVIOUSLY USED ...

$+\ -$

IYGB – MP2 PAPER P – QUESTION 11

STARTING FROM THE SECOND EQUATION

$$\Rightarrow \tan\theta + \tan\phi = 3$$

$$\Rightarrow \frac{\sin\theta}{\cos\theta} + \frac{\sin\phi}{\cos\phi} = 3$$

$$\Rightarrow \frac{\sin\theta\cos\phi + \sin\phi\cos\theta}{\cos\theta\cos\phi} = 3$$

$$\Rightarrow \sin\theta\cos\phi + \sin\phi\cos\theta = 3\cos\theta\cos\phi$$

$$\Rightarrow \sin(\theta+\phi) = 3\cos\theta\cos\phi$$

NOW THE FIRST EQUATION SIMPLIFIES

$$\Rightarrow \sin^2 x + 2\sin x + \cancel{\sin(\theta+\phi)} = \cancel{3\cos\theta\cos\phi} - 1$$

$$\Rightarrow \sin^2 x + 2\sin x = -1$$

$$\Rightarrow \sin^2 x + 2\sin x + 1 = 0$$

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

$$\Rightarrow \sin x = -1$$

AS REQUIRED

IYGB – MP2 PAPER P – QUESTION 12

a) WE START WITH THE DOMAIN OF $f(g(x))$

$x \leqslant 10 \xrightarrow{\text{IN}} \boxed{g(x)} \xrightarrow{\text{OUT}} x-6 \qquad x \geqslant 1 \xrightarrow{\text{IN}} \boxed{f(x)} \xrightarrow{\text{OUT}}$

THE DOMAIN MUST SATISFY

$x \leqslant 10$ **AND** $x-6 \geqslant 1$

$x \geqslant 7$

COMBINING WE OBTAIN

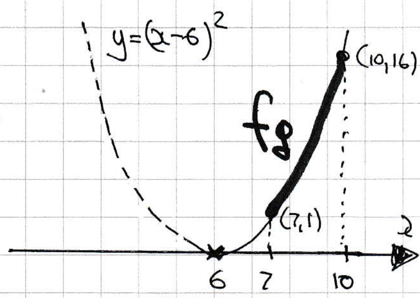
$$7 \leqslant x \leqslant 10$$

TO FIND THE RANGE

$$f(g(x)) = f(x-6) = (x-6)^2$$

SKETCHING NOTING THE DOMAIN

$\therefore \quad 1 \leqslant f(g(x)) \leqslant 16$



b) SOLVING THE EQUATION

$\Rightarrow f(g(x)) = g^{-1}(x)$

$g(x) = x-6$
$y = x-6$
$y+6 = x$
$g^{-1}(x) = x+6$

$\Rightarrow (x-6)^2 = x+6$

$\Rightarrow x^2 - 12x + 36 = x+6$

IYGB – MP2 PAPER P – QUESTION 12

$\Longrightarrow \quad x^2 - 13x + 30 = 0$

$\Longrightarrow \quad (x-10)(x-3) = 0$

$\Longrightarrow \quad x = \begin{cases} 3 \\ 10 \end{cases}$

LOOKING AT THE DOMAIN OF $f(g(x))$

ONLY SOLUTION IS $x = 10$ AS $7 \leq x \leq 10$.

NOW LOOKING AT $g(x)$ & ITS INVERSE

	$g(x)$	$g^{-1}(x)$
DOMAIN	$x \leq 10$	$x \leq 4$
RANGE	$g(x) \leq 4$	$g^{-1}(x) \leq 10$

$\therefore$ DOMAIN OF $g^{-1}(x) \leq 4$

$\therefore \quad x \neq 10$

$\therefore$ NO SOLUTIONS

IYGB - MP2 PAPER P - QUESTION 13

a) OBTAIN THE GRADIENT FUNCTION IN PARAMETRIC

$$\frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta} = \frac{2\cos 2\theta + \sin\theta}{-\sin\theta}$$

$$\left.\frac{dy}{dx}\right|_{\theta=\frac{\pi}{4}} = \frac{2\cos\pi/2 + \sin\pi/4}{-\sin\pi/4} = \frac{0+\frac{\sqrt{2}}{2}}{-\frac{\sqrt{2}}{2}} = -1$$

WITH $\theta = \frac{\pi}{4}$

- $x = \cos\frac{\pi}{4} = \frac{\sqrt{2}}{2}$
- $y = \sin\frac{\pi}{2} - \cos\frac{\pi}{4} = 1 - \frac{\sqrt{2}}{2}$

$\Big\}$ IE $\left(\frac{\sqrt{2}}{2}, 1-\frac{\sqrt{2}}{2}\right)$

FINALLY WE HAVE

$$y - y_0 = m(x - x_0)$$
$$y - \left(1 - \frac{\sqrt{2}}{2}\right) = -1\left(x - \frac{\sqrt{2}}{2}\right)$$
$$y - 1 + \cancel{\frac{\sqrt{2}}{2}} = -x + \cancel{\frac{\sqrt{2}}{2}}$$
$$y + x = 1$$

b) NOW AT $\theta = \frac{5\pi}{4}$

- $\left.\frac{dy}{dx}\right|_{\theta=\frac{5\pi}{4}} = \frac{2\cos\frac{5\pi}{2} + \sin\frac{5\pi}{4}}{-\sin\frac{5\pi}{4}} = \frac{0 - \frac{\sqrt{2}}{2}}{\frac{\sqrt{2}}{2}} = -1$

- $x = \cos\frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$
- $y = \sin\frac{5\pi}{2} - \cos\frac{5\pi}{4} = 1 + \frac{\sqrt{2}}{2}$

$\Big\}$ I.E. $\left(-\frac{\sqrt{2}}{2}, 1+\frac{\sqrt{2}}{2}\right)$

FORMING TANGENT EQUATION AT POINT WITH $\theta = \frac{5\pi}{4}$

$$y - y_0 = m(x - x_0)$$
$$y - \left(1 + \frac{\sqrt{2}}{2}\right) = -1\left(x + \frac{\sqrt{2}}{2}\right)$$
$$y - 1 - \cancel{\frac{\sqrt{2}}{2}} = -x - \cancel{\frac{\sqrt{2}}{2}}$$
$$y + x = 1$$

SAME LINE

IYGB - MP2 PAPER P - QUESTION 13

c) WE ELIMINATE BY MANIPULATING THE "y EQUATION"

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

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

$$\Rightarrow y = (2\sin\theta - 1)\cos\theta$$

$$\Rightarrow \frac{y}{\cos\theta} = 2\sin\theta - 1$$

$$\Rightarrow \frac{y}{\cos\theta} + 1 = 2\sin\theta$$

$$\Rightarrow \frac{y}{x} + 1 = 2\sin\theta$$

$$\Rightarrow \frac{y+x}{x} = 2\sin\theta$$

$$\Rightarrow \frac{(y+x)^2}{x^2} = 4\sin^2\theta$$

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

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

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

AS REQUIRED