Physics 3500
Weekly Quiz 1

The position vector for the motion of a ball along a path at time t is given as,

$$\vec{r} = 2(1+3t^2)\hat{e}_r$$

The motion has an angular speed of $\omega = \dot{\theta} = 1\ rad/s$.

a) Derive an equation for the velocity of the ball at time t.

$$\vec{r} = 2(1+3t^2)\,\hat{e}_r$$

$$\vec{V} = \dot{\vec{r}} = \dot{r}\,\hat{e}_r + r\dot{\theta}\,\hat{e}_\theta \qquad \dot{\theta} = \omega = 1$$

$$\boxed{\vec{V} = 12t\,\hat{e}_r + 2(1+3t^2)\,\hat{e}_\theta}$$

b) Calculate the angle between $\vec{r}$ and $\vec{v}$ at the time t=1 s.

at $t = 1$ $\qquad \vec{r} = 8\,\hat{e}_r$

$$\vec{V} = 12\,\hat{e}_r + 8\,\hat{e}_\theta$$

$$\cos\theta = \frac{\vec{r}\cdot\vec{V}}{|\vec{r}|\,|\vec{V}|} = \frac{96}{(8)(14.4)} = 0.83$$

$$\boxed{\theta = 33.7^\circ}$$