

Sec 4 Differentiation Revision II

1) If $y = (1 + x)e^{3x}$, find the value of the constant k for which

[6]

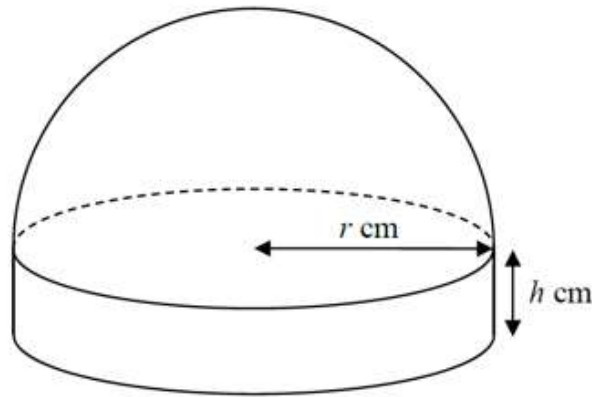
$$\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + ky = 0$$

Sec 4 Differentiation Revision II

2) Liquid is poured into a container at a rate of $k \text{ m}^3/\text{s}$. The volume of liquid in the container is $V \text{ m}^3$ where $V = \frac{1}{3}\pi h^2(3k - h)$ and $h \text{ m}$ is the depth of the liquid in the container. Find, in terms of k , the rate of increase of depth of the liquid when the depth of the liquid is $\frac{2k}{5} \text{ m}$. [4]

Sec 4 Differentiation Revision II

3) In the diagram, a solid model is made up of a hemisphere of radius r cm and a cylinder. The cylinder has a radius of r cm and a height of h cm.



i) Given that the volume of the model is 650 cm^3 , express h in terms of r . [2]

ii) Given that the total surface area of the model is $A \text{ cm}^2$, show that [2]

$$A = \frac{1300}{r} + \frac{5\pi r^2}{3}$$

iii) Given that r and h can vary, find the value of r for which A has a stationary value and determine whether this value of A is a maximum or a minimum. [5]

Sec 4 Differentiation Revision II

Sec 4 Differentiation Revision II

4) A curve has the equation

$$y = \frac{\sin x}{2 - \cos x}, \quad 0 < x < \pi$$

a) Find an expression for $\frac{dy}{dx}$ in its simplest form. [2]

b) Find the integer value of x such that y is an increasing function. [4]

Sec 4 Differentiation Revision II

5) A curve is such that $\frac{d^2y}{dx^2} = 2(1 - 2x)$. The equation of the normal to the curve at the point $(-1, 7)$ is $9y = x + 64$. Find the equation of the curve. [5]