10.3) Forces and acceleration

Worked example

A car of 1000kg has a driving force of 1600N and forces of 400N resisting its motion.
Determine its acceleration.

Your turn

A car of 2000kg has a driving force of 800N and forces of 200N resisting its motion.
Determine its acceleration.

$0.3\ ms^{-2}$

Worked example

An object of mass 140kg experiences air resistance of 600 N. Determine the object's acceleration as it falls towards the ground.

Your turn

An object of mass 70kg experiences air resistance of 300 N. Determine the object's acceleration as it falls towards the ground.

$5.51\ ms^{-2}$ (3 sf)

Worked example

An adult has a mass of 100kg. What is the gravitational force (weight) acting on the adult?

Your turn

A child has a mass of 50kg. What is the gravitational force (weight) acting on the child?

$490\ N$

Worked example

A body of mass 10kg is pulled along a rough horizontal table by a horizontal force of magnitude 40N against a constant friction force of magnitude 8N. Given that the body is initially at rest, find:

(a) the acceleration of the body

(b) the distance travelled by the body in the first 2 seconds

(c) the magnitude of the normal reaction between the body and the table

Your turn

A body of mass 5kg is pulled along a rough horizontal table by a horizontal force of magnitude 20N against a constant friction force of magnitude 4N. Given that the body is initially at rest, find:

(a) the acceleration of the body

(b) the distance travelled by the body in the first 4 seconds

(c) the magnitude of the normal reaction between the body and the table

a) $3.2\ ms^{-2}$

b) $25.6\ m$

c) $49\ N$

Worked example

An objects of mass $8\ kg$ hits soft ground at a speed of $14\ ms^{-1}$ and sinks vertically downwards before coming to rest. The ground is assumed to exert a constant resistive force of magnitude $5000\ N$.

Find the vertical distance that the object sinks into the ground before coming to rest.

Your turn

An objects of mass $4\ kg$ hits soft ground at a speed of $28\ ms^{-1}$ and sinks vertically downwards before coming to rest. The ground is assumed to exert a constant resistive force of magnitude $5000\ N$.

Find the vertical distance that the object sinks into the ground before coming to rest.

$0.32\ m$ (2 sf)

Worked example

A lift of mass $500\ kg$ is lowered or raised by a metal cable attached to its top. The lift contains passengers whose total mass is $100\ kg$. The lift starts from rest and accelerates at a constant rate, reaching a speed of $5\ ms^{-1}$ after moving a distance of $4\ m$. Find:

a) The acceleration of the lift
b) The tension in the cable if the lift is moving vertically downwards
c) The tension in the cable if the lift is moving vertically upwards

Your turn

A lift of mass $400\ kg$ is lowered or raised by a metal cable attached to its top. The lift contains passengers whose total mass is $200\ kg$. The lift starts from rest and accelerates at a constant rate, reaching a speed of $4\ ms^{-1}$ after moving a distance of $5\ m$. Find:

a) The acceleration of the lift
b) The tension in the cable if the lift is moving vertically downwards
c) The tension in the cable if the lift is moving vertically upwards

a) $1.6\ ms^{-2}$
b) $4920\ N$
c) $6840\ N$