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Class 11

Mathematics

Chapter 1

Exercise 1.3

Notes

National Book Foundation

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Exercise # 1.3

Q1 Factorize the following.

i) z^2+169

Sol:-

$= z^2 + 169$

$= z^2 - 169i^2$

$= (z)^2 - (13i)^2$ $\{i^2 = -1\}$

$= (z+13i)(z-13i)$

ii) $2z^2+18$

Sol:-

$= 2z^2+18$

$= 2(z^2+9)$

$= 2(z^2-9i^2)$ $\{\because i^2 = -1\}$

$= 2[(z)^2-(3i)^2]$

$= 2(z+3i)(z-3i)$

iii) $3z^2+363$

Sol:-

$= 3z^2+363$

$= 3(z^2+121)$

$= 3(z^2-121i^2)$

$= 3[(z)^2-(11i)^2]$

$= 3(z+11i)(z-11i)$

iv) $z^2 + \frac{3}{25}$

Sol:-

$$= z^2 + \frac{3}{25} \Rightarrow z^2 - \frac{3}{25} i^2$$

$$= (z)^2 - \left(\frac{\sqrt{3}}{5} i\right)^2$$

$$= \left(z + \frac{\sqrt{3}}{5} i\right)\left(z - \frac{\sqrt{3}}{5} i\right)$$

v) $2z^3 + 3z^2 - 10z - 15$

Sol:-

$$= 2z^3 + 3z^2 - 10z - 15$$
$$= z^2(2z+3) - 5(2z+3)$$
$$= (z^2 - 5)(2z+3)$$
$$= [(z)^2 - (\sqrt{5})^2](2z+3)$$
$$= (z+\sqrt{5})(z-\sqrt{5})(2z+3)$$

vi) $z^3 - 7z + 6$

Sol:-

$$= z^3 - 7z + 6$$
$$= z^3 - z - 6z + 6$$
$$= z^2(z-1) - 6(z-1)$$
$$= (z^2 - 6)(z-1)$$

vii) $z^3+2z^2-23z-60$

Sol:-

Let $P(z) = z^3+2z^2-23z-60$

From $p(z)$ we have $p=-60$ and $q=1$

Possible factors of p and q are

$P = \pm1, \pm2, \pm3 \pm4, \pm5, \pm6, \pm10, \pm12, \pm15, \pm20, \pm30, \pm60$

$q = \pm 1$

So, $\frac{P}{q} = \pm1, \pm2, \pm3, \pm4, \pm5, \pm6, \pm10, \pm12, \pm15, \pm20, \pm30, \pm60$

use $z=5$ in $P(z)$

$\therefore\ P(5) = (5)^3+2(5)^2-23(5)-60$
$= 125+50-155-60$
$P(5) = 0$

So, $(z-5)$ is zero of $P(z)$

Now use $z=-3$ in $P(z)$

$\therefore\ P(-3) = (-3)^3+2(-3)^2-23(-3)-66$
$= -27+18+69-6$
$P(-3) = 0$

Also $(z+3)$ is zero of $P(z)$

Lastly, use $z=-4$ in $P(z)$

$\therefore \quad P(-4) = (-4)^3 + 2(-4)^2 - 23(-4) - 60$

$= -64 + 32 + 92 - 60$

$P(-4) = 0$

So, $(z+4)$ is also zero of $P(z)$

Hence, $P(z) = z^3 + 2z^2 - 23z - 60$ is

$P(z) = (z+4)(z+3)(z-5)$

viii) $2z^3 + 9z^2 - 11z - 30$

Sol:-

Let $P(z) = 2z^3 + 9z^2 - 11z - 30$

From $P(z)$, $p = -30$, $q = 2$

Possible factors of $P(z)$ are

$P = \pm 1, \pm 2, \pm 3, \pm 5, \pm 6, \pm 10, \pm 15, \pm 30$

$q = \pm 1, \pm 2$

So, $p/q = \pm 1, \pm 2, \pm 3, \pm 5, \pm 6, \pm 10, \pm 15, \pm 30, \pm \frac{1}{2}$

$\pm 3/2, \pm 5/2, \pm 15/2,$

Use $z = -5$

$\therefore P(-5) = 2(-5)^3 + 9(-5)^2 - 11(-5) - 30$

$= -250 + 225 + 55 - 30$

$P(-5) = 0$

So, $(z+5)$ is zero of $P(z)$

Now, use $z = 2$ in $P(z)$

$\therefore P(2) = 2(2)^3 + 9(2)^2 - 11(2) - 30$

$= 16 + 36 - 22 - 30$

$P(2) = 0$

also, $(z-2)$ is zero of $P(z)$

Lastly, use $z = -3/2$ in $P(z)$

$\therefore P\left(\frac{-3}{2}\right) = 2\left(\frac{-3}{2}\right)^3 + 9\left(\frac{-3}{2}\right)^2 - 11\left(\frac{-3}{2}\right) - 30$

$= -27/4 + 81/4 + 33/2 - 30$

$P(-3/2) = 0$

So, $(2z+3)$ is zero of $P(z)$

Hence, $P(z) = 2z^3 + 9z^2 - 11z - 30$ is

$P(z) = (z+5)(z-2)(2z+3)$

iv) $z^2 - 7z - 8$

Sol:-

$= z^2 - 7z - 8$

$= z^2 + z - 8z - 8$

$= z(z+1) - 8(z+1)$

$= (z+1)(z-8)$

v) $4z^2 - 7z - 11$

Sol:-

$= 4z^2 - 7z - 11$

$= 4z^2 + 4z - 11z - 11$

$= 4z(z+1) - 11(z+1)$

$= (z+1)(4z-11)$

Q2 Solve the following by completing square method.

i) $z^2 - 6z + 2 = 0$

Sol:-

$z^2 - 6z + 2 = 0$

$z^2 - 6z = -2$

Add $(6/2)^2$ on b/s

$\therefore \quad z^2 - 6z + \left(\frac{6}{2}\right)^2 = -2 + \left(\frac{6}{2}\right)^2$

$(z)^2 - 2(z)\left(\frac{6}{2}\right) + \left(\frac{6}{2}\right)^2 = \frac{36}{4} - 2$

ix) $z^2 - 7z - 8$

Sol:-

$$= z^2 - 7z - 8$$
$$= z^2 + z - 8z - 8$$
$$= z(z+1) - 8(z+1)$$
$$= (z+1)(z-8)$$

x) $4z^2 - 7z - 11$

Sol:-

$$= 4z^2 - 7z - 11$$
$$= 4z^2 + 4z - 11z - 11$$
$$= 4z(z+1) - 11(z+1)$$
$$= (z+1)(4z-11)$$

Q2. Solve the following by completing square method.

i) $z^2 - 6z + 2 = 0$

Sol:-

$$z^2 - 6z + 2 = 0$$
$$z^2 - 6z = -2$$

Add $(6/2)^2$ on b/s

$$\therefore \quad z^2 - 6z + \left(\frac{6}{2}\right)^2 = -2 + \left(\frac{6}{2}\right)^2$$

$$(z)^2 - 2(z)\left(\frac{6}{2}\right) + \left(\frac{6}{2}\right)^2 = \frac{36}{4} - 2$$

$$\left[z-\frac{6}{2}\right]^2 = \frac{36-2(4)}{4}$$

$$\left[z-\frac{6}{2}\right]^2 = 7 \qquad \{\text{Taking square root}\}$$

$$\therefore \sqrt{\left[z-\frac{6}{2}\right]^2} = \pm\sqrt{7}$$

$$z-\frac{6}{2} = \pm\sqrt{7} \Rightarrow z = \frac{6}{2} \pm \sqrt{7}$$

OR $$z = \frac{6 \pm 2\sqrt{7}}{2} \Rightarrow z = 3 \pm \sqrt{7}$$

$$S.S = \{3 \pm \sqrt{7}\}$$

ii) $$-\frac{1}{2}z^2 - 5z + 2 = 0$$

Sol:-

$$-\frac{1}{2}z^2 - 5z + 2 = 0$$

$$-\frac{1}{2}z^2 - 5z = -2$$

Divide $(-1/2)$ on b/s and add $(10/2)^2$ on b/s

$$z^2 - \frac{5}{-1/2}z = \frac{-2}{-1/2}$$

$$z^2 + 10z + \left(\frac{10}{2}\right)^2 = 4 + \left(\frac{10}{2}\right)^2$$

$$(z)^2 + 2(z)\left(\frac{10}{2}\right) + \left(\frac{10}{2}\right)^2 = 4 + 25$$

$$\left[z + \frac{\overset{5}{\cancel{10}}}{\cancel{2}}\right]^2 = 29$$

$$\left[z + 5\right]^2 = 29 \quad \{\text{Taking square root}\}$$

$$\therefore \sqrt{(z+5)^2} = \pm\sqrt{29} \Rightarrow z+5 = \pm\sqrt{29}$$

$$z = -5 \pm \sqrt{29}$$

$$S.S = \{-5 \pm \sqrt{29}\}$$

iii) $4z^2 + 5z = 14$

Sol:-

$$4z^2 + 5z = 14$$

Divide "4" on b/s

$$\therefore z^2 + \frac{5}{4}z = \frac{7}{2}$$

Now add $(5/4\times2)^2$ on b/s

$$\therefore z^2 + \frac{5}{4}z + \left(\frac{5}{8}\right)^2 = \frac{7}{2} + \left(\frac{5}{8}\right)^2$$

$$(z)^2 + 2(z)\left(\frac{5}{8}\right) + \left(\frac{5}{8}\right)^2 = \frac{7}{2} + \frac{25}{64}$$

$$\left[z + \frac{5}{8}\right]^2 = \frac{249}{64}$$

Taking square root on b/s

$$\Rightarrow \sqrt{\left[z+\frac{5}{8}\right]^2} = \pm\sqrt{\frac{249}{64}}$$

$$z+\frac{5}{8} = \pm\frac{\sqrt{249}}{8} \Rightarrow z = -\frac{5}{8} \pm \frac{\sqrt{249}}{8}$$

$$z = \frac{-5 \pm \sqrt{249}}{8}$$

$$S.S = \left\{\frac{-5\pm\sqrt{249}}{8}\right\}$$

iv) $z^2 = 5z - 3$

Sol:-

$$z^2 = 5z - 3$$

$$z^2 - 5z = -3$$

Add $(5/2)^2$ on b/s

$$\therefore z^2 - 5z + \left(\frac{5}{2}\right)^2 = -3 + \left(\frac{5}{2}\right)^2$$

$$(z)^2 - 2(z)\left(\frac{5}{2}\right) + \left(\frac{5}{2}\right)^2 = -3 + \frac{25}{4}$$

$$\left[z - \frac{5}{2}\right]^2 = \frac{13}{4}$$

Taking square root on b/s

$$\therefore \sqrt{\left[z-5/2\right]^2} = \pm\sqrt{\frac{13}{4}}$$

$$z - 5/2 = \pm\sqrt{13}/2$$

$$z = \frac{5}{2} \pm \frac{\sqrt{13}}{2} \Rightarrow z = \frac{5 \pm \sqrt{13}}{2}$$

$$S.S = \left\{ \frac{5 \pm \sqrt{13}}{2} \right\}$$

Q3. Solve the following quadratic equations.

i) $\frac{1}{3}z^2 + 2z - 16 = 0$

Sol:-

$$\frac{1}{3}z^2 + 2z - 16 = 0$$

Here $a = 1/3$, $b = 2$, $c = -16$

using, $z = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$\therefore z = \frac{-(2) \pm \sqrt{(2)^2 - 4(1/3)(-16)}}{2(1/3)}$$

$$z = \frac{-2 \pm \sqrt{4 + 64/3}}{2/3}$$

$$z = \frac{3(-2 \pm \sqrt{76/3})}{2}$$

$$z = \frac{3(-2 \pm 2\sqrt{57}/3)}{2}$$

$$z = \frac{-6 \pm 2\sqrt{57}}{2}$$

$z = -3 \pm \sqrt{57}$

$\therefore$ S. S $= \{-3 \pm \sqrt{57}\}$

ii) $z^2 - \frac{1}{2}z + 17 = 0$

Sol:.

$$z^2 - \frac{1}{2} z + 17 = 0$$

Here, $a = 1$, $b = -1/2$, $c = 17$

using, $z = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\therefore \quad z = \frac{-(-1/2) \pm \sqrt{(-1/2)^2 - 4(1)(17)}}{2(1)}$

$z = \frac{1/2 \pm \sqrt{1/4 - 68}}{2} \Rightarrow z = \frac{1/2 \pm \sqrt{-271/4}}{2}$

$z = \frac{1/2 \pm \sqrt{271}/2 \, i}{2} \qquad \{\because i = \sqrt{-1}\}$

$z = \frac{1 \pm \sqrt{271}\, i}{2} \times \frac{1}{2} \Rightarrow z = \frac{1 \pm \sqrt{271}\, i}{4}$

S. S $= \left\{ \frac{1 \pm \sqrt{271}\, i}{4} \right\}$

iii) $z^2 - 6z + 25 = 0$

iv) $z^2 - 9z + 11 = 0$

Sol:-

$$z^2 - 9z + 11 = 0$$

Here, $a = 1$, $b = -9$, $c = 11$

using $z = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$\therefore \quad z = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(1)(11)}}{2(1)}$$

$$z = \frac{9 \pm \sqrt{81 - 44}}{2}$$

$$z = \frac{9 \pm \sqrt{37}}{2}$$

$$S.S = \left\{ \frac{9 \pm \sqrt{37}}{2} \right\}$$

Q4. Solve the following simultaneous equations

i) $(1-i)z + (1+i)\omega = 3$; $2z - (2+5i)\omega = 2+3i$

Sol:-

Given,

$$(1-i)z + (1+i)\omega = 3 \quad \text{— (i)}$$
$$2z - (2+5i)\omega = 2+3i \quad \text{— (ii)}$$

Multiply eq.(i) with "2." and eq.(ii) with $(1-i)$

$\therefore \quad 2(1-i)z + 2(1+i)\omega = 2(3) \quad -(iii)$

$2(1-i)z - (1-i)(2+5i)\omega = (1-i)(2+3i) \quad -(iv)$

eq.(iii) $\Rightarrow (2-2i)z + (2+2i)\omega = 6 \quad -(v)$

eq.(iv) $\Rightarrow (2-2i)z - (7+3i)\omega = 5+i \quad -(vi)$

Subract eq.(iv) from (v).

$$\therefore \quad \cancel{(2-2i)z} + (2+2i)\omega = 6$$
$$\pm \cancel{(2-2i)z} \mp (7+3i)\omega = \pm(5+i)$$
$$0z + (2+2i)\omega + (7+3i)\omega = 6-(5+i)$$

So, $(2+2i)\omega + (7+3i)\omega = 6-5-i$

$$\omega\left[(2+2i)+(7+3i)\right] = 1-i$$
$$\omega(2+7+2i+3i) = 1-i$$
$$\omega(9+5i) = 1-i$$
$$\omega = \frac{1-i}{9+5i} \Rightarrow \omega = \frac{1-i}{9+5i} \times \frac{9-5i}{9-5i}$$

$$\omega = \frac{(1-i)(9-5i)}{(9)^2-(5i)^2} \Rightarrow \omega = \frac{4-14i}{81-25(-1)}$$

$$\omega = \frac{4-14i}{106} \Rightarrow \omega = \frac{2}{53} - \frac{7}{53}i$$

Now put value of "ω" in eq. (ii)

$$\therefore\ 2z-(2+5i)\left(\frac{2-7i}{53}\right)=2+3i$$

$$2z-\frac{39-4i}{53}=2+3i$$

6 $$2z=2+3i+\frac{39-4i}{53}$$

$$2z=\frac{145+155i}{53} \Rightarrow z=\frac{145+155i}{53}\times\frac{1}{2}$$

$$z=\frac{145}{106}+\frac{155}{106}i$$

$$S.S=\{(\omega,z)\}=\left\{\left(\frac{2}{53}-\frac{7}{53}i,\ \frac{145}{106}+\frac{155}{106}i\right)\right\}$$

ii) $2iz+(3-2i)\omega=1+i$; $(1-2i)z+(3+2i)\omega=5+6i$

Sol:-

Given

$$2iz+(3-2i)\omega=1+i \text{ ——— (i)}$$
$$(1-2i)z+(3+2i)\omega=5+6i \text{ ——— (ii)}$$

Multiply eq.(i) with "$(1-2i)$" and eq.(ii) with "$2i$"

$(1-2i)2iz + (1-2i)(3-2i)w = (1+i)(1-2i)$

$(2i-4i^2)z + (-1-8i)w = 3-i$ — (iv)

and, $(1-2i)2iz + (3+2i)2iw = 2i(5+6i)$

$(2i-4i^2)z + (-4+6i)w = -12+10i$ — (iii)

Subtract eq. (iv) from (iii)

$$\therefore \quad \begin{array}{r} \cancel{(2i-4i^2)z} + (-1-8i)w = 3-i \\ \pm\cancel{(2i-4i^2)z} \pm (-4+6i)w = \pm(-12+10i) \\ \hline 0z + [(-1-8i)-(-4+6i)]w = 3-i-(-12+10i) \end{array}$$

So, $(-1-8i+4-6i)w = 3-i+12-10i$

$(3-14i)w = 15-11i$

$$w = \frac{15-11i}{3-14i}$$

$$w = \frac{15-11i}{3-14i} \times \frac{3+14i}{3+14i} \Rightarrow w = \frac{(15-11i)(3+14i)}{(3)^2-(14i)^2}$$

$$w = \frac{199+177i}{9-196(-1)} \Rightarrow w = \frac{199+177i}{205}$$

$$w = \frac{199}{205} + \frac{177}{205}i$$

Put value of "w" in eq. (i)

$$\therefore \; 2iz + (3-2i)\left(\frac{199+177i}{205}\right) = 5+6i$$

$$2iz + \frac{951+133i}{205} = 5+i$$

$$2iz = 5+i - \frac{951+133i}{205}$$

$$2iz = \frac{74+72i}{205} \Rightarrow z = \frac{74+72i}{2i(205)}$$

$$z = \frac{74+72i}{410i} \Rightarrow z = \frac{74+72i}{410i} \times \frac{-410i}{-410i}$$

$$z = \frac{-410i(74+72i)}{-(410i)^2} \Rightarrow z = \frac{29520-30340i}{168100}$$

$$z = \frac{29520}{168100} - \frac{30340}{168100}i$$

$$z = \frac{36}{205} - \frac{37}{205}i$$

$$S.S = \{(\omega, z)\} = \left\{\left(\frac{199}{205} + \frac{177}{205}i, \frac{36}{205} - \frac{37}{205}i\right)\right\}$$

iii) $\frac{3}{i}z - (6+2i)\omega = 5$; $\frac{i}{2}z + \left(\frac{3}{4} - \frac{1}{2}i\right)\omega = \frac{1}{2} + 2i$

Sol:-

$$\frac{3}{i}z - (6+2i)\omega = 5$$

$$\frac{3}{i} \times \frac{-i}{-i} z - (6+2i)\omega = 5$$

$$-3iz - (6+2i)\omega = 5 \quad \text{—(i)}$$

and, $\frac{i}{2}z+\left(\frac{3}{4}-\frac{1}{2}i\right)w = \frac{1}{2}+2i$

$$\frac{i}{2}z+\left(\frac{3-2i}{4}\right)w = \frac{1+4i}{2}$$

$$\frac{2iz+(3-2i)w}{\cancel{4}\,2} = \frac{1+4i}{\cancel{2}\,1}$$

$$2iz+(3-2i)w = 2(1+4i)$$
$$2iz+(3-2i)w = 2+8i \quad \text{— (ii)}$$

Multiply eq.(i) with "2i" and eq.(ii) with "-3i"

$\therefore$ eq.(i) $\Rightarrow 2i(-3iz)-2i(6+2i)w = 5(2i)$
$$-6i^2z+(4-12i)w = 10i$$
$$6z+(4-12i)w = 10i \quad \text{— (iii)}$$

eq.(ii) $\Rightarrow -3i(2iz)-3i(3-2i)w = (2+8i)(-3i)$
$$-6i^2z-(6+9i)w = 24-6i$$
$$6z-(6+9i)w = 24-6i \quad \text{— (iv)}$$

Subtract eq.(iv) from (iii)

So, $\cancel{6z}+(4-12i)w = 10i$
$$\pm\cancel{6z}\mp(6+9i)w = \pm(24-6i)$$
$$0z+(4-12i)w+(6+9i)w = 10i-(24-6i)$$

$$[4-12i+6+9i]\omega = 10i-24+6i$$

$$(10-3i)\omega = -24+16i$$

$$\omega = \frac{-24+16i}{10-3i}$$

$$\omega = \frac{-24+16i}{10-3i} \times \frac{10+3i}{10+3i} \Rightarrow \omega = \frac{(-24+16i)(10+3i)}{(10)^2-(3i)^2}$$

$$\omega = \frac{-288+88i}{100-9(-1)} \Rightarrow \omega = \frac{-288+88i}{109}$$

$$\omega = -\frac{288}{109} + \frac{88}{109}i$$

Now put value of "ω" in eq. (i)

$$\therefore \quad -3iz-(6+2i)\left(\frac{-288+88i}{109}\right) = 5$$

$$-3iz + \frac{1904+48i}{109} = 5$$

$$-3iz = 5 - \frac{1904+48i}{109}$$

$$-3iz = -\frac{1359-48i}{109}$$

$$z = \frac{+(1359+48i)}{+3i(109)}$$

$$z = \frac{1359+48i}{327i} \Rightarrow z = \frac{1359+48i}{327i} \times \frac{-327i}{-327i}$$

$$z = \frac{-327i(1359+48i)}{-(327i)^2}$$

$$z = \frac{15696 - 444393i}{106929} \Rightarrow z = \frac{15696}{106929} - \frac{444393}{106929}$$

$$z = \frac{16}{109} - \frac{453}{109}i$$

$$S.S = \{(\omega, z)\} = \left\{\left(-\frac{288}{109} + \frac{88}{109}i, \frac{16}{109} - \frac{453}{109}i\right)\right\}$$

iv) $\frac{1}{1-i}z + (1+i)\omega = 3$; $\frac{2}{i}z - (2-3i)\omega = 2+6i$

Sol:-

$$\frac{1}{1-i}z + (1+i)\omega = 3$$

$$\frac{1}{1-i} \times \frac{1+i}{1+i} z + (1+i)\omega = 3$$

$$\frac{1+i}{(1)^2-(i)^2} z + (1+i)\omega = 3$$

$$\frac{1+i}{2} z + (1+i)\omega = 3$$

$$\frac{(1+i)z + 2(1+i)\omega}{2} = 3$$

OR $(1+i)z + 2(1+i)\omega = 2 \times 3 = 6 \quad -(i)$

and, $\frac{2}{i}z - (2-3i)\omega = 2+6i$

$$\frac{2}{i} \times \frac{-i}{-i} z - (2-3i)\omega = 2+6i$$

$$-2iz - (2-3i)\omega = 2+6i \quad -(ii)$$

Multiply "(1+i)" with eq.(ii) and "-2i" with eq.(i)

eq.(i) $\Rightarrow$ $-2i(1+i)z + 2(1+i)(-2i)\omega = -2i(6)$

$$(2-2i)z + (4-4i)\omega = -12i \quad -(iii)$$

e.q.(ii) $\Rightarrow$ $(1+i)(-2iz) - (1+i)(2-3i)\omega = (1+i)(2+6i)$

$$(2-2i)z - (5-i)\omega = -4+8i \quad -(iv)$$

Subtract eq.(iv) from (iii)

$\therefore$ $\cancel{(2-2i)}z + (4-4i)\omega = -12i$

$\pm \cancel{(2-2i)}z \mp (5-i)\omega = \pm(-4+8i)$

$$0z + (4-4i)\omega + (5-i)\omega = -12i - (-4+8i)$$

So, $(4-4i+5-i)\omega = -12i+4-8i$

$$\omega(9-5i) = 4-20i$$

$$\omega = \frac{4-20i}{9-5i}$$

$$\omega = \frac{4-20i}{9-5i} \times \frac{9+5i}{9+5i} \Rightarrow \omega = \frac{(4-20i)(9+5i)}{(9)^2-(5i)^2}$$

$$\omega = \frac{136-160i}{81-25(-1)} \Rightarrow \omega = \frac{136-160i}{106}$$

$$\omega = \frac{68}{53} - \frac{80}{53}i$$

Now put value of "ω" in eq. (ii)

$$\therefore \quad -2iz - (2-3i)\left(\frac{68-80i}{53}\right) = 2+6i$$

$$-2iz + \frac{104+364i}{53} = 2+6i$$

$$-2iz = 2+6i - \frac{104+364i}{53}$$

$$-2iz = \frac{2-46i}{53} \Rightarrow z = \frac{2-46i}{-2i(53)}$$

$$z = \frac{2-46i}{-106i} \Rightarrow z = \frac{2-46i}{-106i} \times \frac{106i}{106i}$$

$$z = \frac{106i(2-46i)}{-(106i)^2} \Rightarrow z = \frac{4876+212i}{11236}$$

$$z = \frac{4876}{11236} + \frac{212}{11236}i \Rightarrow z = \frac{23}{53} + \frac{1}{53}i$$

$$S.S = \{(\omega, z)\} = \left\{\left(\frac{68}{53} - \frac{80}{53}i, \frac{23}{53} + \frac{1}{53}i\right)\right\}$$