

**PHY 303: Classical Electrodynamics**  
**MONSOON SEMESTER 2022**  
**TUTORIAL 01**

1. Use symmetry and superposition-principle related arguments to answer (a)-(c), and solve (d) explicitly:
  - (a) Twelve equal charges,  $q$ , are situated at the corners of a regular 12-sided polygon (for instance, one on each numeral of a clock face). What is the net force on a test charge  $Q$  at the center?
  - (b) Suppose *one* of the 12  $q$ 's is removed (say the one at "6 o'clock"). What is the force on  $Q$ ?
  - (c) Will your answers to the above two change if, say, there were thirteen equal charges at the corners of a regular 13-sided polygon? Provide reasoning to support your answer.
  - (d) Derive the total force on the center charge mathematically for the case of an  $N$ -sided regular polygon to confirm your answers to the above.

2. Evaluate the integral

$$\int_a^b dx f(x) \delta'(x - \gamma),$$

where  $f(x)$  is an analytic function and  $\delta'(x)$  represents the first derivative of Dirac-delta function. It is also given that  $a, b, \gamma$  are real ( $\in \mathbb{R}$ ) and unequal.