



Jun 22-2:18 PM

Complex Numbers: Form  
 $a + bi$   
where  $a$  &  $b$  are Real numbers and the "i" is the imaginary number

Examples

$5 + 8i, -1 - 10i,$   
 $\frac{2}{5} + 4i, \frac{7}{6} - \frac{11}{6}i$   
 $a + bi$  form

$5 + 0i, 0 + 2i$

Jun 22-2:30 PM

$$\frac{19 \cdot 1}{1}$$

Jun 22-2:38 PM

$$x^2 + 1 = 0$$

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

$x = \sqrt{-1}$  *Meaning what?*

$(?)^2 = -1$

$(1)^2 = 1 \cdot 1 = 1$   
 $(-1)^2 = (-1) \cdot (-1) = 1$

Fact #2  $(-i)^2 = -1$

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

Jun 22-2:39 PM

- Facts**
- ①  $\sqrt{-1} = i$
  - ②  $i^2 = -1$
  - ③  $i^3 = i^2 \cdot i = (-1) \cdot i = -i$
  - ④  $i^4 = i^2 \cdot i^2 = (-1) \cdot (-1) = 1$
- 
- $i^5 = i^4 \cdot i = 1 \cdot i = i$
- 
- $i^9 = (i^4)^2 \cdot i = (1)^2 \cdot i = 1 \cdot i = i$

Jun 22-2:48 PM

$$x^2 + 4 = 0$$

$$\sqrt{x^2} = \sqrt{-4}$$

$$x = \pm \sqrt{-4}$$

$$= \pm \sqrt{(-1) \cdot 4}$$

$$= \pm \sqrt{-1} \cdot \sqrt{4}$$

$$= \pm i \cdot 2$$

$$= \pm 2i$$

Jun 22-2:49 PM

Simplifying

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

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

$$-\sqrt{-49} = (-1) \cdot \sqrt{-49}$$

$$= (-1) \cdot \sqrt{(-1) \cdot 49}$$

$$= (-1) \cdot i \cdot 7$$

$$= -7i$$

Jun 22-2:48 PM

$$\sqrt{-5} = \sqrt{(-1) \cdot 5}$$

$$= \sqrt{-1} \cdot \sqrt{5}$$

$$= i\sqrt{5}$$

\* note: with radicals, leave the "i" in front

$$\sqrt{5}i \rightarrow \text{we may think } \sqrt{5i}$$

Jun 22-2:56 PM

Product Rule Issue!

$$\sqrt{-4} \cdot \sqrt{-9} \neq \sqrt{-4 \cdot -9} = \sqrt{36} = 6$$

these are complex

$$= 2i \cdot 3i$$

$$= 6i^2 \text{ use Fact \#2}$$

$$= 6 \cdot (-1)$$

$$= -6$$

Jun 22-2:59 PM

$$i^{21} = (i^4)^5 \cdot i^1$$

$$\frac{21}{4} = 5$$

$$= (1)^5 \cdot i$$

$$= 1 \cdot i$$

$$= i$$

$$i^{22} = (i^4)^5 \cdot i^2$$

$$= (1)^5 \cdot (-1)$$

$$= 1 \cdot (-1)$$

$$= -1$$

$$i^{23} = (i^4)^5 \cdot i^3$$

$$= 1 \cdot i^2 \cdot i$$

$$= 1 \cdot (-1) \cdot i$$

$$= -i$$

$$i^{24} = (i^4)^6 = (1)^6 = 1$$

$$\frac{24}{4} = 6$$

Jun 22-3:12 PM

- ①  $\sqrt{-1} = i$
- ②  $i^2 = -1$
- ③  $i^3 = -i$
- ④  $i^4 = 1$

$\frac{1}{4} \text{ r0} = 1$

$i^5 = i^4 \cdot i^1 = \frac{5}{4} \text{ r1} = i \quad 0.25$

$i^6 = \frac{6}{4} \text{ r2} = -1 \quad 0.50$

$i^7 = \frac{7}{4} \text{ r3} = -i \quad 0.75$

$i^8 = \frac{8}{4} \text{ r0} = 1 \quad 1.0$

Jun 22-3:16 PM

$$i^{187} = (i^4)^{46} \cdot i^3$$

$$= 1 \cdot i^2 \cdot i^1$$

$$= 1 \cdot (-1) \cdot i$$

$$= -i$$

$$\frac{187}{4} = 46 \text{ r3}$$

$$= 46.75$$

$$4 \cdot 46 = 184$$

$$187 - 184 = 3$$

Jun 22-3:22 PM