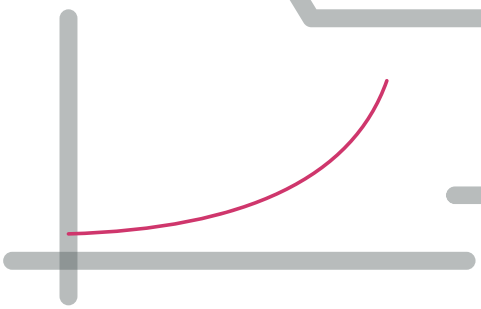
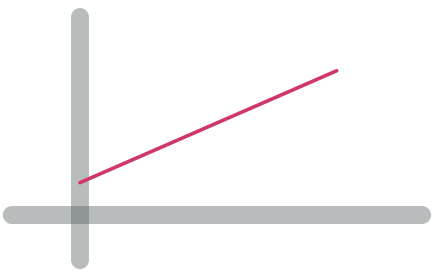
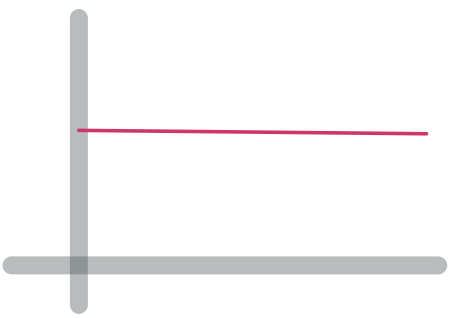
Motion With Constant acceleration



Positive Variesly



Slope = a



Slope(a) = 0

IMPORTANT

Equation
$v = v_0 + at$
$x - x_0 = v_0 t + \frac{1}{2}at^2$
$v^2 = v_0^2 + 2a(x - x_0)$
$x - x_0 = \frac{1}{2}(v_0 + v)t$
$x - x_0 = vt - \frac{1}{2}at^2$

example: A particle starts motion at 15 m/s. If it moves 20 m in 2 s, its final velocity is:

Formula

Solution: $x - x_0 = \frac{1}{2}(V_0 + V)t$

$20 = \frac{1}{2}(15 + V) \cdot 2$

$20 = (15 + V)$

$V = 5\ m/s$

DONE!

Solution:

(A) 10 m/s
(B) 5 m/s → B
(C) 3 m/s
(D) zero

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example: A car takes 10 s to accelerate from 0 to 50 m/s with constant acceleration. This acceleration is:

Solution: $V = V_0 + at \quad (V_0 = 0)$

$a = V/t = 50/10 = 5$

$= 5\ m/s^2$

DONE!

Solution:

(A) 15 m/s²
(B) 9 m/s²
(C) 5 m/s² → C
(D) 2 m/s²

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example: A train changes its velocity from 70 km/h to 20 km/h in 6 s. The distance it covered is:

DONE!

Solution:

$V_0 = \frac{70 \cdot 10^3}{3600} = 19.44\ m/s$

$V = \frac{20 \cdot 10^3}{3600} = 5.56\ m/s$

Solution:

$X = \frac{1}{2}(V_0 + V)t$

$= \frac{1}{2}(19.44 + 5.56)\,6 = 75\ m$

(A) 75.0 m → A
(B) 9.87 m
(C) 15.4 m
(D) 20.6 m

example:

A car moves along the x-axis with constant speed, the acceleration of the car is:

Solution:

Solution:

(A) Decreasing
(B) Increasing
(C) 9.8 m/s²
(D) Zero

→ D

Free Fall acceleration

the velocity begines to increase 9.8 per second which means the accleration of the free fall is $9.8\ m/s^2$

the formula should be $V = V_0 - gt$

- The equations will be as follows:

$$v = v_0 - gt \longrightarrow (1)$$

$$y - y_0 = v_0 t - \frac{1}{2}gt^2 \longrightarrow (2)$$

$$v^2 = v_0^2 - 2g(y - y_0) \longrightarrow (3)$$

$$y - y_0 = \frac{1}{2}(v_0 + v)t \longrightarrow (4)$$

$$y - y_0 = vt + \frac{1}{2}gt^2 \longrightarrow (5)$$

Free Falling Bodies

Free-Fall Acceleration

- Important example of straight line motion with constant acceleration.
- Described by constant acceleration equations, but need to make two changes:
  1) Replace x by y.
  2) Replace a by $-g$, where $g = 9.8\ m/s^2$

example:

A ball is thrown vertically upward at a speed of 12 m/s. It will reach its maximum height in:

$V_i = 12\ m/s$ $V_f = 0$ $g = 9.8\ m/s^2$ $t = ??$

Solution:

$$V_f = V_i - gt$$

$$0 = 12 - gt$$

$$t = \frac{12}{9.8}$$

Solution:

(A) 1.22 s
(B) 1.84 s
(C) 2.33 s
(D) 3.21 s

→ A

$T = 1.22\ s$

example :

A stone is dropped vertically downwards from a height h. If the stone reaches a height of 10 m above the ground in 2 s, the height h is:

$V_0 = 0$ $\quad t = 2\ s$ $\quad Y = h - 10$ $\quad g = 9.8\ m/s^2$

Solution

$$Y_F - Y_i = V_i t + (1/2) g t^2$$

$h - 10 = 0 + 0.5 \cdot 9.8 \cdot 4$

$h = 19.6$ then $h + 10 = Y$

$\therefore Y = 10 + 19.6$

$Y = 29.6\ m$

Solution:

(A) 4.9 m
(B) 9.6 m
(C) 19.6 m
(D) 29.6 m

→ D