LESSON MAKER PRO

Decimal Detectives

Look for the pattern that decides whether a number is rational.

GRADE 8 · 8.NOS.A.1

8.NOS.A.1 "Identify a number as irrational when its decimal expansion neither terminates nor repeats, and explain that irrational numbers cannot be expressed as the ratio of two integers."

NAME _____ DATE _____

THE BIG IDEA

A decimal that ends or repeats a fixed block is rational, so it can be written as a ratio of two integers. For example, 0.474747... repeats 47 and equals 47/99. A decimal that never ends or repeats is irrational and cannot equal a ratio of two integers. The square root of a whole number that is not a perfect square is also irrational.

WORKED EXAMPLE

Is 0.303003000300003... rational or irrational? Between each pair of 3s, there is one more 0 than before.

1. Count the zeros between consecutive 3s: 1, 2, 3, then 4.
2. The growing gaps mean no fixed block of digits repeats forever.
3. A decimal that never ends or repeats cannot be a ratio of two integers.

Answer: Irrational

PRACTICE 6 problems

1 Classify 0.625 as rational or irrational. Explain using its decimal.

ANSWER _____

2 Classify 0.181818... as rational or irrational. Write it as a ratio of two integers.

ANSWER _____

3 Classify 0.101001000100001... as rational or irrational. Between each pair of 1s, there is one more 0 than before. Explain.

ANSWER _____

4 Find the square root of 49. Is it rational or irrational? Explain.

ANSWER _____

5 Is the square root of 18 rational or irrational? Explain.

ANSWER _____

6 Classify 0.252255222555... as rational or irrational. Its digits come in blocks of 2, 5, 22, 55, 222, 555, and so on. Explain.

ANSWER _____

APPLY IT Show your work

1 A square sticker for a laptop has an area of 72 cm^2. Its side length is the square root of 72 cm. Is that length rational or irrational? Can it be written as a ratio of two integers?

WORK SPACE

ANSWER _____

2 A game designer enters 0.363636... as an exact speed setting, with 36 repeating forever. Is the setting rational or irrational? Write it as a ratio of two integers.

WORK SPACE

ANSWER _____

CHALLENGE One step up

An app shows only the first six digits after the decimal point of a mystery number: 0.121212. A friend says this proves the number is rational. Is the friend right? Give one rational number and one irrational number that both begin with those six digits. Explain how you know.

WORK SPACE AND ANSWER

ANSWER KEY

Decimal Detectives

GRADE 8 · 8.NOS.A.1

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Classify 0.625 as rational or irrational. Explain using its decimal.	**Rational. Its decimal ends.**
2	Classify 0.181818... as rational or irrational. Write it as a ratio of two integers.	**Rational; 0.181818... = 18/99 = 2/11.**
3	Classify 0.101001000100001... as rational or irrational. Between each pair of 1s, there is one more 0 than before. Explain.	**Irrational. The growing gaps of zeros never form a repeating block.**
4	Find the square root of 49. Is it rational or irrational? Explain.	**7, which is rational because 7 = 7/1.**
5	Is the square root of 18 rational or irrational? Explain.	**Irrational. 18 is not a perfect square.**
6	Classify 0.252255222555... as rational or irrational. Its digits come in blocks of 2, 5, 22, 55, 222, 555, and so on. Explain.	**Irrational. The blocks keep growing, so no fixed block repeats forever.**

PART 2 · APPLY IT

1. **Irrational. It cannot be written as a ratio of two integers.** 72 is not a perfect square, so its square root is irrational.
2. **Rational; 0.363636... = 36/99 = 4/11.** The block 36 repeats forever, so the setting is rational. Put the repeating two-digit block over 99 and simplify.

CHALLENGE

No. The rational number 0.1212121212... repeats 12 forever. The irrational number 0.12121210100100010000 1... begins with the same six digits, but after them, the gaps of zeros between 1s keep growing, so it never repeats.

For an irrational decimal, accept a clear explanation that its stated pattern never repeats, not just that the shown digits look irregular. The challenge allows other valid examples with the same first six decimal digits.