

习题一

1. B

2. D

3. $\vec{a} = -\vec{i} + 4\vec{j}$

4. (1) $\vec{v}_0 = 5\vec{i}$

(2) $\vec{v} = 17\vec{i}$

5. $a = \frac{dv}{dt} = -ky$

6. (1) $\vec{v} = \frac{x(2) - x(1)}{2-1} \vec{i} = 16\vec{i}$

(2) $\vec{v} = \frac{dx}{dt} \vec{i} \quad \vec{v}(2) = -6\vec{i}$

(3) $\vec{v} = \frac{dx}{dt} \vec{i} = (9t^2 - 6t) \vec{i}$ 令 $\vec{v} = 0$ 得 $t_1 = 0, t_2 = 1.5$

$$s = |x(1.5) - x(1)| + |x(2) - x(1.5)| = 2.25 \text{ m}$$

5. $a = \frac{dv}{dt} = -ky$ 又 $\frac{dv}{dt} = \frac{dv}{dy} \cdot \frac{dy}{dt} = -ky \Rightarrow v dv = -ky dy$

$$\therefore \int v dv = -k \int y dy \quad \frac{1}{2} v^2 = -\frac{1}{2} ky^2 + C$$

$$\therefore \frac{1}{2} v_0^2 + \frac{1}{2} ky_0^2 = C \quad \therefore \text{关系式为 } \frac{1}{2} v^2 = -\frac{1}{2} ky^2 + \frac{1}{2} v_0^2 + \frac{1}{2} ky_0^2$$

习题二

1. B

2. D

3. (1) $a_T = C \quad a_n = \frac{b^2 - 2bct + c^2 t^2}{R}$

(2) $t = \frac{b \pm \sqrt{RC}}{C}$

4. $g \sin \theta \quad g \cos \theta$

5. (1) $\vec{r} = r \cos \omega t \vec{i} + r \sin \omega t \vec{j}$

(2) $\vec{v} = \frac{d\vec{r}}{dt} = -r\omega \sin \omega t \vec{i} + r\omega \cos \omega t \vec{j}$

$$\vec{a} = \frac{d\vec{v}}{dt} = -r\omega^2 \cos \omega t \vec{i} - r\omega^2 \sin \omega t \vec{j}$$

(3) 由 (1)(2), $\vec{a} = -\omega^2 \vec{r}$ 即 \vec{a} 与 \vec{r} 共线且方向相反

∵ 位矢从圆心发出 ∴ 加速度指向圆心

$$6. \omega_2 = \frac{v_2}{R} = 16 \text{ rad/s} \quad \because \omega_2 = k \cdot t_2^2 \Rightarrow k = 4$$

$$\therefore t = 1 \text{ s 时 } \omega_1 = k t_1^2 = 4 \text{ rad/s} \quad v_1 = \omega_1 \times R = 8 \text{ m/s}$$

$$a_n = \frac{v_1^2}{R} = 32 \text{ m/s}^2, \quad a_r = \frac{dv}{dt} = \frac{d(\omega R)}{dt} = \frac{d(k t^2)}{dt} \quad \therefore a_r = 16 \text{ m/s}^2$$

$$\therefore a = \sqrt{a_r^2 + a_n^2} = 16\sqrt{5} \text{ m/s}^2$$