

Exercise walk-through

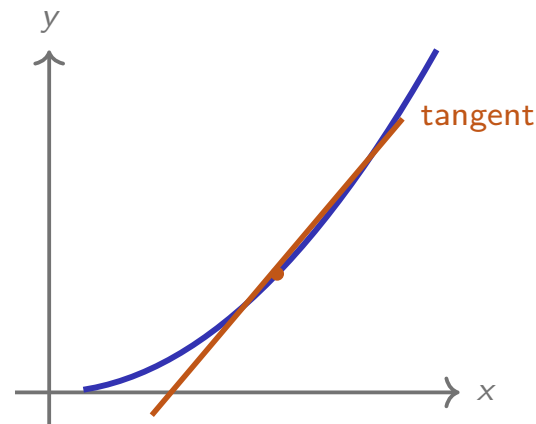
2.8

The Product Rule

AP Calculus BC

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 product rule

A product is **not** the product of the derivatives. Use the **product rule** :

$$(uv)' = u'v + uv'.$$

“Derivative of the first times the second, **plus** the first times the derivative of the second.”

Differentiate $f(x) = x^2 \sin x$

$u = x^2$ ($u' = 2x$), $v = \sin x$ ($v' = \cos x$):

$$f'(x) = 2x \sin x + x^2 \cos x.$$

Read the **structure** first – a product needs the product rule.

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 product rule.

[1]

2.2 Differentiate $x e^x$.

[2]

2.3 State when you need the product rule.

[1]

Exercises 2.1·2.3

2.1 State the product rule.

[1]

2.1

- $(fg)' = f'g + fg'$

2.2 Differentiate $x e^x$.

[2]

2.2

- $(1)e^x + x e^x = e^x(1 + x)$

2.3 State when you need the product rule.

[1]

2.3

- when differentiating a product of two functions of x

Exercises 3.1-3.2

3.1 $(fg)'$ equals

[1]

☐

A $f'g'$

B $f'g + fg'$

C $f'g - fg'$

D f'/g'

3.2 $\frac{d}{dx}[x^2 \sin x]$ uses the

[1]

☐

A power rule only

B product rule

C quotient rule

D chain rule only

Exercises 3.1-3.2

3.1 $(fg)'$ equals

[1]

☐

A $f'g'$

B $f'g + fg'$

C $f'g - fg'$

D f'/g'

3.1 B

- $f'g + fg'$.

3.2 $\frac{d}{dx}[x^2 \sin x]$ uses the

[1]

☐

A power rule only

B product rule

C quotient rule

D chain rule only

3.2 B

- product rule.

Exercise 3.3 (a)

3.3 $y = x \cos x$.

(a) Identify f and g .

[1]

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(a) Identify f and g .

[1]

(a)

- $f = x, g = \cos x$

Exercise 3.3 (b)

3.3 $y = x \cos x$.

(b) Apply the product rule.

[1]

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3.3 $y = x \cos x$.

(b) Apply the product rule.

[1]

(b)

- $(1) \cos x + x(-\sin x)$

Exercise 3.3 (c)

3.3 $y = x \cos x$.

(c) State y' .

[1]

Exercise 3.3 (c)

3.3 $y = x \cos x$.

(c) State y' .

[1]

(c)

- $y' = \cos x - x \sin x$