

Exercise walk-through

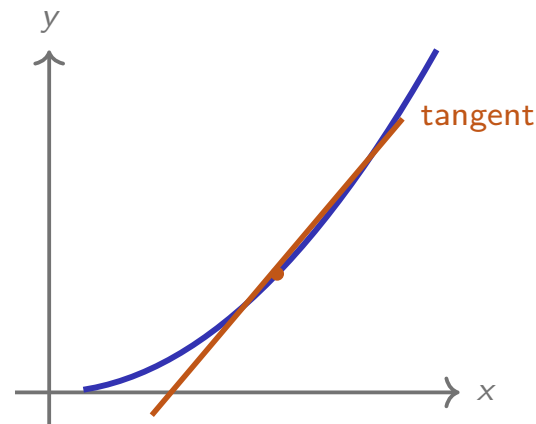
2.9

The Quotient Rule

AP Calculus AB

What we will cover

- 1 Average vs instantaneous rate
- 2 The derivative as a limit
- 3 When a derivative exists
- 4 Basic derivative rules
- 5 Product & quotient rules
- 6 Trig, exp & log derivatives



The quotient rule

Quotient rule :

$$\left(\frac{u}{v}\right)' = \frac{u'v - uv'}{v^2}.$$

The **order matters** – there is a minus sign. Write the numerator carefully.

Differentiate $\frac{x}{\cos x}$

$$\begin{aligned} & \frac{1 \cdot \cos x - x \cdot (-\sin x)}{\cos^2 x} \\ &= \frac{\cos x + x \sin x}{\cos^2 x}. \end{aligned}$$

Unit 2 – key takeaways

1

The derivative

the limit of the secant slope – the tangent's gradient

2

Existence

differentiable $\Rightarrow$ continuous;
corners and vertical tangents fail

3

The rules

power, constant multiple, sum;
product and quotient

4

Building blocks

$\sin$, $\cos$, e^x , $\ln x$ – know them by heart

Exercises 2.1·2.3

2.1 State the quotient rule.

[1]

2.2 Differentiate $\frac{1}{x}$ using the quotient rule.

[2]

2.3 State the denominator of the quotient-rule result.

[1]

Exercises 2.1·2.3

2.1 State the quotient rule.

[1]

2.1

- $\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$

2.2 Differentiate $\frac{1}{x}$ using the quotient rule.

[2]

2.2

- with $f = 1$, $g = x$: $\frac{(0)(x) - (1)(1)}{x^2} = -\frac{1}{x^2}$

2.3 State the denominator of the quotient-rule result.

[1]

2.3

- g^2 (the square of the denominator)

Exercise 3.1

3.1 $\left(\frac{f}{g}\right)$ equals

[1]

☐

A $\frac{f'g - fg'}{g^2}$

B $\frac{f'g + fg'}{g^2}$

C $\frac{f'}{g'}$

D $\frac{fg' - f'g}{g^2}$

Exercise 3.1

3.1 $\left(\frac{f}{g}\right)$ equals

[1]

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A $\frac{f'g - fg'}{g^2}$

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C $\frac{f'}{g'}$

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3.1 A

• $\frac{f'g - fg'}{g^2}.$

Exercise 3.2

3.2 In the quotient rule, the denominator is

[1]

☐

A g

B g^2

C f^2

D fg

Exercise 3.2

3.2 In the quotient rule, the denominator is

[1]

☐

A g

B g^2

C f^2

D fg

3.2 B

- g^2 .

Exercise 3.3 (a)

3.3 $y = \frac{x}{x+2}.$

(a) Identify f and g .

[1]

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(a) Identify f and g .

[1]

(a)

- $f = x, g = x + 2$

Exercise 3.3 (b)

3.3 $y = \frac{x}{x+2}.$

(b) Apply the rule.

[1]

Exercise 3.3 (b)

3.3 $y = \frac{x}{x+2}.$

(b) Apply the rule.

[1]

(b)

•
$$\frac{(1)(x+2) - x(1)}{(x+2)^2}$$

Exercise 3.3 (c)

3.3 $y = \frac{x}{x+2}.$

(c) Simplify.

[1]

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3.3 $y = \frac{x}{x+2}.$

(c) Simplify.

[1]

(c)

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