

# 7.7 COMPLEX NUMBERS

## Essential Question

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

$$\sqrt{-9} = 3i$$

$$i^2 = -1$$

$$i^3 = i^2 i^1 = -i$$

$$i^4 = i^2 i^2 = 1$$

Repeats

$$a + bi$$

Complex #

$$\text{ex. } i^{23} = i^{20} \cdot i^3 = \boxed{-i}$$

(1) (-i)

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Operations with complex numbers.

ex.  $(6+3i) - (2+2i)$

$$4 + 5i.$$

ex.  $(6+3i)(2-2i)$

$$12 - 12i + 6i - 6i^2$$

$$i^2 = -1$$

$$12 + 6 - 12i + 6i$$

$$18 - 6i$$

complex conjugate  $\rightarrow$  change sign on  $i$

ex.  $\frac{3+2i}{6-4i}$

$$6 - 4i$$

$$\frac{3+2i}{6-4i} \cdot \frac{6+4i}{6+4i}$$

$$\frac{18 + 12i + 12i + 8i^2}{36 + 24i - 24i - 16i^2}$$

$$= \frac{10 + 24i}{52} = \frac{10}{52} + \frac{24}{52}i$$

$$= \frac{5}{26} + \frac{6}{13}i$$

$$a + bi$$

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How do I simplify expressions with complex numbers?

$$\sqrt{2} \cdot \sqrt{3} = \sqrt{6}$$

ex.  $\sqrt{-2} \cdot \sqrt{-5} \neq \sqrt{10}$

$$i\sqrt{2} \cdot i\sqrt{5}$$

$$i^2 \sqrt{10} = \boxed{-\sqrt{10}}$$

ex. Find all solutions of the equation

$$x^2 + 36 = 0$$

$$\begin{matrix} -36 & -36 \\ x^2 & + 36 \end{matrix}$$

$$\sqrt{x^2} = \sqrt{-36}$$

$$\boxed{x = \pm 6i}$$

