EXPLORATION

5-9 Operations with Complex Numbers

Recall that $i = \sqrt{-1}$ and that $i^2 = -1$. You can use these facts to simplify other powers of i. For example, $i^3 = i^2 \cdot i = -1 \cdot i = -i$.

1. Complete the table by simplifying the powers of i.

$i^1 =$	$i^2 =$	$i^3 =$	$i^4 =$
$i^5 =$	$i^6 =$	$i^7 =$	$i^8 =$
$i^9 =$	$i^{10} =$	$i^{11} =$	$i^{12} =$
$i^{13} =$	$i^{14} =$	$i^{15} =$	$i^{16} =$

2. What values are possible for the positive integer powers of i?

THINK AND DISCUSS

3. **Discuss** the pattern you notice in the table.

4. **Explain** how you can quickly find the value of i^{64}.

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1. Complete the table by simplifying the powers of i.

$i^1 = i$	$i^2 = -1$	$i^3 = -i$	$i^4 = 1$
$i^5 = i$	$i^6 = -1$	$i^7 = -i$	$i^8 = 1$
$i^9 = i$	$i^{10} = -1$	$i^{11} = -i$	$i^{12} = 1$
$i^{13} = i$	$i^{14} = -1$	$i^{15} = -i$	$i^{16} = 1$

2. What values are possible for the positive integer powers of i?

THINK AND DISCUSS

3. Discuss the pattern you notice in the table.

4. Explain how you can quickly find the value of i^{64}.

2. $i, -1, -i, 1$

3. As the exponents increase starting with 1, the values of the positive integer powers of i are $i, -1, -i,$ and 1 in a repeating pattern.

4. If the exponent is a positive integer that is a multiple of 4, then the value of i raised to that exponent is 1. Because 64 is a positive integer multiple of 4, $i^{64} = 1$.

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