

Powers of i

i is a unique number, that has a distinctive pattern when it gets raised to powers. See if you can determine the pattern.

$$\begin{aligned}
 i^1 &= i \\
 i^2 &= -1 \\
 i^3 &= -i \\
 i^4 &= i^3 \cdot i = -i \cdot i = -i^2 = -(-1) = 1 \\
 i^5 &= i \\
 i^6 &= -1 \\
 i^7 &= -i \\
 i^8 &= 1 \\
 i^9 &= i
 \end{aligned}$$

What do you notice about the pattern?

always $\pm 1, \pm i$ sets of 4
 even: ± 1 multiples of 4 = 1
 odds: $\pm i$

How can you find the answer with any exponent?

$i^{64} = 1$	$i = i$	$1/4 = .25$
	$i^2 = -1$	$2/4 = .5$
$i^{25} = i$	$i^3 = -i$	$3/4 = .75$
$25/4 = 6.25$	$i^4 = 1$	$4/4 = 1.0$

$i^{512} = 1$	$i^{319} = -i$
$512/4 = 128$	$319/4 = 79.75$

$.25 = i$
 $.5 = -1$
 $.75 = -i$
 $.0 = 1$

$$i = i$$

$$i^2 = -1$$

$$i^3 = -i$$

$$i^4 = 1$$

$$i^5 = i$$

$$i^9 = i$$

$$1/4 = \underline{.25}$$

$$2/4 = .5$$

$$3/4 = .75$$

$$4/4 = 1.0$$

$$5/4 = \underline{1.25}$$

$$9/4 = 2.25$$

your turn!

i^{314}

i^{65}

Complex Numbers

Complex numbers are numbers that have both a real and an imaginary part

$$a+bi$$

real imaginary

$$4-5i$$

$$7.2 + 3.5i$$

Edit
Check
Reset
?

Real			Imaginary		Complex	
$5 + 2\sqrt{5}$	-45	$3\sqrt{7}$	$4i$	$5i - 2i$	$4 + i$	$3.5 + 2i$
$\sqrt[3]{-64}$		$-4\pi + 8$	$\sqrt{-48}$	$\frac{-5i}{2}$	$6 - 7i$	$\sqrt{7} - \sqrt{-7}$
	$\sqrt{6} + \sqrt{32}$		$4\sqrt{-5}$			$\sqrt{5} - i\sqrt{6}$

Adding Complex Numbers

$$\underline{(3 + 6i)} + \underline{(4 - 2i)}$$

$$7 + 4i$$

When adding complex numbers, you combine like terms by adding the real parts together and the imaginary parts together.

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

$$15 - 6i + 30 + 10i$$

$$45 + 4i$$

Subtracting Complex Numbers

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

$$\begin{array}{r} 3 + 6i - 4 + 2i \\ -1 + 8i \end{array}$$

When subtracting, remember to distribute the negative. Just like subtracting polynomials!

$$2(6 - i) - 3(5 - 4i)$$

$$\begin{array}{r} 12 - 2i - 15 + 12i \\ -3 + 10i \end{array}$$

your turn!

$$1. (4 - 2i) + (3 - 3i) = 7 - 5i$$

$$2. 2(3 - 2i) - 5(2 - 3i) = 6 - 4i - 10 + 15i = -4 + 11i$$

$$3. -3(2 + 5i) + (3 + 2i) = -6 - 15i + 3 + 2i = -3 - 13i$$

Homework: powers of i
worksheet and p.295 #1-6

