MATHEMATICS · GRADES 10-12

Piecewise functions

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you work out a bill that charges one rate up to a limit and a different rate after it, like a phone plan or a taxi fare with a first kilometre price. A taxi charges one price for the first kilometre and a lower rate after that, and a phone plan charges one rate up to a data cap and more after it. Tax brackets work the same way, with each slice of income taxed at its own rate. Whenever the rule changes at a boundary, you work out each piece separately and put the pieces together.



Rule

For a piecewise function, check which rule applies to the x value, then use only that rule.

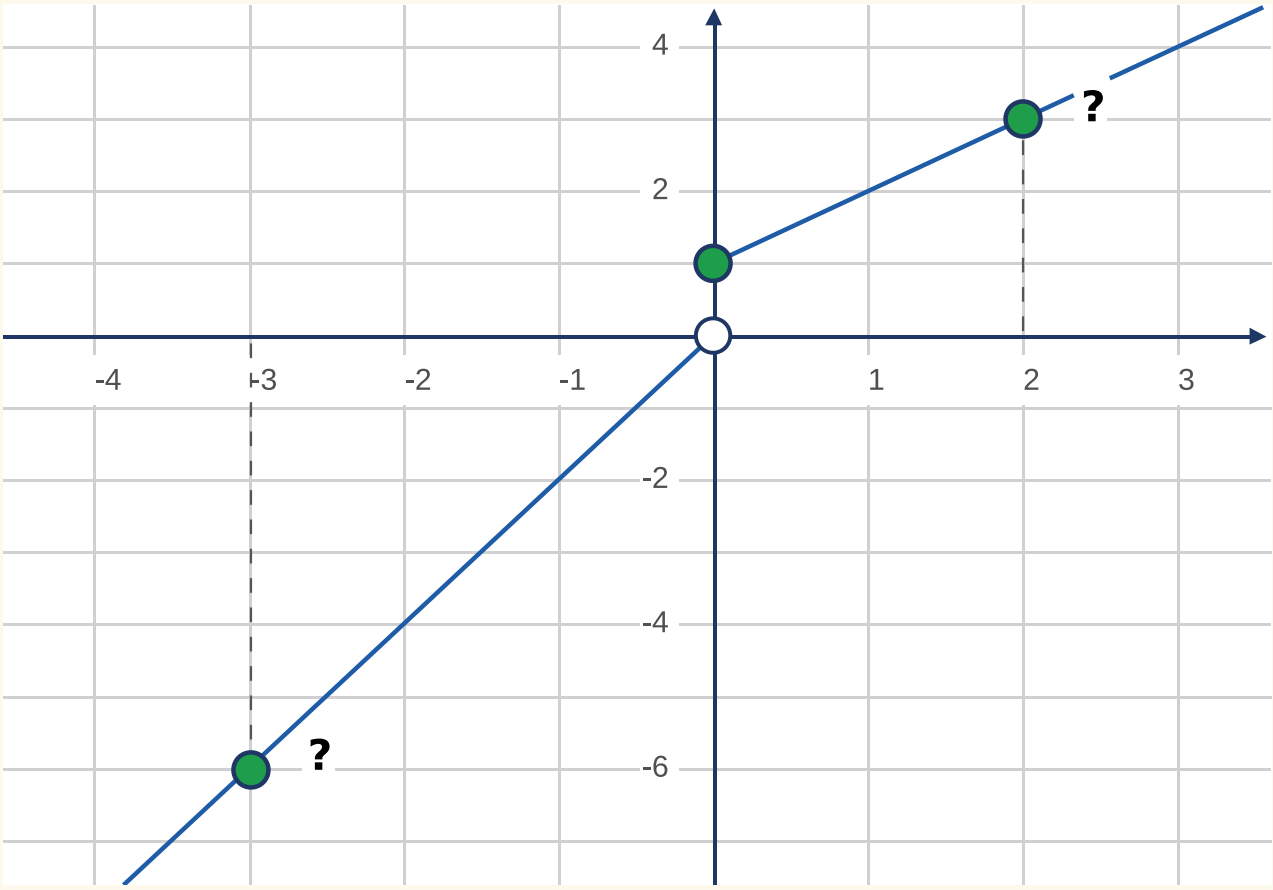
A value belongs to exactly one piece, so only one rule ever applies to it.

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Worked examples

EXAMPLE 1

Q For f(x) = 2x when x is less than 0, and f(x) = x + 1 when x is 0 or greater, find f(-3) and f(2)



SOLUTION

For x = -3, use the first rule, since -3 is less than 0: f(-3) = 2 × -3 = -6.

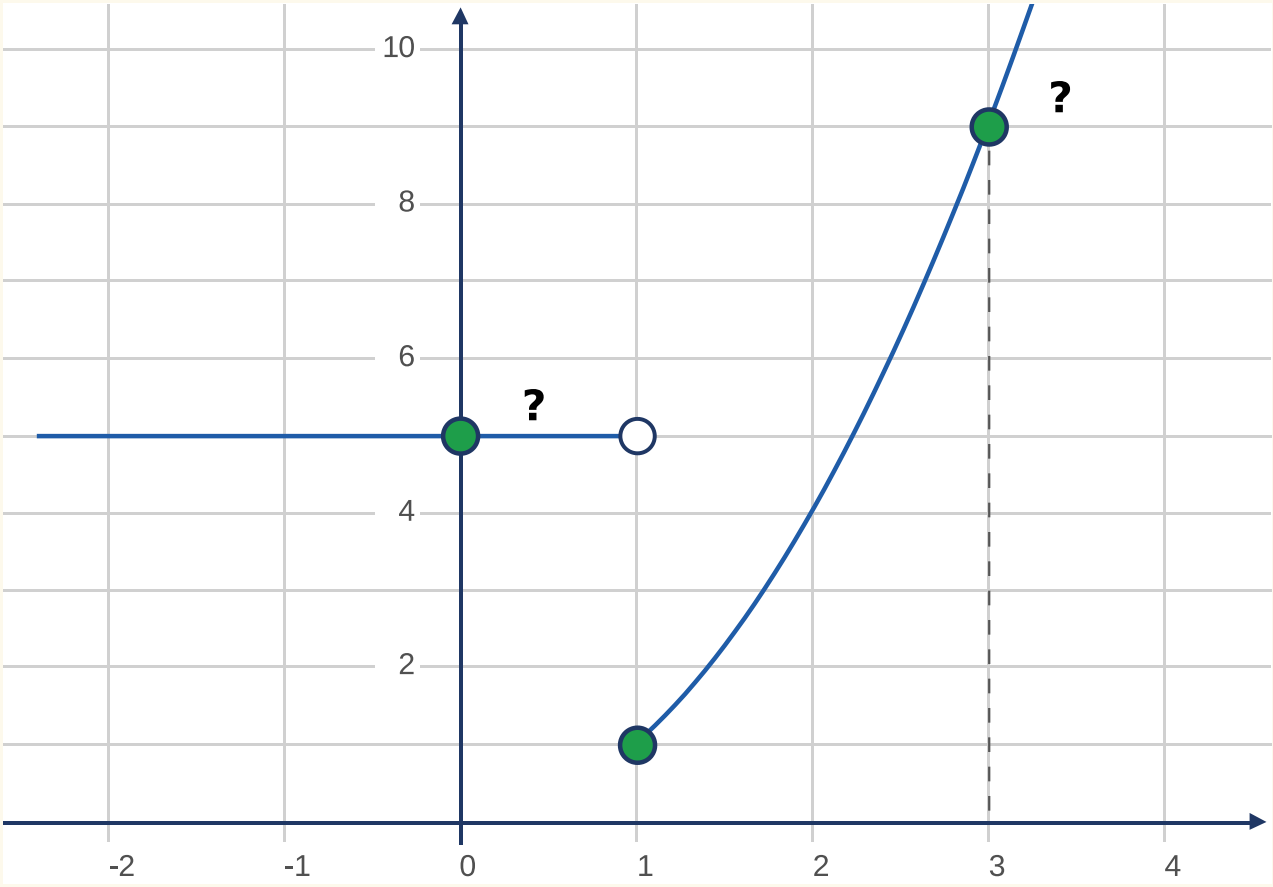
For x = 2, use the second rule, since 2 is 0 or greater: f(2) = 2 + 1 = 3.

So f(-3) = -6 and f(2) = 3

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EXAMPLE 2

Q For $f(x) = 5$ when x is less than 1, and $f(x) = x^2$ when x is 1 or greater, find $f(0)$ and $f(3)$



SOLUTION

For $x = 0$, use the first rule: $f(0) = 5$.

For $x = 3$, use the second rule: $f(3) = 3^2 = 9$.

So $f(0) = 5$ and $f(3) = 9$

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Practice questions

1 For the function
$f(x) = 2x$ when x is less than 0,
and $f(x) = x + 1$ when x is 0 or greater,
find $f(-2)$.

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2 For the function
$f(x) = 2x$ when x is less than 0,
and $f(x) = x + 1$ when x is 0 or greater,
find $f(0)$.

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3 For the function
$f(x) = 2x$ when x is less than 0,
and $f(x) = x + 1$ when x is 0 or greater,
find $f(4)$.

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4 A car park charges $4 per hour for the first 3 hours, then a flat $12 for any longer stay. How much does a 2-hour stay cost?

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5 A bike hire charges $5 per hour for the first 2 hours, then a flat $10 for any longer hire. How much does a 4-hour hire cost?

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6 A taxi charges $3 per kilometre for trips under 5 km, then a flat $15 for trips of 5 km or more. How much is a 3 km trip?

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7 A gym charges a flat $20 a month for up to 4 visits, then $5 per visit for each visit after that. How much does a member pay in a month with 6 visits?

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8 A delivery fee is $8 for orders under $50, and there is no delivery fee for orders of $50 or more. How much is the delivery fee on a $60 order?

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9 A swimming pool charges $6 entry for children aged under 12, and $9 for ages 12 or more. How much is entry for a 10-year-old?

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10 A cinema charges $6 for children aged under 12, and $9 for ages 12 or more. How much is a ticket for a 15-year-old?

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ANSWER KEY

1. -4

2. 1

3. 5

4. $8

5. $10

6. $9

7. $30

8. $0

9. $6

10. $9

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