

## Homework

## Question 1.

$$t_1 = 200m \div 5.0m/s = 40s, t_2 = 280m \div 4.0m/s = 70s, t = t_1 + t_2 = 110s$$

$$v_{avr} = \frac{d_1 + d_2}{t} = \frac{200m + 280m}{100s} = 4.3636m/s, \vec{v}_{avr} = \frac{\vec{d}_1 + \vec{d}_2}{t} = \frac{200m - 280m}{110s} = -0.7273m/s$$

## Question 2.

$$\vec{v}_A = \vec{v}_B = \frac{40m - 20m}{3s - 0s} = 6.6667m/s, \vec{v}_c = 0, \vec{v}_D = \vec{v}_E = \vec{v}_F = \frac{0 - 40m}{6s - 5s} = -40m/s, \vec{v}_G = 0$$

## Question 3.

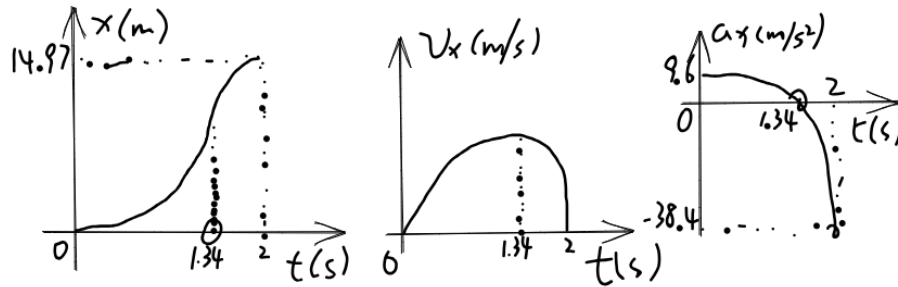
(1)

$$\vec{v}(t) = \frac{dx}{dt} = (9.60m/s^2)t - (0.600m/s^6)t^5, \vec{v}(t_0) = (9.60m/s^2)t_0 - (0.600m/s^6)t_0^5 = 0 \Rightarrow t_0 = 2s$$

$$\vec{x}_0 = 2.17m + (4.80m/s^2)(2s)^2 - (0.100m/s^6)(2s)^6 = 14.97m$$

$$\vec{a}(t) = \frac{dv}{dt} = 9.60m/s^2 - (3.000m/s^6)t^4, \vec{a}(t_0) = -38.4m/s^2$$

(2)



## Question 4.

(a&amp;b)

$$\vec{v}(t) = \int a(t)dt = at + C, \because \vec{v}(0) = 0 \therefore \vec{v}(t) = at, at_f = 20m/s$$

$$\vec{x}(t) = \int \vec{v}(t)dt = \frac{1}{2}at^2 + C, \vec{x}(0) = 0, \vec{x}(t) = \frac{1}{2}at^2 \Rightarrow \frac{1}{2}at_f^2 = 120m$$

$$a = 1.6667m/s^2, t_f = 12s$$

(c)

$$d = 20m/s \times t_f = 240m$$

## Question 5.

$$\text{The same as above : } at_f = 3.8m/s, \frac{1}{2}at_f^2 = 6.80m \Rightarrow a = 1.062m/s^2$$

$$\frac{1}{2}at_1^2 = 3.40m \Rightarrow t_1 = 2.531s \Rightarrow v(t_1) = at_1 = 2.687m/s$$

**Question 6.**

$$\text{Assume } g = -10\text{m/s}^2$$

(a)

$$t_h = \frac{0 - 20\text{m/s}}{-10\text{m/s}^2} = 2\text{s}, x = \frac{1}{2}gt^2 + v_0t + 50\text{m} = 70\text{m}$$

(b)

$$\text{from the highest point : } v = gt, x = \frac{1}{2}gt^2 \Rightarrow v^2 = 2gs \Rightarrow v = -10\sqrt{14}\text{m/s} \approx -37.42\text{m/s}$$

(c)

$$t = \frac{(-10\sqrt{14})\text{m/s} - 20\text{m/s}}{g} \approx 5.742\text{s}$$

**Question 7.**

$$\Delta \vec{d} = (5.3\text{m} - 1.1\text{m}, -0.5\text{m} - 3.4\text{m}) = (4.2\text{m}, -3.9\text{m})$$

$$\vec{v} = \frac{|\Delta \vec{d}|}{\Delta t} = 5.731\text{m/s}$$

$$\text{Direction : } \arctan\left(\frac{3.9}{4.2}\right) = 42.8789^\circ \text{ below the } x - \text{axis}$$

**Question 8.**

$$\vec{d} = d_0 + \vec{v} \cdot t = (-3.8\text{m/s}, 4.9\text{m/s}) \cdot 12\text{s} = (-45.6\text{m}, 58.8\text{m}), |\vec{d}| = 74.41\text{m}$$

**Question 9.**  $\Rightarrow 9t^2 + 2$ **Question 10.**

$$v(t) = \frac{dr}{dt} = 3t^2 - 4 = 0 \Rightarrow t = \sqrt{\frac{4}{3}}\text{s} \therefore r(t) = 10 - \frac{8}{3}\sqrt{\frac{4}{3}}\text{m}$$