Tutorial - 01 (2 Aug 2021)
(Based on Lecture 1)

1. Using index notation write the expression for $\cos\theta$ and $\sin\theta$, where θ is the angle between vectors **a** and **b**.

2. Simplify the following:
   (a) $\delta_{ij}(a_{ij} - a_{ji})$,
   (b) $\delta_{ip}\delta_{jq}a_p b_j c_q$, and
   (c) $(\delta_{ij} + a_{ij})(\delta_{ij} - a_{ij})$.

3. If **n** is a unit vector and **a** is some nonzero vector then show $a_i = a_k n_k n_i - \epsilon_{ijk}\epsilon_{krs}n_j a_r n_s$.

4. Show that
   (a) $\epsilon_{ijk}\epsilon_{jki} = 6$,
   (b) $\epsilon_{ijk}A_j A_k = 0$ for all i
   (c) $\epsilon_{ilm}\epsilon_{jlm} = 2\delta_{ij}$.

5. Write the following set of equations using index notation
   $a_{111} + a_{122} + a_{133} + b_1 = r_1$
   $a_{211} + a_{222} + a_{233} + b_2 = r_2$
   $a_{311} + a_{322} + a_{333} + b_3 = r_3$

6. Prove the $\epsilon - \delta$ identity: $\epsilon_{ijk}\epsilon_{ipq} = \delta_{jp}\delta_{kq} - \delta_{jq}\delta_{kp}$.