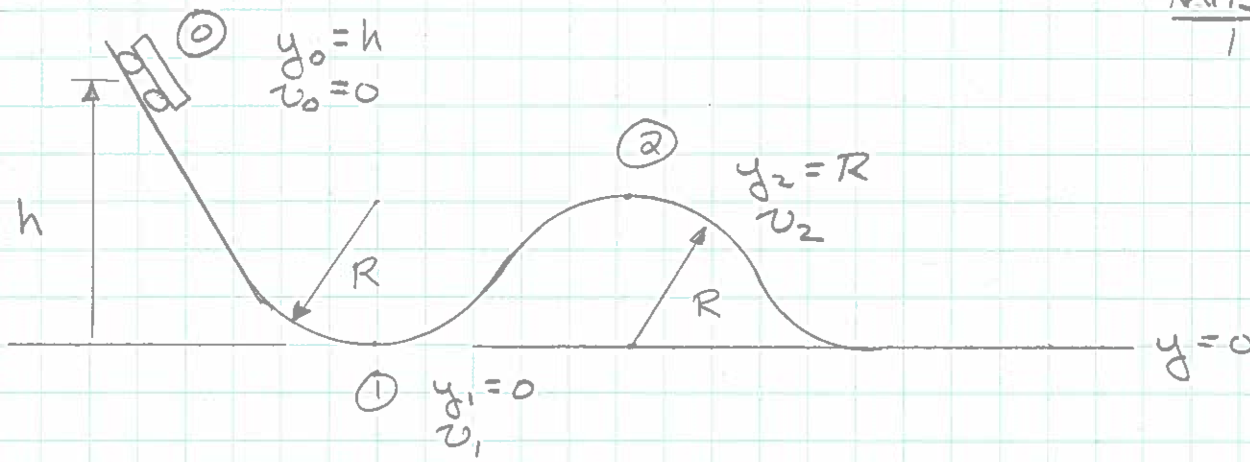


a.) First find maximum speed at ② to just stay on the track:

<u>at 2:</u> FBD


$$\Sigma F_r = w - n = ma_r = \frac{mv^2}{r}$$

when can just leave track, $n \to 0$, so

$$mg = \frac{mv_2^2}{R} \Rightarrow v_2 = \sqrt{gR}$$

Now, conserve energy $0 \to 2$:

$$\Delta E_{mech} = \Delta K + \Delta U_g = 0$$

$$\frac{1}{2}m(v_2^2 - v_0^2) + mg(y_2 - y_0) = 0$$

$$\frac{1}{2}v_2^2 + g(R - h) = 0$$

From above, $v_2^2 = gR$

$$\frac{1}{2}gR + gR - gh = 0$$

$$\therefore \underline{h = \frac{3}{2}R}$$

b.) Here's a better part b:

"What is the apparent weight felt by the rider at the bottom of the first loop (point 1)?"

Find speed at 1: Conserve energy 0 → 1:

$$\Delta E_{mech} = \Delta K + \Delta U_g = 0$$

$$\frac{1}{2} m (v_1^2 - v_0^2) + mg(y_1 - y_0) = 0$$

$$\frac{1}{2} v_1^2 - gh = 0$$

$$\therefore \quad v_1 = \sqrt{2gh}$$

Now, at 1, FBD:


$$\Sigma F_r = n - w = m a_r = \frac{m v^2}{r}$$

"apparent weight" = $n$

So, $$n = \frac{m v_1^2}{R} + mg$$

from above, $v_1^2 = 2gh$

and from part a, $h = \frac{3}{2} R$

So,
$$n = \frac{m}{R} 2g\left(\frac{3}{2} R\right) + mg$$

$$= 3mg + mg$$

$$= 4mg$$

$$\therefore \quad n = w_{app} = 4w$$