Objective: Identify Numbers in the Set of Complex Numbers

Concept

Complex Number: a number that can be written in the form $a + bi$, where a and b are real numbers, and i is the imaginary unit. a is called the real part and bi is called the imaginary part
Examples: $-3 + 4i, 7 - i$

Imaginary unit: the number $i.$ (Note: $i = \sqrt{-1}$)

Pure Imaginary Number: square roots of negative real numbers; (the real part is 0)
Examples: $8i, -2i$

Real Number: a number with an imaginary part equal to 0
Examples: $5, -3, \sqrt{7}$

Types of Complex Numbers

$2 + 5i$ $-5i$ 3

                                    ↑   ↑

                              pure   real number
                     imaginary number

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Concept

Complex Numbers

$$a + bi$$

$$-2 + 3i, \quad 4 - 8i, \quad 1 + \sqrt{3}i$$

Real Numbers

$a + 0i$ or a

$$17 \quad -2 \quad \sqrt{11}$$

$$\frac{3}{4} \quad \pi \quad 3.\overline{2}$$

Pure Imaginary Numbers

$0 + bi$ or bi

$$-3i \quad 2i$$

$$\sqrt{7}i \quad 6.3i$$

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Ex) Simplify the expression.

$$\sqrt{-49} \qquad\qquad \sqrt{-25} \qquad\qquad \sqrt{-32}$$

$$\sqrt{49} \cdot \sqrt{-1} \qquad\qquad \sqrt{25} \cdot \sqrt{-1} \qquad\qquad \sqrt{32} \cdot \sqrt{-1}$$

$$= \boxed{7i} \qquad\qquad = \boxed{5i} \qquad\qquad \sqrt{16} \cdot \sqrt{2} \cdot \sqrt{-1}$$

$$= \boxed{4\sqrt{2}\, i}$$

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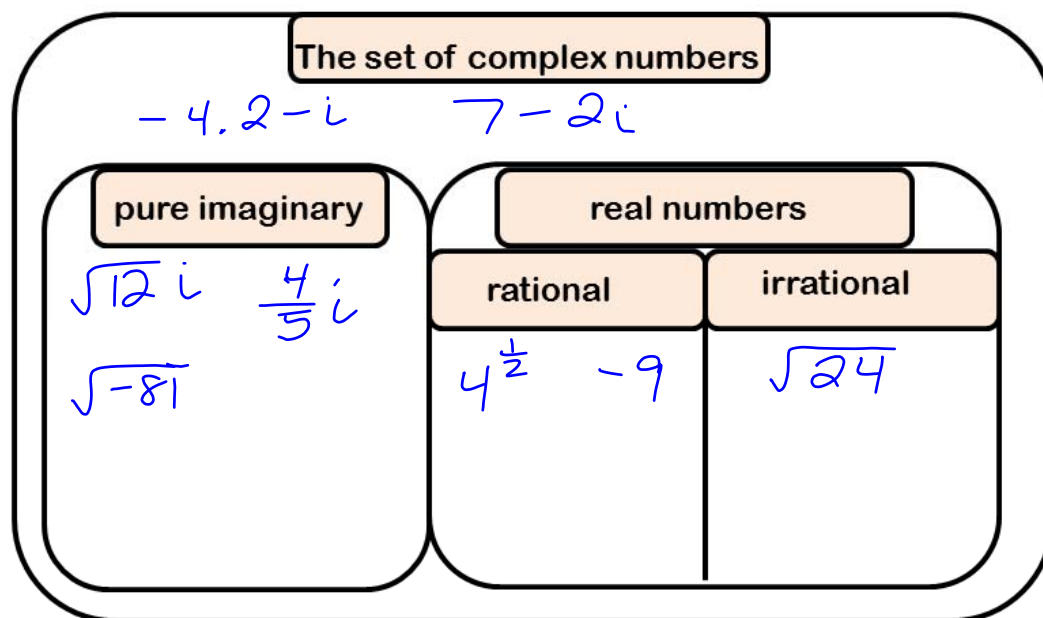Ex) Place each number under the best heading in the Venn Diagram.

$1 - \sqrt{5}i$

-8.4, $\sqrt{50}$, $1 - i\sqrt{5}$, $-3i$,

$\dfrac{7}{3}$, $2.\overline{83}$, $-2 + 3i$, $\sqrt{-16}$,
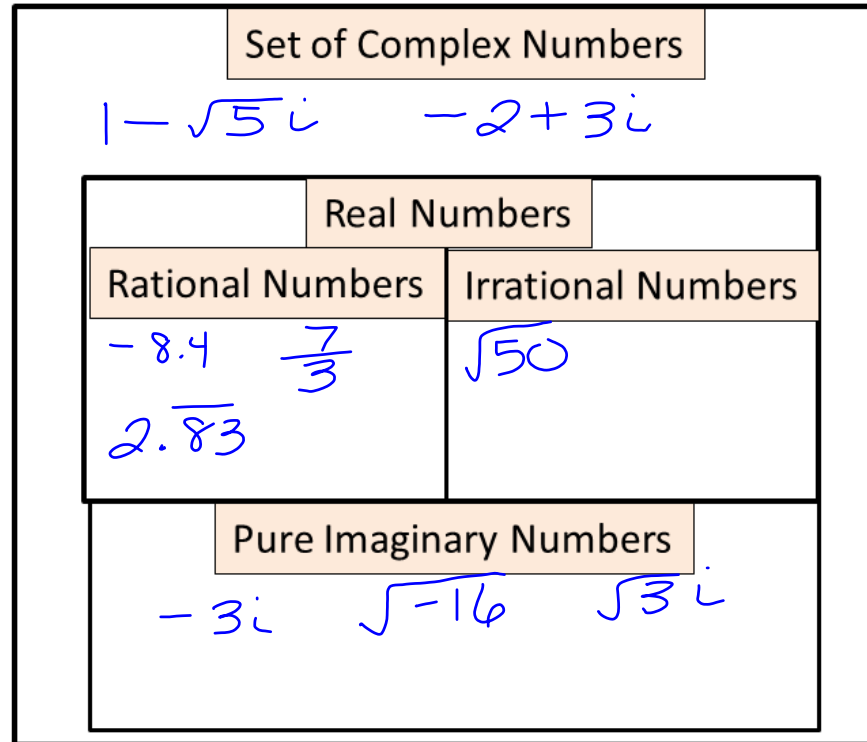
$= 4i$

$\sqrt{3}\,i$

Set of Complex Numbers		
$1 - \sqrt{5}i$ $\qquad$ $-2 + 3i$		

Real Numbers	
Rational Numbers	**Irrational Numbers**
-8.4 $\quad$ $\dfrac{7}{3}$ $2.\overline{83}$	$\sqrt{50}$

Pure Imaginary Numbers		
$-3i$ $\qquad$ $\sqrt{-16}$ $\qquad$ $\sqrt{3}\,i$		

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Practice) Place each number under the best heading in the Venn Diagram.

$$-4.2 - i, \quad 4^{\frac{1}{2}}, \quad \sqrt{12}i, \quad -9, \quad \frac{4}{5}i, \quad 7-2i, \quad \sqrt{-81}, \quad \sqrt{24}$$

The set of complex numbers

$-4.2-i$ $7-2i$

pure imaginary

$\sqrt{12}i$ $\frac{4}{5}i$

$\sqrt{-81}$

real numbers

rational

$4^{\frac{1}{2}}$ -9

irrational

$\sqrt{24}$

Objective: Identify Numbers in the Set of Complex Numbers

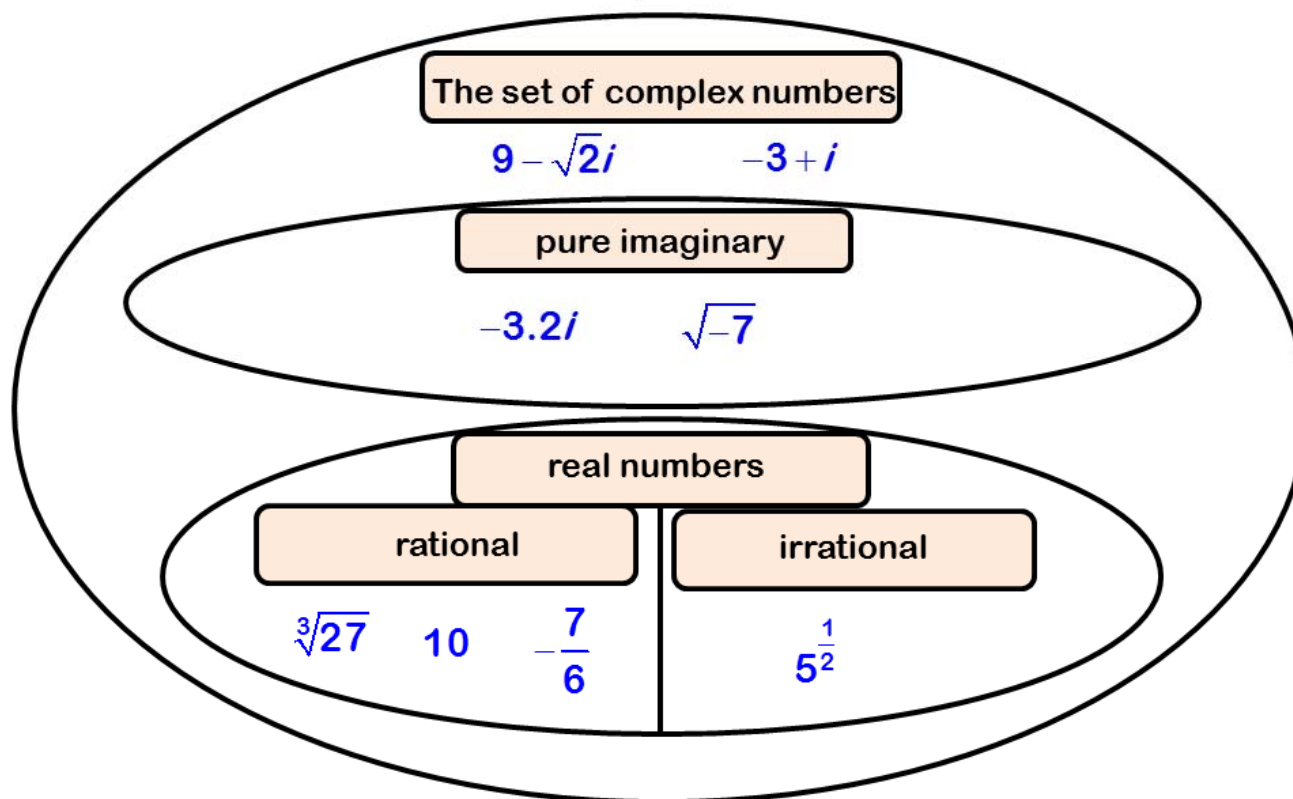Practice) Place each number under the best heading in the Venn Diagram.

$$\sqrt[3]{27}, \ 5^{\frac{1}{2}}, \ -3.2i, \ 10, \ -\frac{7}{6}, \ \sqrt{-7}, \ 9-\sqrt{2}i, \ -3+i$$

The set of complex numbers

$$9-\sqrt{2}i \qquad -3+i$$

pure imaginary

$$-3.2i \qquad \sqrt{-7}$$

real numbers

rational	irrational
$\sqrt[3]{27}$ 10 $-\frac{7}{6}$	$5^{\frac{1}{2}}$

<u>Objective</u>: Identify Numbers in the Set of Complex Numbers

<u>Closure</u>

Give at least three examples for each of the following descriptions.

A pure imaginary number.

Sample answers: $2i$, $-6i$, $\sqrt{-5}$

A real number that is also rational.

Sample answers: -5, $\frac{2}{3}$, 7.1, $10.\overline{2}$, $\sqrt{25}$

A complex number that is not a real number.

Sample answers: $-5 + i$, $2 - 3i$, $5i$, $\sqrt{-4}$

A complex number that is not pure imaginary.

Sample answers: $-5 + i$, $2 - 3i$, 5, $\frac{5}{2}$, $9.\overline{6}$, $\sqrt{7}$