Differentiation - Composite Functions using the Chain Rule

Question Paper 1

Level	A Level
Subject	Maths
Exam Board	OCR
Module	Core 3
Topic	Differentiation
Sub Topic	Composite Functions using the Chain Rule
Booklet	Question Paper - 1

Time Allowed: **61 minutes**

Score: **/52**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

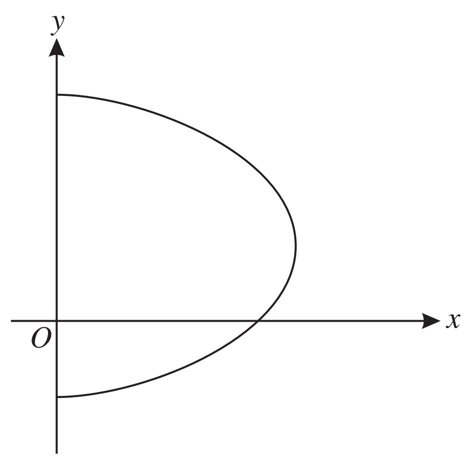
1 Find $\frac{dy}{dx}$ in each of the following cases:

(i) $y = x^3 e^{2x}$, **[2]**

(ii) $y = \ln(3 + 2x^2)$, **[2]**

(iii) $y = \frac{x}{2x + 1}$. **[2]**

2



The diagram shows the curve with equation $x = (37 + 10y - 2y^2)^{\frac{1}{2}}$.

(i) Find an expression for $\frac{dx}{dy}$ in terms of y. **[2]**

(ii) Hence f nd the equation of the tangent to the curve at the point (7, 3), giving your answer in the form $y = mx + c$. **[5]**

3 The gradient of the curve $y = (2x^2 + 9)^{\frac{5}{2}}$ at the point P is 100.

(i) Show that the x-coordinate of P satisfi s the equation $x = 10(2x^2 + 9)^{-\frac{3}{2}}$. [3]

(ii) Show by calculation that the x-coordinate of P lies between 0.3 and 0.4. [3]

(iii) Use an iterative formula, based on the equation in part **(i)**, to f nd the x-coordinate of P correct to 4 decimal places. You should show the result of each iteration. [3]

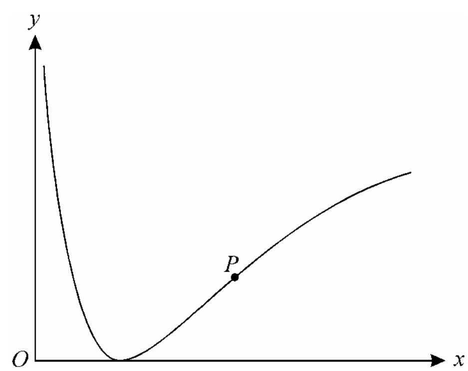
4 Differentiate each of the following with respect to x.

(i) $x^3(x+1)^5$ [2]

(ii) $\sqrt{3x^4+1}$ [3]

5 Find the equation of the tangent to the curve $y = \sqrt{4x+1}$ at the point $(2, 3)$. [5]

6



The diagram shows the curve $y = (\ln x)^2$.

(i) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$. [4

(ii) The point P on the curve is the point at which the gradient takes its maximum value. Show that the tangent at P passes through the point $(0, -1)$. [6]

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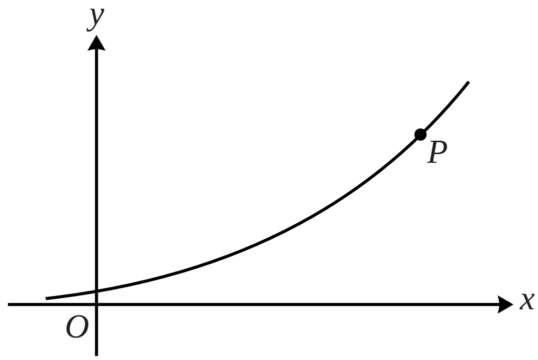

The diagram shows the curve with equation $x = \ln(y^3 + 2y)$. At the point P on the curve, the gradient is 4 and it is given that P is close to the point with coordinates (7.5, 12).

(i) Find $\frac{\mathrm{d}x}{\mathrm{d}y}$ in terms of y. **[2]**

(ii) Show that the y-coordinate of P satisfies the equation

$$y = \frac{12y^2 + 8}{y^2 + 2}.$$ **[3]**

(iii) By first using an iterative process based on the equation in part **(ii)**, find the coordinates of P, giving each coordinate correct to 3 decimal places. **[5]**