

## 0.1 Homework 01 - Forces + Newton's Laws

9.

$$x''(0.7) = -16.8$$

$$y''(0.7) = -18$$

a)

$$a = \sqrt{16.8^2 + 18^2} = 24.62$$

$$ma = (0.340)(24.62) = \boxed{8.37N}$$

b)  $-133.025^\circ$

c)

$$\arctan\left(\frac{v_y}{v_x}\right)\bigg|_{t=0.7} = \boxed{-124.716^\circ}$$

13.

$$\begin{bmatrix} 9.8 & -9.8 \\ 49 - 9.8 & -9.8 \\ 58.8 - 49 & -9.8 \\ 98 - 58.8 & -9.8 \end{bmatrix} X = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$X = \begin{bmatrix} 1 & 1 \\ 1 & 4 \\ 1 & 1 \\ 1 & 4 \end{bmatrix}^T$$

Therefore,  $\boxed{A = 4\text{kg}, B = 1\text{kg}, C = 4\text{kg}, D = 1\text{kg}}$

17.

$$\text{a) } 8.5g\sin(30) = \boxed{41.65N}$$

$$\text{b) } 8.5g\cos(30) = \boxed{72.14N}$$

c)

$$a = \frac{8.5g\sin(30^\circ)}{8.5} = 5.02N$$

26.

$$v_f^2 = v_0^2 + 2a(\Delta x)$$

$$0 = 2.8^2 - 2a(0.11)$$

$$a = 35.636m/s^2$$

$$\sum F = ma = \frac{85}{9.8}(35.63) = \boxed{309N}$$

27.

$$(30 \cdot 10^{-3}m) \frac{s}{1.2 \cdot 10^7m} = 2.5 \cdot 10^{-9}m$$

$$4.5 \cdot 10^{-16} = (9.11 \cdot 10^{-11})(a)$$

$$a = 4.93 \cdot 10^{14}m/s^2$$

$$\frac{1}{2}a(2.5 \cdot 10^{-9})^2 = \boxed{0.00154m}$$

41.

a)

$$\sum F = ma$$

$$387 - 449 = \frac{449}{9.8}$$

$$a = -1.352m/s$$

b)

$$v_f^2 = v_0^2 + 2a(\Delta x)$$

$$= 2(1.352)(6.1)$$

$$v_f = 4.06m/s$$

44.

a)

$$89 - mg = ma$$

$$89 - mg = m(-2.4)$$

$$m = 12.027kg$$

b)

$$12.027 \cdot 9.8 + 2.4 \cdot 9.8 = 141.3846N$$

54.

$$T_2 = ma$$

$$T_4 = \left(\sum m\right)a = 222N$$

$$111 = 35a$$

$$a = 3.2$$

$$m_2 = 23kg$$