Name: _____ Date: _____

Notes: Classifying Numbers

Do Now: Match each description with the set of numbers that most appropriately be represents it. No repeating.

B Money

D Number of Students in Class

C Golf Score

A Fraction of a Whole

A. $\{\frac{1}{6}, \frac{2}{5}, \frac{5}{9}, \frac{13}{14} \dots\}$

B. $\{\dots, -2.50, 0.00, 5.25, 16.73, \dots\}$

C. $\{\dots -2, -1, 0, +1, +2 \dots\}$

D. $\{0,1,2,3,4,5,6,7, \dots\}$

Using the diagram to the right, match each of the number sets with its name.

F Real Number **A.** $\{1,2,3,4, \dots\}$

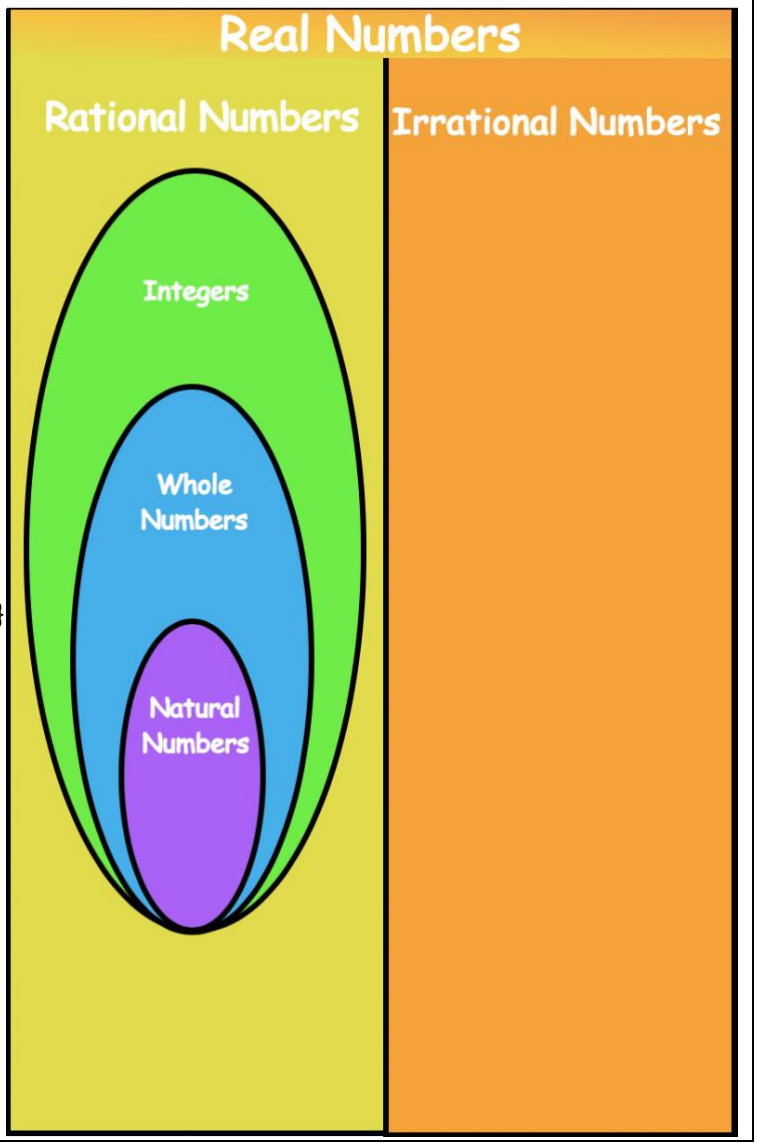
E Irrational Numbers **B.** $\{0,1,2,3,4, \dots\}$

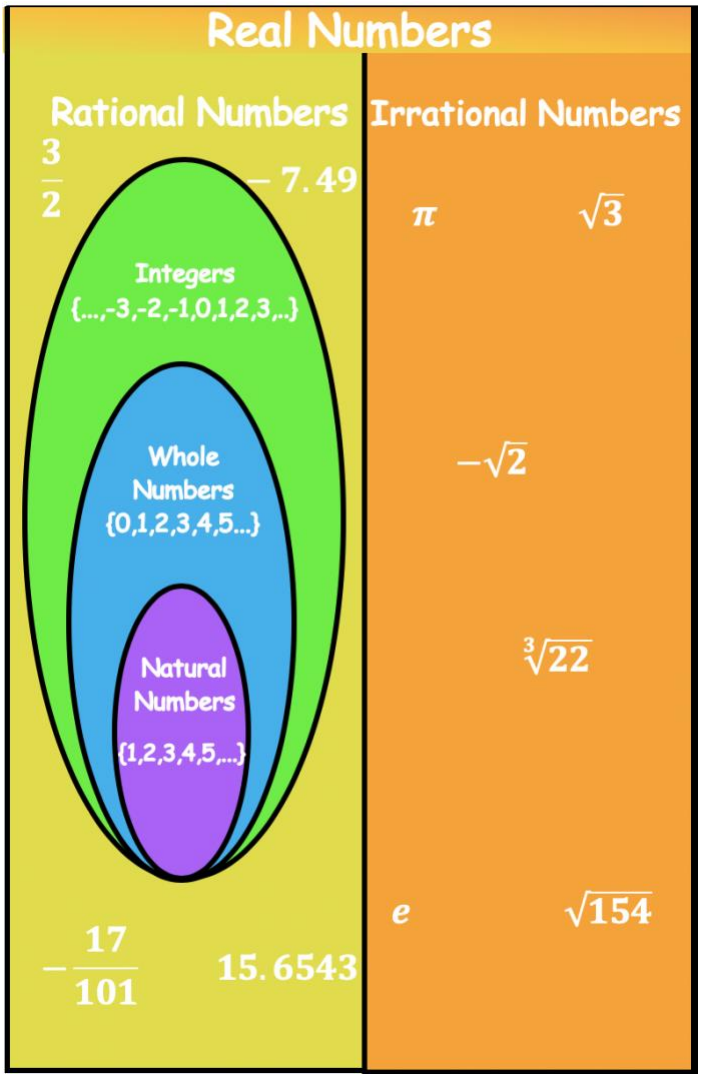
D Rational Numbers **C.** $\{\dots, -2, -1, 0, 1, 2, \dots\}$

C Integers **D.** $\{\dots, -2, -\frac{3}{2}, 0, 1.5, \dots\}$

B Whole Numbers **E.** $\{\dots, -\sqrt{5}, \sqrt{2}, \pi, \dots\}$

A Natural Numbers F. $\{\dots, -\frac{3}{2}, 0, 4, \pi, \dots\}$





Describe what the diagram above tells us about the relationship between natural numbers, whole numbers, integers, rational numbers, irrational numbers, and real numbers.

All natural numbers are whole numbers.
All whole numbers are integers.
All natural numbers, whole numbers, and integers are rational numbers.
All rational and irrational numbers are real numbers.

What Should I Be Able to Do?

- I can define natural numbers and list the number set.

- I can define whole numbers and list the number set.

- I can define integers and list the number set.

- I can define rational numbers and explain why a given number is rational.

- I can define irrational numbers and explain why a given number is irrational.

- I can define real numbers and explain why a given number is real.

- I can create the "Numbers Web" and explain how each number set is related.

Natural Numbers (denoted , $\mathbb{N}$): $\{1, 2, 3, 4, \ldots\}$

- Numbers we use for counting.
- Set of all the positive integers.

Whole Numbers (denoted $\mathbb{W}$): $\{0, 1, 2, 3, 4, \ldots\}$

- Nonnegative numbers that can be written without a fraction or decimal.
- Set of all the nonnegative integers.

Integers (denoted $\mathbb{Z}$): $\{\ldots, -2, -1, 0, 1, 2, \ldots\}$

- A number that can be written without a fractional part.

Rational Numbers (denoted $\mathbb{Q}$): $\{\ldots -10, -\frac{5}{6}, 0, \frac{1}{3}, 0.6, \sqrt{25}, 19.\overline{51} \ldots\}$

- All numbers that can be written as a fraction, $\frac{a}{b}$, where a and b are integers and $b \neq 0$.
- All numbers are either terminating or repeating.

Irrational Numbers (denoted $\mathbb{I}$): $\{\ldots, 0.56093271546 \ldots, \sqrt{2}, \pi, 1.21211211121111, \ldots\}$

- Numbers that ***CANNOT*** be written as a fraction, $\frac{a}{b}$, when a and b are integers and $b \neq 0$.
- All numbers that are non-terminating and non-repeating.

Real Numbers (denoted $\mathbb{R}$): $\ldots, -17.5102, -\frac{18}{4}, 0, \sqrt{15}, \pi, 10, \ldots$

- All the rational and irrational numbers.

Real Numbers

Rational Numbers

$\frac{3}{2}$

-7.49

Integers
{...,-3,-2,-1,0,1,2,3,..}

Whole Numbers
{0,1,2,3,4,5...}

Natural Numbers
{1,2,3,4,5,...}

$-\frac{17}{101}$

15.6543

Irrational Numbers

π

$\sqrt{3}$

$-\sqrt{2}$

$\sqrt[3]{22}$

e

$\sqrt{154}$

Imaginary Numbers

$\sqrt{-16}$

$\sqrt{-1}$

$9i$

$\sqrt{-7}$

i

$\sqrt{-36}$

$-12i$

1) Match each set of numbers with their most appropriate classification.

Classifications:		
Whole Numbers	Integers	Rational Numbers
Irrational Numbers	Real Numbers	Imaginary Numbers

a) $\sqrt{7}, \pi, \frac{\sqrt{2}}{5}, -7.5\pi$ Irrational Numbers

b) $0, 5, 10, 15$ Whole Numbers

c) $-\frac{5}{2}, 12, 16.5, \sqrt{100}$ Rational Numbers

d) $\sqrt{-16}, \sqrt{-20}, 72i$ Imaginary Numbers

e) $-9, -1, 6, 29, 1076$ Integers

f) $-15.5, -\frac{9}{5}, 0.001, \frac{\pi}{2}, \pi, 97$ Real Numbers

2) What type of number is -7?

a) whole number
b) irrational number
c) integer
d) imaginary number

3) Which does *not* describe 107?

a) whole number
b) integer
c) real number
d) irrational number

4) Which would be the most appropriate domain for finding you weight in pounds?

a) integers
b) rational numbers
c) positive integers
d) positive rational numbers

5) Nancy was asked the question, "Is the number $\frac{\pi}{2}$ a rational or irrational number?" She answered, "The number $\frac{\pi}{2}$ is a rational number because it can be represented as a fraction. Is Nancy correct? Explain your reasoning. Nancy is incorrect because π is not an integer, therefore cannot be written as a fraction $\frac{a}{b}$, where a and b are integers and $b \neq 0$.

6) Which statement is not always true?

a) The sum of two rational numbers is rational.
b) The product of two irrational number is rational. $I \cdot I = I_2$
c) The sum of a rational number and an irrational number is irrational.
d) The product of a nonzero rational number and an irrational number is irrational.

Success Criteria

- I can define natural numbers and list the number set.

Set of all positive integers. $\{1, 2, 3, \ldots\}$

- I can define whole numbers and list the number set.

Set of all nonnegative integers. $\{0, 1, 2, 3, \ldots\}$

- I can define integers and list the number set.

Set of numbers that can be written without a fractional part. $\{\ldots -2, -1, 0, 1, 2, \ldots\}$

- I can define rational numbers and explain why a given number is rational.

Define the set of rational numbers. Then, explain why $\frac{5}{7}$ is a rational number.

Set of numbers that can be written as a fraction, $\frac{a}{b}$, where a and b are integers and $b \neq 0$. $5/7$ is a rational number because 5 and 7 are integers.

- I can define irrational numbers and explain why a given number is irrational.

Define the set of irrational numbers. Then, explain why $\sqrt{2}$ is an irrational number.

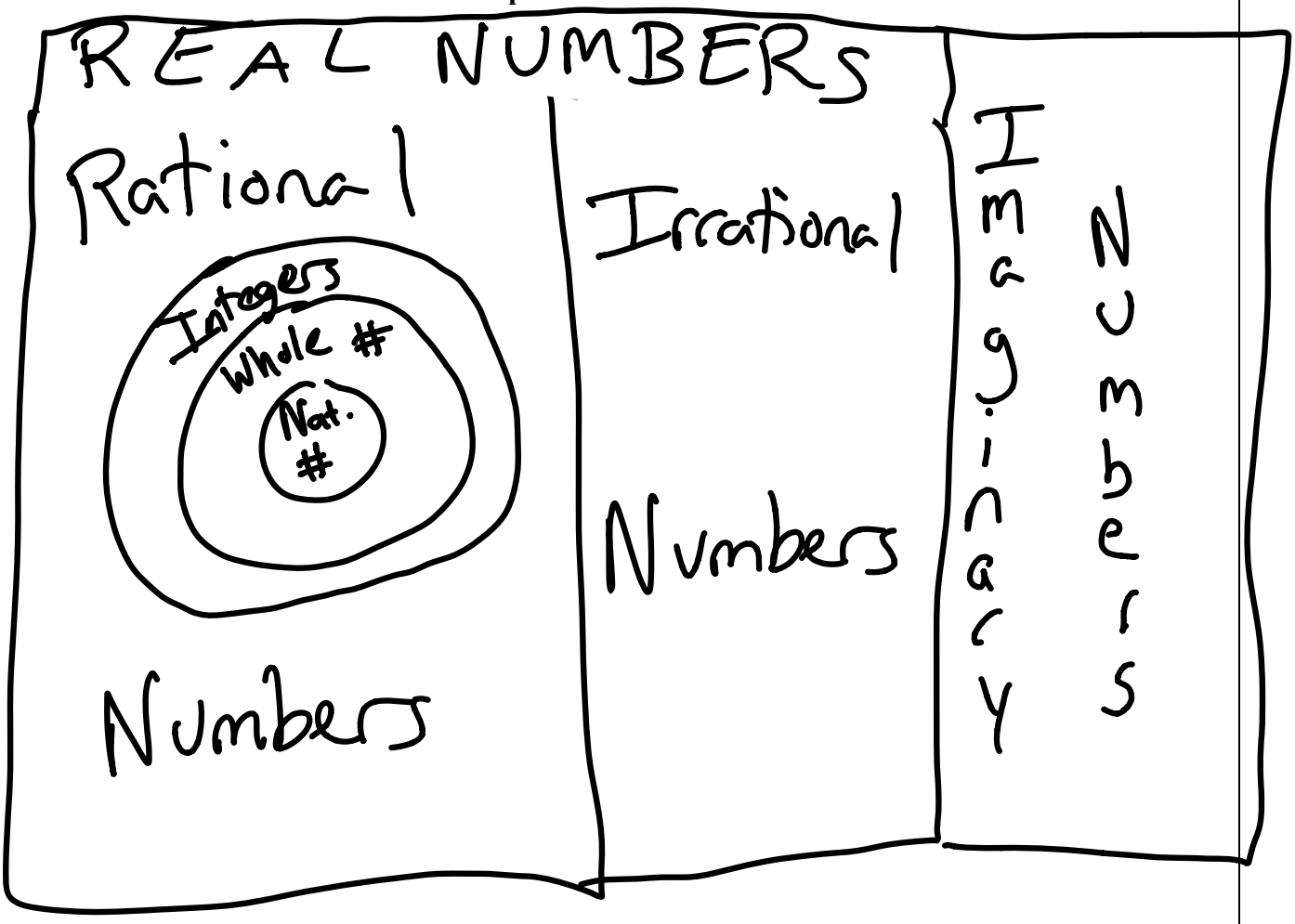
Set of numbers that are non-terminating and non-repeating. $\sqrt{2}$ is a non-terminating and non-repeating number, therefore irrational.

- I can define real numbers and explain why a given number is real.

Define the set of real numbers. Then explain why $\sqrt{19}$ is a real number.

Set of all rational and irrational numbers. $\sqrt{19}$ is an irrational number and therefore is a real number

- I can create the "Numbers Web" and explain how each number set is related.



Natural numbers are a subset of whole numbers.
Whole numbers are a subset of integers.
Integers are a subset of rational numbers.
All rational and irrational numbers are real numbers.

Imaginary numbers are their own separate number group.

Name: _____ Date: _____

Classwork/Homework: Classifying Numbers

1 What type of number is $\sqrt{17}$?

(1) rational number
(2) irrational number
(3) imaginary number
(4) whole number

2 What type of number is 16.2?

(1) rational number
(2) irrational number
(3) integer
(4) whole number

3 All of the following numbers are integers *except*

(1) -18
(2) 0
(3) 6.5
(4) 1,500

4 If x is whole number, then $-7x$ must be a

5

$-7(5) = -35$

(1) whole number
(2) integer
(3) irrational number
(4) imaginary number

5 Write a fraction that is ***not*** a rational number

$\frac{\sqrt{2}}{5}$

Explain why this fraction is not a rational number

This fraction is not a rational number because $\frac{\sqrt{2}}{5}$ is in the form of $\frac{a}{b}$ and $a \neq$ an integer.

6 The cost of production of shoes in a factory is most appropriately represented by

(1) nonnegative rational numbers
(2) integers
(3) nonnegative real numbers
(4) irrational numbers

7 Describe a scenario when it would be most appropriate to use rational numbers.

Measuring the amount of water in a pool

8 You are counting the number of dogs at a local dog park. What set of numbers would be most appropriate to use?

(1) $\{\ldots -2, -1, 0, 1, 2, \ldots\}$
(2) $\{0, 1, 2, 3, 4, 5, \ldots\}$
(3) $\{0, \frac{1}{2}, 1, 1\frac{1}{2}, 2, 2\frac{1}{2}, 3, \ldots\}$
(4) $\{-1, 0, 1, 2, 3, 4\}$

9 Given the following expressions:

I. $-\frac{1}{2} + \frac{9}{2} = \frac{8}{2} = 4$
II. $\frac{14\pi}{\pi} = 14$
III. $\sqrt{16} \cdot \pi$
IV. $7(\sqrt{81})$ $7 \cdot 9 = 63$

Which expression(s) result in an integer?

(1) I,II,IIV
(2) I,IV, only
(3) I,III,IV
(4) II, only

10 Which statement is *not* always true?
(1) The product of an integer and a whole number is an integer.
(2) The product of an integer and a whole number is a whole number. $(-7)(1) = -7$
(3) The sum of two rational numbers is rational.
(4) The difference of two real numbers is real.

11 Could you ever add a rational number and an irrational number to obtain a rational number? If yes, provide an example. If no, explain your reasoning.

No because adding a rational number to an irrational number could not result in a number that terminates or repeats.

12 Determine if the sum of $5\sqrt{7}$ and $2\sqrt{7}$ is rational or irrational. Explain your answer.

$5\sqrt{7} + 2\sqrt{7} = 7\sqrt{7}$

$7\sqrt{7}$ is a non-terminating and non-repeating number so it is irrational.

13

Which polynomial has a leading coefficient of 4 and a degree of 3?

(1) $3x^4 - 2x^2 + 4x - 7$

(2) $4 + x - 4x^2 + 5x^3$

(3) $4x^4 - 3x^3 + 2x^2$

(4) $2x + x^2 + 4x^3$

$4x^3 + x^2 + 2x$

14

John was given the equation $4(2a + 3) = -3(a - 1) + 31 - 11a$ to solve. Some of the steps and their reasons have already been completed. State a property of numbers for each missing reason.

$4(2a + 3) = -3(a - 1) + 31 - 11a$	Given
$8a + 12 = -3a + 3 + 31 - 11a$	Distributive Property
$8a + 12 = 34 - 14a$	Combining like terms
$22a + 12 = 34$	Additive Property of Equality

15 Could you ever multiply an irrational number by an irrational number to obtain a rational number? If yes, provide an example. If no, explain your reasoning.

Yes, $\sqrt{2}\left(\frac{1}{\sqrt{2}}\right) = \frac{\sqrt{2}}{\sqrt{2}} = 1$

16 Given the following expressions:

I. $-\frac{1}{2} + \frac{9}{2} = \frac{8}{2} = 4$

II. $4\pi - 1$

III. $\frac{17}{4} - \frac{\sqrt{13}}{4}$

IV. $(\sqrt{10})(\sqrt{10}) = 10$

Which expression(s) result in an irrational number?

(1) II, only

(2) IV, only

(3) I, II, III, IV

(4) II, III

17 Which statement is *not* always true? (Select all that apply)

$\sqrt{2}\left(\frac{1}{\sqrt{2}}\right) = \frac{\sqrt{2}}{\sqrt{2}} = 1$

(1) The product two irrational numbers is irrational.

(2) The product of two rational numbers is rational.

(3) The sum of two irrational numbers is irrational.

$\pi + (-\pi) = 0$

(4) The difference of a rational number and an irrational number is irrational.

18 Match each set of numbers with their most appropriate classification.

Classifications:		
Whole Numbers	Integers	Rational Numbers
Irrational Numbers	Real Numbers	Imaginary Numbers

a) $\{\ldots, -2, -1, 0, 1, 2, \ldots\}$ Integers

b) $\{0, 1, 2, 3, 4, \ldots\}$ Whole

c) $-8i, \sqrt{-5}, \sqrt{-49}$ Imaginary

d) $\sqrt{2}, \pi, \sqrt{701}$ Irrational

e) $-8, -1.05, \frac{1}{2}$ Rational

f) $-8, \pi, \frac{1}{2}, \sqrt{701}$ Real

19 What type of number is $\sqrt{36}$?

(1) rational number
(2) irrational number
(3) imaginary number
(4) negative integer

20 What type of number is 67.8?

(1) positive rational number.
(2) positive irrational number
(3) integer
(4) positive integer

21 If y is a negative integer, then $-10y$ must be a

-5

$-10(-5) = 50$

(1) whole number
(2) negative rational number
(3) irrational number
(4) imaginary number

22 Describe a scenario when it would be most appropriate to use whole numbers.

When counting workers at a restaurant.

23 Which statement is always true?

(1) The sum of an integer and a rational number is an integer
(2) The sum of an integer and a whole number is an integer.
(3) The product of real number and a whole number is a whole number.
(4) The product of two irrational numbers is an integer.

$1 + \frac{1}{2} = \frac{3}{2}$

$-1 + 5 = 4$

$\sqrt{2} \cdot 1 = \sqrt{2}$

$\pi \cdot \pi = \pi^2$

24 The number of cashiers at a local supermarket is most appropriately represented by

(1) integers
(2) real numbers
(3) rational numbers
(4) whole numbers

25 The area of a circle is most appropriately represented by $A_0 = \pi r^2$

(1) nonnegative rational numbers
(2) integers
(3) nonnegative real numbers
(4) irrational numbers

26 For which value of M and N is $M + N$ a rational number?

(1) $M = \frac{1}{\sqrt{9}}$ and $N = \frac{1}{\sqrt{2}}$
(2) $M = \frac{1}{\sqrt{3}}$ and $N = \frac{1}{\sqrt{2}}$
(3) $M = \frac{1}{\sqrt{25}}$ and $N = \frac{1}{\sqrt{64}}$
(4) $M = \frac{1}{\sqrt{9}}$ and $N = \frac{1}{\sqrt{6}}$

$\frac{1}{5} + \frac{1}{8} = \frac{8}{40} + \frac{5}{40}$ $\frac{13}{40}$

27 Jamal is given the following values:

$A = 4.5$
$B = \sqrt{4}$
$C = -17$
$D = \frac{19}{2}$

He states that $BC + AD$ is an integer. Is Jamal correct? Explain your reasoning

$\sqrt{4}(-17) + 4.5(\frac{19}{2})$
$2(-17) + 4.5(9.5)$
$-34 + 42.75$
8.75

Jamal is incorrect because 8.75 has a necessary fractional part.

28 Is the sum of $2\sqrt{2}$ and $9\sqrt{32}$ rational or irrational? Explain your reasoning.

$2\sqrt{2} + 9\sqrt{32} = 15.556349186\ldots$

The sum of $2\sqrt{2}$ and $9\sqrt{32}$ is irrational because it is a non-terminating and non-repeating number.

29 Is the product of $2\sqrt{2}$ and $9\sqrt{32}$ rational or irrational? Explain your reasoning.

$2\sqrt{2} \cdot 9\sqrt{32}$

$18\sqrt{64}$

$18(8)$

144

Rational number because 144 terminates.

30 For which value of P and Q is PQ an irrational number?

(1) $P = \frac{1}{\sqrt{2}}$ and $Q = \frac{1}{\sqrt{50}}$

(2) $P = \frac{1}{\sqrt{4}}$ and $Q = \frac{1}{\sqrt{5}}$

(3) $P = \frac{1}{\sqrt{4}}$ and $Q = \frac{1}{\sqrt{9}}$

(4) $P = \frac{1}{\sqrt{25}}$ and $Q = \frac{1}{\sqrt{81}}$

$\frac{1}{\sqrt{2}} \cdot \frac{1}{\sqrt{50}} = \frac{1}{\sqrt{100}}$ $\quad \frac{1}{10}$

$\frac{1}{\sqrt{4}} \cdot \frac{1}{\sqrt{5}} = \frac{1}{\sqrt{20}}$

31 Given:

$W = 3\sqrt{4}$

$X = \sqrt{7}$

$Y = \sqrt{6}$

$Z = -2\sqrt{9}$

Which results in a rational number?

(1) XY $\sqrt{7} \cdot \sqrt{6} = \sqrt{42}$

(2) $X + Y$

(3) $W + Z$

(4) WZ $3\sqrt{4}(-2\sqrt{9}) = -6\sqrt{36}$

$-6 \cdot 6 = -36$

32 Diane said that "All integers are real numbers." Do you agree with Diane? Explain your reasoning.

Yes because integers are a subset of real numbers.

33 State whether $9 - \sqrt{3}$ is rational or irrational. Explain your answer.

$9-\sqrt{3}$ is irrational because it is a non-terminating and non-repeating number.

34
A formula for determining the finite sum, S, of an arithmetic sequence of numbers is $S = \frac{n}{2}(a + b)$, where n is the number of terms, a is the first term, and b is the last term. Express b in terms of a, S, and n.

$\frac{2}{n}(S) = \left[\frac{n}{2}(a+b)\right]\frac{2}{n}$

$\frac{2S}{n} = a+b$

$-a \quad -a$

$\frac{2S}{n} - a = b$

35 Could you ever subtract an irrational number by an irrational number to obtain a rational number? If yes, provide an example. If no, explain your reasoning.

$\pi - \pi = 0$

Yes

36 The product of $\sqrt{324}$ and $\sqrt{466}$ is

18

(1) irrational because both factors are irrational
(2) irrational because one factor is irrational
(3) rational because both factors are rational
(4) rational because one factor is rational

37 The solution to the equation $2x - \sqrt{5} = 10$ is a

(1) whole number
(2) rational number
(3) irrational number
(4) imaginary number

$2x - \sqrt{5} = 10$
$+\sqrt{5} \quad +\sqrt{5}$
$\frac{2x}{2} = \frac{10+\sqrt{5}}{2}$
$x = \frac{10+\sqrt{5}}{2}$

38 Given:

$R = \sqrt{36}$ $=6$
$S = \sqrt{4}$ $=2$
$T = \sqrt{12}$
$U = \sqrt{3}$

Which results in an irrational number?

(1) TU $\sqrt{12}\cdot\sqrt{3} = \sqrt{36} = 6$
(2) SU $\sqrt{4}\cdot\sqrt{3} = \sqrt{12}$
(3) RS $6\cdot 2 = 12$
(4) U^2 $(\sqrt{3})^2 = 3$

39 The sum of $\sqrt{200}$ and $\sqrt{676}$ is

(1) irrational because both addends are irrational
(2) irrational because one addend is irrational
(3) rational because both addends are rational
(4) rational because one addend is rational

40 Is the product of $3\sqrt{3}$ and $7\sqrt{3}$ rational or irrational? Explain your reasoning.

$3\sqrt{3}(7\sqrt{3})$
$21\sqrt{9}$
$21(3)$
63

Rational because 63 is a terminating number.

41 Ms. Robbins asked her class, "Is the sum of 5.27 and $\sqrt{5}$ rational or irrational?" Giovani answered that the sum was irrational.

State whether Giovani is correct or incorrect. Justify your reasoning.

Giovani is correct because $5.27+\sqrt{5}$ is a non-terminating and non-repeating number.

42 Chris said that "All rational numbers are real numbers." Do you agree with Chris? Explain your reasoning.

Yes because rational numbers are a subset of real numbers.

43 Derrick said that "All real numbers are rational numbers." Do you agree with Derrick? Explain your reasoning.

No because irrational numbers are real numbers that are not rational.

44 Which statement is *not* always true?
(1) The product of an integer and a whole number is an integer.
(2) The sum of an integer and a whole number is an integer.
(3) The product of two irrational numbers is irrational. → $\frac{1}{\pi}(\pi) = 1$
(4) The sum of a rational number and an irrational number is irrational.

45 The amount of a bill at a local restaurant is most appropriately represented by

(1) positive rational numbers
(2) positive irrational numbers
(3) whole numbers
(4) integers

46 You are counting the value of a certain number of quarters. What set of numbers would be most appropriate to use?

(1) $\{\ldots -2, -1, 0, 1, 2, \ldots\}$
(2) $\{0, 1, 2, 3, 4, 5, \ldots\}$
(3) $\{0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1, 1\frac{1}{4}, 1\frac{1}{2}, \ldots\}$
(4) $\{-1, 0, 1, 2, 3, 4\}$

47 Is the product of $\sqrt{36}$ and $\frac{6}{7}$ rational or irrational? Explain your reasoning.

$\sqrt{36} = 6$

$6\left(\frac{6}{7}\right) = \frac{36}{7}$

$\frac{36}{7}$ is a rational number because it is written in the form $\frac{a}{b}$ where a and b are integers and $b \neq 0$.