

1. If  $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \dots + \infty}}}$  prove that  $\frac{dy}{dx} = \frac{\cos x}{2y-1}$  (4)
2. If  $x = a \sin pt, y = b \cos pt$  find the value of  $\frac{d^2y}{dx^2}$  at  $t = 0$  (4)
3. If  $f(x) = \sqrt{\frac{\sec x - 1}{\sec x + 1}}$ , find  $f'(x)$  also find  $f'\left(\frac{\pi}{2}\right)$  (4)
4. If  $y = \sin^{-1}\left(\frac{5x + 12\sqrt{1-x^2}}{13}\right)$  find  $\frac{dy}{dx}$  (4)
5. Differentiate the following w.r.t. to  $x$   $\tan^{-1}\left(\frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}}\right)$  (4)
6. For what value of K is the following function continuous at  $x = 2$ ? (4)  

$$f(x) = \begin{cases} 2x+1 & ; x < 2 \\ K & ; x = 2 \\ 3x-1 & ; x > 2 \end{cases}$$
7. If  $e^{y^y(x+1)} = 1$  show that  $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2$  (4)
8. Find  $\frac{dy}{dx}$  if  $y = \sin^{-1} x + \sin^{-1} \sqrt{1-x^2}$  (4)
9. Find  $\frac{dy}{dx}$  if  $y^x + x^y + x^x = a^3$  (4)
10. Find all points of discontinuity if  $f(x) = \begin{cases} |x|+3, & \text{if } x \leq -3 \\ -2x, & \text{if } -3 < x < 3 \\ 6x+2, & \text{if } x \geq 3 \end{cases}$  (4)