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) $-133.025°$

c)

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

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.

a) $8.5gsin(30) = \boxed{41.65N}$

b) $8.5gcos(30) = \boxed{72.14N}$

c)

$$a = \frac{8.5gsin(30°)}{8.5} = 5.02N$$

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.

$$(30 \cdot 10^{-3}m)\frac{s}{1.2 \cdot 10^7 m} = 2.5 \cdot 10^{-9}m$$
$$4.5 \cdot 10^{-16} = (9.11 \cdot 10^{-11})(a)$$
$$a = 4.93 \cdot 10^{14}m/s^2$$
$$\frac{1}{2}a(2.5 \cdot 10^{-9})^2 = \boxed{0.00154m}$$

41.

a)

$$\sum F = ma$$

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

$$\boxed{a = -1.352 m/s}$$

b)

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

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

$$v_f = \boxed{4.06 m/s}$$

44.

54.