



Differentiation Collated Past Questions – Differentiation

2023 Question 1a.

(a) Differentiate $y = \sqrt{3x - 2}$.

You do not need to simplify your answer.

2023 Question 2a.

(a) Differentiate $f(x) = \frac{x^2}{\cos x}$.

You do not need to simplify your answer.

2023 Question 2b.

(b) Find the gradient of the tangent to the curve $y = \cot(2x)$ at the point where $x = \frac{\pi}{12}$.

You must use calculus and show any derivatives that you need to find when solving this problem.

2023 Question 3a.

(a) Differentiate $y = \ln(x^2 - x^4 + 1)$.

You do not need to simplify your answer.

2022 Question 1a.

(a) Differentiate $y = (\ln x)^2$.

You do not need to simplify your answer.

2022 Question 2a.

(a) Differentiate $f(x) = (5x - 3)\sin(4x)$.

You do not need to simplify your answer.

2022 Question 3a.

(a) Differentiate $y = e^{4\sqrt{x}}$.

You do not need to simplify your answer.

2021 Question 1a.

(a) Differentiate $y = e^{3x}\sin 2x$.

You do not need to simplify your answer.



2021 Question 2a.

(a) Differentiate $f(x) = (1 - x^2)^5$.

You do not need to simplify your answer.

2021 Question 3a.

(a) Differentiate $y = \frac{\cot x}{x^2 + 1}$.

You do not need to simplify your answer.

2020 Question 1a.

(a) Differentiate $y = (3x - x^2)^5$.

You do not need to simplify your answer.

2020 Question 2a.

(a) Differentiate $y = \frac{\tan x}{x^3}$.

You do not need to simplify your answer.

2020 Question 3a.

(a) Differentiate $y = 3 \ln(x^2 - 1)$.

You do not need to simplify your answer.

2020 Question 3e.

(e) A curve has the equation $y = (3x + 2)e^{-2x}$.

Prove that $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 0$.

You must use calculus and show any derivatives that you need to find when solving this problem.

2019 Question 1a.

(a) Differentiate $y = \sqrt{3x^2 - 1}$.

You do not need to simplify your answer.

2019 Question 1b.

(b) Find the rate of change of the function $f(t) = 5 \ln(3t - 1)$ when $t = 4$.

You must use calculus and show any derivatives that you need to find when solving this problem.

2019 Question 2a.

(a) Differentiate $y = (2x - 5)^4$.

You do not need to simplify your answer.



2019 Question 2b.

- (b) Find the gradient of the tangent to the curve $y = \tan 2x$ at the point on the curve where $x = \frac{\pi}{6}$.

You must use calculus and show any derivatives that you need to find when solving this problem.

2019 Question 3a.

- (a) Differentiate $y = \frac{4}{\sin x}$.

You do not need to simplify your answer.

2018 Question 1a.

- (a) Differentiate $y = 2x^3 + \frac{5}{(x^3 + 2)^3}$

You do not need to simplify your answer.

2018 Question 1b.

- (b) If $f(x) = 3 \cos 3x$, show that $9f(x) + f'''(x) = 0$.

2018 Question 1c.

- (c) Find the gradient of the curve $y = \ln|\sin^2 x|$ at the point where $x = \frac{\pi}{6}$

You must use calculus and show any derivatives that you need to find when solving this problem.

2018 Question 2a.

- (a) Differentiate $y = 3\sqrt{x} + \operatorname{cosec} 5x$.

2018 Question 2b.

- (b) A particle is travelling in a straight line. The distance, in metres, travelled by the particle may be modelled by the function

$$s(t) = \ln(3t^2 + 3t + 1) \quad t \geq 0$$

where t is time measured in seconds.

Find the velocity of this particle after 2 seconds.

You must use calculus and show any derivatives that you need to find when solving this problem.

2018 Question 3a.

- (a) Differentiate $y = \frac{e^{2x}}{x^2 + 1}$.

You do not need to simplify your answer.



2017 Question 1a.

(a) Differentiate $y = \sqrt{x} + \tan(2x)$.

2017 Question 2a.

(a) Differentiate $y = 2(x^2 - 4x)^5$.

You do not need to simplify your answer.

2017 Question 3a.

(a) Differentiate $y = x \ln(3x - 1)$.

You do not need to simplify your answer.

2017 Question 3b.

b) Find the gradient of the curve $y = \frac{1}{x} - \frac{1}{x^2}$ at the point $\left(2, \frac{1}{4}\right)$.

You must use calculus and show any derivatives that you need to find when solving this problem.

2017 Question 3e.

(e) For the function $y = e^x \cos kx$:

(i) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

ii) Find all the value(s) of k such that the function $y = e^x \cos kx$ satisfies the equation

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0 \text{ for all values of } x.$$

2016 Question 1a.

(a) Differentiate $y = 1 + x - \frac{1}{x} + \frac{1}{x^2}$.

2016 Question 2a.

(a) Differentiate $f(x) = x \ln(3x - 1)$.

2016 Question 3a.

(a) Differentiate $f(x) = \sqrt[4]{3x+2}$.

2016 Question 3d.

(d) If $y = \frac{e^x}{\sin x}$, show that $\frac{dy}{dx} = y(1 - \cot x)$.

2015 Question 1a.

(a) Differentiate $y = 6 \tan(5x)$.



2015 Question 2a.

(a) Differentiate $f(x) = \sqrt[5]{x - 3x^2}$.

2015 Question 3d.

(d) The equation of motion of a particle is given by the differential equation

$$\frac{d^2x}{dt^2} = -k^2x$$

where x is the displacement of the particle from the origin at time t , and k is a positive constant.

- (i) Show that $x = A \cos kt + B \sin kt$, where A and B are constants, is a solution of the equation of motion.
- (ii) The particle was initially at the origin and moving with velocity $2k$.

Find the values of A and B in the solution $x = A \cos kt + B \sin kt$.

2014 Question 1a.

(a) Differentiate $y = 5 \cos(3x)$.

2014 Question 2a.

a) Differentiate $f(x) = \frac{e^{4x}}{2x - 1}$.

You do not need to simplify your answer.

2014 Question 2b.

(b) Find the gradient of the curve defined by $y = 8 \ln(3x - 2)$ at the point where $x = 2$.

Show any derivatives that you need to find when solving this problem.

2014 Question 3a.

(a) Differentiate $y = \left(\sqrt[3]{x^2 + 4x}\right)^2$.

2013 Question 1a.

(a) Differentiate $y = \tan(x^2 + 1)$.

You do not need to simplify your answer.

2013 Question 1b.

(b) Find the gradient of the tangent to the function $f(x) = \ln(3x - e^x)$ at the point where $x = 0$.

2013 Question 2a.

(a) Differentiate $y = \sqrt[3]{\pi - x^2}$.

You do not need to simplify your answer.



2013 Question 3a.

(a) Differentiate $y = \frac{\sin(2x)}{x^2}$.

You do not need to simplify your answer.

