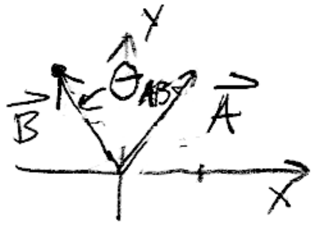
1 (a) $\vec{A}\cdot\vec{B} = (3\hat{\imath} + 4\hat{\jmath})\cdot(-3\hat{\imath} + 4\hat{\jmath}) = -9 + 16 = \boxed{7}$

(b) $\cos\theta_{AB} = \dfrac{\vec{A}\cdot\vec{B}}{|A||B|} = \dfrac{7}{3^2+4^2} = \boxed{\dfrac{7}{25} = 0.28}$

(c) Two ways:

(1) $\vec{A}\times\vec{B} = \hat{k}\begin{vmatrix} 3 & 4 \\ -3 & 4 \end{vmatrix} = \hat{k}\,(12+12) = \boxed{24\hat{k}}$

(2)



from drawing, $\vec{A}\times\vec{B} \propto \hat{z}$

$$|\vec{A}\times\vec{B}| = |\vec{A}|\,|\vec{B}|\,|\sin\theta_{AB}|$$

$$|\sin\theta_{AB}| = \sqrt{1-\cos^2\theta_{AB}}$$

$$= \sqrt{1-\frac{7^2}{25^2}} = \sqrt{\frac{625-49}{25^2}} = \sqrt{\frac{576}{25^2}}$$

$$= \frac{24}{25}$$

so $\vec{A}\times\vec{B} = +|\vec{A}||\vec{B}||\sin\theta_{AB}|\,\hat{z}$

$$= \sqrt{25}\cdot\sqrt{25}\cdot\frac{24}{25}\,\hat{z} = 24\hat{z}$$

(d) from method #1

$$\underbrace{|\vec{A}||\vec{B}|}_{\sqrt{25}\cdot\sqrt{25}} \sin\theta_{AB} = 24$$

$$\boxed{\sin\theta_{AB} = \frac{24}{25}}$$

method #2 ... already got it.

2 (a) $\vec{r}(t) = (2-t)\hat{\imath} + (-5+2t)\hat{\jmath} - \frac{1}{2}t^2\hat{k}$

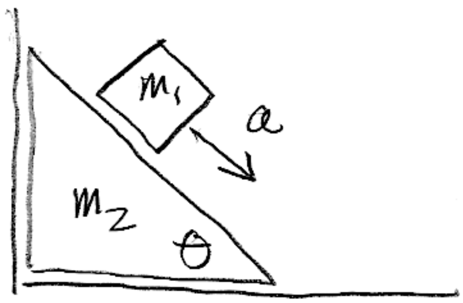
$$\boxed{\vec{v}(t) = \frac{d\vec{r}}{dt} = -\hat{\imath} + 2\hat{\jmath} - t\hat{k}}$$

(b) $\text{speed} = |\vec{v}(t)| = \sqrt{(-1)^2 + (2)^2 + (t)^2}$

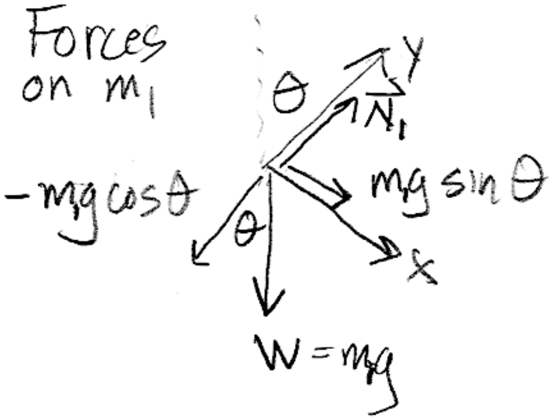
$$\boxed{\text{speed} = \sqrt{5 + t^2}}$$

(c) $\boxed{\vec{a}(t) = \frac{d\vec{v}}{dt} = -\hat{k}}$

3 (a)



Forces on m_1



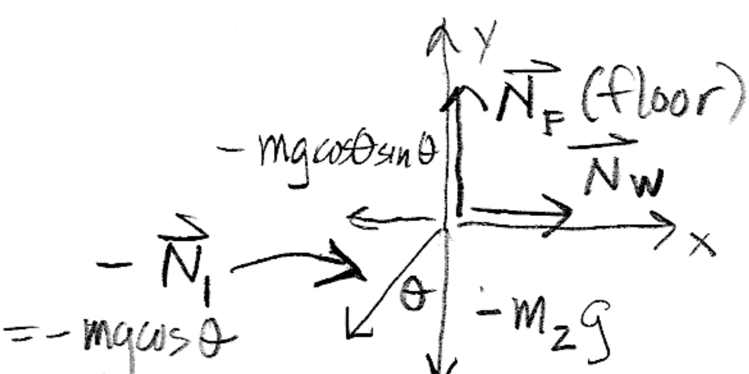
x: $m_1 a = m_1 g \sin\theta$

$$\boxed{a = g \sin\theta}$$

also, $N_1 - mg\cos\theta = 0$

$N_1 = mg\cos\theta$

(b) Forces on m_2:



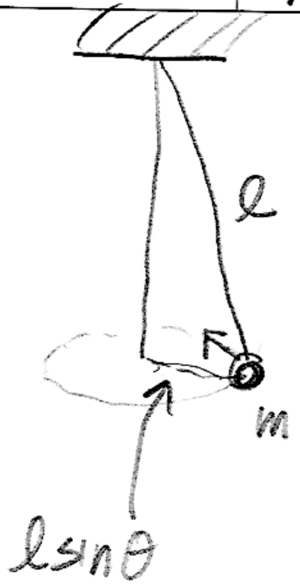
x:

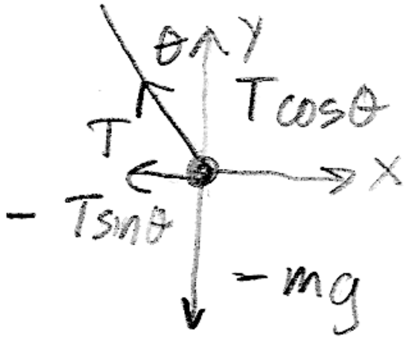
$N_W - mg\cos\theta\sin\theta = 0$

$N_W = mg\cos\theta\sin\theta$

by newton III, force of incline on wall is: $\boxed{-N_W = -mg\cos\theta\sin\theta \text{ in } x}$

4 (a)





$$T\cos\theta - mg = 0$$

$$\boxed{T = \frac{mg}{\cos\theta}}$$

(b)

$$-T\sin\theta = m a_r = m\left(\frac{-v^2}{\ell\sin\theta}\right)$$

so $$\frac{mg\sin\theta}{\cos\theta} = \frac{mv^2}{\ell\sin\theta}$$

$$v^2 = \ell g \cdot \frac{\sin^2\theta}{\cos\theta}$$

$$\boxed{v = \sqrt{\frac{\ell g}{\cos\theta}} \cdot \sin\theta}$$