SC1069684

Candidate Name **Script 3, Paper 32** .... Centre No. ..... Candidate No. .....

Subject Mathematics Paper Pure 32

Read the instructions on the front page of your question paper. Write on both sides of this paper.

On the first sheet used, write the number of each question attempted:	1	2	3	4	5	6	7	8	9	10	TOTAL MARKS

Quest Nos.	MARKS

Q1

$h = \frac{\frac{1}{2}\pi - 0}{3} = \frac{1}{6}\pi$

0 $\frac{1}{6}\pi$ $\frac{2}{6}\pi$ $\frac{3}{6}\pi$

$y = \ln(1+\sin x)$

x	0	$\frac{1}{6}\pi$	$\frac{1}{3}\pi$	$\frac{1}{2}\pi$
y	0	$\ln \frac{3}{2}$	$\ln\left(\frac{2+\sqrt{3}}{2}\right)$	$\ln(3)$

$$\int_0^{\frac{1}{2}\pi} \ln(1+\sin x) = \left(\frac{1}{6}\pi\right)\left(\frac{1}{2}\right)\left\{0 + 2\left(\ln\frac{3}{2} + \ln\left(\frac{2+\sqrt{3}}{2}\right)\right) + \ln 3\right\}$$

$$= \frac{1}{12}\pi\,(3.157) = 0.83$$

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Q2 $u = 4^x$

$4^x + 4^2 = 4^{x+2}$

$u + 16 = u * 16$

$16 = 16u - u$

$16 = 15u$

$16/15 = u.$

$4^x = 16/15$

$x = \log_4 16/15$

$x = 0.0466$

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Q3. $y = \cos x \cos 2x$.

$\frac{dy}{dx}$ $u = \cos x$ $v = \cos 2x$

$\frac{dy}{dx} = -\sin x$ $dv = -2\sin 2x$

$u\,dv + v\,du$

$= -2\cos x \sin 2x - \cos 2x \sin x$.

let $2x = u$ $= -2\cos x \sin u - \cos u \sin x$

$= -2\cos x (2\sin x \cos x) - (1 - 2\sin^2 x)(\sin x)$

$= -4\cos^2 x \sin x - \sin x + 2\sin^3 x$.

$= -4(1 - \sin^2 x)\sin x - \sin x + 2\sin^3 x$.

$= -4(\sin x - \sin^3 x) - \sin x + 2\sin^3 x$

$= -4\sin x + 4\sin^3 x - \sin x + 2\sin^3 x$.

$6\sin^3 x - 5\sin x = 0$.

$\sin x \ (6\sin^2 x - 5) = 0$

$\sin x = 0$ $6\sin^2 x = 5$

$x = 0$ $\sin^2 x = 5/6$

$\sin x = \sqrt{5/6}$

$x = 1.15$

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Q4 $3\sin\theta + 2\cos\theta \Rightarrow R\sin(\theta + \alpha)$

$R\sin\theta\cos\alpha + R\cos\theta\sin\alpha.$

$R\sin\theta\cos\alpha = 3\sin\theta$ $+ R\cos\theta\sin\alpha = 2$

$R\cos\alpha = 3$ $R\sin\alpha = 2$

$\tan\alpha = 2/3$

$\alpha = 33.69^\circ$

$R = \sqrt{2^2 + 3^2}$

$= \sqrt{13}$

$\sqrt{13}\sin(\theta + 33.69)$

ii $\sqrt{13}\sin(\theta + 33.69) = 1$

$\sin(\theta + 33.69) = \frac{1}{\sqrt{13}}$

$\theta + 33.69 = 16.1$ $180 - 16.1 = 163.9$

$\theta = -17.59.$ $\theta + 33.69 = 163.9$

$\theta = 130.21$

$\theta = 130.21$

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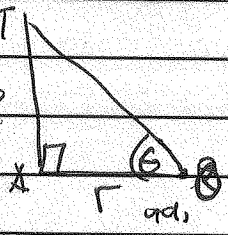
Q5



$AT = r\tan\theta = BT \quad \theta = x.$

$= r\tan x$

Arc $AB = r\theta = r2x = 2rx.$

Circumference $= 2\pi r$

$2\pi r = 2rx + 2r\tan x.$

$\pi = x + \tan x$

$\pi - x = \tan x.$

ii $\tan x + x - \pi =$

$\tan(1) + (1) - \pi = -0.584$

$\tan(1.3) + (1.3) - \pi = 1.760$

← Change in direction hence root lies between $x=1$ and $x=1.3$

iii $x_0 = 1.2.$

$x_1 = \tan^{-1}(\pi - 1.2) = 1.0951$

$x_2 = 1.1163$

$x_3 = 1.1122$

$x_4 = 1.1130$ $\quad x = 1.11$

$x_5 = 1.1128$

$x_6 = 1.1128$

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Q6 $\frac{\sqrt{x}}{2-\sqrt{x}}$ $u = 2-\sqrt{x}$ $x=0$ $x=1$ Do not write in this margin

$-\sqrt{x} = (u-2)\cdot -1$ $u=2$ $u=1$

$x = (u-2)^2$

$\frac{dx}{du} = 2(u-2)^1$

$dx = 2(u-2)\,du$.

$\int_1^2 \frac{(2-u)}{u} \times 2(2-u)\,du$.

$\int_1^2 \frac{2(2-u)^2}{u}\,du$. $2(2-u)^2 = 2(4-4u+u^2)$

$= 8-8u+2u^2$.

$\frac{2(2-u)^2}{u} = 8 + \frac{2u-8}{u}$.

$= 8 - 8 + \frac{2}{u}$.

$2u-8$

$u \overline{)\ 2u^2 - 8u + 8}$

$2u^2$

$-8u+8$

$-8u-8$

8.

2

$u \overline{)\ 2u - 8}$.

$2u$

-8.

$2\int \frac{(2-u)^2}{u}\,du$. $dv = 1/u$ $v = \ln u$. $u = (2-u)^2$

$du = 2(2-u)$

$uv - \int v\,du$.

$= (2-u)^2 \ln u - \int 2\ln u\,(2-u)$

$u = \ln u$ $dv = 2-u$

$du = 1/u$ $v = 2u - \frac{1}{2}u^2$

$2\left[(2-u)^2\ln u - (2u-\tfrac{1}{2}u^2)\ln u + \int 2 - \tfrac{1}{2}u\,du\right]_1^2$

$2\left[(2-u)^2\ln u - (2u-\tfrac{1}{2}u^2)\ln u + 2u - \tfrac{1}{4}u^2\right]_1^2$

$\left((0)^2\ln 2 - 2(2)+\tfrac{1}{2}(2)^2\ln 2 - 2(2) - \tfrac{1}{4}2^2\right) - \left(0 - 2 + \tfrac{1}{2}\ln 2 - 2 - \tfrac{1}{4}\right) = 2(\tfrac{1}{2}\ln 2) - 5 = 8\ln 2 - 5$

Turn over

Quest Nos.

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$$\int_1^2 \left[(2-u)^2 \ln u - \left(2u - \tfrac{1}{2}u^2\right)\ln u + 2u - \tfrac{1}{4}u^2\right]_1^2$$

$$2\left[\left(0 - \left(2(2) - \tfrac{1}{2}(2)^2\right)\ln 2 + 2(2) - \tfrac{1}{4}(2)^2\right] -\right.$$

$$\left. - \left((2-1)^2 \ln 1 - \left(2(1) - \tfrac{1}{2}(1)^2\right)\ln 1 + 2(1) - \tfrac{1}{4}(1)^2\right]\right.$$

$$= 2\left[(-2\ln 2 + 4 - 1) - (0 - 0 + 2 - \tfrac{1}{4})\right.$$

$$= \underline{8\ln 2 - 5}$$

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Q7 $u = -1 + 4\sqrt{3}i \qquad u = -1 - 4\sqrt{3}i$

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$(u+1-4\sqrt{3}i)(u+1+4\sqrt{3}i)$ ✓

$u^2 + u + 4u\sqrt{3}i + u + 1 + 4\sqrt{3}i - 4u\sqrt{3}i - 4\sqrt{3}i - (4\sqrt{3}i)^2$

$u^2 + 2u + 1 - 48i^2.$

$= u^2 + 2u + 49$

$\frac{-2 \pm \sqrt{2^2 - 4(1)(49)}}{2} = \frac{-2 \pm \sqrt{4(1-49)}}{2}$

$= -2 \pm 2.$

$\sqrt{u} = \sqrt{-1 + 4\sqrt{3}i}$

$= 2i$ ✓

(10)

Quest Nos.

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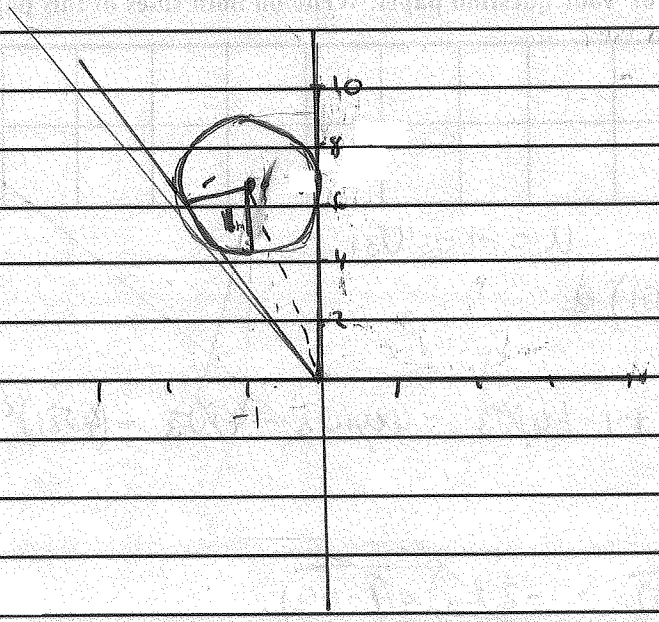
Q7ii $|z-(-1+4\sqrt{3}i)|=1$

Centre $(-1, 4\sqrt{3})$ radius $=1$ $6.93 = 4\sqrt{3}$



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Q8

$5x^2+x+6 = A(x^2+4) + B(3-2x)(Bx+C)(3-2x)$

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$x = 3/2$.

$5(3/2)^2+(3/2)+6 = A((3/2)^2+4)$

$\frac{75}{4} = \frac{25}{4}A$

$3 = A$

Coefficient of x^2

$5 = A - 2B$

$5 = 3 - 2B$

$2 = -2B$

$-1 = B$

Coefficient of x

$1 = +3B - 2C$

$1 = 3(-1) - 2C$

$1 = -3 - 2C$

$4 = -2C$

$-2 = C$

$\frac{5x^2+x+6}{(3-2x)(x^2+4)} = \frac{3}{(3-2x)} + \left(\frac{x+2}{x^2+4}\right)$

$\frac{5x^2+x+6}{(3-2x)(x^2+4)} = \frac{3}{(3-2x)} + \left(\frac{x+2}{x^2+4}\right)$

Quest Nos.

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ii

$3(3-2x)^{-1} - (x+2)(x^2+4)$

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

$= \frac{1}{3}\left(1 + \frac{2}{3}x + \frac{4}{9}x^2\right)$

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

$= \frac{1}{4} - \frac{1}{16}x^2$

$\left(1 + \frac{2}{3}x + \frac{4}{9}x^2\right)\frac{1}{3} - (x+2)\left(\frac{1}{4}\frac{1}{3} - \frac{1}{16}x^2\right)$

$1 + \frac{2}{3}x + \frac{4}{9}x^2 - \left(\frac{1}{4}x + \frac{1}{2} - \frac{1}{8}x^2\right)$

$1 + \frac{2}{3}x + \frac{4}{9}x^2 - \frac{1}{4}x \frac{1}{3} - \frac{1}{2} + \frac{1}{8}x^2$

$= \frac{1}{2} + \frac{5}{12}x + \frac{41}{72}x^2$

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Q4i

$$\frac{1}{x}\,dx = \frac{e^{-t}}{k+e^{-t}}\,dt$$

$$k + \frac{1}{e^t} = \frac{e^t k + 1}{e^t} \qquad \frac{\frac{1}{e^t}}{\frac{e^t k+1}{e^t}} = \frac{1}{e^t k+1}$$

$$\frac{1}{x}\,dx = \frac{1}{e^t k+1}\,dt$$

$$\ln x = k e^t \ln(e^t k+1) + C.$$

$$\ln 10 = k \ln|k+1| = c. \qquad \ln x = k e^t \ln(e^2 k+1) - k \ln|k+1| + \ln 10$$

$$\ln 10 - k \ln|k+1) = c$$

ii $\ln 20 = k e \ln(ke+1) - k \ln|k+1| + \ln 10$

$\ln 2^{1/k} =$

$2 =$ $\qquad k = 1 - 2e^{-1}$

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Quest Nos.

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$$\ln x = \frac{1}{(et-2)}\left(1-2e^{-t}\right)e^{t}\ln\left(e^{t}(k+1)\right) - \left(1-2e^{-t}\right)\ln(k+1) - \ln 10$$

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Q10 i $AB = AO + OB$

$$\begin{pmatrix}-2\\1\\-3\end{pmatrix} + \begin{pmatrix}1\\1\\5\end{pmatrix} = \begin{pmatrix}-1\\2\\2\end{pmatrix} \qquad L = \begin{pmatrix}2\\-1\\3\end{pmatrix} + \lambda\begin{pmatrix}-1\\2\\2\end{pmatrix}$$

$$L = \begin{pmatrix}2-\lambda\\-1+2\lambda\\3+2\lambda\end{pmatrix} \qquad r = \begin{pmatrix}1+3\mu\\1+\mu\\2-\mu\end{pmatrix}$$

$2-\lambda = 1+3\mu$

$-1+2\lambda = 1+\mu$

$3+2\lambda = 2-\mu$

$-1+2\lambda = 1+\mu$

$3+2\lambda = 2-\mu$

$-4 = -1+2\mu$

$-3 = 2\mu$

$-3/2 = \mu$

$\lambda = 1/4$

$2-(1/4) = 1+3(-3/2)$

$7/4 \neq -7/2$

not equal hence do not intersect.

ii $OA \begin{pmatrix}2\\-1\\3\end{pmatrix}$ $L = \begin{pmatrix}2\\-1\\3\end{pmatrix} + \lambda\begin{pmatrix}-1\\2\\2\end{pmatrix}$ or $L = \begin{pmatrix}1\\1\\5\end{pmatrix} + \lambda\begin{pmatrix}-1\\2\\2\end{pmatrix}$

1. $2a - b + 3c = d$
2. $3a + 2b + 2c = d$
3. $a + b + 2c = d$

Let $c = 1$

2. + 3.

$-a + 2b + 2 = d$

$+a + b + 2 = d$

$3b + 4 = 0$

$3b = -4$

$b = -4/3$ $a = 2/3$.

Quest Nos.

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ii

$2a - b + 3c = d$

$2a - b + 3 = d$

$a + b + 5 = d$

$3a + 8 = d$

$a = -8/3$

$b = 23/3.$

$a + b + 5c = d$ let $c = 1$

$a + b + 5 = d$

$3b + 7 = d$

$b = 7/3.$

$\frac{23}{3}x + 2$

$-\frac{8}{3}x - \frac{23}{3}y + z = d.$

$-8x - 23y + 3z =$

$8x + 23y + 3z = 32.$