No.	SOLUTION
A	A1) **c** A2) **a** A3) **d** A4) **c** A5) **b**
B1	$\Delta = \begin{vmatrix} -2 & 3 & 2 \\ 3 & -8 & 1 \\ 5 & 0 & -k \end{vmatrix}$ $= -16k + 15 + 0 - (-80) - (0) - (-9k)$ $= 95 - 7k$ $\Delta_Z = \begin{vmatrix} -2 & 3 & -13 \\ 3 & -8 & 51 \\ 5 & 0 & 11 \end{vmatrix}$ $= 176 + 765 + 0 - 520 - (0) - (99)$ $= 322$ $Z = \dfrac{\Delta_Z}{\Delta}$ $= \dfrac{322}{95 - 7k}$
B2 (a)	$\boldsymbol{A} + \boldsymbol{3B} = \begin{pmatrix} 2 & 0 \\ 9 & 1 \end{pmatrix} + \begin{pmatrix} 6 & 3 \\ 0 & 9 \end{pmatrix} = \begin{pmatrix} 8 & 3 \\ 9 & 10 \end{pmatrix}$
(b)	$\boldsymbol{AB} = \begin{pmatrix} 2 & 0 \\ 9 & 1 \end{pmatrix}\begin{pmatrix} 2 & 1 \\ 0 & 3 \end{pmatrix} = \begin{pmatrix} 4 & 2 \\ 18 & 12 \end{pmatrix}$
(c)	$\lvert \boldsymbol{A} \rvert = 2$ $adj(\boldsymbol{A}) = \begin{pmatrix} 1 & 0 \\ -9 & 2 \end{pmatrix}$ $\boldsymbol{A}^{-1} = \dfrac{1}{2}\begin{pmatrix} 1 & 0 \\ -9 & 2 \end{pmatrix}$

<table>
<tr><th>No.</th><th>SOLUTION</th></tr>
<tr><td>B3
(a)</td><td>$z_1 = 1 - j = \sqrt{2}\angle -45^o \ \ or\ 1.4142\angle{-45^o}$
$z_2 = 4\angle -120^o = -2 - j2\sqrt{3}$</td></tr>
<tr><td>(b)i</td><td>$z_1 + z_2 = (1 - j) + \left(-2 - j2\sqrt{3}\right)$
$= -1 - j4.464$
$= 4.57\angle -103^o$</td></tr>
<tr><td>(b)ii</td><td>$z_1\ \overline{z_2} = \left(\sqrt{2}\angle -45^o\right)\left(4\angle 120^o\right)$
$= 4\sqrt{2}\angle 75^o \quad \text{or} \quad 5.66\angle 75^o$</td></tr>
<tr><td>(b)
iii</td><td>$\dfrac{z_1}{z_2} = \dfrac{\sqrt{2}\angle -45^o}{4\angle -120^o} = \dfrac{\sqrt{2}}{4}\angle 75^o \quad \text{or} \quad 0.354\angle 75^o$</td></tr>
<tr><td>(b)
iv</td><td>$(z_1)^3 = \left(\sqrt{2}\angle -45^o\right)^3$
$= 2\sqrt{2}\ \angle -135^o \quad \text{or} \quad 2.83\angle -135^o$</td></tr>
<tr><td>B4
(a)</td><td>Vertical Axis Y = WS
Horizontal Axis X = W</td></tr>
<tr><td>(b)</td><td>
<table>
<tr><td>W</td><td>7.20</td><td>2.40</td><td>1.44</td><td>1.03</td><td>0.80</td></tr>
<tr><td>WS</td><td>36.0</td><td>24.0</td><td>21.6</td><td>20.6</td><td>20</td></tr>
</table>
</td></tr>
<tr><td>(c)</td><td>$b = gradient$
$= \dfrac{24-20}{2.4-0.8}$
$= 2.50$

Substitute (0.8 , 20) into WS=bW + a :
$20 = 2.5(0.8) + a$
a = 18</td></tr>
</table>

No.	SOLUTION
B5 (a)	$f'(x)=\frac{1}{4x-1}(4)+\left(\frac{1}{1+4x^2}\right)(2)$ $f'(0)=\frac{1}{-1}(4)+\left(\frac{1}{1+0}\right)(2)=-2$
B5 (b)	$\frac{dy}{dx}=3e^{2x}\left[\cos(x)\right]+3\left(2e^{2x}\right)\sin(x)$ $=3e^{2x}\left[\cos(x)+2\sin(x)\right]$

No.	SOLUTION
B5 (a)	$f'(x)=\frac{1}{4x-1}(4)+\left(\frac{1}{1+4x^2}\right)(2)$ $f'(0)=\frac{1}{-1}(4)+\left(\frac{1}{1+0}\right)(2)=-2$
B5 (b)	$\frac{dy}{dx}=3e^{2x}\left[\cos(x)\right]+3\left(2e^{2x}\right)\sin(x) \quad =3e^{2x}\left[\cos(x)+2\sin(x)\right]$
B6a (i) (ii)	$A=\pi r^2$ $\frac{dA}{dr}=2\pi r$ $\left.\frac{dA}{dr}\right\|_{r=3}=6\pi$ $\frac{dr}{dt}=0.5\,cm/s$ $\frac{dA}{dt}=\frac{dA}{dr}\frac{dr}{dt} \quad =6\pi(0.5) \quad =3\pi \quad \mathrm{cm}^2/s$
B6b	$\frac{dv}{dt}=-110-9.8t$ $F=10(-110-9.8t)$ At *t = 10 s*, $F=-1100-98(10)=-2080$
B7 (a)i B7 (a)ii	$\int\left(\frac{2}{x}-e^{6x}+9\sin(3x)\right)dx=2\ln\|x\|-\frac{e^{6x}}{6}+\frac{9(-\cos(3x))}{3}+C$ $\int\left(\frac{1}{\sqrt{100-x^2}}\right)dx=\int\left(\frac{1}{\sqrt{10^2-x^2}}\right)dx=\sin^{-1}\left(\frac{x}{10}\right)+C$
B7 (b)	$h=\int(100-25t)\,dt=100t-\frac{25t^2}{2}+C$ At $t=0,\ h=0\Rightarrow C=0.$ Therefore $h=100t-\frac{25t^2}{2}$ When $t=3,\ h=100(3)-\frac{25(3)^2}{2}=187.5$ metres

No.	SOLUTION
C1	$\int x^3\,dx = \frac{x^4}{4} + C$ $A = \left\|\int_{-2}^{-1} x^3\,dx\right\|$ or $-\int_{-2}^{-1} x^3\,dx$ or $\int_{-1}^{-2} x^3\,dx$ $= \left[\frac{(-2)^4}{4}\right] - \left[\frac{(-1)^4}{4}\right]$ $= \frac{15}{4}$ $B = \int_0^k x^3\,dx$ $= \left[\frac{(k)^4}{4}\right] - \left[\frac{(0)^4}{4}\right]$ $= \frac{k^4}{4}$ $B = 4A$ $\frac{k^4}{4} = 4\left(\frac{15}{4}\right)$ $k^4 = 60$ $k = 2.78$ or -2.78 (reject)

No.	SOLUTION
C2 (a)	$\frac{dy}{dx}+2x=2\left(3y^2\frac{dy}{dx}\right)-\left(\frac{1}{x}\right)$ $\frac{dy}{dx}\left(1-6y^2\right)=\frac{-1-2x^2}{x}$ $\frac{dy}{dx}=\frac{-1-2x^2}{x\left(1-6y^2\right)}$ or $\frac{1+2x^2}{x\left(6y^2-1\right)}$
C2 (b) i	$Volume=(x)(5x)(h)=300$ $h=\frac{300}{5x^2}=\frac{60}{x^2}$ $C=10(x)(5x)+5(2)(x)(h)+5(2)(5x)(h)$ $=50x^2+60xh$ $=50x^2+60x\left(\frac{60}{x^2}\right)$ $=50x^2+\frac{3600}{x}$
ii	$\frac{dC}{dx}=100x-3600x^{-2}$ $100x-3600x^{-2}=0$ $\frac{100x^3-3600}{x^2}=0$ $x^3=36$ $x=3.30$ cm $\frac{d^2C}{dx^2}=100+7200x^{-3}$ $\left.\frac{d^2C}{dx^2}\right\vert_{x=3.3}=100+7200(3.30)^{-3}>0$ Since $\frac{d^2C}{dx^2}>0, C$ is minimum when x = 3.30 cm.

No.	SOLUTION
C3	$Z^2 + mZ + 2 = 0$ $Z = \dfrac{-m \pm \sqrt{m^2 - 4(1)(2)}}{2}$ $= \dfrac{-m \pm \sqrt{m^2 - 8}}{2}$ $= \dfrac{-m \pm \sqrt{-(8 - m^2)}}{2}$ $= \dfrac{-m \pm j\sqrt{8 - m^2}}{2}$ Roots are : $Z_1 = \dfrac{-m}{2} + j\dfrac{\sqrt{8-m^2}}{2}$ and $Z_2 = \dfrac{-m}{2} - j\dfrac{\sqrt{8-m^2}}{2}$ $Z_1 - Z_2 = \left(\dfrac{-m}{2} + j\dfrac{\sqrt{8-m^2}}{2}\right) - \left(\dfrac{-m}{2} - j\dfrac{\sqrt{8-m^2}}{2}\right)$ $= 0 + j\dfrac{2\sqrt{8-m^2}}{2}$ $= j\sqrt{8-m^2}$ $\lvert Z_1 - Z_2 \rvert = \sqrt{0 + \left(\sqrt{8-m^2}\right)^2} = 2$ $\sqrt{8-m^2} = 2$ $8 - m^2 = 4$ $m^2 = 4$ $m = \pm 2$