

5.2.

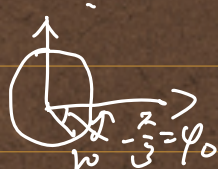
解: $A = 5.0$. $T = 2 \times 1.2 = 2.4$. $\omega = \frac{2\pi}{T} = \frac{5\pi}{6}$ $\varphi_0 = -\frac{\pi}{3}$

$$x = 5 \cos\left(\frac{5\pi}{6}t - \frac{\pi}{3}\right)$$

(1) a: 0, b: $\frac{\pi}{3}$ c: $\frac{\pi}{2}$ d: $\frac{2}{3}\pi$ e: $\frac{4}{3}\pi$.

(2) $x = 5 \cos\left(\frac{5\pi}{6}t - \frac{\pi}{3}\right)$

(3)



5.10.

$A = 0.24$. $\omega = \frac{2\pi}{1.5} = \frac{4}{3}\pi$ $\varphi_0 = 0$.

$$x = 0.24 \cos\left(\frac{4}{3}\pi t\right)$$

(1) $x(0.5) = -0.12 \text{ m}$

(2) $a(t) = -\left(\frac{4}{3}\pi\right)^2 \cdot 0.24 \cos\left(\frac{4}{3}\pi t\right)$

$F(0.5) = ma(0.5) \Rightarrow F = 0.42 \text{ N}$ 正向

(3) $\sqrt{2} x(0) = -0.18$

$\Rightarrow t = \frac{3}{4\pi} \text{ or } \cos \frac{3}{4}$

(4) $\cos \theta = -\frac{3}{4}$ $\sin \theta = \frac{\sqrt{7}}{4}$

$v = \frac{4}{3}\pi \times \frac{\sqrt{7}}{4} \times \frac{4}{3}x = \frac{4}{9}\sqrt{7} \times 0.18$

$\Rightarrow v = 0.02 \text{ m/s}$

5.18.

$k\Delta x = mg$ 且 $\omega = \sqrt{\frac{k}{m}} \Rightarrow \omega = 16$

设 $x = A \cos(16t + \varphi)$. $v(t) = -16A \sin(16t + \varphi)$

$v(0) = -16A \sin \varphi = 0.5$ $\frac{1}{2}kA^2 = \frac{1}{2}mv^2$

$\Rightarrow A = 0.031 \text{ m} = 3.1 \text{ cm}$

$$\varphi = \arctan \frac{0.4}{1.6 \times 0.01} = \arctan \frac{40}{1.6}$$

$$x = 3.1 \cos(16t + \varphi) \quad \varphi = \arctan \frac{40}{1.6}$$

5.24.

$$1) \quad \omega = \sqrt{\frac{k}{M}} \quad \omega' = \sqrt{\frac{k}{M+m}}$$

$$\Rightarrow \omega' = \sqrt{\frac{M}{M+m}} \cdot \omega$$

$$\Rightarrow \frac{1}{2} k A^2 = \frac{1}{2} k (A \sin \omega t_1)^2 + \frac{1}{2} (M+m) \left(\frac{M \omega A \cos \omega t_1}{M+m} \right)^2$$

$$\Rightarrow A' = A \sqrt{1 - \frac{M}{M+m} \cos^2 \omega t_1}$$

5.28.

3.2.28.

$$T_1 - mg = ma. \quad (k \Delta x - T_1) R = \frac{1}{2} M R^2 - \beta. \quad \beta R = a.$$

$$\Rightarrow a = \frac{k}{m + \frac{1}{2} M} \Delta x - \frac{mg}{m + \frac{1}{2} M}.$$

$$\Rightarrow \omega = \sqrt{\frac{k}{m + \frac{1}{2} M}} \quad T = 2\pi \sqrt{\frac{2m + M}{2k}}$$

5.47.

$$1). \varphi_2 = \frac{\pi}{6} + 2k\pi \quad k \in \mathbb{Z} \quad A_{\max} = 0.6 \text{ m}$$

$$2). \varphi_2 = \frac{7}{6}\pi + 2k\pi \quad k \in \mathbb{Z} \quad A_{\min} = 0.2 \text{ m}$$

5.51.

$$x = x_1 + x_2 + x_3 = 0.04 \left[\frac{\sqrt{3}}{2} \cos \theta - \frac{1}{2} \sin \theta - \sin \theta - \frac{\sqrt{3}}{2} \cos \theta - \frac{1}{2} \sin \theta \right]$$

$$= -0.08 \sin \theta \quad \theta = 120\pi t$$

$$\Rightarrow x = -0.08 \sin 120\pi t$$

5.53.

$$x = A \sin \omega t.$$

有 $x^2 + \left(\frac{v}{2}\right)^2 = A^2$ 即 $x^2 + \frac{v^2}{4} = A^2$. 为椭圆

顺时针

