## Guided Practice 2.5

**Example 1**

Identify the real and imaginary parts of the complex number $8+\frac{1}{3}i$.

1. Identify the real part of the complex number.

   Identify the part that is not a multiple of *i*.

   8 is not a multiple of *i*.

   The real part of $8+\frac{1}{3}i$ is 8.

2. Identify the imaginary part of the complex number.

   Identify the part that is a multiple of *i*.

   $\frac{1}{3}$ is a multiple of *i*.

   The imaginary part of $8+\frac{1}{3}i$ is the term $\frac{1}{3}i$.

**Example 2**

Rewrite the complex number 2*i* using a radical.

1. Replace *i* with $\sqrt{-1}$.

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

2. Place the squared value of any whole multiples of *i* under the radical sign.

   $2\bullet\sqrt{-1}=\sqrt{2^2\bullet(-1)}$

3. Simplify the radical expression.

   $\sqrt{2^2\bullet(-1)}=\sqrt{4\bullet(-1)}=\sqrt{-4}$

**Example 3**

Rewrite the radical $\sqrt{-32}$ using the imaginary unit *i*.

1. Rewrite the radicand as the product of –1 and a positive value.

   $\sqrt{-32}=\sqrt{(-1)\bullet 32}$

2. Rewrite the radical $\sqrt{-1}$ as *i*.

   $\sqrt{(-1)\bullet 32}=\sqrt{-1}\bullet\sqrt{32}=i\bullet\sqrt{32}$

3. If possible, rewrite the real number radicand as the product of two factors, where one factor is the largest perfect square factor of the radicand.

   $32 = 16 \bullet 2$, and 16 is the factor of 32 that is the largest perfect square.

   $i\bullet\sqrt{32}=i\bullet\sqrt{16\bullet 2}$

4. Rewrite the radicand as the product of two roots, and simplify the square root of the perfect square. Then, write the result as the coefficient of *i*.

   $i\bullet\sqrt{16\bullet 2}=i\bullet\sqrt{4^2\bullet 2}=4i\sqrt{2}$

**Example 4**

Simplify $i^{57}$.

1. Find the remainder of the power of *i* when divided by 4.

   $14 \bullet 4 = 56$; therefore, $57 \div 4 = 14$ remainder 1.

   The remainder is 1.

2. Use the remainder to simplify the power of *i*.

   $i^{57} = (i^4)^{14} \bullet i^1 = 1 \bullet i^1 = i$

**Example 5**

Impedance, $Z$, is the measure of a circuit's opposition to the flow of current. Complex numbers are used to represent the impedance of a circuit. The resistance, $R$, is the real part of the impedance, and the reactance, $X$, is the coefficient of the imaginary unit $i$. So, impedance is $R + Xi$, where $R$ and $X$ are both measured in ohms. A certain circuit has a resistance of 18 ohms and a reactance of 2 ohms. Use a complex number to represent the circuit's impedance.

1. Use the resistance to write the real part of the complex number.

   The resistance is 18 ohms; therefore, the real part of the number is 18.

2. Use the reactance to write the imaginary part of the complex number.

   The reactance is the coefficient of $i$.

   The reactance is 2 ohms; therefore, the coefficient of $i$ is 2.

   The imaginary part of the number is $2i$.

3. The complex representation of impedance is the sum of the real and imaginary parts.

   The circuit's impedance in ohms is $18 + 2i$.