

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.

$$\begin{aligned}
 i^1 &= i & 1/4 &= .25 \\
 i^2 &= -1 \\
 i^3 &= -i \\
 i^4 &= -i \cdot i = -i^2 = -(-1) = 1 \\
 i^5 &= i & 5/4 &= 1.25 \\
 i^6 &= i \cdot i = i^2 = -1 \\
 i^7 &= -i & i^{13} &= i & 13/4 &= 3.25 \\
 i^8 &= 1 & i^{14} &= -1 \\
 i^9 &= i & 9/4 &= 2.25 \\
 i^{10} &= -1 \\
 i^{11} &= -i \\
 i^{12} &= 1
 \end{aligned}$$

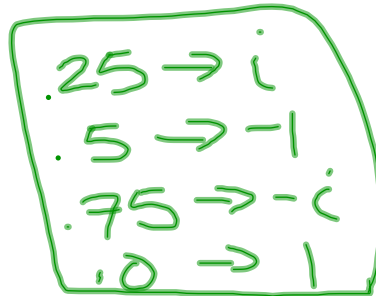
What do you notice about the pattern?

all ± 1 or $\pm i$ $(, -1, -i, 1)$
 all multiples of 4 = 1

How can you find the answer with any exponent?

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

$$\begin{aligned}
 i^{319} &= -i \\
 319/4 &= 79.75
 \end{aligned}$$



$$i = i \leftrightarrow .25$$

$$i^2 = -1 \leftrightarrow .5$$

$$i^3 = -i \leftrightarrow .75$$

$$i^4 = 1 \leftrightarrow 1$$

your turn!

$$i^{314} = -1$$

$$i^{65} = i$$

Complex Numbers

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

$$a+bi$$

real imaginary

$$3+4i$$

$$7.5-3.5i$$

Edit
Check
Reset
?

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

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

2. $2(3 - 2i) - 5(2 - 3i)$

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

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

