

1.
30

$$\vec{A} = -3\hat{i} + 4\hat{k}$$

$$\vec{B} = 4\hat{i} + 3\hat{k}$$

10 (a) $\vec{A} \cdot \vec{B} = -12 + 12 = 0$

20 (b) $\vec{A} \times \vec{B} = (-3\hat{i} + 4\hat{k}) \times (4\hat{i} + 3\hat{k})$
 $= -9(\hat{i} \times \hat{i}) + 16(\hat{k} \times \hat{i})$
 $= -9\hat{j} + 16\hat{j}$
 $= 9\hat{j} + 16\hat{j}$

$\vec{A} \times \vec{B} = 25\hat{j}$

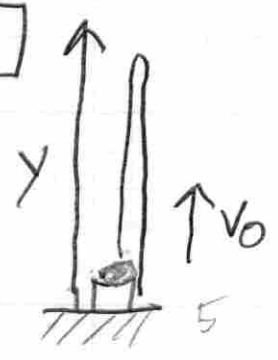
cross check:

$$|\vec{A}| = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$$

$$|\vec{B}| = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} = \sqrt{25} = 5$$

since $\cos\theta = 0$, $\sin\theta = 1$, $|\vec{A} \times \vec{B}| = |\vec{A}||\vec{B}|\sin\theta = 25\checkmark$

2.
30



$$v_y = v_0 - gt$$

to top: takes $t = T/2$

$$v_y = 0 = v_0 - gT/2$$

$$v_0 = \frac{1}{2} gT$$

how long? \rightarrow twice as long as time to maximum.



$$v_{0y} = v_0 \sin\theta$$

$$v_y = v_{0y} - gt = 0 \quad (\text{maximum height})$$

$$v_0 \sin \theta - gt = 0$$

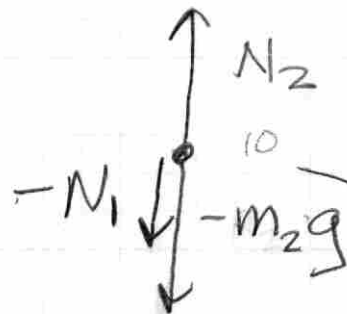
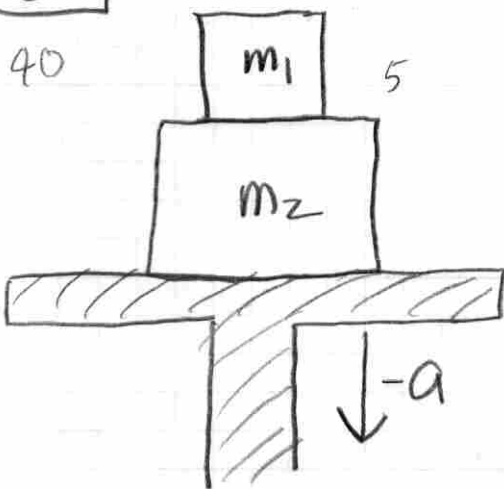
$$t = \frac{v_0 \sin \theta}{g}$$

total flight time

$$= 2t = \frac{2v_0 \sin \theta}{g} = \frac{2 \cdot \frac{1}{\sqrt{2}} g T \cdot \sin(45^\circ)}{g}$$

$$\boxed{\text{total flight time} = \frac{1}{\sqrt{2}} T}$$

3.



$$N_1 - m_1 g = -m_1 a$$

$$N_1 = m_1 (g - a)$$

$$N_2 - N_1 - m_2 g = -m_2 a$$

$$N_2 = N_1 + m_2 (g - a)$$

$$= m_1 (g - a) + m_2 (g - a)$$

$$\boxed{N_2 = (m_1 + m_2)(g - a)} \quad \underline{\underline{\text{upward}}}$$