

dynamics explanation

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1 basketball question

by decomposing the Force F into the x and y directions

$$\sum F_x = F \cos(\theta) = Ma = 40M \quad (1)$$

$$\sum F_y = -Mg - F \sin(\theta) = Ma = -50M \quad (2)$$

Now, there are 2 equations with 3 unknowns $M, F, \text{ and } \theta$. However, using the relations found the equation in the y-direction can be rewritten and solved for the mass

$$-10M - F \sin(\theta) = -50M \quad (3)$$

$$-10 = -40M \quad (4)$$

$M = 0.25 \text{ kg}$ (5) using the equation of the x direction we can find

$$F \cos(\theta) = 40 \times 0.25 = 10 \quad (6)$$

Now by dividing $F \sin(\theta)$ by $F \cos(\theta)$ we get

$$\frac{F \sin(\theta)}{F \cos(\theta)} = \tan(\theta) = -1 \quad (7)$$

$$\theta = -45 \quad (8)$$