Section 4-8
Complex Numbers

Students will be able to:
-identify, graph, and perform operations with complex numbers.
-find complex number solutions of quadratic equations.

Complex numbers - based on a number whose square is -1.
imaginary unit *i* whose square is -1

$\sqrt{-a}$

$a^2 = -1$

$i^2 = -1$

$i = \sqrt{-1}$

Simplify : $\sqrt{-18}$

$\sqrt{-18} = \sqrt{-1} \cdot \sqrt{18}$

$i\sqrt{18} = i\sqrt{9 \cdot 2} = 3i\sqrt{2}$

An imaginary number is in the form a + bi
-imaginary and real numbers make up the set called the complex numbers.

$a + bi$

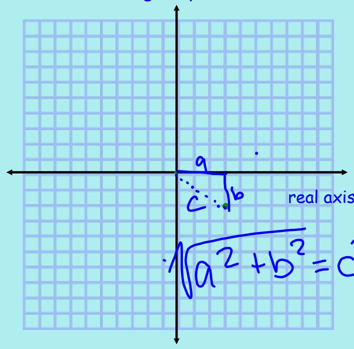
real part imaginary part

Complex Plane

(a, b) represents
a + b*i*

Graph:
3 - 2*i*

$(3, -2)$



$\sqrt{a^2 + b^2} = c^2$

|a + b*i*| is the distance of the number from the origin in the complex plane.

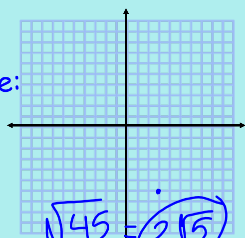
$|a + bi| = \sqrt{a^2 + b^2}$

#17. Plot and find distance:
3 - 6i

$\sqrt{3^2 + (6)^2}$

$\sqrt{9 + 36} = \sqrt{45} = 3\sqrt{5}$

9·5



To add or subtract complex numbers, combine like parts.

(7 - 2i) + (-3 + i) $= 4 - i$

(1 + 5i) - (8i) $=$ $1 - 3i$

0+8i

Multiply:

$2i(4 + 2i) =$

$8i + 4i^2$ $\quad i^2 = -1$

$(i)^2 = (\sqrt{-1})^2$

$i^2 = -1$

$8i + 4(-1) = -4 + 8i$

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

$2 + 3i - 2i + 3i^2$ $\quad +1$

$2 + i \quad +3$

$5 + i$

Find the quotient:

$\frac{(4 - i) \cdot i}{6i \cdot i} = \frac{4i - i^2}{6i^2} = \frac{4i + (+1)}{6(-1)}$

$= \frac{1 + 4i}{-6}$

$\frac{(5 - 2i)(3 - 4i)}{(3 + 4i)(3 - 4i)} = \frac{15 - 20i - 6i + 8i^2}{9 - \cancel{12i} + \cancel{12i} + 16i^2}$ $\quad -1 \quad +1$

$\frac{7 - 26i}{25} = \frac{7}{25} - \frac{26i}{25}$

Solve:

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

$a = 3$

$b = -1$

$c = 2$

$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(3)(2)}}{2(3)}$ $\quad 1 - 24$

$= \frac{1 \pm \sqrt{-23}}{6}$

$\sqrt{-1} = i$

$\frac{1 \pm i\sqrt{23}}{6}$

$\frac{1}{6} \pm \frac{i\sqrt{23}}{6}$

Hwk: pg 253 - 255

#12, 15, 22 - 42 (4th),

48 - 54 (even), 58, 62, 66, 68