Exercise # 1.3

Q.1 Factorize the following:

i) $a^2 + 4b^2$

Sol:— $a^2 + 4b^2 = a^2 - (-4b^2)$

$= a^2 - (-1 \times 4b^2) \quad \because i^2 = -1$

$= a^2 - (i^2 2^2 b^2)$

$= a^2 - (2bi)^2 \quad \because a^2 - b^2 = (a+b)(a-b)$

$$\boxed{a^2 + 4b^2 = (a+2bi)(a-2abi)}$$ Ans

ii) $9a^2 + 16b^2$

Sol:— $9a^2 + 16b^2 = 9a^2 - (-16b^2)$

$= 9a^2 - (-1 \times 16b^2) \quad \because i^2 = -1$

$= 9a^2 - i^2 4^2 b^2$

$= (3a)^2 - (4bi)^2$

$$\boxed{9a^2 + 16b^2 = (3a + 4bi)(3a - 4bi)}$$ Ans

iii) $3x^2 + 3y^2$

Sol:— $3x^2 + 3y^2 = 3(x^2 + y^2)$

$= 3(x^2 - (-y^2))$

$= 3(x^2 - (-1 \times y^2))$

$= 3(x^2 - i^2 y^2) \quad \because i^2 = -1$

$= 3[(x)^2 - (yi)^2]$

$$\boxed{3x^2+3y^2 = 3(x+iy)(x-iy)}$$ Ans

(iv) $144x^2+225y^2$

Sol:- $144x^2+225y^2 = 144x^2-(-225y^2)$

$= 144x^2-(-1\times 225y^2)$

$= 144x^2-i^2 15^2 y^2$

$= (12x)^2-(15yi)^2$

$$\boxed{144x^2+225y^2 = (12x+15yi)(12-15yi)}$$ Ans

(v) $Z^2-2iZ-1$

Sol:- $Z^2-2iZ-1 = Z^2-2iZ+(-1)$

$= Z^2-2iZ+i^2$

$= (Z-i)^2$

$$\boxed{Z^2-2iZ-1 = (Z-i)(Z-i)}$$ Ans

(vi) $Z^2+6Z+13$

Sol:- $Z^2+6Z+13 = Z^2+6Z+9+4$

$= (Z+3)^2+4$

$= (Z+3)^2-(-4)$

$= (Z+3)^2-(-1\times 4)$

$= (Z+3)^2-i^2 2^2$

$$= (Z+3)^2 - (2i)^2$$

$$\boxed{Z^2+6Z+13 = (Z+3+2i)(Z+3-2i)}$$ Ans

vii) Z^2+4Z+5

Sol:— $Z^2+4Z+5 = Z^2+4Z+4+1$

$$= Z^2+4Z+2^2-(-1)$$

$$= (Z+2)^2 - i^2$$

$$\boxed{Z^2+4Z+5 = (Z+2+i)(Z+2-i)}$$ Ans

viii) $2Z^2-22Z+65$

Sol:— $2Z^2-22Z+65 = 2\left(Z^2-11Z+\frac{65}{2}\right)$

$$= 2\left(Z^2-11Z+\left(\frac{11}{2}\right)^2+\frac{65}{2}-\left(\frac{11}{2}\right)^2\right)$$

$$= 2\left[\left(Z-\frac{11}{2}\right)^2+\frac{65}{2}-\frac{121}{4}\right]$$

$$= 2\left[\left(Z-\frac{11}{2}\right)^2+\frac{130-121}{4}\right]$$

$$= 2\left[\left(Z-\frac{11}{2}\right)^2+\frac{9}{4}\right]$$

$$= 2\left[\left(Z-\frac{11}{2}\right)^2-\left(-1\times\frac{9}{4}\right)\right]$$

$$= 2\left[\left(Z-\frac{11}{2}\right)^2-\left(i^2\frac{3^2}{2^2}\right)\right]$$

$$= 2\left[\left(Z-\frac{11}{2}\right)^2-\left(\frac{3}{2}i\right)^2\right]$$

$$\boxed{2Z^2-22Z+65 = 2\left(Z-\frac{11}{2}+\frac{3i}{2}\right)\left(Z-\frac{11}{2}-\frac{3i}{2}\right)}$$ Ans

Q.2 Factorize the following polynomial into its linear factors.

i) z^3+8

Sol:— $z^3+8 = z^3+2^3$ $\because a^3+b^3=(a+b)(a^2-ab+b^2)$

$= (z+2)(z^2-2z+2^2)$

$= (z+2)(z^2-2z+4)$

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

$= (z+2)[(z-1)^2-(-3)]$

$= (z+2)[(z-1)^2-i^2(\sqrt{3})^2]$

$= (z+2)[(z-1)^2-(\sqrt{3}i)^2]$

$$\boxed{z^3+8 = (z+2)(z-1+\sqrt{3}i)(z-1-\sqrt{3}i)}$$ Ans

ii) z^3+27

Sol:— $z^3+27 = z^3+3^3$ $\because a^3+b^3=(a+b)(a^2-ab+b^2)$

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

$= (z+3)(z^2-3z+9)$

$= (z+3)(z^2-3z+(\frac{3}{2})^2+9-(\frac{3}{2})^2)$

$= (z+3)[(z-\frac{3}{2})^2+9-\frac{9}{4}]$

$= (z+3)[(z-\frac{3}{2})^2+\frac{36-9}{4}]$

$= (z+3)[(z-\frac{3}{2})^2+\frac{27}{4}]$

$$= (Z+3)\left[\left(Z-\frac{3}{2}\right)^2 - \left(-1\times\frac{27}{4}\right)\right]$$

$$= (Z+3)\left[\left(Z-\frac{3}{2}\right)^2 - \left(i^2\left(\sqrt{27/2}\right)^2\right)\right]$$

$$= (Z+3)\left[\left(Z-\frac{3}{2}\right)^2 - \left(\frac{3\sqrt{3}}{2}i\right)^2\right]$$

$$\boxed{Z^3+27 = (Z+3)\left(Z-\frac{3}{2}+\frac{3\sqrt{3}}{2}i\right)\left(Z-\frac{3}{2}-\frac{3\sqrt{3}}{2}i\right)}$$

Ans

iii) $Z^3-2Z^2+16Z-32$

Sol:- $Z^3-2Z^2+16Z-32 = Z^2(Z-2)+16(Z-2)$

$$= (Z^2+16)(Z-2)$$

$$= (Z^2-(-16))(Z-2)$$

$$= [Z^2-(-1\times 16)](Z-2)$$

$$= (Z^2-i^2 4^2)(Z-2)$$

$$= [Z^2-(4i)^2](Z-2)$$

$$\boxed{Z^3-2Z^2+16Z-32 = (Z+4i)(Z-4i)(Z-2)}$$

Ans

iv) Z^4+21Z^2-100

Sol:- $Z^4+21Z^2-100 = Z^4+25Z^2-4Z^2-100$

$$= Z^2(Z^2+25)-4(Z^2+25)$$

$$= (Z^2-4)(Z^2+25)$$

$$= (Z^2-2^2)(Z^2-(-25))$$

$= (Z+2)(Z-2)(Z^2 - 5^2 i^2)$

$= (Z+2)(Z-2)(Z^2 - (5i)^2)$

$$\boxed{Z^4 + 21Z^2 - 100 = (Z+2)(Z-2)(Z+5i)(Z-5i)}$$ Ans

v) $Z^4 - 16$

Sol:- $Z^4 - 16 = (Z^2)^2 - 4^2$

$= (Z^2 - 4)(Z^2 + 4)$

$= (Z^2 - 2^2)(Z^2 - (-4))$

$= (Z^2 - 2^2)(Z^2 - i^2 2^2)$

$= (Z^2 - 2^2)(Z^2 - (i2)^2)$

$$\boxed{Z^4 - 16 = (Z-2)(Z+2)(Z+2i)(Z-2i)}$$ Ans

vi) $Z^4 + 3Z^2 - 4$

Sol:- $Z^4 + 3Z^2 - 4 = Z^4 + 4Z^2 - Z^2 - 4$

$= Z^2(Z^2 + 4) - 1(Z^2 + 4)$

$= (Z^2 - 1)(Z^2 + 4)$

$= (Z-1)(Z+1)(Z^2 - (-4))$

$= (Z-1)(Z+1)(Z^2 - 2^2 i^2)$

$= (Z-1)(Z+1)(Z^2 - (2i)^2)$

$$\boxed{Z^4 + 3Z^2 - 4 = (Z-1)(Z+1)(Z+2i)(Z-2i)}$$ Ans

vii) Z^4+5Z^2+6

Sol:— $Z^4+5Z^2+6 = Z^4+3Z^2+2Z^2+6$

$= Z^2(Z^2+3)+2(Z^2+3)$

$= (Z^2+2)(Z^2+3)$

$= (Z^2-(-2))(Z^2-(-3))$

$= (Z^2-(\sqrt{2}i)^2)(Z^2-(\sqrt{3}i)^2)$

$$\boxed{Z^4+5Z^2+6 = (Z+\sqrt{2}i)(Z-\sqrt{2}i)(Z+\sqrt{3}i)(Z-\sqrt{3}i)}$$

viii) Z^4+7Z^2-144

Sol:— $Z^4+7Z^2-144 = Z^4+16Z^2-9Z^2-144$

$= Z^2(Z^2+16)-9(Z^2+16)$

$= (Z^2-9)(Z^2+16)$

$= (Z^2-3^2)(Z^2-(-16))$

$= (Z+3)(Z-3)(Z^2-(4i)^2)$

$$\boxed{Z^4+7Z^2-144 = (Z+3)(Z-3)(Z+4i)(Z-4i)}$$ Ans

Q.3 Find the roots of $Z^4+7Z^2-144=0$ and hence express it as a product of linear factors.

Sol:—

$Z^4+7Z^2-144=0$

$Z^4+16Z^2-9Z^2-144=0$

$Z^2(Z^2+16)-9(Z^2+16)=0$

$$(z^2+16)(z^2-9)=0$$

$z^2+16=0$ ∧ $z^2-9=0$

$z^2=-16$ | $z^2=9$

Taking Sq. root | Taking Sq. root

$\sqrt{z^2}=\pm\sqrt{-16}$ | $\sqrt{z^2}=\pm\sqrt{9}$

$z=\pm 4\sqrt{-1}$ | $\boxed{z=\pm 3}$

$\boxed{z=\pm 4i}$

Thus, the roots of the equation are $\pm 4i$ & ± 3

Now $(z^2+16)(z^2-9)=0$

$$(z^2-(-16))(z^2-3^2)=0$$

$$(z^2-(4i)^2)(z^2-3^2)=0$$

$$(z+4i)(z-4i)(z+3)(z-3)=0$$

Hence the product of linear factor of the eq. are $(z+4i)(z-4i)(z+3)(z-3)$

Q.4 Solve the following Complex quadratic equation by Completing Square Method:

i) $2z^2-3z+4=0$

Sol:- $2z^2-3z+4=0$

$$2z^2 - 3z = -4$$

÷ing by 2

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

Add $\left(\frac{3}{4}\right)^2$ on both side

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

$$\left(z - \frac{3}{4}\right)^2 = -2 + \frac{9}{16} = \frac{-32+9}{16}$$

$$\left(z - \frac{3}{4}\right)^2 = \frac{-23}{16}$$

Taking square root on b/s

$$\sqrt{\left(z - \frac{3}{4}\right)^2} = \pm\sqrt{\frac{-23}{16}}$$

$$z - \frac{3}{4} = \pm\frac{\sqrt{23}\times\sqrt{-1}}{4} = \pm\frac{\sqrt{23}\,i}{4}$$

$$z = \frac{3}{4} \pm \frac{\sqrt{23}}{4}i$$

$$z = \frac{3 \pm \sqrt{23}\,i}{4}$$

$$\boxed{S.S = \left\{\frac{3 \pm \sqrt{23}\,i}{4}\right\}}$$ Ans

ii) $z^2 - 6z + 30 = 0$

Sol:- $z^2 - 6z + 30 = 0$

$$z^2 - 6z = -30$$

Add $(3)^2$ on b/s we get

$$z^2 - 6z + (3)^2 = -30 + (3)^2$$

$$(Z-3)^2 = -30+9 = -21$$

Taking square root on b/s

$$\sqrt{(Z-3)^2} = \pm\sqrt{-21}$$

$$Z-3 = \pm\sqrt{21}\times\sqrt{-1} = \pm\sqrt{21}\,i$$

$$Z = 3\pm\sqrt{21}\,i$$

$$\boxed{S.S = \{3\pm\sqrt{21}\,i\}}$$ Ans

iii) $3Z^2-18Z+50=0$

Sol:- $3Z^2-18Z+50=0$

$$3Z^2-18Z = -50$$

÷ing by 3 on b/s we get

$$\Rightarrow Z^2-6Z = -\frac{50}{3}$$

Add $(3)^2$ on b/s

$$Z^2-6Z+(3)^2 = -\frac{50}{3}+(3)^2$$

$$(Z-3)^2 = -\frac{50}{3}+\frac{9}{1} = \frac{-50+27}{3} = -\frac{23}{3}$$

Taking Sq. root on b/s

$$\sqrt{(Z-3)^2} = \pm\sqrt{-\frac{23}{3}}$$

$$Z-3 = \pm\sqrt{\frac{23}{3}}\times\sqrt{-1} = \pm\sqrt{\frac{23}{3}}\,i$$

$$Z = 3\pm\sqrt{\frac{23}{3}}\,i$$ $$\boxed{S.S = \{3\pm\sqrt{\frac{23}{3}}\,i\}}$$ Ans

iv) $z^2 + 4z + 13 = 0$

Sol:— $z^2 + 4z + 13 = 0$

$z^2 + 4z = -13$

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

$z^2 + 4z + (2)^2 = -13 + (2)^2$

$(z+2)^2 = -13 + 4 = -9$

Taking Square root on b/s

$\sqrt{(z+2)^2} = \pm\sqrt{-9}$

$z+2 = \pm 3\sqrt{-1} = \pm 3i$

$z = -2 \pm 3i$

$\boxed{S.S = \{-2 \pm 3i\}}$ Ans

v) $2z^2 + 6z + 9 = 0$

Sol:— $2z^2 + 6z + 9 = 0$

$2z^2 + 6z = -9$

÷ing by 2 on b/s we get

$\Rightarrow z^2 + 3z = -\frac{9}{2}$

Add $(\frac{3}{2})^2$ on b/s

$z^2 + 3z + (\frac{3}{2})^2 = (-\frac{9}{2}) + (\frac{3}{2})^2$

$(z + \frac{3}{2})^2 = -\frac{9}{2} + \frac{9}{4}$

$$\left(Z+\frac{3}{2}\right)^2 = \frac{-9\times2+9}{4} = \frac{-18+9}{4} = -\frac{9}{4}$$

Taking Square root on b/s

$$\sqrt{\left(Z+\frac{3}{2}\right)^2} = \pm\sqrt{\frac{-9}{4}}$$

$$Z+\frac{3}{2} = \pm\frac{3}{2}\sqrt{-1} = \pm\frac{3}{2}i$$

$$Z = -\frac{3}{2} \pm \frac{3}{2}i = \frac{-3\pm 3i}{2} = \frac{3(-1\pm i)}{2}$$

$$\boxed{S.S = \left\{\frac{3}{2}(-1\pm i)\right\}}$$ Ans

vi) $3Z^2 - 5Z + 7 = 0$

Sol:- $3Z^2 - 5Z + 7 = 0$

$3Z^2 - 5Z = -7$ ÷ing by 3

$\Rightarrow Z^2 - \frac{5}{3}Z = -\frac{7}{3}$ Add $\left(\frac{5}{6}\right)^2$

$$Z^2 - \frac{5}{3}Z + \left(\frac{5}{6}\right)^2 = -\frac{7}{3} + \left(\frac{5}{6}\right)^2$$

$$\left(Z-\frac{5}{6}\right)^2 = -\frac{7}{3} + \frac{25}{36} = \frac{-84+25}{36} = \frac{-59}{36}$$

Taking Square root on b/s

$$\sqrt{\left(Z-\frac{5}{6}\right)^2} = \pm\sqrt{\frac{-59}{36}}$$

$$Z-\frac{5}{6} = \pm\frac{\sqrt{59}}{6}\sqrt{-1} = \pm\frac{\sqrt{59}\,i}{6}$$

$$Z = \frac{5}{6} \pm \frac{\sqrt{59}}{6}i = \frac{5\pm\sqrt{59}}{6}$$

$$\boxed{S.S = \left\{\frac{5\pm\sqrt{59}}{}\right\}}$$ Ans

Q.5 Solve the following equations

i) $2Z^4 - 32 = 0$

Sol:- $2Z^4 - 32 = 0$

$2(Z^4 - 16) = 0$

$(Z^2)^2 - 4^2 = 0$

$(Z^2 - 4)(Z^2 + 4) = 0$

$Z^2 - 4 = 0 \wedge Z^2 + 4 = 0$

$Z^2 = 4 \qquad Z^2 = -4$

$\Rightarrow Z = \pm 2 \qquad \Rightarrow Z = \pm 2i$

$\boxed{S.S = \{\pm 2, \pm 2i\}}$

ii) $3Z^5 - 243Z = 0$

Sol:- $3Z^5 - 243Z = 0$

$3Z(Z^4 - 81) = 0$

$3Z = 0 \wedge (Z^4 - 81) = 0$

$\boxed{Z = 0} \qquad (Z^2)^2 - 9^2 = 0$

$(Z^2 + 9)(Z^2 - 9) = 0$

$Z^2 + 9 = 0 \wedge Z^2 - 9 = 0$

$Z^2 = -9 \qquad Z^2 = 9$

$\Rightarrow \boxed{Z = \pm 3i} \qquad \boxed{Z = \pm 3}$

$\boxed{S.S = \{\pm 3, \pm 3i, 0\}}$

iii) $5Z^5 - 5Z = 0$

Sol:- $5Z^5 - 5Z = 0$

$5Z(Z^4 - 1) = 0$

$5Z = 0 \wedge Z^4 - 1 = 0$

$\boxed{Z = 0} \qquad (Z^2)^2 - 1^2 = 0$

$(Z^2 + 1)(Z^2 - 1) = 0$

$Z^2 + 1 = 0 \wedge Z^2 - 1 = 0$

$Z^2 = -1 \qquad Z^2 = 1$

$\Rightarrow Z = \pm i \qquad Z = \pm 1$

$\boxed{S.S = \{0, \pm 1, \pm i\}}$ Ans

iv) $Z^3 - 5Z^2 + Z - 5 = 0$

Sol:- $Z^3 - 5Z^2 + Z - 5 = 0$

$Z^2(Z - 5) + 1(Z - 5) = 0$

$(Z - 5)(Z^2 + 1) = 0$

$Z - 5 = 0 \wedge Z^2 + 1 = 0$

$\boxed{Z = 5} \qquad Z^2 = -1$

$\Rightarrow \boxed{Z = \pm i}$

$\boxed{S.S = \{5, \pm i\}}$ Ans

v) $4z^4 - 25z^2 + 21 = 0$

Sol: $4z^4 - 25z^2 + 21 = 0$

put $z = 1$

$4(1) - 25(1) + 21 = 0$

$4 - 25 + 21 = 0$

$0 = 0$

As $\boxed{z = 1}$ is satisfying the equation so $z = 1$ is the root of the eq.

$$\begin{array}{r|rrrrr} 1 & 4 & 0 & -25 & 0 & 21 \\ & & 4 & 4 & -21 & -21 \\ \hline & 4 & 4 & -21 & -21 & 0 \end{array}$$

$4z^3 + 4z^2 - 21z - 21 = 0$

$4z^2(z+1) - 21(z+1) = 0$

$(z+1)(4z^2 - 21) = 0$

$z+1 = 0 \wedge 4z^2 - 21 = 0$

$\boxed{z = -1}$ $\quad 4z^2 = 21$

$z^2 = \frac{21}{4}$

$\Rightarrow z = \pm\frac{\sqrt{21}}{2}$

$$\boxed{S.S = \left\{\pm 1, \pm\frac{\sqrt{21}}{2}\right\}}$$ Ans

Alternative

$4z^4 - 25z^2 + 21 = 0$

$4z^2 - 21z^2 - 4z^2 + 21 = 0$

$(4z^2 - 21)z^2 - 1(z^2 - 21) = 0$

$(z^2 - 1)(4z^2 - 21) = 0$

$z^2 - 1 = 0 \wedge 4z^2 - 21 = 0$

$z^2 = 1 \qquad 4z^2 = 21$

$z = \pm 1 \qquad z^2 = \frac{21}{4}$

$\Rightarrow z = \pm\frac{\sqrt{21}}{2}$

$$\boxed{S.S = \left\{\pm 1, \pm\frac{\sqrt{21}}{2}\right\}}$$ Ans

vi) $z^3 + z^2 + z + 1 = 0$

Sol:- $z^3 + z^2 + z + 1 = 0$

$z^2(z+1) + 1(z+1) = 0$

$(z+1)(z^2+1) = 0$

$z+1 = 0 \wedge z^2 + 1 = 0$

$\boxed{z = -1} \qquad z^2 = -1$

$z = \pm\sqrt{-1}$

$\boxed{z = \pm i}$

$$\boxed{S.S = \{-1, \pm i\}}$$ Ans

Q.6 Find a polynomial of degree 3 with zero's $3, -2i, 2i$ and satisfying $p(1) = 20$.

Sol:- Given zero's $3, -2i, 2i$ i.e $z_0 = 3$, $z_1 = -2i$, $z_2 = 2i$

The Complex polynomial of degree 3 is

$$p(z) = a(z - z_0)(z - z_1)(z - z_2)$$

putting the values

$$p(z) = a(z-3)(z+2i)(z-2i) \quad \because a^2 - b^2 = (a+b)(a-b)$$

$$p(z) = a(z-3)(z^2 - (2i)^2) = a(z-3)(z^2 - 4i^2)$$

$$p(z) = a(z-3)(z^2 - 4(-1)) = a(z-3)(z^2+4) \quad \text{--- } (1)$$

put $z = 1$

$$p(1) = a(1-3)(1^2+4) = a(-2)(5) = -10a$$

using $p(1) = 20$

$$20 = -10a \Rightarrow \boxed{a = -2} \text{ put in } (1)$$

$$p(z) = -2(z-3)(z^2+4) = -2(z^3 + 4z - 3z^2 - 12)$$

$$p(z) = -2(z^3 - 3z^2 + 4z - 12)$$

$$\boxed{p(z) = -2z^3 + 6z^2 - 8z + 24}$$ Req. poly. of degree 3

Q.7 Find a polynomial of degree 4 with zero's $2i, -2i, -1, 1$ and satisfying $p(2) = 240$

Sol:- Given zero's i.e $z_0 = 2i$, $z_1 = -2i$, $z_2 = -1$, $z_3 = 1$

The Complex polynomial of degree 4 is

$$p(z) = a(z - z_0)(z - z_1)(z - z_2)(z - z_3)$$

putting the values.

$p(z) = a(z-2i)(z+2i)(z+1)(z-1)$

$p(z) = a(z^2-(2i)^2)(z^2-1^2) = a(z^2-4i^2)(z^2-1)$

$p(z) = a(z^2-4(-1))(z^2-1) = a(z^2+4)(z^2-1)$ — (1

put $z=2$ in eq. (1 we get

$p(2) = a(2^2+4)(2^2-1) = a(4+4)(4-1) = a(8)(3)$

using $p(2) = 240$

$240 = 24a \Rightarrow \boxed{a=24}$ put in (1

$p(z) = 24(z^2+4)(z^2-1) = 24(z^4-z^2+4z^2-4) = 24(z^4+3z^2-4)$

$\boxed{p(z) = 24z^4+72z^2-96}$ which is req.

Q.8 Find a polynominal of degree 4 with zero's 4, −4, 1+i, 1−i and satisfying $p(2) = 72$.

Sol:- Given zero's $z_0 = 4$, $z_1 = -4$, $z_2 = 1+i$, $z_3 = 1-i$

Complex polynominal of degree 4 is

$p(z) = a(z-z_0)(z-z_1)(z-z_2)(z-z_3)$

putting the values

$p(z) = a(z-4)(z+4)(z-(1+i))(z-(1-i))$

$p(z) = a(z^2-4^2)(z^2-z(1-i)-z(1+i)+(1-i)(1+i))$

$p(z) = a(z^2-16)(z^2-z+\cancel{zi}-z-\cancel{zi}+1-i^2)$

$p(z) = a(z^2-16)(z^2-2z+1-(-1)) = a(z^2-16)(z^2-2z+1+1)$

$p(z) = a(z^2-16)(z^2-2z+2)$ (1 put $z=2$

$p(2) = a(2^2-16)(2^2-2(2)+2) = a(4-16)(4-4+2)$

$p(2) = a(-12)(2) = -24a$ using $p(2) = 72$

$72 = -24a \Rightarrow \boxed{a=-3}$ put in (1

$p(z) = (z^4-2z^3+2z^2-16z^2-32z-32)$

$\boxed{p(z) = -3z^4+6z^3+42z^2+96z+96}$ Which is req.