

Lesson 14

A-Level Pure Mathematics : Year 2 Differentiation III

14.1 Extension Material

Marks Available : 40

Question 1

Differentiate each of the following with respect to x ,

(i) $y = e^x$ (ii) $y = x^e$ (iii) $y = e^e$

[6 marks]

Question 2

Write down the derivative of each of the following with respect to x ,

(i) $y = \ln x$ (ii) $y = \ln x^2$ (iii) $y = \ln\left(\frac{1}{x}\right)$

[6 marks]

Question 3

Find the equation of the tangent to the curve

$$y = e^{\frac{1}{2}x}$$

at the point where it intercepts the y -axis.

Write your answer in the form $ay + bx + c = 0$, where $a, b, c \in \mathbb{Z}$

[6 marks]

Question 4

Find the points on the following curve where the gradient is 3

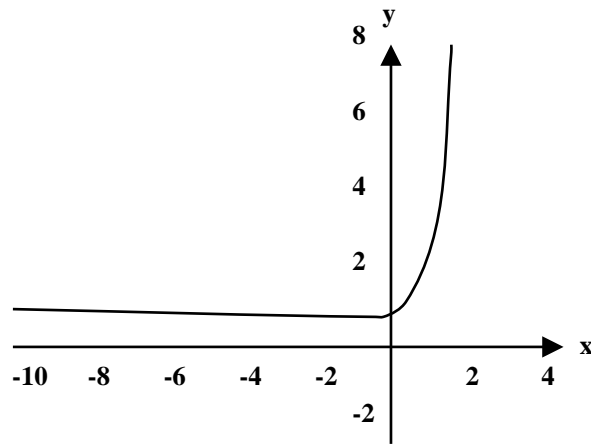
$$y = 5\sqrt{x} - \frac{1}{2} \ln x \quad x \in \mathbb{R}, x > 0$$

Give your answers correct to three significant figures.

[10 marks]

Question 5

A sketch graph of the function, $f(x) = e^{2x} - e^x + 1$ is given below,



- (i) Find $f'(x)$
- (ii) Explain, briefly, why the equation $e^x = 0$ has no solution for $x \in \mathbb{R}$
- (iii) Find the value of x such that $f'(x) = 0$
- (iv) The graph of the $f(x)$ has a turning point of the form $(\ln a, b)$
Determine the value of a and the value of b
- (v) Find $f''(x)$ at the turning point
- (vi) Explain what your part (v) answer tells you about the turning point

[12 marks]