Activity

1-1 Operations on Real Numbers

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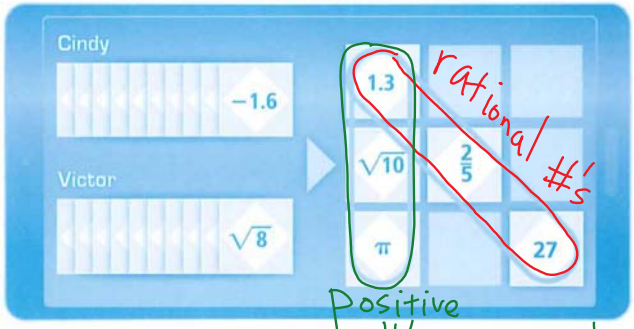
CRITIQUE & EXPLAIN

Cindy and Victor are playing a math game. The winner must get three in a row of the same type of real number and justify how the numbers are alike. Cindy said she won because she was able to get three rational numbers on a diagonal. Victor said he won with three positive numbers in a column.



rational # → integer / integer

ex's) $\frac{1}{4}$, $\frac{7}{9}$, -3

0.25 (terminating decimal), $.7\overline{7}$.... (repeating decimal/pattern), $\frac{-3}{1}$

A. Can both players say they won, for different reasons? Explain.

Yes. Cindy: subset of #s call rational #s

Victor: Subset of positive #'s

irrational # → not rational

ex's) $\sqrt{7}$, π

2.645751311... (no pattern), 3.14159265...

B. **Reason** Can you make other groups using the numbers shown that are all the same kind of real number? In how many ways can you do this? MP.2

HABITS OF MIND

Construct Arguments Cindy says that $\frac{1}{3}$ is an irrational number because the fraction form doesn't terminate. Construct an argument to support or refute Cindy's position. MP.3

$\frac{1}{3} = 0.\overline{3}$ or $0.333...$ (repeating decimal/patter.)

$\frac{1}{3}$ is not irrational. It is rational.

Notes

Assess

EXAMPLE 1 **Try It! Understand Sets and Subsets**

1. Which numbers in set *A* are elements in both the subset of odd numbers and the subset of multiples of 3?

ex1) set of #s 1→10

A = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

elements

Subset of even #s

B = {2, 4, 6, 8, 10}

Subset of multiples of 5

C = {5, 10}

→ 10 is the only element of both subsets

Subset of odd #s

D = {1, 3, 5, 7, 9}

Subset of multiples of 3

E = {3, 6, 9}

→ 3 & 9 are elements of both subsets

HABITS OF MIND

Generalize Can a number of a set also be an element of more than one subset? Explain. MP.8

Yes... for example, 2 is a subset of rational #, integer, whole #, & natural #

EXAMPLE 2 **Try It! Compare and Order Real Numbers**

2. Order each set of numbers from least to greatest.

a. $0.25, \sqrt{\frac{1}{9}}, \frac{6}{25}$

b. $\sqrt{\frac{121}{25}}, 2.25, \sqrt{5}$

→ use a calculator!

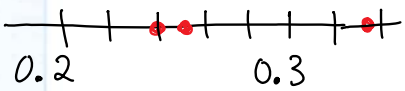
Convert to a decimal...

$\sqrt{\frac{1}{9}} = 0.\overline{3}$, $\frac{6}{25} = 0.24$

→ $\frac{6}{25}, 0.25, \sqrt{\frac{1}{9}}$

$\sqrt{\frac{121}{25}} = 2.2$, $\sqrt{5} = 2.24$

→ $\sqrt{\frac{121}{25}}, \sqrt{5}, 2.25$



Notes

Assess

EXAMPLE 3 **Try It! Operations With Rational Numbers**

3. Is the quotient of two rational numbers always a rational number? Explain.

Is the sum of two rat'l numbers always a rat'l number?

$\frac{1}{2}+\frac{1}{3}=\frac{5}{6}$ ... $\frac{7}{8}+\frac{3}{4}=\frac{13}{8}$ ...

$\frac{11}{5}+\frac{1}{6}=\frac{71}{30}$

→ Yes + two rat'ls = rat'l

divide

mult by reciprocal...

$\frac{1}{2} \div \frac{1}{4}$

• skip, flip, multiply

→ $\frac{1}{2} \cdot \frac{4}{1} \rightarrow \frac{4}{2} \rightarrow \frac{2}{1}$

→ ÷ two rat'ls = rat'l

EXAMPLE 4 **Try It! Operations With Rational and Irrational Numbers**

4. Is the difference of a rational number and an irrational number always irrational? Explain.

subt.

* The sum of a rat'l and irrational number is always irrational.

ex) $\frac{4}{5} + \pi =$ irrational

rat'l irrat'l

• rat'l − irrat'l = irrational

HABITS OF MIND

Reason When is the square root of a number irrational? Give an example. MP.2

$\sqrt{\text{irrational}}$ = irrational

ex) $\sqrt{\pi} \approx 1.772453851...$

no pattern

Assess

Do You UNDERSTAND?

1. ESSENTIAL QUESTION How can you classify the results of operations on real numbers?

2. **Communicate Precisely** Explain why the sum of a rational number and an irrational number is always irrational. MP.6

rational + irrational

ex) $3+\sqrt{5}$

$= 3 + 2.236067977\ldots$

$= 5.236067977\ldots$ irrational

3. **Vocabulary** Are the rational numbers a subset of the *set* of all real numbers? Are the rational numbers a *subset* of the irrational numbers? Explain?

Real #s

Yes....

rat'l #s	irrat'l #s

No... Separate Subsets

4. **Error Analysis** Jacinta says that the product of a positive and a negative rational number is always irrational. Explain her error. MP.3

** irrational × rational

• zero

= rational

5. **Reason** Let $D = \{-2, -1, 0, 1, 2\}$. Is D a subset of itself? Explain. MP.2

Yes, all elements are within itself.

Do You KNOW HOW?

Determine whether set B is a subset of set A.

6. $A = \{0, 1, 2, 3, 4\}$, $B = \{1, 2\}$

Yes

7. $A = \{2, 3, 5, 7, 11\}$, $B = \{3, 5, 7, 9, 11\}$

No, 9 is not an element in set A.

Order each set of numbers from least to greatest.

7. $\sqrt{200}, 14, \frac{41}{3}$

$\sqrt{200}$ → 14.142135623...

$\frac{41}{3}$ → $13.\overline{6}$

$\frac{41}{3}, 14, \sqrt{200}$

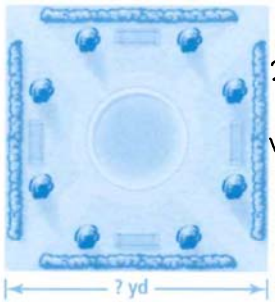
8. $\frac{2}{3}, \sqrt{\frac{9}{16}}, 0.6$

$\frac{2}{3}$ → $.\overline{6}$

$\sqrt{\frac{9}{16}}$ → .75

$0.6, \frac{2}{3}, \sqrt{\frac{9}{16}}$

9. The park shown is in the shape of a square. Is its perimeter rational or irrational?



rat'l

$A = l \cdot l$

$24200 = l^2$

$\sqrt{24200} = l$

$\approx l$

$155.5635\ldots$

no pattern

→ irrational

$4 \cdot l =$

$4 \cdot 155.5635\ldots$

→ irrational

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