

# Warmup:

**Simplify.**

1)  $2\sqrt{6} + 3\sqrt{6} + 3\sqrt{2}$

2)  $-2\sqrt{3} + 2\sqrt{27} + 3\sqrt{12}$

✓  $5\sqrt{6} + 3\sqrt{2}$

$$\begin{aligned}
 & -2\sqrt{3} + 2\sqrt{9 \cdot 3} + 3\sqrt{4 \cdot 3} \\
 & -2\sqrt{3} + 2\sqrt{3 \cdot 3 \cdot 3} + 3\sqrt{2 \cdot 2 \cdot 3} \\
 & -2\sqrt{3} + 2 \cdot 3\sqrt{3} + 3 \cdot 2\sqrt{3} \\
 & -2\sqrt{3} + 6\sqrt{3} + 6\sqrt{3}
 \end{aligned}$$

✓  $10\sqrt{3}$

**Simplify.**

1)  $2\sqrt{20} \cdot -2\sqrt{10}$

2)  $-5\sqrt{6} \cdot -3\sqrt{3}$

3)  $\sqrt{5a} \cdot -\sqrt{2a^2}$

4)  $\sqrt{3x^2} \cdot \sqrt{12x^2}$

$$\begin{aligned}
 1) & \quad 2\sqrt{20} \cdot -2\sqrt{10} \\
 & \quad = 2\sqrt{2 \cdot 2 \cdot 5} \cdot -2\sqrt{2 \cdot 5} \\
 & \quad = -4\sqrt{20 \cdot 10} \\
 & \quad = -4\sqrt{2 \cdot 10 \cdot 10} \\
 & \quad = -4 \cdot 10 \sqrt{2} \\
 & \quad = -40\sqrt{2}
 \end{aligned}$$

$$\begin{aligned}
 2) & \quad -5\sqrt{6} \cdot -3\sqrt{3} \\
 & \quad = 15\sqrt{6 \cdot 3} \\
 & \quad = 15\sqrt{2 \cdot 3 \cdot 3} \\
 & \quad = 15 \cdot 3 \sqrt{2} \\
 & \quad = 45\sqrt{2}
 \end{aligned}$$

$$\begin{aligned}
 3) & \quad \sqrt{5a} \cdot -\sqrt{2a^2} \\
 & \quad = -\sqrt{5 \cdot 2 \cdot a \cdot a^2} \\
 & \quad = -a\sqrt{10a}
 \end{aligned}$$

$$\begin{aligned}
 4) & \quad \sqrt{3x^2} \cdot \sqrt{12x^2} \\
 & \quad = \sqrt{3 \cdot 12 \cdot x^2 \cdot x^2} \\
 & \quad = x^2 \sqrt{3 \cdot 3 \cdot 4} \\
 & \quad = 3x^2 \sqrt{4} = 3 \cdot 2 \cdot x^2 \\
 & \quad = 6x^2
 \end{aligned}$$

# HW #7 Answer Key

1)  $\sqrt{6} + \sqrt{54}$

$$\sqrt{6} + \sqrt{9 \cdot 6}$$

$$\sqrt{6} + 3\sqrt{6}$$

$$4\sqrt{6}$$

2)  $\sqrt{3} + \sqrt{12}$

$$\sqrt{3} + \sqrt{4 \cdot 3}$$

$$\sqrt{3} + 2\sqrt{3}$$

$$3\sqrt{3}$$

3)  $\sqrt{12} + \sqrt{3}$

$$\sqrt{4 \cdot 3} + \sqrt{3}$$

$$2\sqrt{3} + \sqrt{3}$$

$$3\sqrt{3}$$

4)  $\sqrt{6} + \sqrt{6}$

$$2\sqrt{6}$$

$$5) -3\sqrt{27} - 2\sqrt{27}$$

$$-5\sqrt{27}$$

$$-5\sqrt{9 \cdot 3}$$

$$-5 \cdot 3 \sqrt{3}$$

$$\boxed{-15\sqrt{3}}$$

$$7) -2\sqrt{5} - 2\sqrt{45}$$

$$-2\sqrt{5} - 2\sqrt{9 \cdot 5}$$

$$-2\sqrt{5} - 2 \cdot 3 \sqrt{5}$$

$$-2\sqrt{5} - 6\sqrt{5}$$

$$\boxed{-8\sqrt{5}}$$

$$6) 2\sqrt{3} + 3\sqrt{12}$$

$$2\sqrt{3} + 3\sqrt{4 \cdot 3}$$

$$2\sqrt{3} + 3 \cdot 2\sqrt{3}$$

$$2\sqrt{3} + 6\sqrt{3}$$

$$\boxed{8\sqrt{3}}$$

$$8) -2\sqrt{27} + 2\sqrt{3}$$

$$-2\sqrt{9 \cdot 3} + 2\sqrt{3}$$

$$-2 \cdot 3\sqrt{3} + 2\sqrt{3}$$

$$-6\sqrt{3} + 2\sqrt{3}$$

$$\boxed{-4\sqrt{3}}$$

$$9) -2\sqrt{2} + 2\sqrt{27} - 3\sqrt{2}$$

$$-5\sqrt{2} + 2\sqrt{27}$$

$$-5\sqrt{2} + 2\sqrt{9 \cdot 3}$$

$$-5\sqrt{2} + 2 \cdot 3\sqrt{3}$$

$$-5\sqrt{2} + 6\sqrt{3}$$

$$11) \sqrt{6} \cdot \sqrt{10}$$

$$\sqrt{6 \cdot 10}$$

$$\sqrt{2 \cdot 3 \cdot 2 \cdot 5}$$

$$2\sqrt{3 \cdot 5}$$

$$2\sqrt{15}$$

$$10) 3\sqrt{45} - 3\sqrt{12} - \sqrt{27}$$

$$3\sqrt{9 \cdot 5} - 3\sqrt{4 \cdot 3} - \sqrt{9 \cdot 3}$$

$$3 \cdot 3\sqrt{5} - 3 \cdot 2\sqrt{3} - 3\sqrt{3}$$

$$9\sqrt{5} - 6\sqrt{3} - 3\sqrt{3}$$

$$9\sqrt{5} - 9\sqrt{3}$$

$$12) \sqrt{2} \cdot \sqrt{3}$$

$$\sqrt{6}$$

$$13) 2\sqrt{5} \cdot -2\sqrt{5}$$

$$-4\sqrt{5 \cdot 5}$$

$$-4 \cdot 5$$

$$\textcircled{-20}$$

$$15) \sqrt{5x} \cdot \sqrt{20x^2}$$

$$\sqrt{5 \cdot x \cdot 5 \cdot 4 \cdot x^2}$$

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

$$\textcircled{10x\sqrt{x}}$$

$$14) 3\sqrt{6} \cdot 2\sqrt{15}$$

$$6\sqrt{6 \cdot 15}$$

$$6\sqrt{3 \cdot 2 \cdot 5 \cdot 3}$$

$$6 \cdot 3 \sqrt{2 \cdot 5}$$

$$\textcircled{18\sqrt{10}}$$

$$16) \sqrt{15b} \cdot \sqrt{15b}$$

$$\sqrt{15b \cdot 15b}$$

$$\textcircled{= 15b}$$

$$17) -3\sqrt{10v^3} \cdot 4\sqrt{5v^2}$$

$$-12 \sqrt{10v^3 \cdot 5v^2}$$

$$-12 \sqrt{5 \cdot 2 \cdot v \cdot v^2 \cdot 5 \cdot v^2}$$

$$-12 \cdot 5 \cdot v^2 \sqrt{2v}$$

$$\boxed{-60v^2 \sqrt{2v}}$$

$$18) -\sqrt{2m^3} \cdot -5\sqrt{8m}$$

$$5 \sqrt{2 \cdot m^3 \cdot 8 \cdot m}$$

$$5 \sqrt{2 \cdot m \cdot m^2 \cdot 2 \cdot 4 \cdot m}$$

$$5 \cdot 2 \cdot 2 \cdot m \cdot m$$

$$-2- \quad \boxed{20m^2}$$

# Quiz #3

# Radical Expressions



## Rational vs Irrational Numbers

A **rational number** is a number that can be expressed as a fraction or **ratio**.

The numerator and the denominator of the fraction are both integers.

When the fraction is divided out, it becomes a terminating or repeating decimal.

(The repeating decimal portion may be one number or a billion numbers.)

$6$ or $\frac{6}{1}$	can also be written as	$6.0$
$-2$ or $\frac{-2}{1}$	can also be written as	$-2.0$
$\frac{1}{2}$	can also be written as	$0.5$
$\frac{-5}{4}$	can also be written as	$-1.25$
$\frac{2}{3}$	can also be written as	$0.6666666666\dots$ $0.\overline{6}$
$\frac{21}{55}$	can also be written as	$0.38181818\dots$ $.3\overline{81}$
$\frac{53}{83}$	can also be written as	$0.62855421687\dots$ the decimals will repeat after 41 digits

\*Be careful when using your calculator to determine if a decimal number is irrational. The calculator may not be displaying enough digits to show you the repeating decimals, as was seen in the last example to the left.

**An irrational number** cannot be expressed as a fraction.

Irrational numbers cannot be represented as terminating or repeating decimals.

$$\pi = 3.141592654\dots$$

$$\sqrt{2} = 1.414213562\dots$$

$$\sqrt{3} \quad \sqrt{5} \quad \sqrt{6} \quad \sqrt{7} \quad \sqrt{8} \quad \sqrt{10} \dots$$

$$\sqrt{4} = 2 \text{ rational}$$

$$\sqrt{9} = 3$$

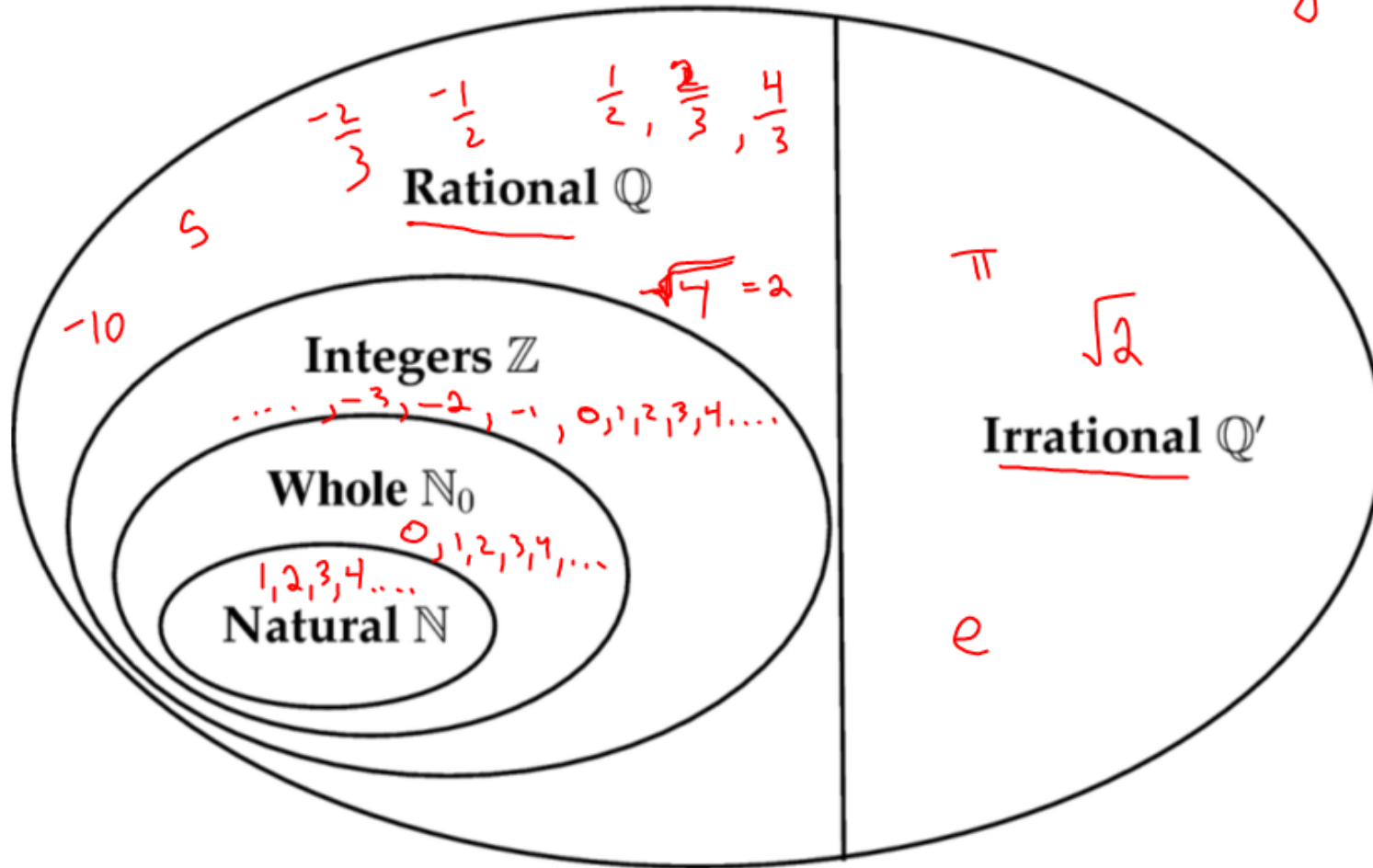
Name three numbers that are rational and three numbers that are irrational.

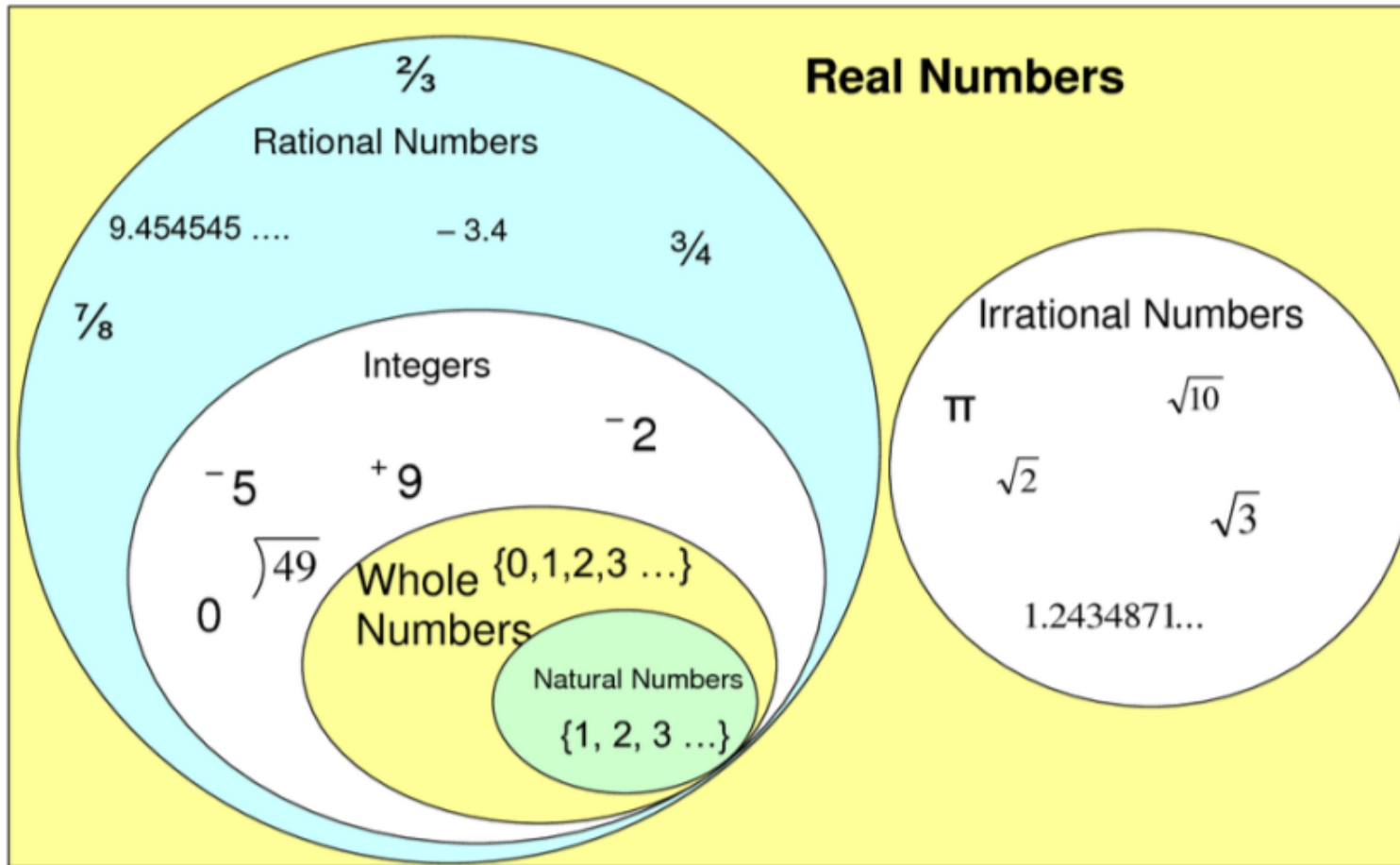
Rational:  $\frac{6}{1}$ ,  $.5$  or  $\frac{1}{2}$ ,  $-\frac{1}{3}$ ,  $0$

Irrational:  $\sqrt{11}$ ,  $\sqrt{8}$ ,  $2\sqrt{2}$ ,  $-\frac{\pi}{2}$ ,  $-\frac{\sqrt{3}}{3}$

# REAL $\mathbb{R}$

$i$  Imaginary #'s





1. Sort the numbers into 2 groups, rational or irrational. Write the numbers in the appropriate bubble.

~~0.8~~     ~~$\sqrt{64}$~~     ~~0~~     ~~$\sqrt{32}$~~     ~~19~~     ~~$-\sqrt{100}$~~     ~~2.343443444...~~  
 ~~$\frac{3}{7}$~~      ~~$\sqrt{75}$~~      ~~$6\frac{2}{7}$~~      ~~$12.\overline{67}$~~      ~~$\sqrt{121}$~~      ~~$\frac{12}{5}$~~      ~~$\pi$~~

Rational  
 $\sqrt{121} = 11$   
 $\frac{12}{5}$   
 $\sqrt{64} = 8$   
 $0$   
 $12.\overline{67}$   
 $-\sqrt{100} = -10$   
 $19$   
 $\frac{3}{7}$   
 $6\frac{2}{7} = \frac{44}{7}$

Irrational  
 $\sqrt{32} = 4\sqrt{2}$   
 $2.343443444...$   
 $\sqrt{75} = 5\sqrt{3}$   
 $\pi$



2. Graph and label each number on the number line below. You may label the number with the letter.

A  $0.75$

B  $\sqrt{3}$

C  $\sqrt{9}$

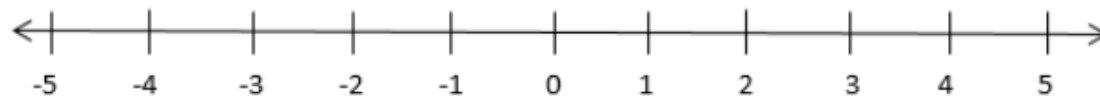
D  $-2\frac{1}{2}$

E  $-\frac{15}{10}$

F  $2.\bar{6}$

G  $-\sqrt{2}$

H  $\pi$



0.25		1.76	$\frac{1}{5}$	$\sqrt{-36}$	$\frac{5}{8}$	2.75			
	$2\frac{5}{6}$	0.125	$\frac{8}{0}$	$\sqrt{17}$	$\sqrt{-4}$	$\frac{9}{11}$	0.45		$8\frac{1}{7}$
$0.\bar{3}$	5.9	$\sqrt{-83}$	.23924...	$\sqrt{6}$	$\sqrt{56}$	$\frac{15}{0}$	$\frac{1}{3}$	$0.\bar{6}$	$4.\bar{1}\bar{3}$
$\frac{3}{4}$	$\frac{25}{0}$	$\sqrt{84}$	$8\frac{5}{12}$	.78321...	$7.\bar{8}\bar{1}$	$\sqrt{21}$	$\sqrt{-49}$	$\sqrt{-23}$	$\frac{3}{0}$
$0.\bar{9}$	$5\frac{3}{7}$	.3295...	.9857...	$\sqrt{41}$	$\sqrt{37}$	.4837...	$\sqrt{26}$	$\sqrt{50}$	$\sqrt{67}$
$\sqrt{9}$	28	$\sqrt{145}$	$9.\bar{5}$	$\sqrt{5}$	127	$\sqrt{3}$	$\frac{5}{0}$	$\sqrt{-16}$	$\sqrt{-25}$
$\frac{12}{3}$	-6	.93823...	$\sqrt{15}$	$\sqrt{101}$	$\sqrt{16}$	.3825...	$\sqrt{-100}$	$\frac{9}{0}$	$\frac{1}{0}$

# HW #8 Rational vs Irrational Numbers