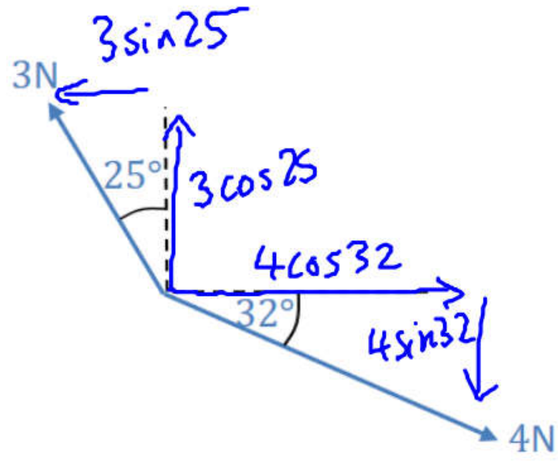
Your Turn

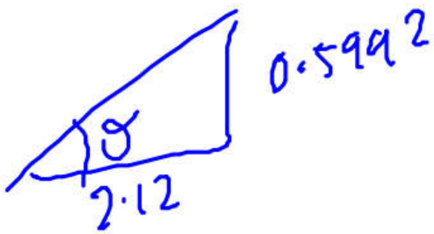
A particle has forces acting on it as indicated in the diagram. Determine the magnitude and direction (anticlockwise from the positive x direction) of the resultant force.



$$\underline{R} = \begin{pmatrix} 4\cos 32 \\ -4\sin 32 \end{pmatrix} + \begin{pmatrix} -3\sin 25 \\ 3\cos 25 \end{pmatrix}$$

$$\underline{R} = \begin{pmatrix} 2.12 \\ 0.5992 \end{pmatrix}$$

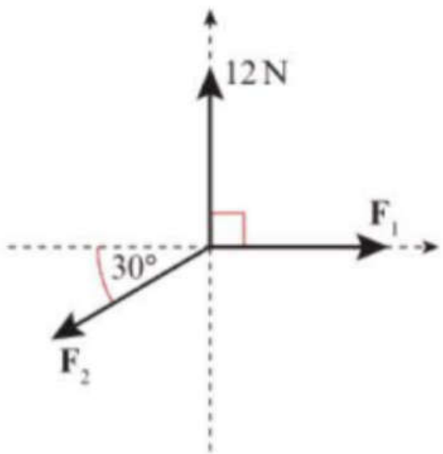
$$R = \sqrt{2.12^2 + 0.5992^2} = \underline{2.21}\,N \ (3sf)$$



$$\theta = \tan^{-1}\left(\frac{0.5992}{2.12}\right) = 15.8° \ (3sf)$$

above the horizontal

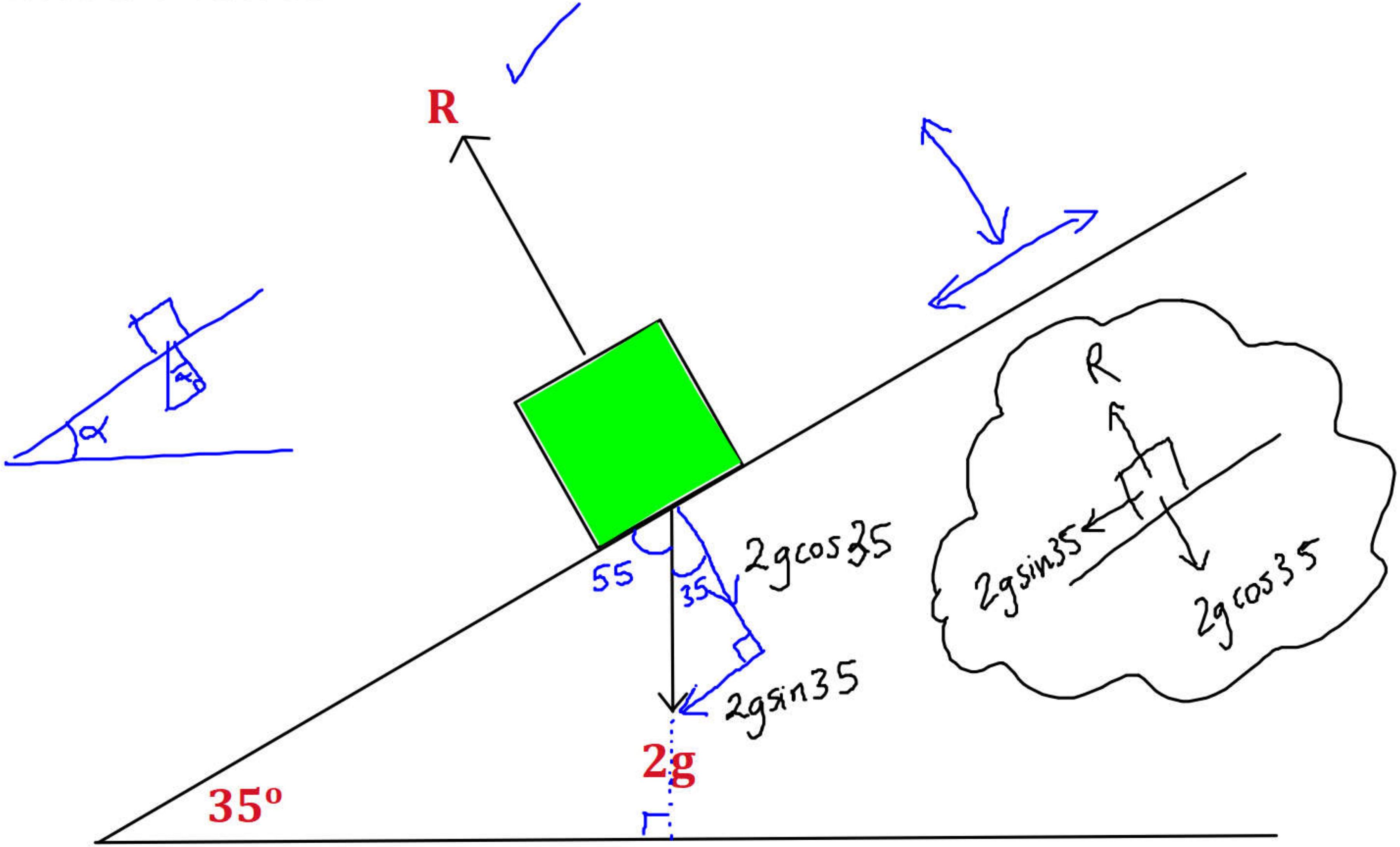
9 A system of forces act upon a particle as shown in the diagram.
The resultant force on the particle is $(2\sqrt{3}\mathbf{i} + 2\mathbf{j})$ N.
Calculate the magnitudes of $\mathbf{F}_1$ and $\mathbf{F}_2$.



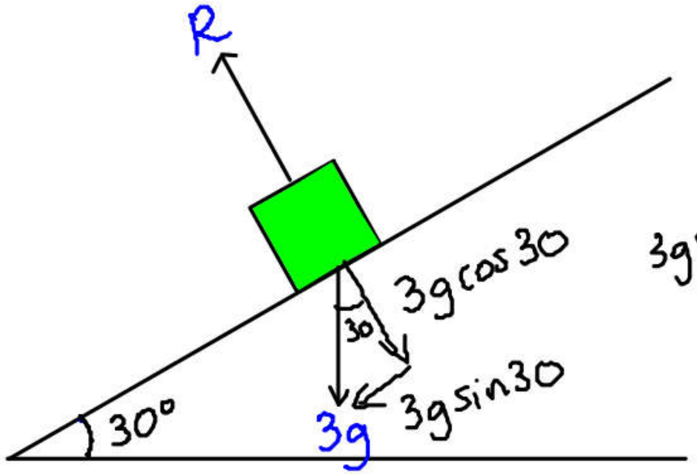
(3 marks)

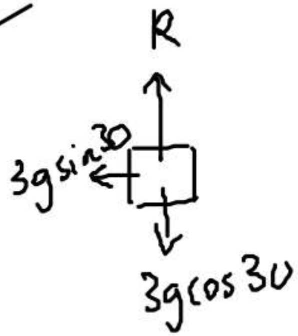
9 $\mathbf{F}_1 = 12\sqrt{3}$N, $\mathbf{F}_2 = 20$N

Inclined Planes



✏ For problems involving inclined planes, resolve forces parallel and perpendicular to the plane.

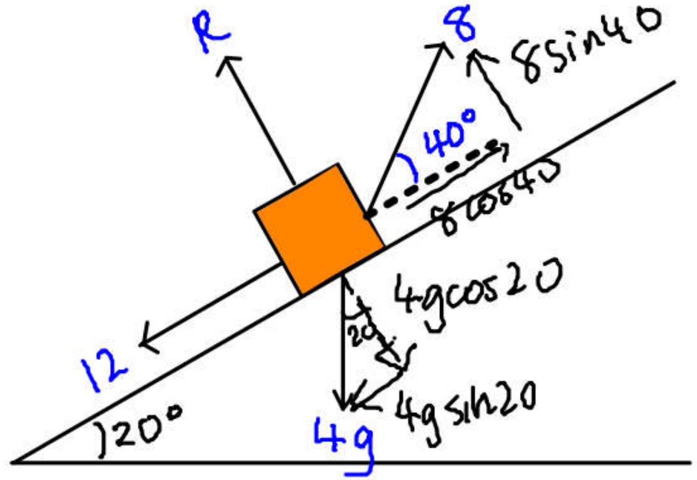


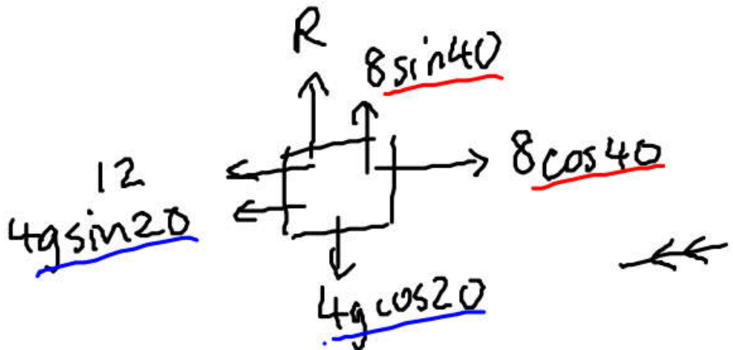


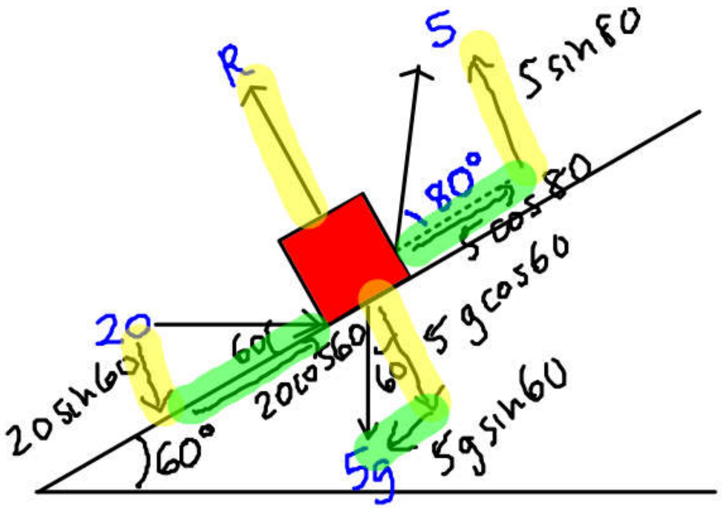
$$F = ma$$
$$3g\sin 30 = 3a$$
$$a = g\sin 30$$
$$a = \underline{\underline{4.9}}\ \text{ms}^{-2}$$

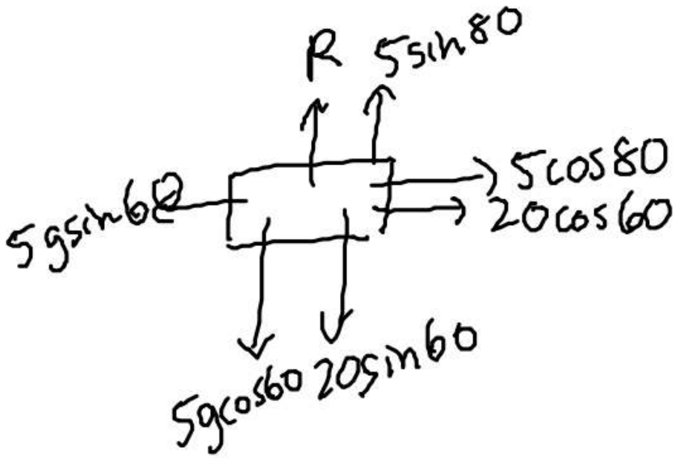
R

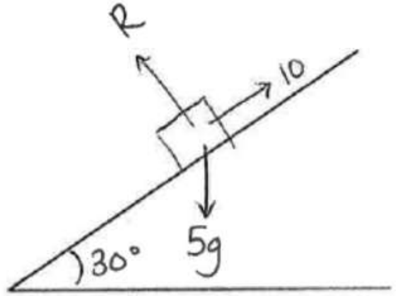
$$R = \underline{\underline{3g\cos 30}}$$

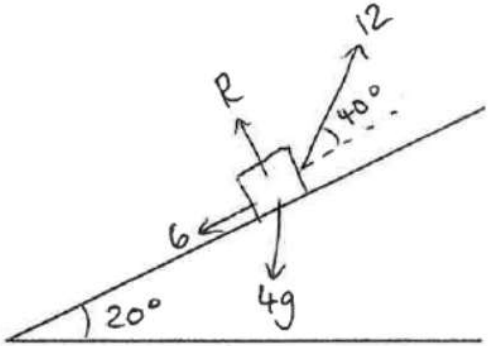


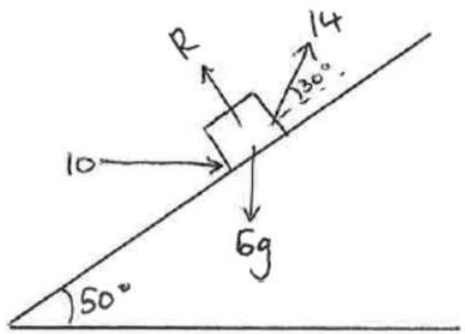


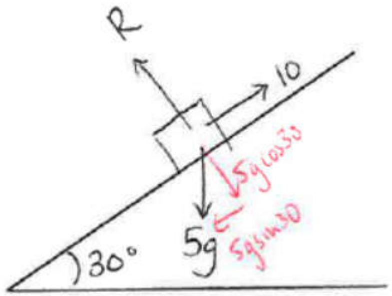


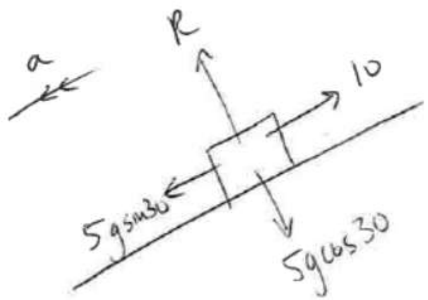



R
10
5g
30°


12
R
40°
6
4g
20°


14
R
30°
10
6g
50°



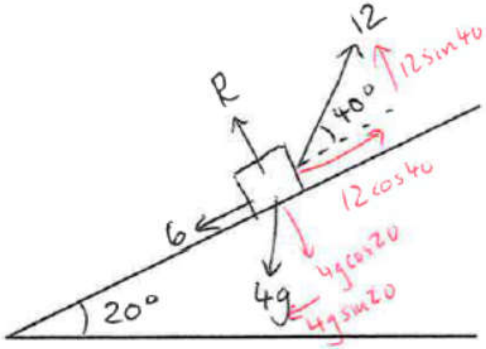


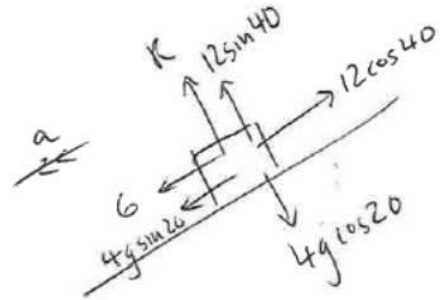
$R = \underline{42.4\ \text{N}}$

$F = ma$

$5g\sin 30 - 10 = 5a$

$a = \underline{2.9}\ \text{ms}^{-2}$ down slope.





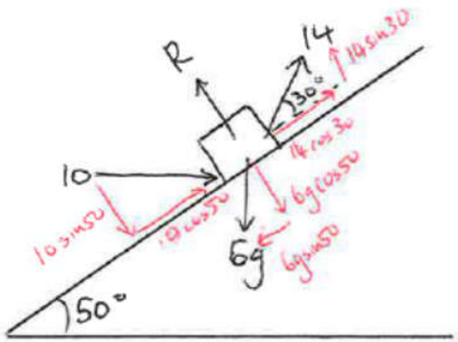
$R + 12\sin 40 = 4g\cos 20$

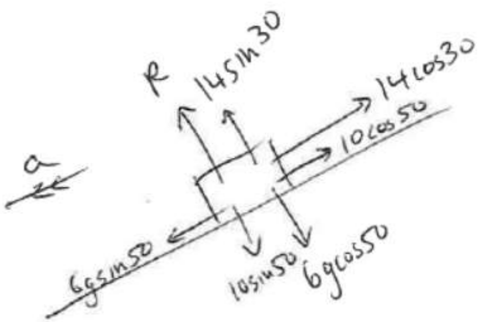
$R = \underline{29.1\ \text{N}}$

$F = ma$

$6 + 4g\sin 20 - 12\cos 40 = 4a$

$a = \underline{2.55}\ \text{ms}^{-2}$ down slope





$R + 14\sin 30 = 10\sin 50 + 6g\cos 50$

$R = \underline{38.5\ \text{N}}$

$F = ma$

$6g\sin 50 - 14\cos 30 - 10\cos 50 = 6a$

$a = \underline{4.42}\ \text{ms}^{-2}$ down slope