

8.1 --2016 Complex Numbers

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8.1 Complex Numbers

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

Basic Concepts of Complex Numbers • Complex Solutions of Equations • Operations on Complex Numbers

Write each number as a product of a real number and i .

18. $\sqrt{-36}$

$$\boxed{6i}$$

22. $\sqrt{-500}$

$$\frac{\sqrt{-1 \cdot 100 \cdot 5}}{\boxed{10i\sqrt{5}}}$$

24. $-\sqrt{-80}$

$$\frac{-\sqrt{-1 \cdot 16 \cdot 5}}{\boxed{-4i\sqrt{5}}}$$

40. $\sqrt{-5} \cdot \sqrt{-15}$

$$\begin{aligned} & i\sqrt{5} \cdot i\sqrt{15} \\ & i^2 \sqrt{5^2 \cdot 3} \\ & \boxed{-5\sqrt{3}} \end{aligned}$$

48. $\frac{\sqrt{-12} \cdot \sqrt{-6}}{\sqrt{8}}$

$$\frac{2i\sqrt{3} \cdot i\sqrt{6}}{2\sqrt{2}}$$

$$\frac{-2\sqrt{18}}{2\sqrt{2}}$$

Write each number in standard form, $a + bi$.

54. $\frac{-5 + \sqrt{-50}}{10}$

$$= \frac{-5}{10} + \frac{5i\sqrt{2}}{10} = \boxed{\frac{-1}{2} + \frac{\sqrt{2}}{2}i}$$

$-1\sqrt{9}$

$$\boxed{-3}$$

Solve each quadratic equation and express all nonreal complex solution in terms of i .

28. $x^2 + 48 = 0$

$$\begin{aligned} & \sqrt{x^2} = \sqrt{-48} \\ & x = \pm \sqrt{-1 \cdot 16 \cdot 3} \\ & \boxed{x = \pm 4i\sqrt{3}} \end{aligned}$$

30. $2x^2 + 3x = -2$

$$\begin{aligned} & 2x^2 + 3x + 2 = 0 \\ & x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ & x = \frac{-3 \pm \sqrt{9 - 4(2)(2)}}{4} \\ & x = \frac{-3 \pm \sqrt{-7}}{4} = \boxed{\frac{-3}{4} \pm \frac{\sqrt{7}}{4}i} \end{aligned}$$

POP the "i" out!

Find each sum, difference, or product. Write the answer in standard form, $a + bi$.

60. $(-4 - i) + (2 + 3i) + (6 + 4i)$

0

64. $(-2 + 3i)(4 - 2i)$

$-8 + 4i + 12i - 6i^2$

$-8 + 16i + 6$

$-2 + 16i$

78. $-5i(4 - 3i)^2$

$-5i(4 - 3i)(4 - 3i)$

$-5i[16 - 12i - 12i + 9i^2]$

$-5i[16 - 24i - 9]$

$-5i[7 - 24i]$

$-35i + 120i^2$

$-120 - 35i$

80. $(3 - i)(3 + i)(2 - 6i)$

$9 + 3i - 3i - i^2$

$10(2 - 6i)$

$20 - 60i$

Find each quotient. Write the answer in standard form, $a + bi$.

104. $\frac{12}{-i} \cdot \frac{i}{i}$

$\frac{12i}{-i^2} = 12i$

$4 - i$

96. $\frac{14 + 5i}{3 + 2i} \cdot \frac{3 - 2i}{3 - 2i} = \frac{42 - 28i + 15i - 10i^2}{9 - 6i + 6i - 4i^2}$

$= \frac{52 - 13i}{13}$

$= \frac{52}{13} - \frac{13i}{13} = 4 - i$