University Physics 1A

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Kinematics

$$v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \frac{\mathrm{d}x}{\mathrm{d}t}$$

$$a = \lim_{\Delta t \to 0} \frac{\Delta v}{\Delta t} = \frac{\mathrm{d}v}{\mathrm{d}t}$$

$$\int_{t_i}^{t^f} v \ \mathrm{d}t = \int_{x_i}^{x_f} \mathrm{d}x = x_f - x_i$$

$$\int_{t_i}^{t_f} a \ \mathrm{d}t = \int_{v_i}^{v_f} \mathrm{d}v = v_f - v_i$$

Example Problem

The velocity of a rocket plane is given by $v = (2.00m/s) + (3.00m/s^3)t^2$

1. What is the speed of the rocket plane at $t = 10.0s$?

$$\begin{aligned} v &= 2\frac{m}{s} + (3\frac{m}{s^2})t^2 \\ &= 2 + (3)(10)^2 \\ &= 302m/s \end{aligned}$$

2. If $x_0 = 5.00m$, what is the position of the rocket plane at $t = 10.0s$?

$$\begin{aligned} x_f - x_i &= \int_{t_i}^{t_f} (2 + 3t^2)\ \mathrm{d}t \\ &= 2(t_f - t_i) + \frac{3}{3}(t_f^3 - t_i^3) \\ x - 5 &= 2(10 - 0) + (10^3 - 0) \\ &= 20 + 1000 \\ x &= 1025m \end{aligned}$$

3. What is the acceleration of the rocket plane at $t = 10.0s$?

$$\begin{aligned} a &= \frac{\mathrm{d}v}{\mathrm{d}t} = 0 + 6t \\ &= 60\frac{m}{s^2} \end{aligned}$$

Vector and Scalar Quantities

Vector Quantities in 1D:

- Position
- Velocity
- Acceleration

Scalar Quantities in 1D:

- Distance
- Speed

Reminders and Homework

Complete the homework on TheExpertTA and WebAssign.

You can find all my notes at `http://omgimanerd.tech/notes`. If you have any questions, comments, or concerns, please contact me at alvin@omgimanerd.tech