MATHEMATICS · GRADES 7-9

Rational versus irrational numbers

Difficulty level: Intermediate

Mathematics: Grades 7-9

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Overview of the concept

This is how you sort numbers into those you can write exactly as a fraction, like a price in dollars and cents, and those that go on forever without repeating, like pi in a circle's circumference. A price of 4 dollars and 50 cents is exactly $\frac{9}{2}$, while pi keeps going without ever settling into a repeating pattern. A builder measuring a diagonal across a square runs into the same kind of number, since $\sqrt{2}$ never ends either. Knowing which kind of number you are dealing with tells you whether an exact answer is possible, or only an approximation.



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Rule

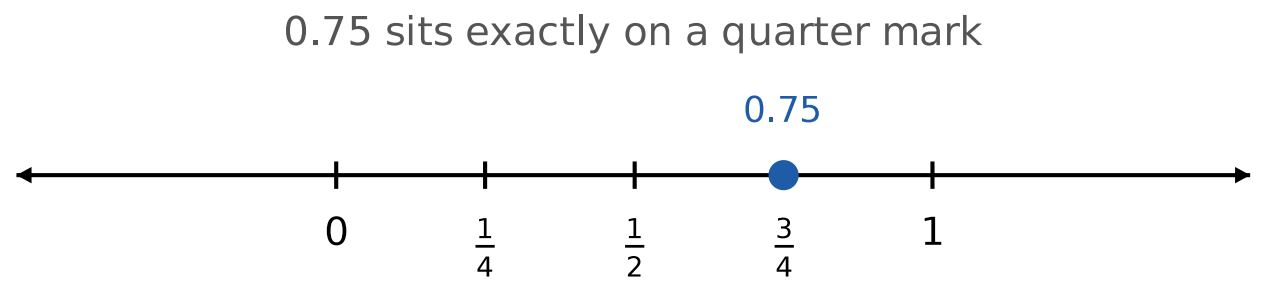
A rational number can be written as a fraction of two integers, and its decimal either ends or repeats (see Terminating and repeating decimals).

An irrational number cannot be written that way, and its decimal never ends or repeats.

Worked examples

EXAMPLE 1

Q Is 0.75 rational or irrational?



SOLUTION

Ask: can it be written as a fraction of integers? Yes, $0.75 = \frac{3}{4}$.

A number that can be written that way is rational.

So 0.75 is rational.

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EXAMPLE 2

Q Is $\sqrt{2}$ rational or irrational?

SOLUTION

Picture it

Is $\sqrt{2}$ rational or irrational?

Work it one step at a time, top to bottom.

Ask: can it be written as a fraction of integers? No, its decimal never ends or repeats.

A number that cannot be written that way is irrational.

So $\sqrt{2}$ is irrational.

Practice questions

1 **The number 0.5 can be written as $\frac{1}{2}$, a fraction of two integers. Is 0.5 rational or irrational?**

A Rational

B Irrational

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2 The number $\sqrt{5}$ cannot be written as a fraction of two integers. Is $\sqrt{5}$ rational or irrational?

- A Rational
- B Irrational

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3 Is 0.125 rational or irrational?

- A Rational
- B Irrational

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4 Write $\frac{2}{7}$ as a decimal: it repeats forever. Is $\frac{2}{7}$ rational or irrational?

- A Rational
- B Irrational

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5 The number pi goes on forever without repeating. Is pi rational or irrational?

- A Rational
- B Irrational

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6 Is $\frac{\sqrt{2}}{2}$ rational or irrational?

- **A** Rational
- **B** Irrational

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7 Is $\sqrt{25}$ rational or irrational?

- **A** Rational
- **B** Irrational

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8 Is $\sqrt{3} \times \sqrt{3}$ rational or irrational?

- **A** Rational
- **B** Irrational

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9 Is $\frac{1}{2} + \frac{1}{4}$ rational or irrational?

A Rational

B Irrational

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10 Is 0.101001000100001... rational or irrational?

A Rational

B Irrational

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ANSWER KEY

1. Rational

2. Irrational

3. Rational

4. Rational

5. Irrational

6. Irrational

7. Rational

8. Rational

9. Rational

10. Irrational

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