18/ENG02/095 Computer engeneering
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COURSE CODE & TITLE: ENG 234 [ENG MECHANICS]

① A particle travels along a straight line with a velocity of $v = (4t - 3t^2)$ m/s, where t is in seconds, determine the position of the particle when t = 4s. S = 0, when t = 0.

Soln

$v = 4t - 3t^2$

to find the position,

$ds = v\,dt$

$s = \int v\,dt = \int 4t - 3t^2\,dt = \frac{4t^2}{2} - \frac{3t^3}{3} + c$

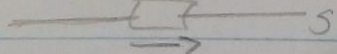
$s_{03} = \frac{4t^2}{2} - \frac{3t^3}{3} = \frac{4t^2}{2} - \frac{3t^3}{3}$

$s = 2t^2 \cdot t^3$

$= 2(4)^2 - 4^3 - 0$

$= 32 - 64 = -32m$

② A particle travels along a straight line with a speed of $v = (0.5t^3 - 8t)$ m/s, where t is in seconds. Determine the acceleration of the particle when t = 2s.



Solution:

data:

$v = (0.5t^3 - 8t)$

$a = ?$

$t = 2s$

to get acceleration

$a = dv/dt$

$a = \frac{d}{dt}(0.5t^3 - 8t) = (1.5t^2 - 8)$

$= t = 2$

Since $t = 2$

$= 1.5(2)^2 - 8$

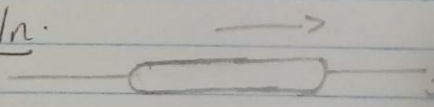
$= 1.5(4) - 8$

$= 6 - 8 = -2 m/s$

$= 2 m/s^2$ //

(3) A particle moves along a straight line such that its acceleration is $a = (4t^2 - 2) m/s$, where t is in seconds, when $t = 0$, the particle is located 2m to the left of the origin. Determine the position of the particle when $t = 4s$.

Soln.



Data.

$a = (4t^2 - 2) m/s^2$

$v = \int(4t^2 - 2)dt = v = 4/3 t^3 - 2t + C_1$

$s = \int(v) = 1/3 t^4 - 2/2 t^2 + Ct + C_2$

Note

$s(0) = -2$

$s(2) = -20$

$s(4) = 28.65m$.

To find position from the velocity function,

at $t = 0$, $s = -2$, $C_2 = -2$

at $t = 2$, $s = -20$, $C_1 = -9.70$

$C_1 = t^4/3 + t^2 + C \cdot t - 2 = \frac{t^4}{3} - t^2 - 9.67t - 2$

$-20 = \frac{2^4}{3} - 2^2 + C \cdot 2 - 2$

$C = -9.67$

at $t = 4$

then

$s(4) = \frac{1}{3}(4)^4 - (4)^2 + (-2)(4) + (-9.7)$

$= \frac{1}{3}(256) - (16) + (-8) + (-9.7)$

$= 28.7m$

position of the particle $= 28.7m$.

④ A particle travels along a straight line with a velocity of $v = (20 - 0.05s^2)m/s$, where s is in meters. Determine the acceleration of the particle of the particle at $s = 15m$

Solution

data

$v = (20 - 0.05s^2)$

$s = 15m$

$a = ?$

$= a = v\,dv/ds$

$= dv/dt = -0.1s\,ds/dt$

where $ds/dt = v$

Since $a = -0.1s$, $v = (20 - 0.05s^2)$, $s = 15m$

$dv = 5ds$

$a = \frac{5s \cdot 5ds}{ds} = 25s$

$a = 25l$, $a = 25m/s$ thus

acceleration $= 0.1s(20 - 0.05s^2) = -2s(0.05s^2)$

$s=15 = -2(15) + 0.0005(15)$

$= -30 + 16.875$

$= -13.125m/s = 13.12m/s^2$ //