

Mathematics Questions by Topic

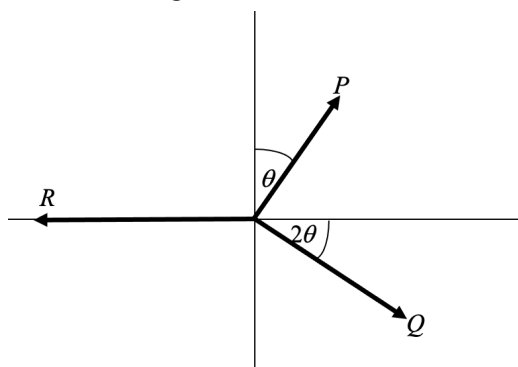
Motion and Force

Answer 20

Source: K14SM2Q20

Question 20

Three coplanar forces of magnitudes P , Q and R newtons act on a particle that is in equilibrium as shown in the diagram below.



Then

- A. $Q = R$ and $P = 2R \sin(\theta)$
- B. $Q = R$ and $P = 2R \cos(\theta)$
- C. $Q = 2P$ and $R = P \sin(\theta)$
- D. $P = Q$ and $R = 2P \sin(\theta)$
- E. $P + Q + R = 0$

ANSWER A

$$\frac{Q}{\sin\left(\frac{\pi}{2} - \theta\right)} = \frac{R}{\sin\left(\frac{\pi}{2} - \theta\right)} = \frac{P}{\sin(2\theta)}$$

$$\frac{Q}{\cos(\theta)} = \frac{R}{\cos(\theta)} = \frac{P}{2\sin(\theta)\cos(\theta)}$$

$$Q = R \text{ and } P = 2R \sin(\theta)$$

Alternatively resolving vertically $P \cos(\theta) - Q \sin(2\theta) = 0$

$$P \cos(\theta) = 2Q \sin(\theta) \cos(\theta) \Rightarrow P = 2Q \sin(\theta) \quad (1)$$

resolving horizontally $P \sin(\theta) + Q \cos(2\theta) - R = 0$

$$P \sin(\theta) + Q(1 - 2\sin^2(\theta)) = R \quad \text{from (1)} \quad P = 2Q \sin(\theta)$$

$$2Q \sin^2(\theta) + Q - 2Q \sin^2(\theta) = R \Rightarrow Q = R \text{ and } P = 2R \sin(\theta)$$

