

Sourm Deb / 19/9/18

**Indian Institute of Science Education and Research Kolkata**  
**Department of Physical Sciences**

*PH1101 :: Physics I*  
*Mid-semester Examination (Autumn 2018)*  
*Marks: 20, Duration: 1 hour*

1. Compute following limits: [2+2]

$$(i) \lim_{x \rightarrow 1} \frac{x^2 - 1}{x - 1}, \quad (ii) \lim_{x \rightarrow 0} \frac{\sin x}{x}.$$

2. Using definition compute the derivative of  $\sqrt{x}$  with respect to  $x$ . [3]
3. Sketch the area between two curves  $y_1(x) = \sin 2x$  and  $y_2(x) = \cos 2x$  in the domain  $[0, \frac{1}{4}\pi]$  and then determine the area. [4]
4. Show that the functions  $\sin x$  and  $\sin 3x$  are linearly independent. [3]
5. The orbital eccentricity of Triton, the largest moon of the planet Neptune, is less than  $10^{-4}$  i.e. the orbit is almost circular. At a given time  $t$ , if the position vector of Triton is  $\vec{r}(t)$  and its orbital speed is  $v$  then find its acceleration vector. [6]