



Verbetering toets Complexe getallen deel 2:

1. Los volgende oefeningen op:

$$\text{a) } \frac{1+2i}{(3+4i)} \cdot \frac{3-i}{(3-4i)}$$

$$\frac{(1+2i) \cdot (3-i)}{(9+16)} \quad ((a+bi) \cdot (a-bi) = a^2 + b^2)$$

$$\frac{(3-i+6i+2)}{(9+16)} \quad (\text{distributiviteit, haakjes zijn puur ter verduidelijking})$$

$$\frac{(5+5i)}{25}$$

$$\frac{1}{5} + \frac{1}{5}i$$

$$\text{b) } \frac{-1+i}{(3-4i)} \cdot \frac{2-2i}{(1+2i)}$$

$$\frac{(-2+2i+2i+2)}{(3-4i+6i+8)} \quad (\text{distributiviteit})$$

$$\frac{4i}{(11+2i)} \quad (\text{reële delen met elkaar optellen, imaginaire delen met elkaar optellen})$$

$$2 + \frac{4}{11}i$$

$$\text{c) } \frac{4-3i}{(2+3i)} \cdot \frac{2}{(2-3i)}$$



$$\frac{8-6i}{(4+9)} \quad ((a+bi) \cdot (a-bi) = a^2 + b^2)$$

$$\frac{8-6i}{13}$$

$$\frac{8}{13} - \frac{6}{13}i$$

$$\mathbf{d)} \quad \frac{2-1i}{(3i)} \cdot \frac{i-5}{(2-3i)}$$

$$\frac{(2i-10+1+5i)}{(6i+9)} \quad (\text{distributiviteit})$$

$$\frac{7i-9}{6i+9} \quad (\text{we willen nu de noemer imaginairvrij krijgen})$$

$$\frac{7i-9}{6i+9} \cdot \frac{6i-9}{6i-9} \quad ((a+bi) \cdot (a-bi) = a^2 + b^2)$$

$$\frac{-42-63i-54i+81}{36+81}$$

$$\frac{39-117i}{117}$$

$$\frac{39}{117} - i$$

$$\mathbf{e)} \quad \frac{1-2i}{i} \cdot \frac{2}{(2+5i)}$$

$$\frac{2-4i}{2i-5}$$



$$\frac{2 - 4i}{-(5 - 2i)} \quad (\text{we willen naar de vorm } a - bi \text{ dus zetten we er een min voor})$$

$$\frac{2 - 4i}{-(5 - 2i)} \cdot \frac{5 + 2i}{5 + 2i} \quad ((a + bi) \cdot (a - bi) = a^2 + b^2)$$

$$\frac{10 - 20i + 4i + 8}{-(25 + 4)}$$

$$\frac{18 - 16i}{-29}$$

$$-\frac{18}{29} + \frac{16}{29}i$$

2. Los volgende oefeningen op in C:

a) $z^2 + 6z + 13 = 0$

$$\omega^2 = b^2 - 4ac = 36 - 4 \cdot 1 \cdot 13 = -16$$

$$\omega = 4i$$

$$z_1 = \frac{-b + \omega}{2a}, z_2 = \frac{-b - \omega}{2a}$$

$$z_1 = \frac{-6 + 4i}{2}, z_2 = \frac{-6 - 4i}{2}$$

$$z_1 = -3 + 2i, z_2 = -3 - 2i$$



$$\mathbf{b) \quad 4z^2 + 5z + 1 = 0}$$

$$\omega^2 = b^2 - 4ac = 25 - 4 \cdot 4 \cdot 1 = 9$$

$$\omega = 3$$

$$z_1 = \frac{-b + \omega}{2a}, z_2 = \frac{-b - \omega}{2a}$$

$$z_1 = \frac{-5 + 3}{8}, z_2 = \frac{-5 - 3}{8}$$

$$z_1 = -0,25, z_2 = -1$$

$$\mathbf{c) \quad z^2 + 6z + 25 = 0}$$

$$\omega^2 = b^2 - 4ac = 36 - 4 \cdot 1 \cdot 25 = -64$$

$$\omega = 8i$$

$$z_1 = \frac{-b + \omega}{2a}, z_2 = \frac{-b - \omega}{2a}$$

$$z_1 = \frac{-6 + 8i}{2}, z_2 = \frac{-6 - 8i}{2}$$

$$z_1 = -3 + 4i, z_2 = -3 - 4i$$

$$\mathbf{d) \quad iz^2 + 3z + 10 = 0}$$

$$\omega^2 = b^2 - 4ac = 9 - 4 \cdot 5 \cdot i = 9 - 40i$$

$$(x + yi)^2 = 9 - 40i$$



$$\begin{cases} x^2 - y^2 = 9 \\ 2xyi = -40i \end{cases}$$

$$\begin{cases} x^2 - y^2 = 9 \\ xy = -20 \end{cases}$$

$$\begin{cases} x^2 - y^2 = 9 \\ x = \frac{-20}{y} \end{cases}$$

$$\begin{cases} \frac{400}{y^2} - y^2 = 9 \\ x = \frac{-20}{y} \end{cases}$$

$$\begin{cases} -y^4 - 9y^2 + 400 = 0 \quad (\text{beide leden maal } y^2) \\ x = \frac{-20}{y} \end{cases}$$

Delers van 4 zijn {1,-1,2,-2,4,-4}

Probeer deze getallen in te vullen, dus y vervangen door bijvoorbeeld 1.

Vervolgens kijk je of de vergelijking nog klopt.

$$\text{Vb 1: } -(1)^4 - 9(1)^2 + 400$$

$$= -1 - 9 + 400$$

$$390 \neq 0$$

Voor het getal 4 en -4 kloppen de vergelijkingen

$$\begin{cases} y = -4 \vee y = 4 \\ x = \frac{-20}{y} \end{cases}$$

$$\begin{cases} y = -4 \vee y = 4 \\ x = 5 \vee x = -5 \end{cases}$$

$$\omega = 5 - 4i \vee \omega = -5 + 4i$$

$$z_1 = \frac{-b + \omega}{2a}, z_2 = \frac{-b - \omega}{2a}$$

$$z_1 = \frac{-3 + 5 - 4i}{2i}, z_2 = \frac{-3 - 5 + 4i}{2i}$$

$$z_1 = -2 + i, z_2 = 2 - 4i$$

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