What is the conclusion of Newton's equations of motion by using differential equations?

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ABSTRACT

Conclusion of Newton's equations of motion by using differential equations

Keywords

Newton's equations, differential equations

Contribution

$y = y_o + c_1 \frac{dy}{dx} + c_2 \frac{d^2y}{dx^2}$

$x = x_o + c_1 v + c_2 a$

Let $c_1 = k_1 \mathrm{t}$ and $c_2 = k_2 t^2$

$x = x_o + k_1 \mathrm{t}\ \ v + k_2 t^2\ a \quad a = \ constant$

$v = 0 + k_1 \mathrm{t}\ \ a + v\ k_1 + a\ k_2 (2\mathrm{t}) + k_2 t^2\ \ (0)$

$v = k_1 a \mathrm{t} + \ k_1 v + 2\ k_2 \mathrm{t} a$

Compare the coefficient of v

$k_1 = 1$

Compare the coefficient of at

$k_1 + 2\ k_2 = 0$

$2\ k_2 = -\ k_1$

$k_2 = -\frac{1}{2}$

$x = x_o + vt - \frac{1}{2} at^2$ ---------- (1)

$y = y_o + c_1 \frac{dy}{dx}$

$v = v_o + c_3 a$ $\qquad$ $c_3 = k_3 t$

$v = v_o + k_3 t \ \ a$ $\qquad$ $v_o = constant$

$a = 0 + k_3 t \ \ (0) + a \ \ k_3$

Compare the coefficient of a

$k_3 = 1$

$v = v_o + at$ ---------- (2)

From (1) and (2)

$x = x_o + vt - \frac{1}{2} at^2$ ---------- (1)

$v = v_o + at$ ---------- (2)

$x = x_o + (v_o + at) \ \ t - \frac{1}{2} at^2$

$x = x_o + v_o t + at^2 - \frac{1}{2} at^2$

$x = x_o + v_o t + \frac{1}{2} at^2$---------- (3)

If $x_o = 0$

$x = vt - \frac{1}{2} at^2$ ---------- (4)

$v = v_o + at$ ---------- (5)

$x = v_o t + \frac{1}{2} at^2$---------- (6)

Conclusion

$v = v_o + at$ ---------- (5)

$x = v_o t + \frac{1}{2} at^2$---------- (6)