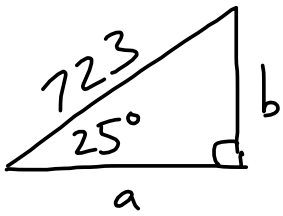
① 

Find a and b.

$\frac{a}{723} = \cos 25°$

$a = 723\cos 25° = 655$ $\quad$ $b = 723\sin 25° = 306$

② Solve the initial value problem

$\vec{a}(t) = \langle 0, -32 \rangle$, $\vec{r}(0) = \langle 0, 45 \rangle$, $\vec{v}(0) = \langle 655, 306 \rangle$

$\vec{v}(t) = \langle C_1, -32t + C_2 \rangle \Longrightarrow \vec{v}(0) = \langle C_1, C_2 \rangle = \langle 655, 306 \rangle$

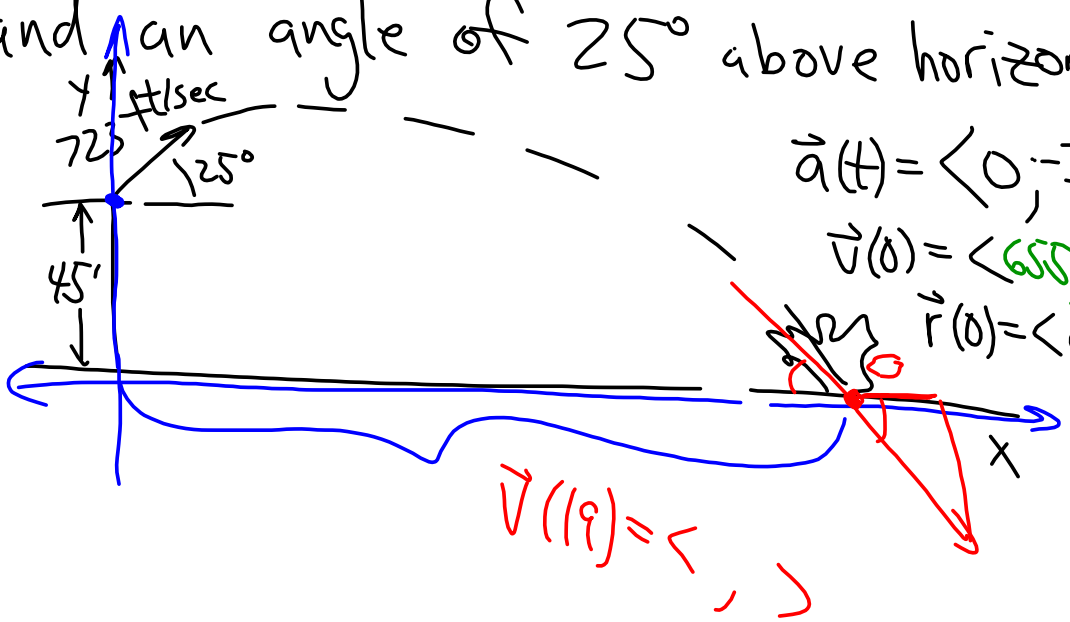
$C_1 = 655, C_2 = 306$

$\vec{v}(t) = \langle 655, -32t + 306 \rangle$

$\vec{r}(t) = \langle 655t + C_3, -16t^2 + 306t + C_4 \rangle \Rightarrow \vec{r}(0) = \langle C_3, C_4 \rangle = \langle 0, 45 \rangle$

$\vec{r}(t) = \langle 655t, \underline{-16t^2 + 306t + 45} \rangle$

A projectile is launched from a height of 45 feet above level ground, at a speed of 723 ft/sec and an angle of 25° above horizontal.



$\vec{a}(t) = \langle 0, -32 \rangle$

$\vec{v}(0) = \langle 655, 306 \rangle$

$\vec{r}(0) = \langle 0, 45 \rangle$

$\vec{v}(19) = \langle \quad , \quad \rangle$

① What is horizontal dist traveled?

When it hits the ground, $-16t^2+306t+45=0$

$\xRightarrow{\text{calc}} t=19$ sec

Hor dist is $655(19)=12445$ ft

② What is max height?

Use $-16t^2+306t+45$ for t when $-32t+306=0$

When $t=9.6$, height is... put in $t=9.6$ sec

③ What is the displacement from launch to landing?

$\Delta\vec{r}=\vec{r}(\text{final})-\vec{r}(\text{initial})$

$=\langle 12445,0\rangle-\langle 0,45\rangle$

$=\langle 12445,-45\rangle$

④ What is the distance travelled through the air?

$\text{dist}=\underbrace{\text{rate}}_{\text{speed}}\times\text{time}=\int_0^{19}\|\vec{v}(t)\|\,dt$

$=\int_0^{19}\sqrt{(655)^2+(-32t+306)^2}\,dt$

⑤ How fast is the projectile going when it hits the ground?

speed

$\|\vec{v}(19)\|=\|\langle 655,-32(19)+306\rangle\|$