MATHEMATICS · GRADES 10-12

Understanding limits intuitively

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you describe what a quantity gets closer and closer to, like a car slowing down toward a stop sign or a ball bouncing lower each time, even if it never quite reaches that value. A limit is the value something is heading for, even if it never actually lands on it. The car approaches the stop line, the ball approaches the ground, and the limit is the number they are closing in on. That idea is the starting point for calculus, and it is how you talk about anything that approaches a value without reaching it.

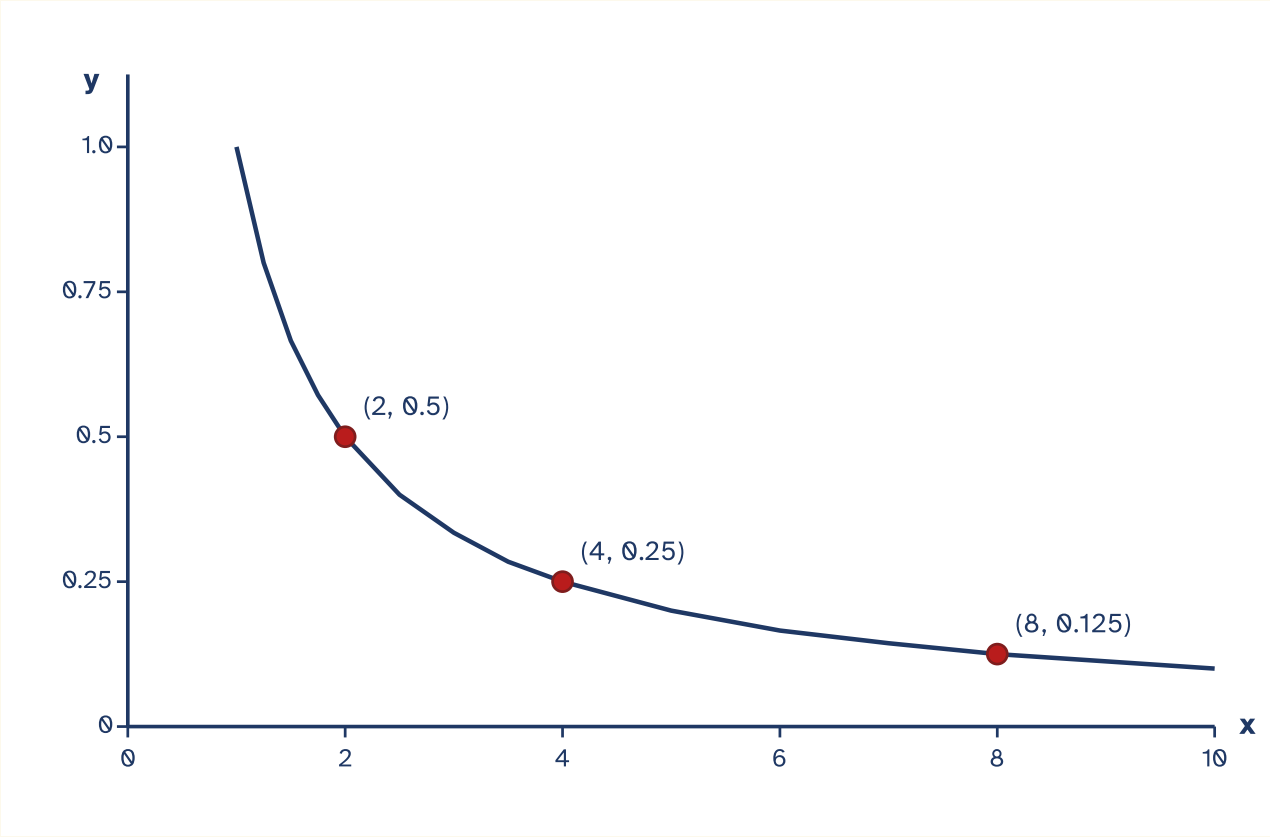


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Worked examples

EXAMPLE 1

Q What value does $\frac{1}{x}$ approach as x grows very large?



SOLUTION

Try x = 10: $\frac{1}{10}$ = 0.1. Try x = 100: 0.01. Try x = 1000: 0.001.

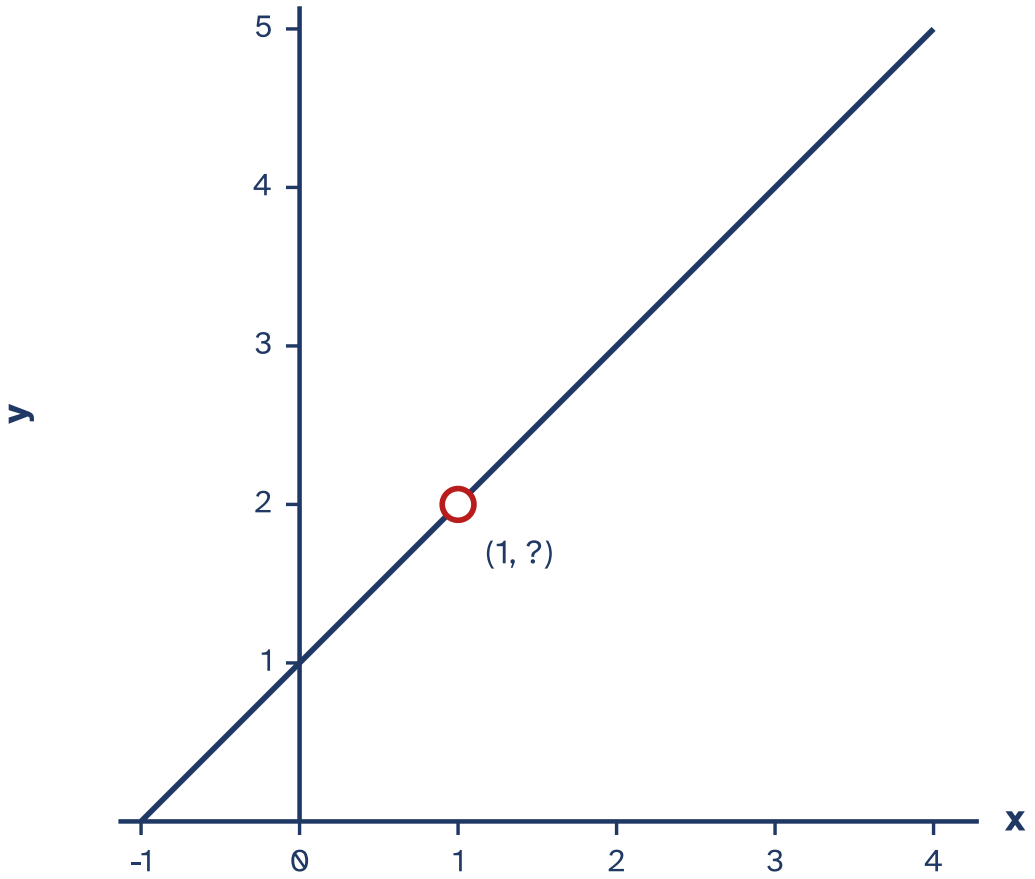
The values get closer and closer to 0.

The limit is 0.

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EXAMPLE 2

Q What does $\frac{(x^2 - 1)}{(x - 1)}$) approach as x approaches 1?



SOLUTION

At x = 1 the fraction is $\frac{0}{0}$, so it is undefined there.

For x near 1:

$$\frac{x^2 - 1}{x - 1} = \frac{(x - 1)(x + 1)}{x - 1} = x + 1$$

As x approaches 1, x + 1 approaches 2, so the limit is 2.

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Practice questions

1 What value does $\frac{(x^2 - 25)}{(x - 5)}$ get closer and closer to as x approaches 5?

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2 As x approaches 2, what does $\frac{(x^2 - 4)}{(x - 2)}$ approach?

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3 As x approaches 3, what does $\frac{(x^2 - 9)}{(x - 3)}$ approach?

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4 As x approaches 2, what does $\frac{(x^3 - 8)}{(x - 2)}$ approach?

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5 As x grows very large, what value does $\frac{3}{x}$ get closer and closer to?

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6 As x grows very large, what does $5 - \frac{1}{x}$ get closer and closer to?

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7 As x gets closer and closer to 3, what does x^2 approach?

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8 As x gets closer and closer to 2, what does $2x + 1$ approach?

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9 For every x, $f(x) = 7$. What does $f(x)$ approach as x approaches 3?

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In words, what is a limit?

A. The value a function approaches as x approaches a point

B. The value of a function at a point

C. The steepest point on a graph

D. The largest value a function reaches

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ANSWER KEY

1. 10

2. 4

3. 6

4. 12

5. 0

6. 5

7. 9

8. 5

9. 7

10. The value a function approaches as x approaches a point

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