

Write your name here	
Surname	Other names
Pearson Edexcel GCE	Centre Number Candidate Number
A level Mathematics Practice Paper Pure Mathematics - Differentiation (part 1)	
You must have: Mathematical Formulae and Statistical Tables (Pink)	Total Marks

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all the questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet ‘Mathematical Formulae and Statistical Tables’ is provided.
- There are 11 questions in this question paper. The total mark for this paper is 100.
- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- Calculators must not be used for questions marked with a * sign.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

1. Differentiate with respect to x , giving your answer in its simplest form,

(a) $x^2 \ln(3x)$, (4)

(b) $\frac{\sin 4x}{x^3}$. (5)

(Total 9 marks)

2. Differentiate with respect to x

(a) $\ln(x^2 + 3x + 5)$, (2)

(b) $\frac{\cos x}{x^2}$. (3)

(Total 5 marks)

3. (a) Express

$$\frac{4x-1}{2(x-1)} - \frac{3}{2(x-1)(2x-1)}$$

as a single fraction in its simplest form.

(4)

Given that

$$f(x) = \frac{4x-1}{2(x-1)} - \frac{3}{2(x-1)(2x-1)} - 2, \quad x > 1,$$

- (b) show that

$$f(x) = \frac{3}{2x-1}.$$

(2)

- (c) Hence differentiate $f(x)$ and find $f'(2)$.

(3)

(Total 9 marks)

4. Given that

$$x = \sec^2 3y, \quad 0 < y < \frac{\pi}{6}$$

- (a) find $\frac{dx}{dy}$ in terms of y .

(2)

- (b) Hence show that

$$\frac{dy}{dx} = \frac{1}{6x(x-1)^{\frac{1}{2}}}$$

(4)

- (c) Find an expression for $\frac{d^2y}{dx^2}$ in terms of x . Give your answer in its simplest form.

(4)

(Total 10 marks)

5.

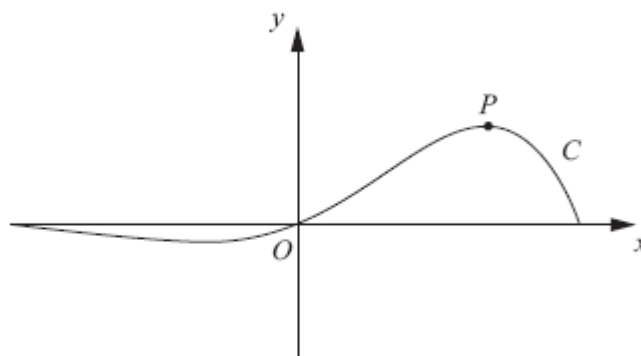


Figure 1

Figure 1 shows a sketch of the curve C which has equation

$$y = e^{x\sqrt{3}} \sin 3x, \quad -\frac{\pi}{3} \leq x \leq \frac{\pi}{3}.$$

- (a) Find the x -coordinate of the turning point P on C , for which $x > 0$.
Give your answer as a multiple of π .

(6)

- (b) Find an equation of the normal to C at the point where $x = 0$.

(3)

(Total 9 marks)

6. Find the gradient of the curve with equation

$$\ln y = 2x \ln x, \quad x > 0, \quad y > 0,$$

at the point on the curve where $x = 2$. Give your answer as an exact value.

(Total 7 marks)

7. (i) Differentiate with respect to x

(a) $y = x^3 \ln 2x$,

(b) $y = (x + \sin 2x)^3$.

(6)

Given that $x = \cot y$,

(ii) show that $\frac{dy}{dx} = \frac{-1}{1+x^2}$.

(5)

(Total 11 marks)

8. (a) Differentiate with respect to x ,

(i) $x^{\frac{1}{2}} \ln(3x)$,

(ii) $\frac{1-10x}{(2x-1)^5}$, giving your answer in its simplest form.

(6)

(b) Given that $x = 3 \tan 2y$ find $\frac{dy}{dx}$ in terms of x .

(5)

(Total 11 marks)

9. $h(x) = \frac{2}{x+2} + \frac{4}{x^2+5} - \frac{18}{(x^2+5)(x+2)}, \quad x \geq 0.$

(a) Show that $h(x) = \frac{2x}{x^2+5}.$

(4)

(b) Hence, or otherwise, find $h'(x)$ in its simplest form.

(3)

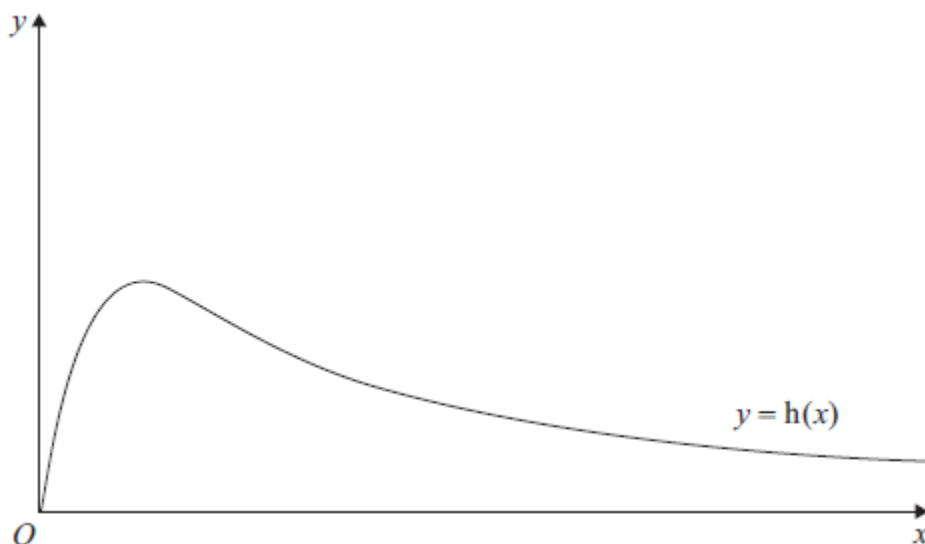


Figure 2

Figure 2 shows a graph of the curve with equation $y = h(x)$.

(c) Calculate the range of $h(x)$.

(5)

(Total 12 marks)

10. The curve C has equation

$$y = \frac{3 + \sin 2x}{2 + \cos 2x}.$$

- (a) Show that

$$\frac{dy}{dx} = \frac{6 \sin 2x + 4 \cos 2x + 2}{(2 + \cos 2x)^2} \quad (4)$$

- (b) Find an equation of the tangent to C at the point on C where $x = \frac{\pi}{2}$.

Write your answer in the form $y = ax + b$, where a and b are exact constants. (4)

(Total 8 marks)

11. Given that

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

- (a) show that $\frac{d}{dx}(\sec x) = \sec x \tan x$. (3)

Given that

$$x = \sec 2y,$$

- (b) find $\frac{dx}{dy}$ in terms of y . (2)

- (c) Hence find $\frac{dy}{dx}$ in terms of x . (4)

(Total 9 marks)

TOTAL FOR PAPER: 100 MARKS