Sec. 1-8 Number Systems

Natural Numbers: {1, 2, 3, 4, …}

Whole Numbers: {0, 1, 2, 3, 4, …}

Integers: {…, -3, -2, -1, 0, 1, 2, 3, …}

Rational numbers: numbers that can be expressed in the form $\frac{a}{b}$, where a and b are integers and b $\neq$ 0.

(A rational number can also be expressed as a decimal that terminates, or as a decimal that repeats indefinitely).

A square root is one of two equal factors of a number. For example, one square root of 64 is written as $\sqrt{64}$, is 8 since 8 • 8 or 8^2 is 64. Another square root of 64 is -8 since $(-8) \bullet (-8) or (-8)^2$ is also 64. A number like 64, with a square root that is a rational number, is called a perfect square. The square roots of a perfect square are rational numbers.

A number such as $\sqrt{3}$ is the square root of a number that is not a perfect square. It cannot be expressed as a terminating or repeating decimal.
Numbers that cannot be expressed as terminating or repeating decimals, or in the form $\frac{a}{b}$, where a and be are integers and b $\neq$ 0, are called irrational numbers. Irrational numbers and rational numbers together form the set of real numbers.

Name the set or sets of numbers to which each real number belongs.

a) $\frac{7}{15}$ RATIONAL

NATURAL

a) $\frac{}{15}$ RATIONAL

b) $\sqrt{121}$ NATURAL Whole # Integer Rational

11

NATURAL
Whole
Integer
RATIONAL

c) -5 Integer, RATIONAL

d) $\sqrt{56}$ IRRATIONAL

e) $\frac{6}{11}$ RATIONAL

f) $-\sqrt{9.16}$ IRRATIONAL

Closure property: when you perform an operation (such as addition, multiplication, etc.) on any two numbers in a set, the result of the computation is another number in the same set.

Determine whether each set of numbers is closed under the indicated operation.

a) whole numbers, multiplication

Closed Yes

b) whole numbers, subtraction

NO $7-2$ $7-8$

NO $\quad 7-2 = 5 \quad -1-0 = -1$

c) integers, division

No $\frac{8}{2}=4$ $\quad \frac{8}{3}$

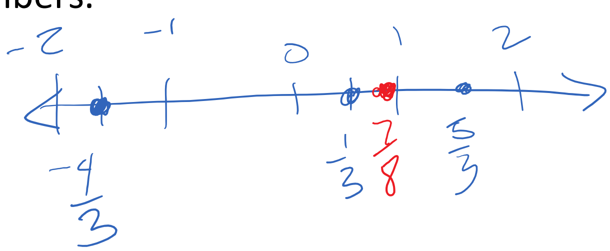
d) integers, addition

Yes $\quad 7+-3=4$

To graph a set of numbers means to draw, or plot, the points named by those numbers on a number line. The number that corresponds to a point on a number line is called the coordinate of that point. Rational numbers alone do not complete the number line. By including irrational numbers, the number line is complete.

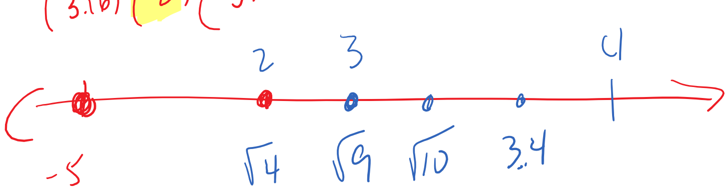
Graph each set of numbers.

a) $\{-\frac{4}{3}, \frac{1}{3}, \frac{5}{3}, \frac{7}{8}\}$



b) $\{-5, 3.4, \sqrt{10}, \sqrt{4}, \sqrt{9}\}$

(3.16) (2) (3)



-5 $\qquad\qquad\qquad\qquad$ 4

Square Roots and Ordering Real Numbers: The symbol $\sqrt{\square}$, called a radical sign, is used to indicate a nonnegative or principal square root of the expression under the radical sign.

$\sqrt{64} = 8$

$-\sqrt{64} = -8$

$\pm\sqrt{64} = \pm 8$

Find: a) $-\sqrt{\frac{4}{121}}$ $\quad -\frac{\sqrt{4}}{\sqrt{121}}$ $\quad -\frac{2}{11}$

$b)$ $\sqrt{\frac{81}{196}}$ $\quad \frac{9}{14}$

$\sqrt{0.000049}$ $\quad .007$

C) $\pm\sqrt{1.69}$

± 1.3

$d)$ $-\sqrt{6.25}$ $\quad 625 \quad 25$

-2.5

Replace each ___ with <, >, or = to make each sentence true.

a) $\sqrt{19}$ $\underline{\;>\;}$ $3.\overline{8}$

b) $2\frac{2}{3}$ $\underline{\;>\;}$ $\sqrt{5}$

Order each set of numbers from least to greatest.

$a)\ \sqrt{0.42}, 0.\overset{\frown}{63}, \sqrt{\frac{4}{9}}$

$0.63, \sqrt{0.42}, \sqrt{\frac{4}{9}}$

$b)\ -1.\overset{\frown}{46}, 0.2, \sqrt{2}, -\frac{1}{6}$

$-1.\overline{46}, -\frac{1}{6}, 0.2, \sqrt{2}$