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| MATRIC. NUMBER | 19/ENG09/021 |
| DEPARTMENT | AEROSPACE ENGINEERING |
| COURSE CODE | ENG 234 |
| COURSE TITLE | ENGINEERING MECHANICS 2 |
| TOPIC | ASSIGNMENT ON KINEMATICS OF A PARTICLE |
| DATE | 27/4/2020 |

QUESTIONS:

1. A particle travels along a straight line with a velocity v = (4t – 3t2) m/s, where t is in seconds. Determine the position of the particle when t = 4 s. Note that when t = 0 s, S = 0 m.
2. A particle travels along a straight line with a speed v = (0.5t3 – 8t) m/s, where t is in seconds. Determine the acceleration of the particle when t = 2 s.
3. A particle moves along a straight line such that acceleration a = (4t2 - 2) m/s2, where t is in seconds. When t = 0, the particle is located at 2 m to the left of the origin. Determine the position of the particle when t = 4 s.
4. A particle travels along a straight line with a velocity of v = (20 – 0.05s2) m/s, where s is in meters. Determine the acceleration of the particle at s = 15 m.

SOLUTIONS:

1. v = (4t – 3t2)

S = $∫$vdt

S = $∫$(4t – 3t2)dt

S = 2t2 – t3 + C

When t = 0, S = 0

0 = 0 – 0 + C

C = 0

S = 2t2 – t3

At t = 4, S = 2(4)2 – (4)3 = -32m

Therefore, at t = 4s, the particle is 32meters to the left of the origin

1. (0.5t3 – 8t)

a = dv/dt

a = 1.5t2 – 8

at t = 2s, a = 1.5(2)2 – 8 = -2

Therefore, at t = 2s, the particle decelerates at 2m/s2

1. a = (4t2 - 2)

at t = 0s, S = -2m

at t = 2s, S = -20m

v = $∫$adt

v = 4t3/3 – 2t + C1

S = $∫$vdt

S = t4/3 – t2 + tC1 + C2

For t = 0s,

-2 = (0)4/3 – (0)2 + (0)C1 + C2

C2 = -2

For t = 2s,

-20 = (2)4/3 – (2)2 + (2C1) - 2

-20 = 16/3 – 4 + 2C1 -2

C1 = (-20 – 16/3 + 4 + 2)/2

C1 = -29/3

S = t4/3 – t2 - (29t/3) – 2

At t = 4s, S = (4)4/3 – (4)2 - (29(4)/3) – 2

Therefore, at t = 4s, S = 28.67m to the right of the origin

1. v = (20 – 0.05s2)

a = dv/dt = dv/ds \* ds/dt

a = dv/ds \* v

dv/ds = -0.1s

dv/ds \* v = -2s + 0.005s3

a = -2s + 0.005s3

at s = 15m, a = -2(15) + 0.005(15)3 = -13.125

Therefore, at s = 15m, the particle decelerates at 13.125m/s2