Am I Rational or Irrational?

Cubed Roots ⟶ $\sqrt[3]{\textbf{\textit{radicand}}}$

- If the radicand is a perfect cube, it is Rational

$\sqrt[3]{1} = 1$	$\sqrt[3]{8} = 2$	$\sqrt[3]{27} = 3$	$\sqrt[3]{64} = 4$	$\sqrt[3]{125} = 5$
$\sqrt[3]{216} = 6$	$\sqrt[3]{343} = 7$	$\sqrt[3]{512} = 8$	$\sqrt[3]{729} = 9$	$\sqrt[3]{1000} = 10$

- If the radicand is NOT a perfect cube, it is IRRational.
  - Examples: $\sqrt[3]{35} \approx 3.27106631018859\ldots$

Squared Roots ⟶ $\sqrt{\textbf{\textit{radicand}}}$

- If the radicand is a perfect square, it is Rational.

$\sqrt{1}$ =1	$\sqrt{4}$ =2	$\sqrt{9}$ =3	$\sqrt{16}$ =4	$\sqrt{25}$ =5	$\sqrt{36}$ =6	$\sqrt{49}$ =7	$\sqrt{64}$ =8	$\sqrt{81}$ =9
$\sqrt{100}$ =10	$\sqrt{121}$ =11	$\sqrt{144}$ =12	$\sqrt{169}$ =13	$\sqrt{196}$ =14	$\sqrt{225}$ =15	$\sqrt{256}$ =16	$\sqrt{289}$ =17	$\sqrt{324}$ =18
$\sqrt{361}$ =19	$\sqrt{400}$ =20	$\sqrt{441}$ =21	$\sqrt{484}$ =22	$\sqrt{529}$ =23	$\sqrt{576}$ =24	$\sqrt{625}$ =25		

- If the radicand is NOT a perfect square, it is IRRational.
  - Example: $\sqrt{38} \approx 6.164414002968976\ldots$

Simple Fractions Written with IntegeRS **(Ex:** $\frac{1}{2}$ **):** $\frac{1}{3}$ $\frac{3}{4}$

- They are Rational because you can divide the numerator (top number) by the denominator (bottom number) and the numbers after the decimal either terminate (stop) or they repeat.

Fractions Written with $\pi, \sqrt{2}, \sqrt{7}$ **(Ex:** $\frac{\pi}{\sqrt{2}}$ **):** $\frac{1}{\pi}$

- They are IRRational because you can divide the numerator (top number) by the denominator (bottom number) and the numbers after the decimal do NOT terminate (stop) AND they do NOT repeat.

ALWAYS True	**SOMETIMES**	**NEVER True**
The sum of a rational number and an irrational number is IRRational Ex: $2+\pi$ * Decimal never stops *This is simplified. Type it in a calculator to see what you get!	The product of a rational number and an irrational numbers is sometimes: -Multiply any irrational number by the rational number zero. The product is Rational. Ex: $0 \cdot \sqrt{2} = 0$ -Choose any other rational with any irrational number and the product is IRRational. Ex: $7 \cdot \sqrt{2}$	The sum of a rational number and an irrational number is never Rational. $2+\sqrt{7}$ IRR
The sum of two rational numbers is Rational. Ex: $2+2=\underline{4}$ Ex: $\sqrt{36}+\sqrt{4}=\underline{8}$ Ex: $\frac{1}{3}+\frac{1}{3}=\underline{\frac{2}{3}}$	The sum of two irrational numbers is sometimes: -If the irrational parts of the numbers have zero sum, the sum is Rational. Ex: $\sqrt{3}-\sqrt{3}=0$ -If not, the sum is IRRational. Ex: $\sqrt{3}+\sqrt{6}$	The sum of two rational numbers is never IRRational $4+2=6$ Rational
The product of two rational numbers is Rational. $4 \cdot 7 = 28$ Why: -If a, b, c, & d are integers with b & d non-zero, then $\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$ is also rational. -If b or d is zero, the product is undefined, which is not the same as irrational.	The product of two irrational numbers is sometimes: IRRational. Ex: $\sqrt{2} \cdot \sqrt{3}$ Rational. Ex: $\sqrt{6} \cdot \sqrt{6} = 6$	The product of two rational numbers is never IRRational $6 \cdot 7 = 42$ Rational

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

$\frac{1}{8}$

$0.\overline{19}$

Be careful to read problems carefully! This statement is ALWAYS true:

The product of a **nonzero** rational number and an irrational number is irrational.