

TIME - ONE HOURS.

IInd class TEST

Max mark → 15

Q.1 The resultant of two forces P and Q is R. if Q is double then R is double again. if direction of Q is reversed then R is too again double. prove it that
 $P^2 : Q^2 : R^2 :: 2 : 3 : 2$

Ans. Resultant force of R if the angle between P & Q is α .
 $R^2 = P^2 + Q^2 + 2PQ \cos \alpha$ (i)

if Q is doubled then R is doubled.

$$(2R)^2 = P^2 + (2Q)^2 + 2P \times 2Q \cos \alpha$$

$$4R^2 = P^2 + 4Q^2 + 4PQ \cos \alpha$$
 (ii)

if direction of Q is reversed then R also doubled.

$$(2R)^2 = P^2 + (-Q)^2 + 2P(-Q) \cos \alpha$$

$$4R^2 = P^2 + Q^2 - 2PQ \cos \alpha$$
 (iii)

Adding the equation i & iii $2P^2 + 2Q^2 - 5R^2 = 0$ (iv)

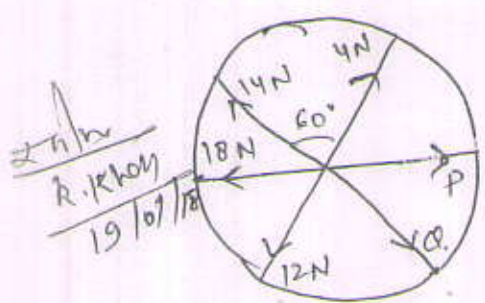
ep. no-3 multiply by 2 & adding eq. no-2
 $P^2 + 2Q^2 - 4R^2 = 0$ (v)

From equation No IV + V

$$\frac{P^2}{-8+10} = \frac{Q^2}{-5+8} = \frac{R^2}{4-2}$$

$P^2 : Q^2 : R^2 = 2 : 3 : 2$
Hence proved.

Q.2 There are six spoke in a wheel if the tension in four wheel consecutive spoke are of magnitude 4, 14, 18 & 12 N respectively then find the tension in remaining two spokes.



Resolving the Horizontal forces.

$$\sum H = 0$$

$$P + 4 \cos 60^\circ + Q \cos 60^\circ - 14 \cos 60^\circ - 18 - 12 \cos 60^\circ = 0$$

$$P + Q + 50Q - 28 - 6 = 0$$

$$P + 50Q = 29 \quad (1)$$

Resolving vertically

$$\Sigma v = 0$$

$$4 \sin 60^\circ + 14 \sin 60^\circ - 12 \sin 60^\circ - \phi \sin 60^\circ = 0$$
$$\sin 60^\circ [4 + 14 - 12 - \phi] = 0$$

$$\boxed{\phi = 6 \text{ N}}$$

put value of ϕ in eqn 0-1

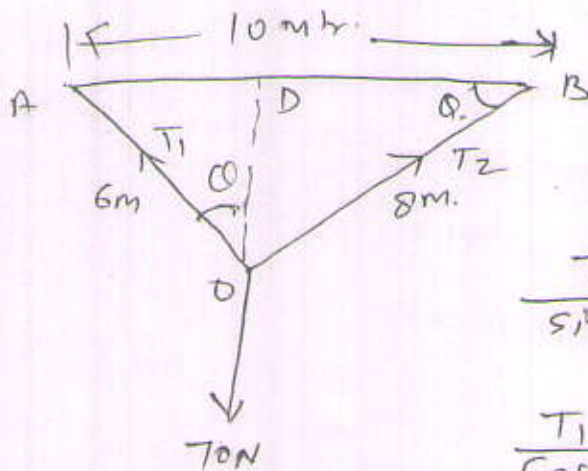
$$P + 50 \times 6 = 29$$

$$\boxed{P = 26 \text{ N}}$$

Q. No-3

A body of weight 70 N is suspended by rope whose length are 6 & 8 mtr. respectively from two points in a horizontal line whose distance apart 10 m. Find the tensions in ropes.

Ans.



using Lami's theorem at point O

$$\frac{T_1}{\sin(90^\circ + \theta)} = \frac{T_2}{\sin(180^\circ - \theta)} = \frac{70}{\sin \theta}$$

$$\frac{T_1}{\cos \theta} = \frac{T_2}{\sin \theta} = \frac{70}{1}$$

$$T_1 = 70 \cos \theta$$

$$T_2 = 70 \sin \theta$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}} = \frac{DB}{AB} = \frac{8}{10}$$

$$\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{OA}{AB} = \frac{6}{10}$$

$$T_1 = 70 \cos \theta = 70 \times \frac{8}{10} = 56 \text{ N}$$

$$T_2 = 70 \sin \theta = 70 \times \frac{6}{10} = 42 \text{ N}$$

~~Ans~~
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19/10/18