7.5) Dynamics and inclined planes

Worked example	Your turn
A particle is held at rest on a rough plane which is inclined to the horizontal at an angle α, where $\tan \alpha = \frac{5}{12}$.	A particle is held at rest on a rough plane which is inclined to the horizontal at an angle α, where $\tan \alpha = \frac{3}{4}$.
The coefficient of friction between the particle and the plane is 0.25.	The coefficient of friction between the particle and the plane is 0.5.
The particle is released and slides down the plane. Find:	The particle is released and slides down the plane. Find:
(a) the acceleration of the particle.	(a) the acceleration of the particle.
(b) the distance it slides in the first 4 seconds.	(b) the distance it slides in the first 2 seconds.
	a) $2.0 \ ms^{-2}$ (2 sf)
	b) $3.9 \ m$ (2 sf)

Worked example

A box of mass $4\ kg$ is pushed up a rough plane by a horizontal force of magnitude $50\ N$.
The plane is inclined to the horizontal at an angle of $20°$.
Given that the coefficient of friction between the box and the plane is 0.1, find the acceleration of the box.

Your turn

A box of mass $2\ kg$ is pushed up a rough plane by a horizontal force of magnitude $25\ N$.
The plane is inclined to the horizontal at an angle of $10°$.
Given that the coefficient of friction between the box and the plane is 0.3, find the acceleration of the box.

$7.1\ ms^{-2}$ (2 sf) up the plane

Worked example

A particle of mass $0.3 \ kg$ slides with constant acceleration down a line of greatest slope of a rough plane, which is inclined at $15°$ to the horizontal.

The particle passes through two points A and B, where $AB = 5 \ m$.

The speed of P at A is $4 \ ms^{-1}$.

It takes $7 \ s$ to move from A to B. Find:
a) The speed of P at B
b) The acceleration of P
c) The coefficient of friction between P and the plane

Your turn

A particle of mass $0.6 \ kg$ slides with constant acceleration down a line of greatest slope of a rough plane, which is inclined at $25°$ to the horizontal.

The particle passes through two points A and B, where $AB = 10 \ m$.

The speed of P at A is $2 \ ms^{-1}$.

It takes $3.5 \ s$ to move from A to B. Find:
a) The speed of P at B
b) The acceleration of P
c) The coefficient of friction between P and the plane

a) $3.7 \ ms^{-1}$ (2 sf)
b) $0.49 \ ms^{-2}$ (2 sf)
c) 0.41 (2 sf)