

THE LINE OF ACTION OF THE RESULTANT FORCE OF TWO LIKE PARALLEL FORCES SHIFTS BY ONE-FOURTH OF THE DISTANCE BETWEEN THE FORCES WHEN THE FORCES ARE INTERCHANGED. THE RATIO OF THE TWO FORCES IS?

**Solution**

Let P and Q are two like parallel forces. The distance between P and the resultant force is  $\frac{d}{2} + a$ , the distance between Q and the resultant force is  $\frac{d}{2} - a$ , where  $d$  is the distance between Q and P. When the forces are interchanged the resultant force shifts symmetrically to the middle of the distance between Q and P by  $2a = \frac{1}{4}d$ . So  $a = \frac{1}{8}d$ . We have that

$$\frac{P}{\frac{d}{2} + a} = \frac{Q}{\frac{d}{2} - a} \rightarrow \frac{P}{\frac{d}{2} + \frac{1}{8}d} = \frac{Q}{\frac{d}{2} - \frac{1}{8}d} \rightarrow \frac{P}{\frac{5}{8}d} = \frac{Q}{\frac{3}{8}d}$$

The ratio of the forces is

$$\frac{P}{Q} = \frac{\frac{5}{8}d}{\frac{3}{8}d} = \frac{5}{3}$$

**Answer:**  $\frac{5}{3}$ .