

DIFFERENTIATION (A2)

A2 Unit 3: Pure Mathematics B

WJEC past paper questions: 2010 – 2017

Total marks available 120 (approximately 2 hours 30 minutes)

1. (a) Differentiate **each** of the following with respect to x , simplifying your answer wherever possible.

(i) $(7 + 2x)^{13}$ (ii) $\sin^{-1} 5x$ (iii) $x^3 e^{4x}$ (7)

(b) By first writing $\tan x = \frac{\sin x}{\cos x}$, show that

$$\frac{d}{dx}(\tan x) = \sec^2 x. \tag{3}$$

(Summer 10)

2. (a) Differentiate each of the following with respect to x , simplifying your answer wherever possible.

(i) $\sqrt{2 + 5x^3}$ (ii) $x^2 \sin 3x$ (iii) $\frac{e^{2x}}{x^4}$ (8)

(b) By first writing $y = \tan^{-1} x$ as $x = \tan y$, find $\frac{dy}{dx}$ in terms of x . (4)

(January 11)

3. Differentiate each of the following with respect to x , simplifying your answer wherever possible.

(a) $(9 - 2x)^{\frac{1}{3}}$ (b) $\ln(\cos x)$ (c) $x^3 \tan 4x$ (d) $\frac{e^{6x}}{(3x+2)^4}$ (2), (3), (3), (3)

(Summer 11)

4. Differentiate each of the following with respect to x , simplifying your answer wherever possible.

(a) $\tan^{-1} 4x$ (b) e^{x^3} (2), (2)

(c) $x^5 \ln x$ (d) $\frac{3-2x^2}{5-4x^2}$ (3), (3)

(January 12)

5. Differentiate each of the following with respect to x .

(a) $\ln(7 + 2x - 3x^2)$ (b) $e^{\tan x}$ (c) $5x^2 \sin^{-1} x$ (2), (2), (3)

(Summer 12)

6. (a) Differentiate each of the following with respect to x .

(i) $\sqrt{5x^2 - 3x}$ (ii) $\sin^{-1} 7x$ (iii) $e^{3x} \ln x$ (7)

(b) By first writing $\cot x = \frac{\cos x}{\sin x}$, show that $\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x$. (3)

(January 13)

7. Differentiate each of the following with respect to x , simplifying your answer wherever possible.

(a) $(7 - 9x^2)^5$ (b) $\tan^{-1} 6x$ (2), (2)

(c) $e^{4x} \tan 2x$ (d) $\frac{3+\sin x}{2+\cos x}$ (3), (3)

(Summer 13)

8. Differentiate each of the following with respect to x , simplifying your answer wherever possible.

(a) $(5x^3 - x)^{10}$ (b) $\sin^{-1}(x^3)$ (2), (2)

(c) $x^4 \ln(2x)$ (d) $\frac{e^{4x}}{(2x+3)^6}$ (3), (4)

(January 14)

9. (a) Differentiate each of the following with respect to x , simplifying your answer wherever possible.

(i) $\frac{1}{\sqrt[4]{9-4x^5}}$ (ii) $\frac{3+2x^3}{7-x^3}$ (5)

(b) (i) Sketch the graph of $y = \sin^{-1} x$ for values of x satisfying $-1 \leq x \leq 1$.

(ii) By first rewriting $y = \sin^{-1} x$ as $x = \sin y$, find an expression for $\frac{dy}{dx}$ in terms of x .

You should justify any choice of sign that you make. (6)

(Summer 14)

10. (a) Differentiate each of the following with respect to x , simplifying your answer wherever possible.

(i) $\ln(4x^2 - 3x - 5)$

(ii) $e^{\sqrt{x}}$

(iii) $\frac{a+b \sin x}{a-b \sin x}$, where a, b are constants. (7)

(b) By first writing $\cot x = (\tan x)^{-1}$ and assuming the derivative of $\tan x$, find an expression for $\frac{d}{dx}(\cot x)$. Simplify your answer. (3)

(Summer 15)

11. Differentiate each of the following with respect to x , simplifying your answer wherever possible.

(a) $\ln(\cos x)$ (3)

(b) $\tan^{-1}\left(\frac{x}{3}\right)$ (3)

(c) $e^{6x}(3x - 2)^4$ (4)

(Summer 16)

12. (a) Differentiate each of the following with respect to x , simplifying your answer wherever possible.

(i) $\sqrt{3x^2 + 5x}$ (ii) $\sin^{-1} 3x$ (4)

(b) By first writing $y = \cot^{-1} x$ as $x = \cot y$, and then assuming the derivative of $\cot y$, find $\frac{dy}{dx}$ in terms of x . (4)

(Summer 17)