

# 3.1 - Solving Quadratic Equations

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Warmup - Solve by factoring

a.  $2t^2 + 5t - 3 = 0$

$$t = \left\{ -3, \frac{1}{2} \right\}$$

b.  $3x^2 - 8x + 5 = 0$

$$x = \left\{ \frac{5}{3}, 1 \right\}$$

c.  $3p^2 - 7p - 6 = 0$

$$p = \left\{ -\frac{2}{3}, 3 \right\}$$

d.  $4r^2 + 8r + 3 = 0$

$$r = \left\{ -\frac{3}{2}, -\frac{1}{2} \right\}$$

# Chapter 3

# Quadratic Equations and Complex Numbers

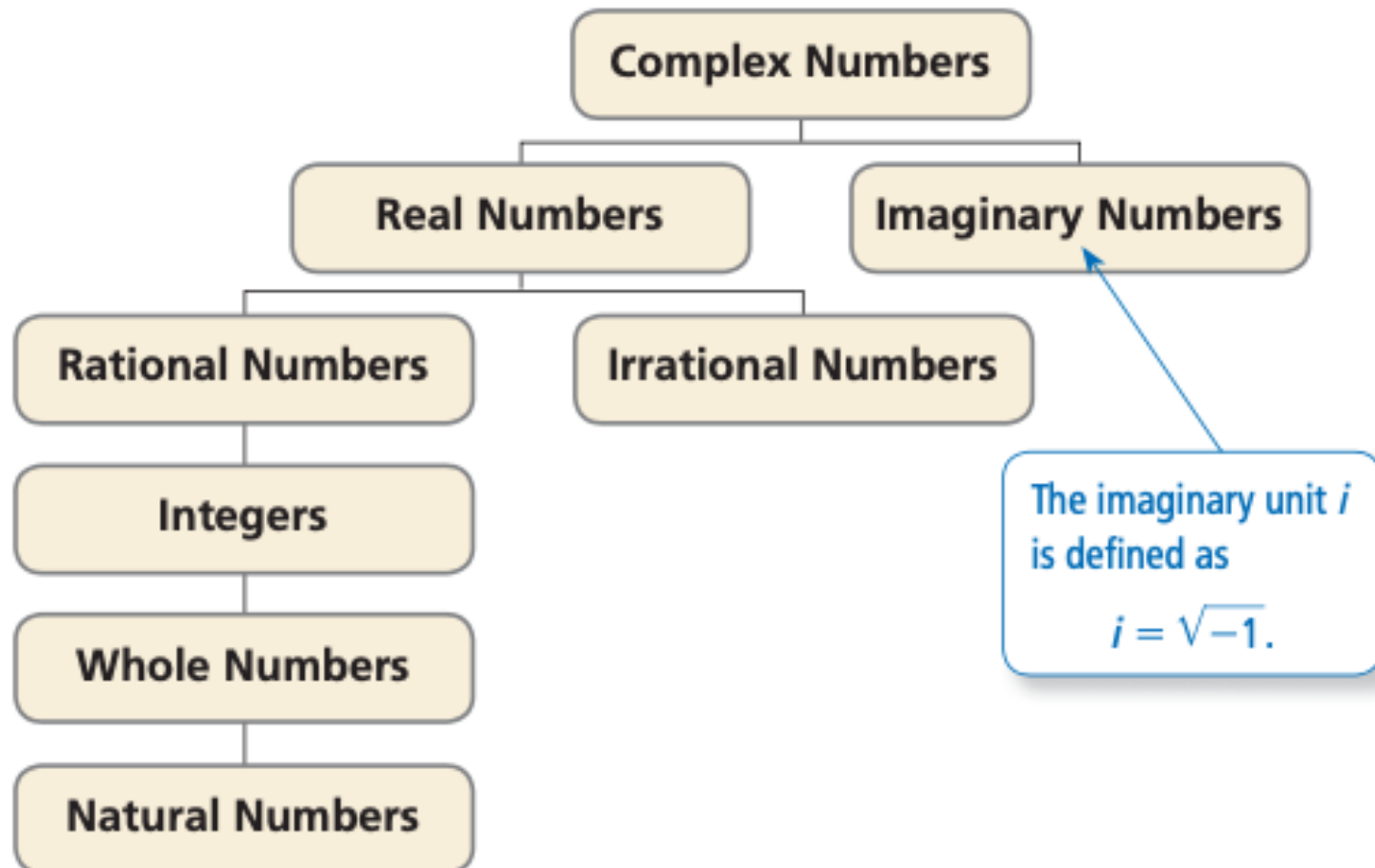
1. Solving Quadratic Equations
- 2. Complex Numbers**
3. Completing the Square
4. Using the Quadratic Formula
5. Solving Nonlinear Systems
6. Quadratic Inequalities



# 3.2 - Complex Numbers

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Subsets of the set of complex numbers



# 3.2 - Complex Numbers

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**The Imaginary Unit  $i$**

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

$$\sqrt{-81} = 9i$$

$$\sqrt{-56} = 2i\sqrt{14}$$

$$-7\sqrt{-12} = -14i\sqrt{3}$$

# 3.2 - Complex Numbers

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A **complex number** is written in standard form as

$$a + bi$$

where  $a$  is the real part and  $bi$  is the imaginary part.

$a + bi$  is an **imaginary number** ( $b \neq 0$ ).

$bi$  is a **pure imaginary number**.

# 3.2 - Complex Numbers

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Find  $x$  and  $y$  that satisfy the equation

$$5x - 20i = 35 + yi$$

$$x = 7, y = -20$$

Simplify the expression and write in standard form.

$$16 - (13 + 6i) + 8i$$

$$3 + 2i$$

# 3.2 - Complex Numbers

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Practice: Simplify the expression and write in standard form.

**10.**  $(1 + i) + (3 + i)$

**12.**  $(-4 - i) - (4 + 5i)$

**11.**  $(4 - 3i) + (2 + 6i)$

**13.**  $(5 - 3i) + (-3 - 6i)$

# 3.2 - Complex Numbers

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## Multiplying complex numbers

$$15i(-1 + 2i)$$

$$-30 - 15i$$

$$(4 - 12i)(11 + 8i)$$

$$140 - 100i$$



# 3.2 - Complex Numbers

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Practice: Multiply the complex numbers

**14.**  $3i(4 + 2i)$

**15.**  $-2i(3 - i)$

**16.**  $(2 + i)(4 + 2i)$

**17.**  $(5 - 2i)(1 - 3i)$

# 3.2 - Complex Numbers

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## Solving Quadratic Equations

$$x^2 + 121 = 0$$

$$x = \pm 11i$$

$$3x^2 + 25 = -416$$

$$x = \pm 7i\sqrt{3}$$

# 3.2 - Complex Numbers

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## Practice

**Solve the equation.**

1.  $x^2 = -36$

2.  $x^2 + 121 = 0$

4.  $x^2 = 2x^2 + 4$

5.  $3x^2 + 40 = -x^2 - 56$

7.  $(x - 3)^2 = -12$

8.  $-2(x - 1)^2 = 36$

# 3.2 - Complex Numbers

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**Simplify (rationalize denominator)**

$$\frac{5 - i}{2 + 3i}$$

$$\frac{7 - 17i}{13}$$

**Practice**

Find the reciprocal of  $3 - i$

$$\frac{3 + i}{10}$$

# 3.2 - Complex Numbers

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## Exponents of $i$

$$i =$$

$$i^2 =$$

$$i^3 =$$

$$i^4 =$$

$$i^{54} =$$

