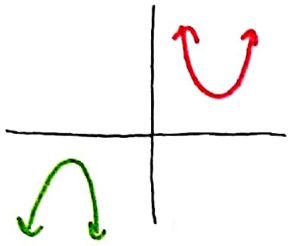
Objective: To apply operations of complex numbers and solve quadratic equations with complex solutions

Complex numbers

- real numbers ($\frac{1}{2}$, 0.25, -4, 5)
- imaginary numbers ($3i$, $-2i$)
- combinations of both ($3+4i$ or $2-3i$)



No x-intercepts, but there are zeros/roots that are imaginary

$\sqrt{x^2} = \sqrt{-1}$

$x = \pm i$

★ $\sqrt{-1} = i$

$\sqrt{-4} = i\sqrt{4} = \boxed{2i}$

$\sqrt{-75} = i\sqrt{75} = i\sqrt{25}\cdot\sqrt{3}$

$= \boxed{5i\sqrt{3}}$

Examples: simplifying powers of i

$\boxed{i^{25} = i}$

$4\overline{)25}$ R 1

-24

(1) → new power

$i^1 = i$

★ Divide the power by 4 and use the remainder as the new power.

$\boxed{i^{34} = -1}$

$4\overline{)34}$ R 2

-32

(2) → new power

$i^2 = -1$

$\boxed{i^{16} = 1}$

$4\overline{)16}$

-16

(0) → new power

$i^0 = 1$

★ $\boxed{i^2 = -1}$

$i^0 = 1$

$i^1 = i$

$i^2 = -1$

$i^3 = i^2 \cdot i = -i$

4 possible answers when simplifying powers of i

complex numbers in standard form : $\boxed{a + bi}$

$\boxed{a - bi}$

operations of complex numbers :

Add/subtracting : combining like terms

1.) $(-3 + 4i) + (2 - 3i)$

$(-3+2) + (4i - 3i)$

$-1 + i$

$\boxed{-1+i}$

2.) $(-5 - 2i) - (4 + 5i)$

$-5 - 2i - 4 - 5i$

$\boxed{-9 - 7i}$

Multiplying : FOIL

3.) $(2 + 4i)(3 - 6i)$

$6 - 12i + 12i - 24i^2$

$6 - 24(-1)$

$6 + 24 = \boxed{30}$

★ Remember the fact $i^2 = -1$

4.) $(-3 - 5i)(2 + 7i)$

$-6 - 21i - 10i - 35i^2$

$-6 - 31i - 35(-1)$

$-6 - 31i + 35$

$\boxed{29 - 31i}$ → complex number

Solving quadratics with complex solutions.

1.) $(x-3)^2 + 4 = -8$

Square root Method

$-4 \quad -4$

$\sqrt{(x-3)^2} = \sqrt{-12}$

Remember $\pm$

$x - 3 = \pm\sqrt{-12}$

$+3 \quad +3$

$x = 3 \pm \sqrt{-12}$

take out $(-)$ as an i

$\sqrt{-1} = i$

$x = 3 \pm i\sqrt{12}$

$x = 3 \pm i\sqrt{4}\cdot\sqrt{3}$

$\boxed{x = 3 \pm 2i\sqrt{3}}$

$x = 3 + 2i\sqrt{3} \qquad x = 3 - 2i\sqrt{3}$

2.) $x^2 + 4x + 29 = 0$

Not factorable

$\downarrow$

completing square

$\downarrow$

quadratic formula

$-29 \quad -29$

$x^2 + 4x + (2)^2 = -29 + 4$

$\sqrt{(x+2)^2} = \sqrt{-25}$

$x + 2 = \pm\sqrt{-25}$

$-2 \quad -2$

$x = -2 \pm \sqrt{-25}$

$x = -2 \pm i\sqrt{25}$

$x = -2 \pm 5i$

$\boxed{x = -2 + 5i} \qquad \boxed{x = -2 - 5i}$