

Equality.

$$x(3+4i) + y(2-3i) = 8+5i \quad \text{find } x \text{ and } y.$$

$$\underbrace{3x}_{\text{R}} + \underbrace{4xi}_{\text{I}} + \underbrace{2y}_{\text{R}} - \underbrace{3yi}_{\text{I}} = \underbrace{8}_{\text{R}} + \underbrace{5i}_{\text{I}}$$

$$\begin{aligned} 3x + 2y &= 8 \\ 4x - 3y &= 5 \end{aligned}$$

Solve to get $x = 2$ $y = 1$

Given $w\bar{w} - 2iw = 7-4i$ find 2 possible values for w .

Let $w = a + bi$

$$\bar{w} = a - bi$$

$$w\bar{w} = a^2 - b^2i^2 = a^2 + b^2$$

$$a^2 + b^2 - 2i(a + bi) = 7 - 4i$$

$$a^2 + b^2 - 2ai - 2bi^2 = 7 - 4i$$

$$\underbrace{a^2}_{\text{R}} + \underbrace{b^2}_{\text{R}} - \underbrace{2ai}_{\text{I}} + \underbrace{2b}_{\text{R}} = \underbrace{7}_{\text{R}} - \underbrace{4i}_{\text{I}} \quad \begin{aligned} \text{Real} &= \text{Real} \\ \text{Imag} &= \text{Imag} \end{aligned}$$

$$a^2 + b^2 + 2b = 7$$

$$-2a = -4$$

$$a = 2$$

$$4 + b^2 + 2b = 7$$

$$b^2 + 2b - 3 = 0$$

$$(b + 3)(b - 1) = 0$$

$$b = -3 \quad b = 1$$

$$w = 2 - 3i \quad \text{or} \quad w = 2 + i$$

$a(a+c) - bc(3+bc) = 10(1+c)$ find the values for a and b where $a, b \in \mathbb{R}$.

$$a^2 + ac - 3bc - bc^2 = 10 + 10c$$

$$a^2 + ac - 3bc + b^2 = 10 + 10c$$

$$\begin{array}{l} R = R \\ I = I \end{array}$$

$$a^2 + b^2 = 10$$

$$a - 3b = 10$$

$$a = 3b + 10$$

$$(3b+10)^2 + b^2 = 10$$

$$9b^2 + 60b + 100 + b^2 - 10 = 0$$

$$10b^2 + 60b + 90 = 0$$

$$b^2 + 6b + 9 = 0$$

$$(b+3)^2 = 0$$

$$b = -3$$

$$a = -9 + 10 \quad a = 1$$

Square

Roots

Find

$$\sqrt{5+12i}$$

$$\sqrt{5+12i} \neq \sqrt{5} + \sqrt{12i}$$

$$\sqrt{5+12i} = (5+12i)^{\frac{1}{2}} \quad ? \text{ where to go?}$$

$$\text{Let } \sqrt{5+12i} = a+bi$$

Square both side

$$5 + 12i = a^2 + 2abc + b^2c^2$$

$$5 + 12i = a^2 + 2abc - b^2$$

$$5 = a^2 - b^2$$

Real

$$12 = 2ab$$

Imag

$$ab = 6$$

$$b = \frac{6}{a} \quad \text{sub } u$$

$$S = a^2 - b^2$$

$$S = a^2 - \frac{36}{a^2}$$

$$\left(\frac{x}{y}\right)^2 = \frac{x^2}{y^2}$$

$$5a^2 = (a^2)^2 - 36$$

$$t = a^2$$

$$t^2 - 5t - 36 = 0$$

$$(t-9)(t+4) = 0$$

$$t = 9 \quad t = -4$$

$$a^2 = 9$$

$$\cancel{a^2 = -4}$$

$$a = \pm 3$$

$$b = \frac{6}{a} \Rightarrow b = \pm 2$$

$$3+2i \quad \text{or} \quad -3-2i$$