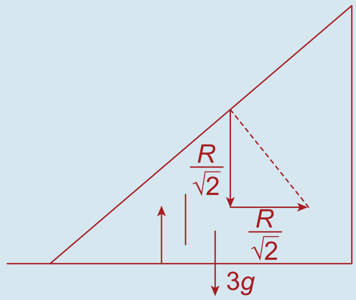
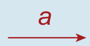
The Wedge:

Forces



Acceleration



$F = ma$

$\Rightarrow \frac{R}{\sqrt{2}} = 3a$

$\Rightarrow R = 3\sqrt{2}a$ .... ③

Putting this result into equation ② gives:

$g - \sqrt{2}(3\sqrt{2}a) = a$

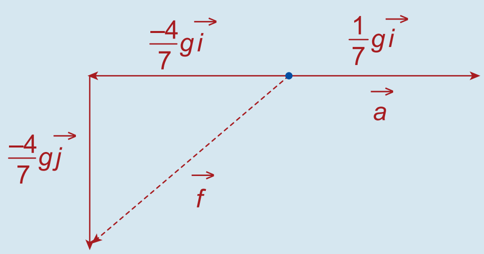
$\Rightarrow a = \frac{1}{7}g$ m/s^2

Putting this result into equation ① gives:

$g = \sqrt{2}f - \frac{1}{7}g$

$\Rightarrow f = \frac{4\sqrt{2}g}{7}$ m/s^2

Here are $\vec{f}$ and $\vec{a}$ resolved:



$\therefore \vec{f} + \vec{a} = \left(-\frac{4}{7}g\vec{i} - \frac{4}{7}g\vec{j}\right) + \frac{1}{7}g\vec{i}$

$= -\frac{3}{7}g\vec{i} - \frac{4}{7}g\vec{j}$

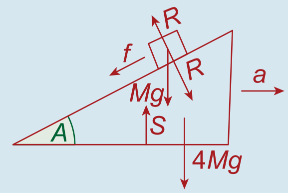
$\therefore |\vec{f} + \vec{a}| = \sqrt{\frac{9}{49}g^2 + \frac{16}{49}g^2}$

$= \sqrt{\frac{25}{49}g^2}$

$= \frac{5}{7}g$

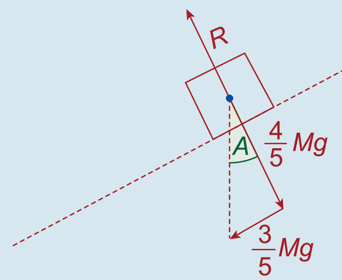
This is the magnitude of the actual acceleration of the particle.

Q. 4. Since $\tan A = \frac{3}{4}$, $\sin A = \frac{3}{5}$, $\cos A = \frac{4}{5}$

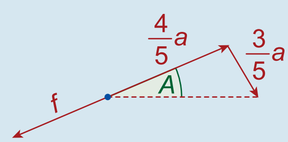


The Particle:

Forces



Accelerations



Parallel to the slope:

$F = ma$

$\Rightarrow \frac{3}{5}Mg = M\left(f - \frac{4}{5}a\right)$

$\Rightarrow 3g = 5f - 4a$ ... ①

Perpendicular to the slope:

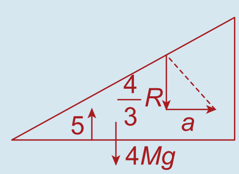
$F = ma$

$\Rightarrow \frac{4}{5}Mg - R = M\left(\frac{3}{5}a\right)$

$\Rightarrow 4Mg - 5R = 3Ma$ ... ②

The Wedge:

Forces **Acceleration**



$F = ma$

$\Rightarrow \frac{3}{5}R = 4Ma$

$\Rightarrow R = \frac{20}{3}Ma$ ... ③

Putting this result into equation ② gives:

$4Mg - \frac{100}{3}Ma = 3Ma \Rightarrow a = \frac{12g}{109}$ m/s^2