



# Rational and irrational

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## What the words actually mean

- Today: the test is not 'does it go on forever'.

# Rational = a **RATIO**

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- Any number you can write as one integer over another.
- $3 = \frac{3}{1}$ .  $0.75 = \frac{3}{4}$ .  $-2.5 = -\frac{5}{2}$ .

**The word contains its own definition: rational.**

# Write these as fractions

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• 0.6    12    -0.125     $4\frac{1}{2}$

**Turn & talk: is every number you can write down rational?**

$$\frac{1}{3} = 0.333\dots$$

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- It goes on forever.
- It is rational anyway — it IS one over three.

**So ‘goes on forever’ cannot be the test.**

# The real test

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- TERMINATES: 0.125. Rational.
- REPEATS: 0.3333..., 0.181818.... Rational.
- Neither: irrational.

$$\sqrt{2} = 1.41421356\dots$$

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- No block of digits ever repeats.
- It cannot be written as a fraction at all.

**But  $\sqrt{9} = 3$ . Not every root is irrational.**

# $\pi$ is not $\frac{22}{7}$

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- $\frac{22}{7} = 3.142857\dots$  and repeats.
- $\pi = 3.14159\dots$  and never does.

**$\frac{22}{7}$  is an approximation. A calculator display is not a proof.**

# Your turn

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- Sort:  $0.7$ ,  $\frac{2}{3}$ ,  $\sqrt{16}$ ,  $\sqrt{7}$ ,  $\pi$ ,  $-5$ ,  $0.121212\dots$

**For each one: terminates, repeats, or neither?**