Motion

Uniform motion

- Speed is constant (speed doesn´t change per a time)

v = ...

Distance:

Distance travelled by uniform motion is proportional to the time and speed.

$$s = v \cdot t,$$

where s – distance (m)

v – velocity ($m.s^{-1}$)

t – time (s)

- Velocity: v = ...

Diagram of uniform motion

s = ...

Uniform accelerated/decelerated (retarded) motion

- Speed is not constant (speed changes per a time)

$$v \neq const$$

- Acceleration:

v = ...,

Where a – acceleration ($m.s^{-2}$)

v – velocity ($m.s^{-1}$)

t – time (s)

Diagram of uniform accelerated motion (no initial speed):

$$v = a \cdot t$$

$$s = \tfrac{1}{2} v \cdot t = \tfrac{1}{2} a \cdot t \cdot t = \tfrac{1}{2} a \cdot t^2$$

Diagram of uniform accelerated motion (at initial speed):

$v = v_0 + a \cdot t$,

where v_0 – initial speed ($m.s^{-1}$)

a – acceleration ($m.s^{-2}$)

t – time (s)

$s = v_0 + \frac{1}{2} (v - v_0) \cdot t = v_0 t + \frac{1}{2} a \cdot t^2$

Diagram of uniform deccelerated/retarted motion (at initial speed):

$v = v_0 - a \cdot t$,

where v_0 – initial speed ($m.s^{-1}$)

a – acceleration ($m.s^{-2}$)

t – time (s)

s = ... $= v_0 t - \frac{1}{2} a \cdot t^2$

1. An express trevells at a speed od 90 km.h-1. It starts to deccelerate at 0,1 $m.s^{-2}$. Calculate the distance and time needed to bring it to the rest.
2. A car starts to move and it travells in 10 seconds a distance of 50 metres. What is the acceleration of the car?
3. A train starts to move at acceleration of 25 $cm.s^{-2}$ in 1 minute. Calculate the velocity and distance travelled after the 1 minute.
4. A plane moving at 1080 $km.h^{-1}$ accelerates 1 minute at 1 $m.s^{-2}$. What will be its final speed and distance travelled in this minute?

Motion

Uniform motion

- Speed is constant (speed doesn´t change per a time)

$$v = const.$$

- Distance:

Distance travelled by uniform motion is proportional to the time and speed.

$$s = v \cdot t,$$

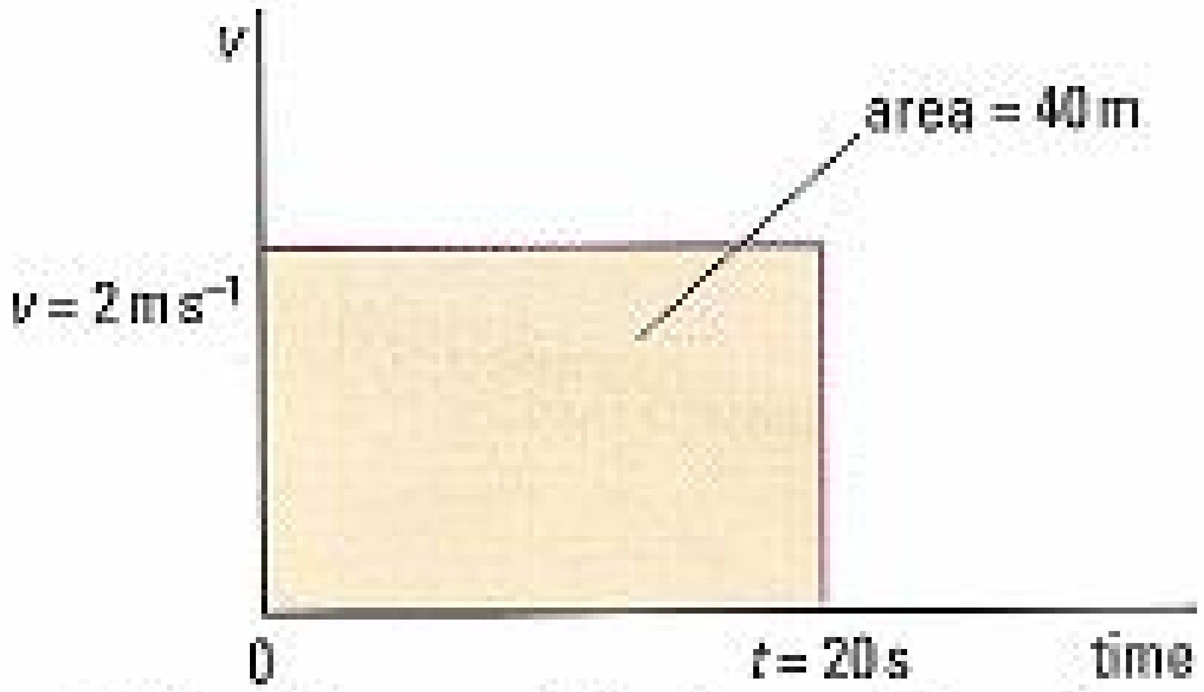
where s – distance (m)

v – velocity ($m.s^{-1}$)

t – time (s)

- Velocity: $v = s : t$

Diagram of uniform motion



Walking in a straight line at 2 m s^{-1}.

$s = v \cdot t$

Uniform accelerated/decelerated (retarded) motion

- Speed is not constant (speed changes per a time)

$$v \neq const$$

- Acceleration:

$$v = a \cdot t,$$

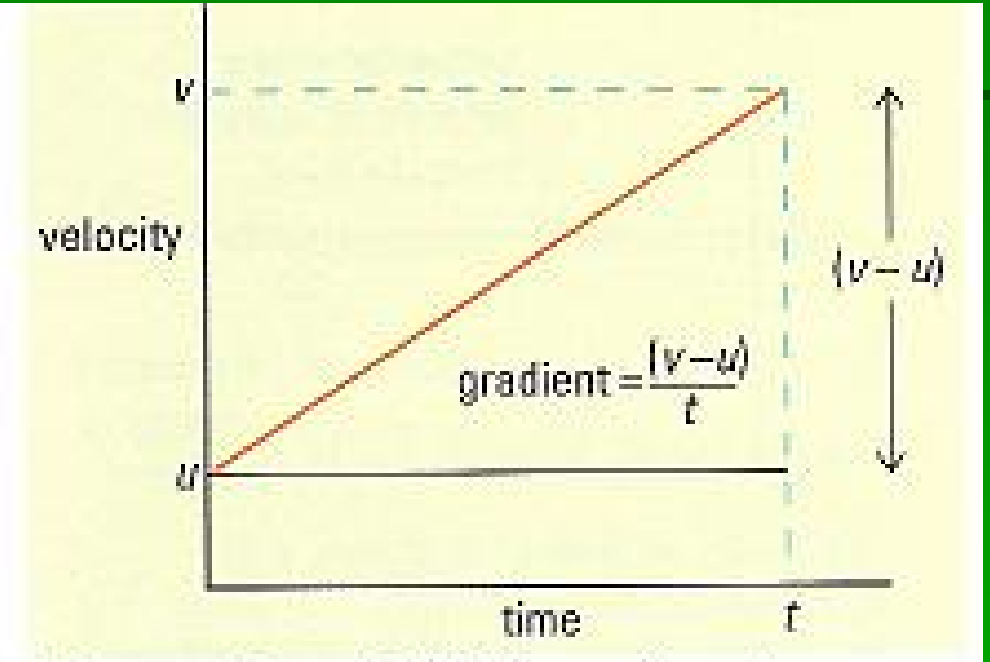
Where a – acceleration ($m.s^{-2}$)

v – velocity ($m.s^{-1}$)

t – time (s)

Diagram of uniform accelerated motion

(no initial speed)



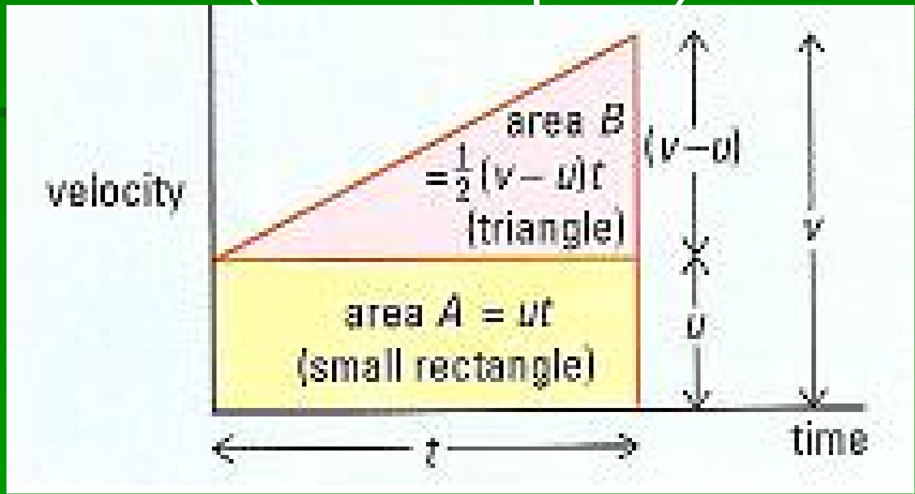
The gradient of this line gives the acceleration.

$v = a \cdot t$

$s = \frac{1}{2} v \cdot t = \frac{1}{2} a \cdot t \cdot t = \frac{1}{2} a \cdot t^2$

Diagram of uniform accelerated motion

(at initial speed)



$v = v_0 + a \cdot t$,

where v_0 – initial speed ($m.s^{-1}$)

a – acceleration ($m.s^{-2}$)

t – time (s)

$s = ½ v \cdot t = ½ a \cdot t \cdot t = ½ a \cdot t^2$

Diagram of uniform deccelerated/retarted motion

(at initial speed)

$v = v_0 - a \cdot t$,

where v_0 – initial speed ($m.s^{-1}$)

a – acceleration ($m.s$-^{2})

t – time (s)

$s = v_0 - \frac{1}{2}(v - v_0) \cdot t = v_0 t - \frac{1}{2} a \cdot t^2$

1. An express trevells at a speed od 90 $km.h^{-1}$. It starts to deccelerate at 0,1 $m.s^{-2}$. Calculate the distance and time needed to bring it to the rest.
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