

1. Consider the equation  $x^2 = -1$ . Is there a real solution to this equation? Why or why not?

$\#^2 \neq -1$   
 $\leftarrow$  Never works

ex.  $5^2 = \underline{25}$   $(-5)^2 = \underline{25}$

2. If  $i^2 = -1$ , what is the value of  $i$ ?

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

3. Calculate each power of  $i$ . Show your thinking.

**Powers of  $i$**

$i = \sqrt{-1}$	$i^2 = -1$	$i^3 = \begin{matrix} i^2 \cdot i \\ -1 \cdot i \\ = -1i \end{matrix}$	$i^4 = \begin{matrix} i^2 \cdot i^2 \\ -1 \cdot -1 \\ = 1 \end{matrix}$
$i^5 = \begin{matrix} i^2 \cdot i^2 \cdot i \\ (i^2)^2 \cdot i \\ (-1)^2 \cdot i = 1i \end{matrix}$	$i^6 = \begin{matrix} i^2 \cdot i^2 \cdot i^2 \\ (i^2)^3 \\ (-1)^3 = -1 \end{matrix}$	$i^7 = \begin{matrix} i^2 \cdot i^2 \cdot i^2 \cdot i \\ (i^2)^3 \cdot i \\ (-1)^3 \cdot i = -1i \end{matrix}$	$i^8 = \begin{matrix} i^2 \cdot i^2 \cdot i^2 \cdot i^2 \\ (i^2)^4 \\ (-1)^4 = 1 \end{matrix}$
$i^9 = \begin{matrix} (i^2)^4 \cdot i \\ (-1)^4 \cdot i \\ = 1i \end{matrix}$	$i^{10} = \begin{matrix} (i^2)^5 \\ (-1)^5 = -1 \end{matrix}$	$i^{11} = \begin{matrix} (i^2)^5 \cdot i \\ (-1)^5 \cdot i \\ = -1i \end{matrix}$	$i^{12} = \begin{matrix} (i^2)^6 \\ (-1)^6 = 1 \end{matrix}$

4. What conjectures can you make about the powers of  $i$  (did you notice a pattern)?

Answers will always be either:

$1, -1, i, -i$

5. Calculate:

$i^{43} \begin{matrix} (i^2)^{21} \cdot i \\ (-1)^{21} \cdot i \\ -1i \end{matrix}$

$i^{84} \begin{matrix} (i^2)^{42} \\ (-1)^{42} \\ 1 \end{matrix}$

$i^{33} \begin{matrix} (i^2)^{16} \cdot i \\ (-1)^{16} \cdot i \\ 1i \end{matrix}$

$i^{50} \begin{matrix} (i^2)^{25} \\ (-1)^{25} \\ -1 \end{matrix}$