MATHEMATICS · GRADES 10-12

Vertical line test

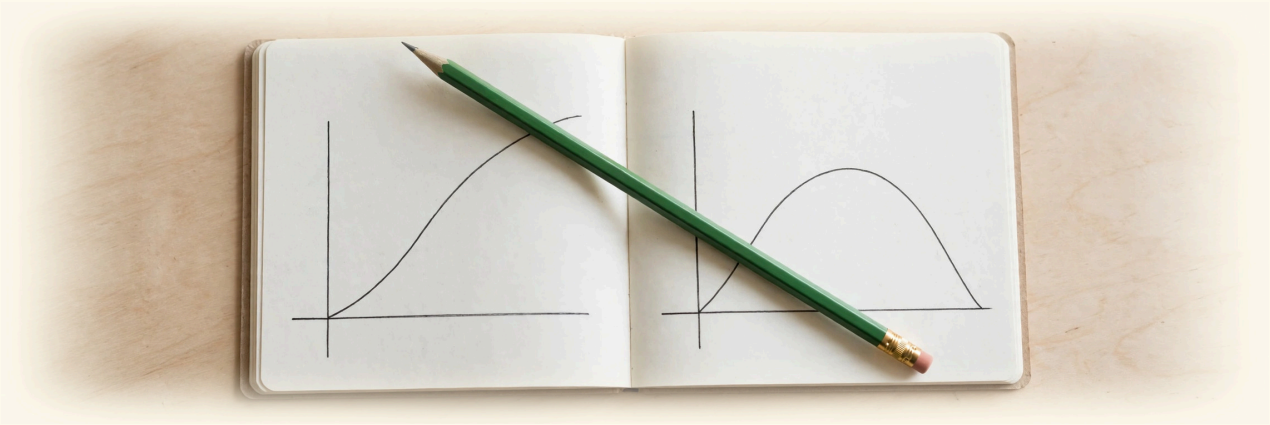
Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you check with one quick picture whether a graph is a function, like checking that each input in a price list gives exactly one output, by seeing if any vertical line hits the graph more than once. A function gives one output for each input, so a vertical line should meet the graph at most once. If it meets it twice, one input has two outputs, and the graph is not a function. That one picture settles the question, without having to test every input by hand.



Rule

Vertical line test: a graph is a function if every vertical line meets it at most once.

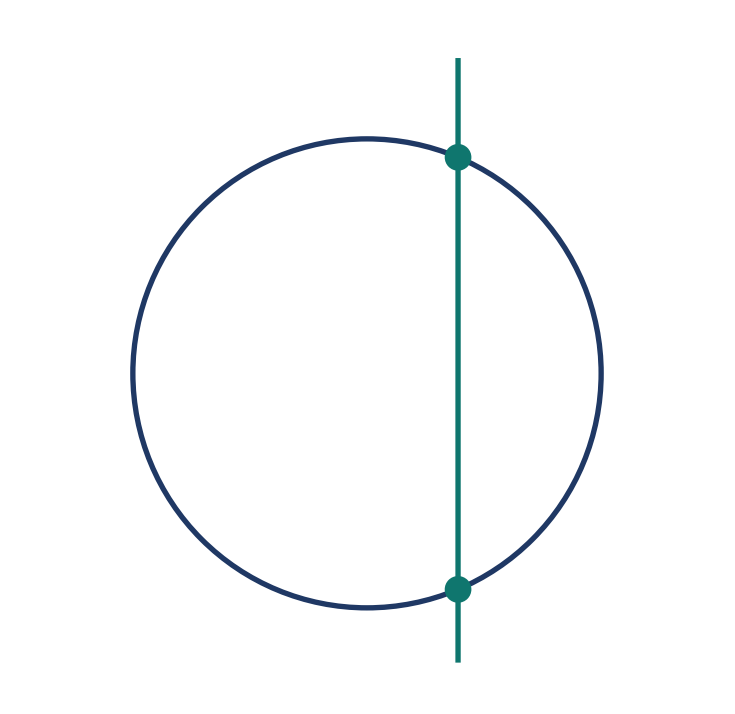
If any vertical line meets the graph twice, one input has two outputs, so it is not a function.

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Worked examples

EXAMPLE 1

Q Use the vertical line test on a circle.



SOLUTION

Imagine a vertical line at an x-value inside the circle.

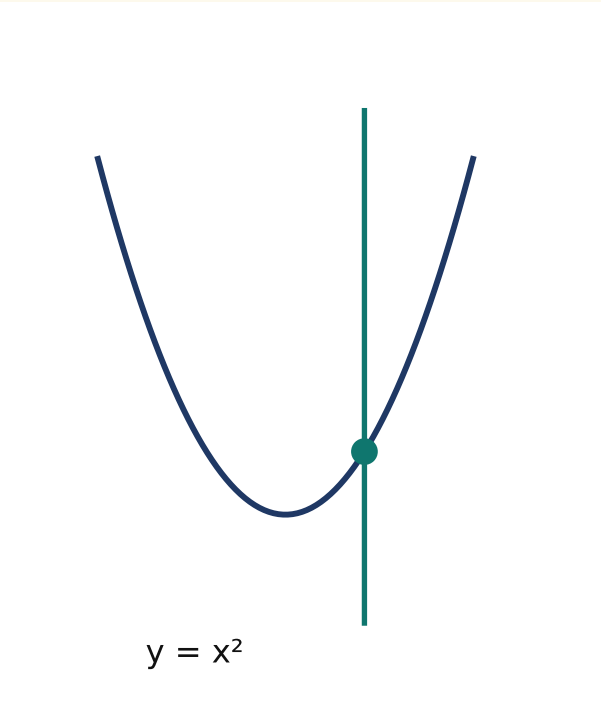
It crosses the circle at two points, top and bottom.

Since one line hits twice, the circle fails the test and is not a function.

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EXAMPLE 2

Q Use the vertical line test on $y = x^2$.



SOLUTION

Imagine a vertical line at any x-value.

It crosses the parabola exactly once.

Since no line hits more than once, it passes the test and is a function.

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Practice questions

1 Two lines cross like the letter X. Use the vertical line test. Is this the graph of a function? Answer yes or no.

- **A** Yes
- **B** No

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2 The curve $y = \frac{1}{x}$ is graphed. Use the vertical line test. Is this the graph of a function? Answer yes or no.

- **A** Yes
- **B** No

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3 The curve $x = y^2$ is graphed. Use the vertical line test. Is this the graph of a function? Answer yes or no.

A Yes

B No

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4 The line $y = 2x + 1$ is graphed. Use the vertical line test. Is this the graph of a function? Answer yes or no.

A Yes

B No

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5 The curve $y = \sqrt{x}$ is graphed. Use the vertical line test. Is this the graph of a function? Answer yes or no.

A Yes

B No

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6 An ellipse is graphed. Use the vertical line test. Is this the graph of a function? Answer yes or no.

A Yes

B No

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7 The curve $y = x^3$ is graphed. Use the vertical line test. Is this the graph of a function? Answer yes or no.

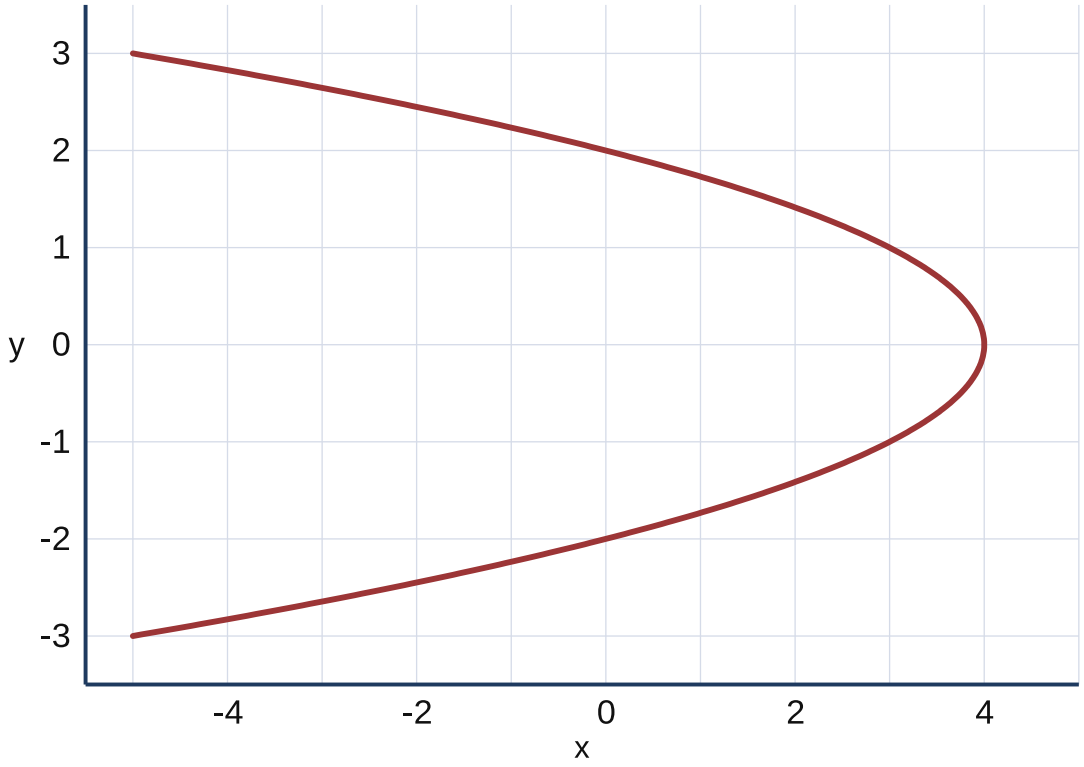
A Yes

B No

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8 The graph below is drawn. Is this the graph of a function? Answer yes or no.



A Yes

B No

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9 A straight line has a hole in it. Does it pass the vertical line test? Answer yes or no.

- A Yes
- B No

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10 The V-shaped graph $y = |x|$ is drawn. Use the vertical line test. Is this the graph of a function? Answer yes or no.

- A Yes
- B No

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ANSWER KEY

1. No

2. Yes

3. No

4. Yes

5. Yes

6. No

7. Yes

8. No

9. Yes

10. Yes

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