MRS21-LESSON-5 Mr. Pineda

Aim: What are complex numbers? (Section 4-8)

Do Now: What are the roots for $5x^2+20$?

$5x^2+20=0$

$5x^2=-20$

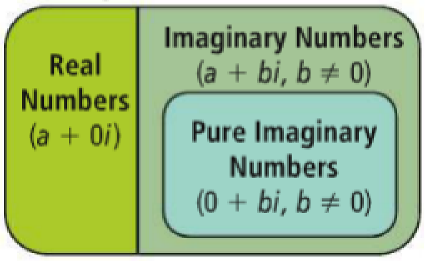
$x^2=\frac{-20}{5}$

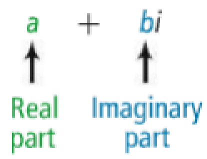
$x^2=-4$

$x=\pm\sqrt{-4}$ Error for Real numbers.

I- Complex Numbers

Complex Numbers ($a+bi$)





example $\sqrt{-4}$

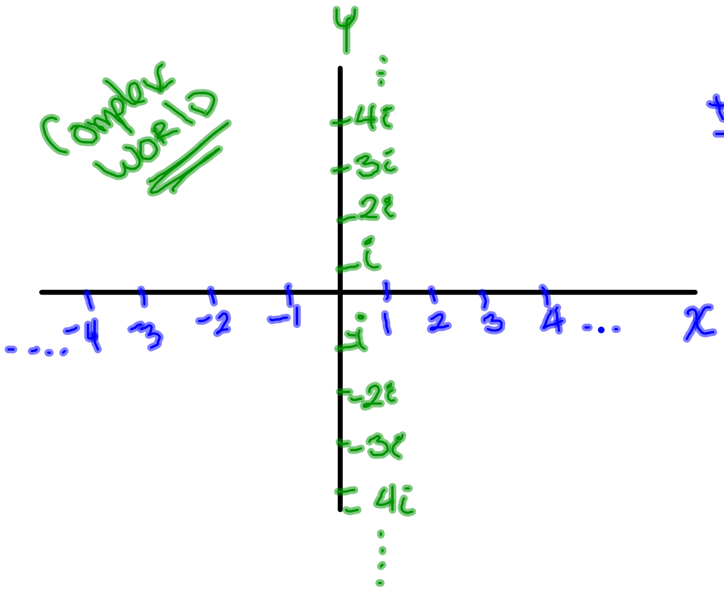
$\sqrt{4}$ Real → ± 2

$\sqrt{-1}$ imaginary → i

$\sqrt{-1}=i$

$=\boxed{\pm 2i}$ Rewrit it $0\pm 2i$

$\underbrace{\text{Real} \quad \text{imaginary}}_{\text{Complex Number}}$



1- Powers i

$\sqrt{2}\cdot\sqrt{2} = 2$ $\quad \underbrace{\sqrt{6}\cdot\sqrt{6}}_{\sqrt{36}} = 6$ $\quad \sqrt{-1}\cdot\sqrt{-1} = -1$

$\sqrt{x}\cdot\sqrt{x} = x$

The **imaginary unit** i is the complex number whose square is -1. So, $i^2 = -1$, and $i = \sqrt{-1}$.

2) Circle of answers

$\sqrt{-1} = i^1$

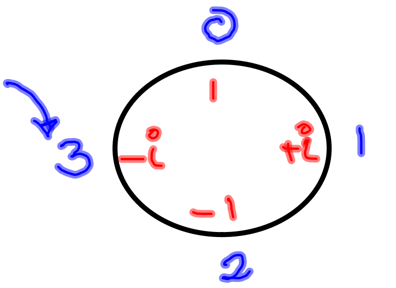
$\sqrt{-1}\cdot\sqrt{-1} = i^2 = -1$

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

$\underbrace{\sqrt{-1}\cdot\sqrt{-1}}_{-1}\cdot\underbrace{\sqrt{-1}\cdot\sqrt{-1}}_{-1} = i^4 = +1$

$= i^5 = i\cdot i^4 = i$

$= i^6 = -1 \quad = i\, i^5 = -1$



$i^4 = 1$ → $4\div 4 =$ Remainder 0

$i^6 = -1$ → $6\div 4 =$ Remainder 2

$i^3 = -i$ → $3\div 4 =$ Remainder 3

$i^{99} = -i$ → $99\div 4 =$ Remainder

$$\begin{array}{r} 24 \\ 4\,\overline{)\,99} \\ -8 \\ \hline 19 \\ -16 \\ \hline 3 \end{array}$$ Remainder

3) **Simplify each number by using the imaginary number *i*.**

1. $\sqrt{-100}$

$\sqrt{-1 \times 100}$

$\sqrt{-1} \times \sqrt{100}$

$\sqrt{-100}$

$\sqrt{-1}$ $\sqrt{100}$

i ± 10

$\pm 10i$

2. $\sqrt{-2}$

$\pm\sqrt{2}\, i$

3. $\sqrt{-48}$

$\sqrt{-1}$ $\sqrt{48}$

$\sqrt{16}$ $\sqrt{3}$

i ± 4 $\sqrt{3}$

$\pm 4i\sqrt{3}$

4. $\sqrt{-36}$

$\sqrt{-1}$

$\sqrt{36}$

$\pm 6i$

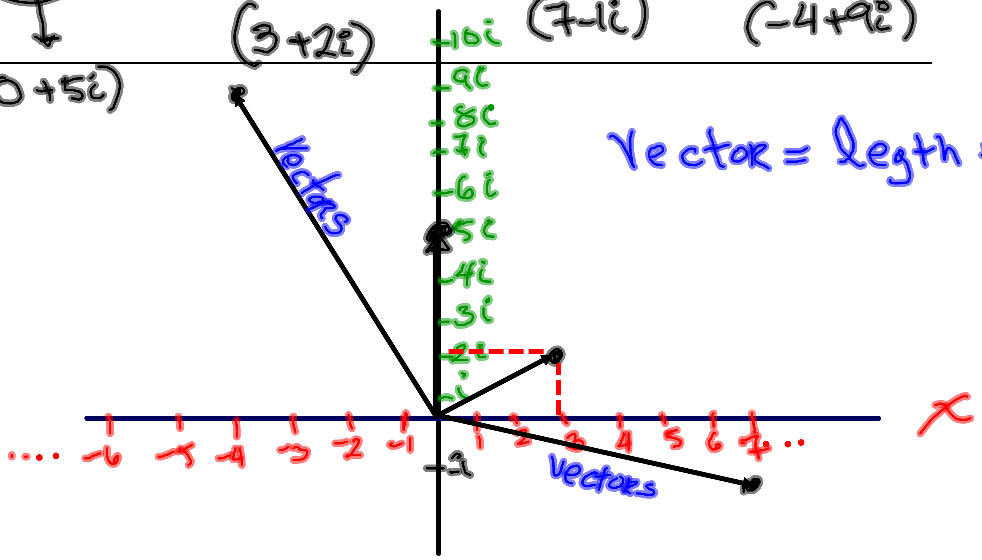
II – Graphing Complex Numbers

Plot each complex number and find its absolute value.

5. $5i$ **6.** $3 + 2i$ **7.** $7 - 1i$ **8.** $-4 + 9i$

$(0 + 5i)$ $(3 + 2i)$ $(7 - 1i)$ $(-4 + 9i)$

Vector = legth + direction



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III – Operations with Complex Numbers

1- **Simplify each expression.**

9. $(9 + 6i) + (2 - i)$

$(9 + 2) + (6i - i)$

$11 + 5i$

10. $(-12i) - (3 + 3i)$

$-3 - 3i$

$-12i$

$-3 - 15i$

11. $(-2i)(5 + 4i)$ multiplication

$= -10i - 8i^2$

$-10i - 8(-1)$

$= -10i + 8$

Don't forget $i^2 = (-1)$

Write each quotient as a complex number.

12. $\frac{5+4i}{7i}$

$\frac{5+4i}{7i}\left(\frac{-7i}{-7i}\right)$

13. $\left(\frac{-1+5i}{3-2i}\right)\cdot\frac{3+2i}{3+2i} =$

14. $\frac{2-6i}{2-3i}\cdot\frac{2+3i}{2+3i} =$

$\frac{5+4i}{7i}\cdot\frac{-7i}{-7i} = \frac{-35i-28i^2}{-49i^2}$

$= \frac{-35i-28(-1)}{-49(-1)} = \frac{-35i+28}{49}$

complex #

$\frac{28}{49} - \frac{35i}{49}$

$\boxed{a+bi}$

form

15. Error Analysis Robert solved the equation $2x^2 + 16 = 0$. His solution was $x = \pm\sqrt{-8}i$. What errors did Robert make? What is the correct solution?

Complete on your own

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