COMPLEX NUMBERS (SAMPLE RESPONSES)

Engage

Not Like the Others

1) *Sample Responses* *The sandwich is not like the others because it's not round.* *The button is not like the others because it's not food.* *The donut is not like the others because it's sweet.*	**2) *Sample Responses*** *The $\sqrt{-16}$ is not like the others because there is a negative number inside the radical.* *The $\sqrt{75}$ is not like the others because it's much bigger than the other numbers.* *The $\sqrt{9}$ is not like the others because it's the only single-digit radicand.*

Explore

Simplify and Justify

3) Simplify: $\sqrt{16} = 4$ *because* $(4)^2 = 16$	**4)** Try to simplify: $\sqrt{-16} \neq \pm 4$ *because* $(4)^2 = 16$ $(-4)^2 = 16$
5) Simplify: $\sqrt{20}$ $= \sqrt{4}\sqrt{5}$ $= 2\sqrt{5}$	**6)** Try again to simplify: $\sqrt{-16}$ $= \sqrt{16}\sqrt{-1}$ $= 4\sqrt{-1}$

I Notice, I Wonder

I Notice… ***Sample Responses*** *I notice that the square root of a negative number can't be simplified…* *I notice $\sqrt{-16} \neq -4$ because $(-4)^2$ is $+16$…*	**I Wonder…** ***Sample Responses*** *I wonder if that is always true.* *I wonder if something squared could equal a negative number.*

Explain

Practice

7) $\sqrt{-48} = \sqrt{4}\sqrt{-1}\sqrt{12}$ $= 2i\sqrt{4}\sqrt{3}$ $= 2i(2)\sqrt{3}$ $= 4i\sqrt{3}$	**8)** $-\sqrt{-36} = -1 \cdot \sqrt{36}\sqrt{-1}$ $= -1 \cdot 6 \cdot i$ $= -6i$

Extend

Simplify and Justify

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

I Notice, I Wonder

I Notice…	**I Wonder…**
Sample Responses	***Sample Responses***
I notice the answer in each row is the same…	*I wonder if that is always true.*
I notice that i to the power of 4 equals 1, which makes simplifying easier…	*I wonder if there are other patterns.*

Practice

9) $i^{100} = (i^4)^{25} = (1)^{25} = 1$ ***or*** *100 is a multiple of 4, so* $i^{100} = 1$
10) $i^{45} = i^{44} \cdot i = (i^4)^{11}(i) = (1)^{11}(i) = i$ ***or*** $i^{45} = i^{44} \cdot i = (1)(i) = i$
11) $i^{67} = i^{64} \cdot i^3 = (i^4)^{16}(i^2)(i) = (1)^{16}(-1)(i) = -i$ ***or*** $i^{67} = i^{64} \cdot i^3 = (1)(-i) = -i$