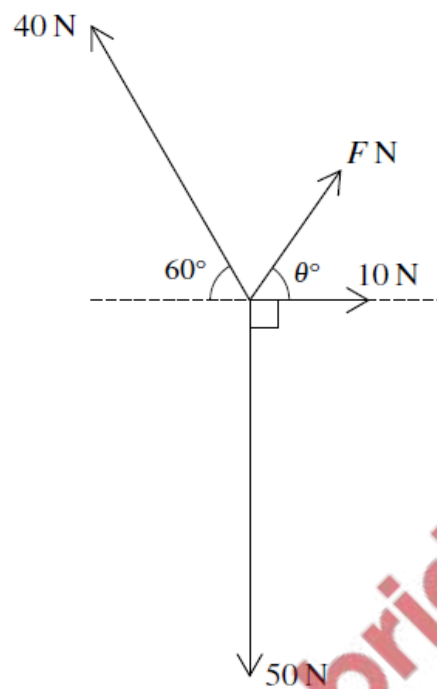1. June/2023/Paper_9709/41/No.5

Four coplanar forces act at a point. The magnitudes of the forces are F N, 10 N, 50 N and 40 N. The directions of the forces are as shown in the diagram.

(a) Given that the forces are in equilibrium, find the value of F and the value of θ. [6]

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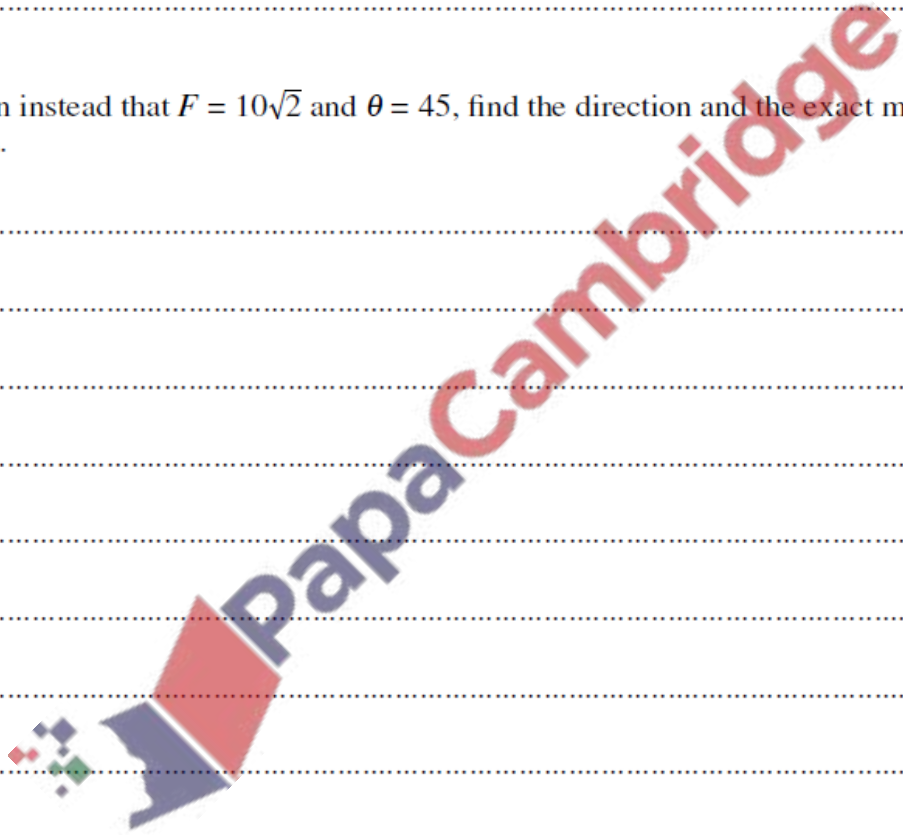
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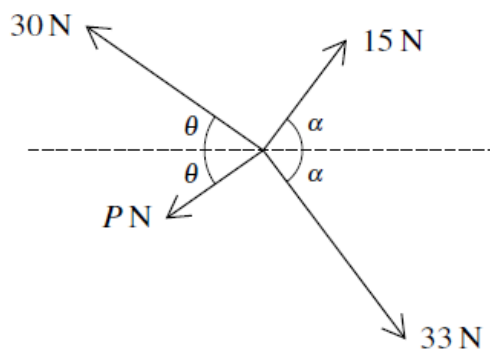..

(b) Given instead that $F = 10\sqrt{2}$ and $\theta = 45$, find the direction and the exact magnitude the resultant force. [3]

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Coplanar forces of magnitudes $30\,\text{N}$, $15\,\text{N}$, $33\,\text{N}$ and $P\,\text{N}$ act at a point in the directions shown in the diagram, where $\tan\alpha = \frac{4}{3}$. The system is in equilibrium.

(a) Show that $\left(\dfrac{14.4}{30-P}\right)^2 + \left(\dfrac{28.8}{P+30}\right)^2 = 1$. [4]

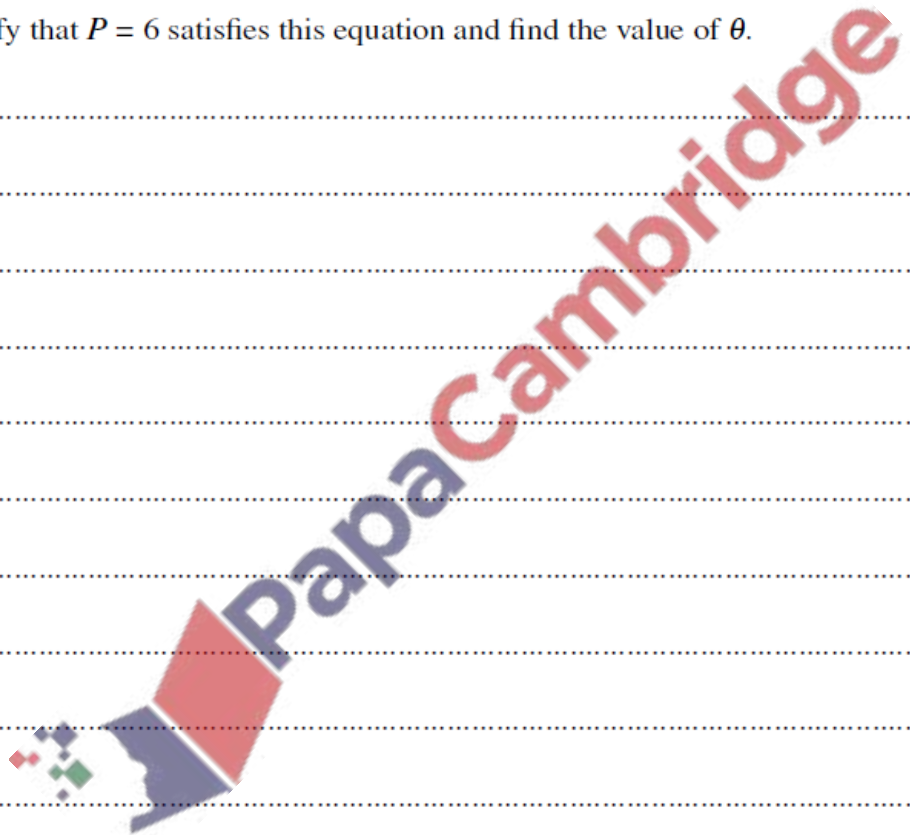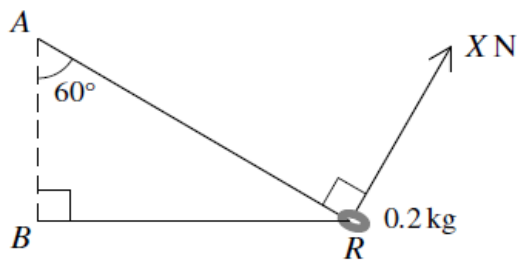...

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(b) Verify that $P = 6$ satisfies this equation and find the value of θ. [2]

A smooth ring R of mass $0.2\,\text{kg}$ is threaded on a light string ARB. The ends of the string are attached to fixed points A and B with A vertically above B. The string is taut and angle $ABR = 90°$. The angle between the part AR of the string and the vertical is $60°$. The ring is held in equilibrium by a force of magnitude $X\,\text{N}$, acting on the ring in a direction perpendicular to AR (see diagram).

Calculate the tension in the string and the value of X. [5]