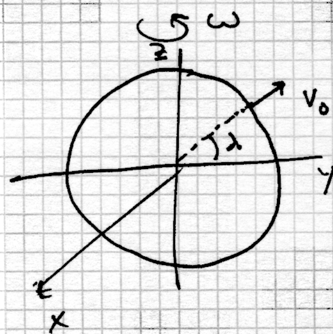

- If the particle moves in the $\hat{r}$ direction with velocity $v_r\hat{r}$, the coriolis force is

$$\vec{F}_{cor} = -2m\vec{\omega}\times\vec{v}_r$$
$$= -2m\omega v_r\, \hat{z}\times\hat{r}$$
$$= -2m\omega v_r \cos\lambda\, \hat{\phi}$$

(neglect the resulting velocity in the $\hat{\phi}$ direction in calculating $\vec{F}_{cor}$, since it would be small)

- The velocity in the $\vec{r}$-direction is: $v_r = v_0 - gt$.

It reaches its peak at t_p: $0 = v_0 - gt_p$

$$t_p = \frac{v_0}{g}$$

and its height is $y_p = h = v_0 t_p - \frac{1}{2}g t_p^2$

$$h = \frac{v_0^2}{g} - \frac{1}{2}g\left(\frac{v_0}{g}\right)^2 = \frac{v_0^2}{2g}$$

$$\sqrt{2gh} = v_0 \longrightarrow t_p = \sqrt{\frac{2h}{g}}$$

So: $v_r(t) = \sqrt{2gh} - gt$

- The acceleration in the $\hat{\phi}$ direction is

$$\frac{dv_\phi}{dt} = (-2\omega\cos\lambda)\, v_r(t)$$

so: $v_\phi(t) = -2\omega\cos\lambda \int v_r(t)\,dt$

$$= -2\omega\cos\lambda\left[\sqrt{2gh}\,t - \frac{1}{2}gt^2\right]$$

and the displacement in the $\hat{\phi}$ direction is

$$d = \int_0^{2t_p} v_\phi\, dt = -2\omega\cos\lambda\left[\sqrt{2gh}\,\frac{t^2}{2} - \frac{1}{6}gt^3\right]_0^{2t_p}$$
$$= -2\omega\cos\lambda\left[(\sqrt{2gh})(2t_p^2) - \frac{1}{6}g(8t_p^3)\right]$$
$$= -2\omega\cos\lambda\left[\sqrt{2gh}\,(2)\left(\frac{2h}{g}\right) - \frac{4}{3}g\left[\frac{2h}{g}\right]^{3/2}\right]$$
$$= (-2\omega\cos\lambda)\left(\frac{h^{3/2}}{g^{1/2}}\right)\underbrace{\left(4\sqrt{2} - \frac{8\sqrt{2}}{3}\right)}_{4\sqrt{2}\left(1-\frac{2}{3}\right) = \frac{4\sqrt{2}}{3}}$$
$$= -2\omega\cos\lambda\sqrt{\frac{h^3}{g}}\;\frac{4\sqrt{2}}{3}$$
$$= -\frac{4}{3}\omega\cos\lambda\sqrt{\frac{8h^3}{3}},$$

i.e. of mag. $\frac{4}{3}\omega\cos\lambda\sqrt{\frac{8h^3}{3}}$ to the <u>west</u> of the start.