

Rationality Rules

Use fraction forms to classify sums and products.

HIGH SCHOOL · HSN-RN.B.3

CCSS.Math.Content.HSN-RN.B.3 "Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational."

NAME _____

DATE _____

THE BIG IDEA

Rational numbers are fractions of integers, including integers such as $4 = 4/1$. The sum and product of two rational numbers are rational because each result can be written as a fraction of integers. A rational plus an irrational is irrational, and a nonzero rational times an irrational is irrational, but 0 times an irrational is 0, which is rational.

WORKED EXAMPLE

Classify $11/14 + \sqrt{23}$.

1. $11/14$ is rational, and $\sqrt{23}$ is irrational.
2. Assume $11/14 + \sqrt{23}$ is rational.
3. Then $\sqrt{23} = (11/14 + \sqrt{23}) - 11/14$ would be rational.
4. This contradicts the fact that $\sqrt{23}$ is irrational.

Answer: Irrational.

PRACTICE 6 problems

- 1** Find $3/8 + 5/12$. Is the result rational or irrational?

ANSWER _____

- 2** Find $(-7/9) * (18/35)$. Is the result rational or irrational?

ANSWER _____

- 3** Classify $4/11 + \sqrt{2}$. Give one reason.

ANSWER _____

- 4** Classify $(-3/5) * \sqrt{13}$. Give one reason.

ANSWER _____

- 5** Simplify $\sqrt{25} + 7/10$. Is the result rational or irrational?

ANSWER _____

- 6** Classify $0 * \sqrt{17}$ as rational or irrational.

ANSWER _____

APPLY IT Show your work

- 1** A student edits a short video. One transition lasts $\frac{5}{6}$ second, and a sound effect lasts $\sqrt{3}$ seconds. If the times are added, write the exact total and classify it.

WORK SPACE

ANSWER _____

- 2** For a club T-shirt design, a logo is $\sqrt{10}$ cm wide. The printer enlarges every length by $\frac{3}{2}$. Write the exact new width and classify it.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Without using decimals, decide whether $(\frac{5}{3})\sqrt{12} + \frac{7}{9}$ is rational or irrational. Explain your reasoning.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Find $\frac{3}{8} + \frac{5}{12}$. Is the result rational or irrational?	$\frac{19}{24}$, rational
2	Find $(-\frac{7}{9}) * (\frac{18}{35})$. Is the result rational or irrational?	$-\frac{2}{5}$, rational
3	Classify $\frac{4}{11} + \sqrt{2}$. Give one reason.	Irrational, because $\frac{4}{11}$ is rational and $\sqrt{2}$ is irrational.
4	Classify $(-\frac{3}{5}) * \sqrt{13}$. Give one reason.	Irrational, because $-\frac{3}{5}$ is a nonzero rational number and $\sqrt{13}$ is irrational.
5	Simplify $\sqrt{25} + \frac{7}{10}$. Is the result rational or irrational?	$\frac{57}{10}$, rational
6	Classify $0 * \sqrt{17}$ as rational or irrational.	0, rational

PART 2 • APPLY IT

- $\frac{5}{6} + \sqrt{3}$ seconds, irrational** $\frac{5}{6}$ is rational and $\sqrt{3}$ is irrational. Their sum is irrational.
- $(\frac{3\sqrt{10}}{2})$ cm, irrational** Multiply: $(\frac{3}{2}) * \sqrt{10} = (\frac{3\sqrt{10}}{2})$. Since $\frac{3}{2}$ is nonzero rational and $\sqrt{10}$ is irrational, the product is irrational.

CHALLENGE

Irrational. $\sqrt{12}$ is irrational, so $(\frac{5}{3})\sqrt{12}$ is irrational because $\frac{5}{3}$ is nonzero rational. Adding $\frac{7}{9}$, a rational number, keeps the result irrational.

Accept equivalent fraction forms, such as $5 \frac{7}{10}$ for $\frac{57}{10}$. For classification items, require that students identify the rational and irrational numbers and apply the correct sum or product rule.