



VIDEO PLAYLIST: [parkermaths.com/y2diff](https://parkermaths.com/y2diff)



DIFFERENTIATION ▶ STANDARD RESULTS ▶ KEY FACTS

$$\frac{d}{dx} \sin x = \cos x$$

$$\frac{d}{dx} \cos x = -\sin x$$

$$\frac{d}{dx} \tan x = \sec^2 x$$

$$\frac{d}{dx} \ln x = \frac{1}{x}$$



DIFFERENTIATION ▶ STANDARD RESULTS ▶ PRACTICE PROBLEMS

Q1  $f(x) = 3\sin x + \frac{1}{2}\cos x - 5\tan x$ . Find  $f'(x)$ .

Q2  $y = 2e^x - 4\ln x + \frac{2}{3}\cos x + 6x^{\frac{5}{3}}$ . Find  $\frac{dy}{dx}$ .

Q3  $\frac{d}{dx} \left( \frac{\tan x}{3} + 4e^{2x} - 3x^{-\frac{1}{2}} + \frac{1}{2}\ln x \right)$

Q4  $y = 2\ln x - 5\cos x + 3\sin x - x^4$ . Find  $\frac{d^2y}{dx^2}$ .



THE CHAIN RULE | KEY FACTS

- The chain rule is used to differentiate composite functions.
  - i.e. functions within functions
- We need to know how to differentiate both the inner and outer function separately.
- For simple cases, you should aim to be able to do the chain rule in your head.

THE CHAIN RULE

If  $y = f(u)$ , where  $u = g(x)$ , then

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$


THE CHAIN RULE | EXAMPLE PROBLEM PAIRS

1E.  $y = (2x - 5)^6$ . Find  $\frac{dy}{dx}$ .

1P(a).  $y = (3x + 1)^5$ . Find  $\frac{dy}{dx}$ .

1P(b).  $y = \left(\frac{1}{3}x + 1\right)^4$ . Find  $\frac{dy}{dx}$ .

2E.  $y = 4(2x^2 - 3x + 7)^3$ . Find  $\frac{dy}{dx}$ .

2P(a).  $y = 3(5x^2 + 2x + 3)^5$ . Find  $\frac{dy}{dx}$ .

2P(b).  $y = \frac{2}{7} \left(x^4 + \frac{1}{3}x^2\right)^4$ . Find  $\frac{dy}{dx}$ .

3E.  $y = \sqrt{3x+1}$ . Find  $\frac{dy}{dx}$ .

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4E.  $y = 3e^{5x} + 7$ . Find  $\frac{dy}{dx}$ .

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5E.  $y = 6\cos 5x$ . Find  $\frac{dy}{dx}$ .

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6E.  $y = \ln(3x+5)$ . Find  $\frac{dy}{dx}$ .

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3P (a).  $y = \sqrt[3]{5x-6}$ . Find  $\frac{dy}{dx}$ .

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4P (a).  $y = 2e^{3x-2}$ . Find  $\frac{dy}{dx}$ .

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5P (a).  $y = 2\sin 6x$ . Find  $\frac{dy}{dx}$ .

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6P (a).  $y = \ln(2x-7)$ . Find  $\frac{dy}{dx}$ .

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3P (b).  $\frac{d}{dx} \frac{3}{\sqrt{4x+9}}$ . Find  $\frac{dy}{dx}$ .

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4P (b).  $y = 2e^{8-3x^2}$ . Find  $\frac{dy}{dx}$ .

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5P (b).  $y = \frac{2}{3} \tan\left(\frac{1}{4}x\right)$ . Find  $\frac{dy}{dx}$ .

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6P (b).  $y = 2\ln(3x^2 + 8x)$ . Find  $\frac{dy}{dx}$ .

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