

Assume we have already proven the product rule, the chain rule and we know the derivative of $p(x) = \frac{1}{x}$.

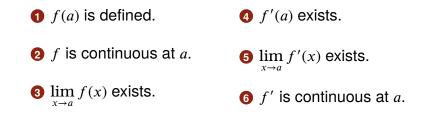
Obtain a formula for the derivative of $h(x) = \frac{f(x)}{g(x)}$.

- **1** Calculate h'(x) for any $x \neq 0$.
- **2** Is h continuous at 0?
- **3** Is *h* differentiable at 0? If so, compute h'(0).
- **4** Is h' continuous at 0?

Let *f* be a function with domain \mathbb{R} and $a \in \mathbb{R}$. Assume that *f* is differentiable everywhere.

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What can we conclude?



Higher order derivatives

Let $g(x) = \frac{1}{x^3}$.

Calculate the first few derivatives.

Make a conjecture for a formula of $g^{(n)}(x)$, the *n*-th derivative. Prove it.

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Computations

Compute the derivative of

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$$f(x) = \sqrt{2x^2 + x + 1}$$

$$f(x) = \sqrt{x + \sqrt{x + \sqrt{x + 1}}}$$

Iterated derivatives of $(f \times g)$

Assume f and g are functions that have all their derivatives.

Find formulas for the following derivatives:

- 1 (fg)'(x)2 (fg)''(x)
- **3** (fg)'''(x)

Do these formulae seem familiar? Make a conjecture for a formula for $(fg)^{(n)}$.

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Rate of change

Let *f* be a continuous function with domain \mathbb{R} .

True or False?

If the average rate of change of f between x = 1 and x = 2 is -3, then f must be decreasing on [1, 2].

True or False?

If, for every $1 \le x_1 < x_2 \le 2$, the average rate of change of *f* between x_1 and x_2 is negative, then *f* must be decreasing on [1,2].

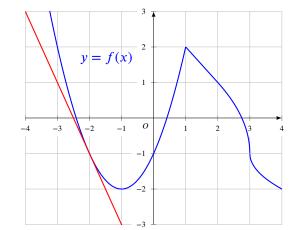
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Tangent line from a graph

Below is the graph of a function f.

Write the equation of the line tangent to it at the point with x-coordinate -2.



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