Question 1

Candidate 1

1.

$$y = 7x \tan 2x$$

$$\frac{dy}{dx} = 7\tan 2x + 7x\left(2\sec^2 2x\right)$$

$$\frac{dy}{dx} = 7\tan 2x + 14x\sec^2 2x$$

Candidate 2

$\cos 2x = 2\cos 2x \sin 2x$

$u'v + uv'$

QUESTION NUMBER

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1.

$$y = 7x\tan 2x$$

$u = 7x \quad u' = 7$

$v = \tan 2x$

$\cancel{v' = 2\tan 2x \sec^2 x}$

$v' = 2\tan 2x \sec^2 2x$

$$\cancel{\frac{dy}{dx} = 7\tan 2x + 7x(2\tan 2x}$$

$$\frac{dy}{dx} = 7\tan 2x + 7x\left(2\tan 2x \sec^2 2x\right)$$

$$= 7\tan 2x + 14x\tan 2x \sec^2 2x$$

$$= 7\tan 2x\left(1 + 2x\sec^2 2x\right)$$

Candidate 3

1. $y = 2x \tan 2x$

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

Question 3

Candidate 4

QUESTION NUMBER

3.

$$\left[\begin{array}{ccc|c} 1 & -3 & 1 & -1 \\ 3 & -2 & 4 & 11 \\ 1 & 4 & 2 & 15 \end{array}\right] \xrightarrow[R_3 - R_1]{R_2 - 3R_1} \left[\begin{array}{ccc|c} 1 & -3 & 1 & -1 \\ 0 & 7 & 1 & 14 \\ 0 & 7 & 1 & 16 \end{array}\right] \xrightarrow{R_3 - R_2} \left[\begin{array}{ccc|c} 1 & -3 & 1 & -1 \\ 0 & 7 & 1 & 14 \\ 0 & 0 & 0 & 2 \end{array}\right]$$

$\therefore$ the system is ~~redondant~~ ~~inconsistant~~ inconsistant as $0 \neq 2$

Candidate 5

redundancy 0 0 0 ¦ 0 inconsistency 0 0 50 ¦ 0

QUESTION NUMBER

3.

$$\left(\begin{array}{ccc|c} 1 & -3 & 1 & -1 \\ 3 & -2 & 4 & 4 \\ 1 & 4 & 2 & 15 \end{array}\right)$$

$R_2 - 3R_1 = 3 - 3(1) = 0$
$-2 - 3(-3) = 4$
$4 - 3(1) = 1$
$11 - 3(-1) = 14$

$R_3 - R_1 = 1 - 1 = 0$
$4 - (-3) = 7$
$2 - 1 = 1$
$15 - -1 = 16.$

$16 \times 4 = 64$ $14 \times 7 = 98$ $98 - 64 = 34$ $14 \times 3 = 42$ $\frac{4}{3} \times \frac{1}{4}$

$\cancel{\begin{pmatrix} 1 & -3 & 1 & -1 \\ 3 & -2 & 4 & 4 \end{pmatrix}}$

$$\begin{pmatrix} 1 & -3 & 1 & -1 \\ 0 & 4 & 1 & 14 \\ 0 & 7 & 1 & 16 \end{pmatrix} \quad 4R_3 - 7R_2$$

$4(7) - 7(4) = 0$
$4(1) - 7(1) = -3$
$4(16) - 7(14) = 64 - 98$
$= -34.$

$$= \begin{pmatrix} 1 & -3 & 1 & -1 \\ 0 & 4 & 1 & 14 \\ 0 & 0 & -3 & -34 \end{pmatrix}$$

results in a <u>unique</u> solution.

$z = \frac{34}{3}$

$4y + z = 14$
$4y + \frac{34}{3} = 14$
$4y = \frac{42}{3} - \frac{34}{3}$
$4y = \frac{8}{3}$
$y = \frac{8}{12}, \quad \frac{2}{3}$

$x - 3y + \frac{34}{3} = -1$
$x - 3(\frac{2}{3}) + \frac{34}{3} = -\frac{3}{3}$
$x = -\frac{3}{3} - \frac{34}{3} + \frac{6}{3}$
$x = -\frac{31}{3}$

$z = \frac{34}{3}$
$y = \frac{2}{3}$
$x = -\frac{31}{3}.$

Candidate 6

3.

$$\left(\begin{array}{ccc|c} 1 & -3 & 1 & -1 \\ 3 & -2 & 4 & 11 \\ 1 & 4 & 2 & 15 \end{array}\right)$$

$$\begin{array}{l} \\ 3R_1 - R_2 \\ R_1 - R_3 \end{array}\left(\begin{array}{ccc|c} 1 & -3 & 1 & -1 \\ 0 & -7 & -1 & -14 \\ 0 & -7 & -1 & -16 \end{array}\right)$$

$$\begin{array}{l} \\ \\ R_2 - R_3 \end{array}\left(\begin{array}{ccc|c} 1 & -3 & 1 & -1 \\ 0 & -7 & -1 & -14 \\ 0 & 0 & 0 & 2 \end{array}\right)$$

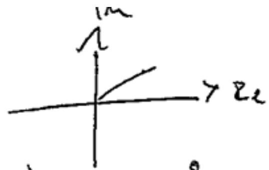
This system shows redurcy as the whole of the bottom line ~~comes~~ becomes zeros

Question 6(a)

Candidate 7

QUESTION NUMBER

6.(a)



$z = 1 + \sqrt{3}i$

$r = \sqrt{1^2 + \sqrt{3}^2}$ $\tan^{-1}\left(\sqrt{3}\right) = 60°$

$= 2$

$\boxed{z = 2(\cos 60 + i\sin 60)}$

$\cancel{z = 2\left(\frac{1}{2} + \frac{\sqrt{3}}{2}i\right)}$

Candidate 8

QUESTION NUMBER

6.(a)

$z = 1 + \sqrt{3}i$

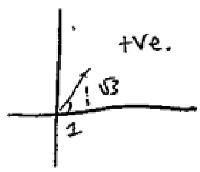
= in polar form

modulus $= \sqrt{1^2 + \sqrt{3}^2}$

$= 2.$

$\arg(z) = \tan^{-1}\left(\frac{\sqrt{3}}{1}\right)$

$= 60°$ or $\frac{\pi}{3}$



$= 2\left(\cos\left(\frac{\pi}{6}\right) + i\sin\left(\frac{\pi}{6}\right)\right)$

Candidate 9

QUESTION NUMBER

6.(a)

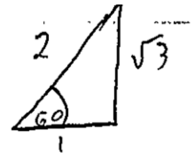
$x \quad y$

$Z = 1 + \sqrt{3}\, i$

$|v| = \sqrt{1^2 + \sqrt{3}^2}$

$= \sqrt{4}$

$= 2$



$\theta = \tan \sqrt{3}/1$

$\theta = \pi/3$

$\arg z = \pi/3$

$\cancel{Z =} \; r^2 \, \cancel{(\cos 2\pi}$

$Z = r^2 \left(\cos 2\pi/3 + i \sin 2\pi/3\right)$

Question 7(a)

Candidate 10

QUESTION NUMBER

7.(a)

$n \times 2n = 2n^2$
$n \times 1 = n$
$1 \times 2n = 2n$
$1 \times 1 = 1$

$n \times 2n^2 = 2n^3$
$n \times 3n = 3n^2$
$n \times 1 = n$

$9n \times n = 9n^2$
$9n \times 1 = 9n$

$$\sum_{r=1}^{n} (r^2 + 3r)$$

$$= \frac{n(n+1)(2n+1)}{6} + 3\frac{n(n+1)}{2}$$

$$= \frac{n(n+1)(2n+1)}{6} + \frac{3n(n+1)}{2}$$

SEE ADITIONAL SPACE

$$= \frac{n(n+1)(2n+1)}{6} + \frac{9n(n+1)}{6}$$

$$= \frac{n(n+1)(2n+1) + 9n(n+1)}{6}$$

$$= \frac{2n^3 + 12n^2 + 10n}{6}$$

$\cancel{= \frac{1}{3}(n^3 + 12n^2 + 10)}$

$\cancel{= \frac{1}{3}n(n^2 + 12n + 10)}$

ADDITIONAL SPACE FOR ANSWERS

ENTER NUMBER OF QUESTION

7a

7a

$$\frac{2n^3 + 12n^2 + 10n}{6} = \frac{1}{3}(n^3 + 6n^2 + 5)$$

$$= \frac{1}{3}n(n^2 + 6n + 5)$$

$$\boxed{= \frac{1}{3}n(n+1)(n+5)}$$

$\frac{5}{1\ 5}$

$\cancel{n^2 + n + 5n + 6}$

$\cancel{n(n+1) + 1(5n+6)}$

$n^2 + n + 5n + 5$

$n(n+1) + 5(n+1)$

Candidate 11

7.(a)

$$\sum_{r=1}^{n}(r^2+3r)$$

$$= \sum_{r=1}^{n} r^2 + 3\sum_{r=1}^{n} r$$

$$= \frac{n(n+1)(2n+1)}{6} + 3\left(\frac{n(n+1)}{2}\right)$$

$$= \frac{n(n+1)(2n+1)}{6} + \frac{3n(n+1)}{2}$$

$$= \frac{n(n+1)(2n+1) + 9n(n+1)}{6}$$

$$= \frac{(n^2+n)(2n+1) + 9n^2 + 9n}{6}$$

$$= \frac{2n^3 + n^2 + 2n^2 + n + 9n^2 + 9n}{6}$$

$$= \frac{2n^3 + 10n^2 + 2n^2 + 10n}{6}$$

go to back of booklet please,

7a

$$\frac{2n^3 + 10n^2 + 2n^2 + 10n}{6}$$

$$= \frac{2n^3 + 12n^2 + 10n}{6}$$

$$= \frac{n(2n^2 + 12n + 10)}{6}$$

$$= \frac{2n(n^2 + 6n + 5)}{6}$$

$$= \frac{1}{3}n(n+1)(n+5)$$

Candidate 12

7.(a)

$$\sum_{r=1}^{n}\left(r^2+3r\right)$$

$$=\sum_{r=1}^{n} r^2 + 3\sum_{r=1}^{n} r$$

$$=\frac{n(n+1)(2n+1)}{6}+3\left[\frac{n(n+1)}{2}\right]$$

$$=\frac{n(n+1)(2n+1)}{6}+3\frac{n(n+1)}{2}$$

$$\cancel{=\frac{n(n+1)(2n+1)}{6}+\frac{9n(n+1)}{6}}$$

$$\cancel{=\frac{1}{6}n(n+1)(2n+1)+\frac{3}{2}n(n+1)}$$

$$\cancel{=}$$

$$\frac{1}{6}(n^2+n)(2n+1)+\frac{3}{2}(n^2+n)$$

$$=\frac{1}{6}(2n^3+n^2+2n^2+n)+\frac{3}{2}(n^2+n)$$

$$=\frac{1}{6}(2n^3+n^2+2n^2+n)+\frac{3}{2}n^2+\frac{3}{2}n$$

$$\cancel{=\frac{1}{3}n^3+\frac{1}{6}n^2+\frac{1}{2}n}$$

$$=\frac{1}{3}n^3+\frac{1}{2}n^2+\frac{1}{6}n+\frac{3}{2}n^2+\frac{3}{2}n$$

$$=\frac{1}{3}n^3+2n^2+\frac{10}{6}n$$

$$=\frac{1}{3}n\left(n^2+6n+5n\right)$$

$$=\frac{1}{3}n(n+1)(n+5)$$

Question 8(b)

Candidate 13

S

8.(b)

n^2 is odd, n^2-1 div. by 4

$n = 2k+1$

$k \in \mathbb{Z}$

$2k \times 2k = 4k^2$

$2k \times 1 = 2k$

$1 \times 2k = 2k$

$1 \times 1 = 1$

$(2k+1)^2 - 1$

$4k^2 + 4k + 1 - 1$

$= 4k^2 + 4k$

$= 4(k^2+k)$ $\therefore$ divisible by 4, true

Candidate 14

8.(b)

let $n = k+1$ prove directly that n^2-1 is divisible by 4.

$4(k+1)^2 - 1$

$4[(k^2+2k+1-1)]$

$= 4(k^2+2k)$

$= 4k(k+2) \longrightarrow$ which is divisible by 4 $\therefore$ statement true.

Candidate 15 Q1

8.(b)

b.) $n = 4h + 1$

$(4h+1)^2 - 1$

$= 16h^2 + 8h + 1 - 1$

$= 16h^2 + 8h$

$= \cancel{4h \ldots}$

both values(constants) are divisible by 4 therefore statement is true.

Question 9

Candidate 16 S1

9.(a)

$$A = \begin{pmatrix} \cos\frac{x}{2} & -\sin\frac{x}{2} \\ \sin\frac{x}{2} & -\cos\frac{x}{2} \end{pmatrix}$$

9.(b) (i)

$$AB = \begin{pmatrix} \cos\frac{x}{2} & -\sin\frac{x}{2} \\ \sin\frac{x}{2} & \cos\frac{x}{2} \end{pmatrix} \begin{pmatrix} -\frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & -\frac{\sqrt{3}}{2} \end{pmatrix}$$

$$= \begin{pmatrix} -\frac{\sqrt{3}}{2}\cos\frac{x}{2} + \frac{1}{2}\sin\frac{x}{2} & \cancel{-\frac{\sqrt{3}}{2}}\frac{1}{2}\cos\frac{x}{2} + \cancel{\frac{1}{2}}\frac{\sqrt{3}}{2}\sin\frac{x}{2} \\ -\frac{\sqrt{3}}{2}\sin\frac{x}{2} \cancel{+} -\frac{1}{2}\cos\frac{x}{2} & \frac{1}{2}\sin\frac{x}{2} - \frac{\sqrt{3}}{2}\cos\frac{x}{2} \end{pmatrix}$$

9.(b) (ii)

$$a = \frac{x}{2}$$

9.(c)

$$I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad (AB)^n = I$$

$$\therefore n = 1$$