

Addition of Complex numbers

$$(2-3i) + (5+2i) = 7-1i = 7-i$$

Subtraction of complex numbers

$$(2i) - (15-3i) = 2i - 15 + 3i \\ = -15 + 5i$$

Multiply Complex numbers

$$(8-3i)(7+5i) = 56 + 40i - 21i - 15i^2 \quad i^2 = -1 \\ = 56 + 19i - 15(-1) \\ = 56 + 19i + 15 \\ = 71 + 19i$$

Divide complex numbers

$$\frac{3-2i}{5+i} \cdot \frac{5-i}{5-i} = \frac{(3-2i)(5-i)}{(5+i)(5-i)}$$

$$w = 5+i \\ \bar{w} = 5-i$$

$$= \frac{15 - 3i - 10i + 2i^2}{25 - 5i + 5i - i^2} \quad i^2 = (-1)$$

$$15 - 13i - 2$$

$$25 - (-1)$$

$$\frac{13-13i}{26}$$

$$\frac{13(1-i)}{26} \\ = \frac{1-i}{2}$$

$$\frac{1-i}{2} = \frac{1}{2} - \frac{1}{2}i$$

## Quadratic Equations in Complex Number System

$$x^2 - 5x + 11 = 0 \quad a=1 \quad b=-5 \quad c=11$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{5 \pm \sqrt{25 - 44}}{2} = \frac{5 \pm \sqrt{-19}}{2}$$

$$\sqrt{-19} = i\sqrt{19}$$

$$x = \frac{5}{2} + \frac{\sqrt{19}}{2} i$$

$$x = \frac{5}{2} - \frac{\sqrt{19}}{2} i$$

$$\left\{ \frac{5}{2} - \frac{\sqrt{19}}{2} i ; \frac{5}{2} + \frac{\sqrt{19}}{2} i \right\}$$

$$13x^2 + 1 = -6x$$

$$13x^2 - 6x + 1 = 0 \quad a=13 \quad b=-6 \quad c=1$$

$$x = \frac{6 \pm \sqrt{36 - 52}}{2 \cdot 13} = \frac{6 \pm \sqrt{-16}}{26} = \frac{6 \pm 4i}{26}$$

$$\sqrt{-16} = 4i$$

$$x = \frac{6}{26} + \frac{4}{26} i = \frac{3}{13} + \frac{2}{13} i$$

$$x = \frac{6}{26} - \frac{4}{26} i = \frac{3}{13} - \frac{2}{13} i$$

$$\left\{ \frac{3}{13} - \frac{2}{13} i ; \frac{3}{13} + \frac{2}{13} i \right\}$$

$$x^2 + 169 = 0$$

$$\sqrt{x^2} = \sqrt{-169}$$

$$x = \pm \sqrt{-169}$$

$$x = \pm 13i$$

$$\{-13i ; 13i\}$$