

## 2.10 Derivatives of Tangent, Cotangent, Secant, and Cosecant

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Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 9 marks

**KEY WORDS** trigonometric functions 三角函数 • derivative 导数

### Objective

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Build the skills to answer exam questions on **the derivatives of tangent, cotangent, secant, and cosecant**.

**You must be able to:**

- state and use the derivatives of the four remaining **trigonometric functions** 三角函数

### 1 Worked examples

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Study these first. Each one shows the method for a question type used later.

#### ■ More trig derivatives

$$\frac{d}{dx}[\tan x] = \sec^2 x, \quad \frac{d}{dx}[\cot x] = -\csc^2 x,$$

$$\frac{d}{dx}[\sec x] = \sec x \tan x, \quad \frac{d}{dx}[\csc x] = -\csc x \cot x.$$

## 2 Practice

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**2.1** State  $\frac{d}{dx}[\tan x]$ . [1]

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**2.2** State  $\frac{d}{dx}[\sec x]$ . [1]

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**2.3** State  $\frac{d}{dx}[\cot x]$  and  $\frac{d}{dx}[\csc x]$ . [2]

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## 3 Exam-style questions

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**3.1**  $\frac{d}{dx}[\tan x]$  equals [1]

- **A**  $\sec^2 x$
  - **B**  $-\csc^2 x$
  - **C**  $\sec x \tan x$
  - **D**  $-\sin x$
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**3.2**  $\frac{d}{dx}[\sec x]$  equals [1]

- **A**  $\sec^2 x$
  - **B**  $\sec x \tan x$
  - **C**  $-\csc x \cot x$
  - **D**  $\tan x$
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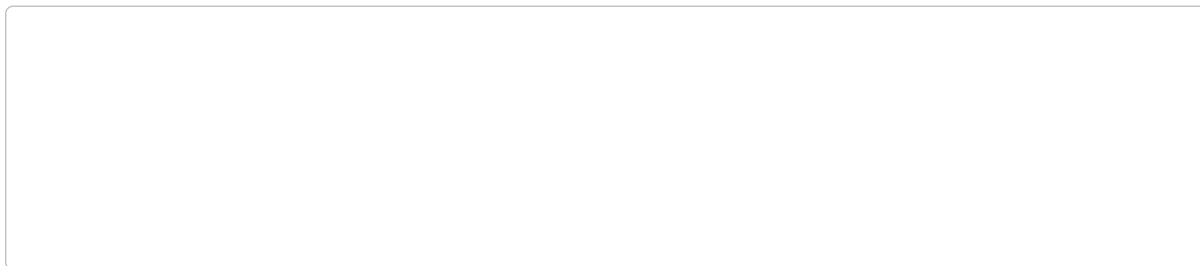
**3.3** Differentiate each.

(a)  $\tan x$ . [1]

(b)  $\cot x$ . [1]

(c)  $\csc x$ .

[1]



## Solutions

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**2.1**  $\sec^2 x$ .

**2.2**  $\sec x \tan x$ .

**2.3**  $\frac{d}{dx}[\cot x] = -\csc^2 x$ ;  $\frac{d}{dx}[\csc x] = -\csc x \cot x$ .

**3.1** A.

**3.2** B.

**3.3** (a)  $\sec^2 x$ . (b)  $-\csc^2 x$ . (c)  $-\csc x \cot x$ .