o) $P(x) = x^4 - 6x^3 + 22x^2 - 54x + 117$ sabiendo que $3 - 2i$ es uno de sus ceros. y el otro es $3+2i$

x^4	x^3	x^2	x	k	
1	-6	22	-54	117	
	$3-2i$	-13	$27-18i$	-117	$3-2i$
1	$-3-2i$	9	$-27-18i$	0	$(x-(3-2i))$

$x^3 + (-3-2i)x^2 + 9x + (-27-18i)$

$(3-2i)(-3-2i)$

$-9 - \cancel{6i + 6i} + 4i^2$

$-9 - 4$

-13

1	$-3-2i$	9	$-27-18i$	
	$3+2i$	0	$27+18i$	$3+2i$
1	0	9	0	$(x-(3+2i))$

$(3-2i)(-27-18i)$

$-81 - \cancel{54i + 54i} + 36i^2$

$-81 - 36$

-117

$(x^2+9) = (x-3i)(x+3i)$

$$\boxed{(x-3i)(x+3i)(x-(3-2i))(x-(3+2i))}$$

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

$a^2 + b^2 = (a-bi)(a+bi)$

r) $P(x) = 4x^4 - 12x^3 + 22x^2 - 16x + 6$ sabiendo que $\frac{1}{2} - \frac{i}{2}$ es un cero de $P(x)$. , el otro es $\frac{1}{2} + \frac{i}{2}$

4	-12	22	-16	6	$\frac{1}{2} - \frac{i}{2}$
	$2-2i$	$-6+4i$	$10-6i$		
4	$-10-2i$	$16+4i$	$6-6i$	$-6i$	$\left(x - \left(\frac{1}{2} - \frac{i}{2}\right)\right)$

$(16+4i)\left(\frac{1}{2} - \frac{i}{2}\right)$

$8 - 8i + 2i - 2i^2$

$8 - 6i + 2$

$10 - 6i$

$(6-6i)\left(\frac{1}{2} - \frac{i}{2}\right)$

$3 - 3i - 3i + 3i^2$

$\cancel{3} - 6i \cancel{-3}$

$-6i$

$4\left(\frac{1}{2} - \frac{i}{2}\right)$

$4 \cdot \frac{1}{2} - 4 \cdot \frac{i}{2}$

$2 - 2i$

$(-10-2i)\left(\frac{1}{2} - \frac{i}{2}\right)$

$-10 \cdot \frac{1}{2} + -10 \cdot \frac{-i}{2} + -2i \cdot \frac{1}{2} + -2i \cdot \frac{-i}{2}$

$-5 + 5i - i + i^2$

$-5 + 4i - 1$

$-6 + 4i$

13. Determine los números complejos z, w que satisfagan simultáneamente las condiciones siguientes:

$$\begin{cases} z - w \in \mathbb{R} \\ \operatorname{Re}(z+w) = 1 \\ z \cdot w = -7 + i \end{cases}$$

$z = a_1 + b_1 i \qquad w = a_2 + b_2 i$

$z - w = k + 0i$, k constante

$$\begin{array}{c} \quad a \qquad\quad b \qquad\qquad c \qquad d \\ z - w = (a_1 - a_2) + (b_1 + b_2) \end{array}$$

$\operatorname{Im}(z-w) = 0$

$b_1 - b_2 = 0$, $\overset{c}{b_1} = \overset{d}{b_2}$

$\operatorname{Re}(z+w) = 1 \qquad z = a_1 + b_1 i \qquad w = a_2 + b_2 i$

$\overset{a}{a_1} + \overset{c}{b_1} = 1$

$\overset{c}{b_1} = 1 - \overset{a}{a_1}$

$z \cdot w = -7 + i \qquad z = a_1 + b_1 i \qquad w = a_2 + b_2 i$

$(\overset{a}{a_1} + \overset{b}{b_1})(\overset{c}{a_2} + \overset{d}{b_2}) \qquad b_1 = b_2$

$ac + ad + bc + bd$

$(ac - bd) + (ad + bc)i$

$(ac - b^2) + (ba + bc)$

$(ac - b^2) + (b(a+c))$

$(ac - b^2) + (b(a+c)) = -7 + i$

$ac - b^2 = -7$ $\qquad$ $a \quad c$

$b(a+c) = 1$ $\qquad$ $a_1 + b_1 = 1$

$c \quad a$

$b(1) = 1$ $\qquad$ $b_1 = 1 - a_1$

$b = 1$

$ac - b^2 = -7$

$a(1-a) - 1^2 = -7$

$a - a^2 - 1 = -7$

$-a^2 + a + 6 = 0 \quad = a = 3 \quad a = -2$

$b = d, \; b = 1, \; d = 1$

$z = a_1 + b_1 i \qquad w = a_2 + b_2 i$

$3 + i \qquad -2 + i \qquad \mathrm{Re}(z + w) = 1$

$-2 + i \qquad 3 + i$