UNDERSTANDING THE "Number of g's"

$$\#g\text{'s} \equiv \frac{\text{APPARENT WEIGHT}}{\text{TRUE WEIGHT}} = \frac{F_N}{mg}$$

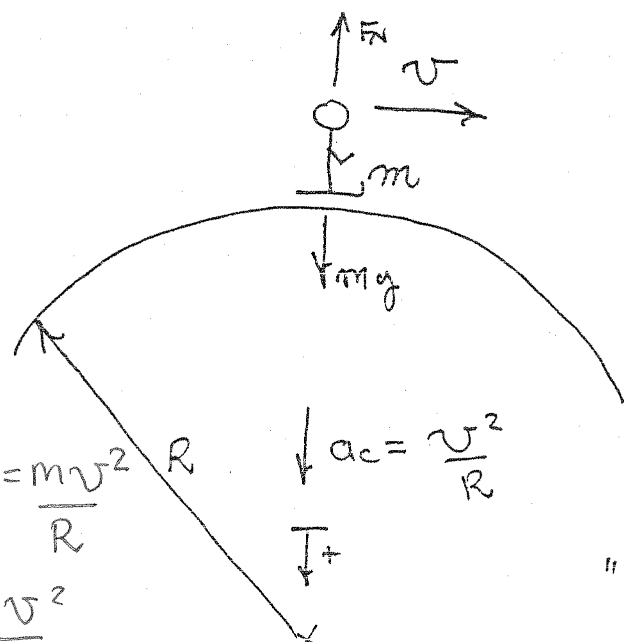
APPARENT WEIGHT $\equiv |\vec{F}_N| = F_N \equiv$ MAGNITUDE OF THE NORMAL FORCE

TRUE WEIGHT $\equiv mg \equiv$ MASS x Acceleration OF GRAVITY

I CAN EXPRESS the NORMAL FORCE IN A Newton's 2nd LAW Problem as

$$F_N = (\#g\text{'s})\,\underbrace{mg}_{\text{True weight}}$$

EXAMPLE: SKIER on A HILL



Newton's 2nd Law:

$$mg - F_N = ma_c = m\frac{v^2}{R}$$

$$\boxed{mg - F_N = \frac{mv^2}{R}}$$

SKIER EXPERIENCES "0.8 g's" at top OF HILL $\Rightarrow$ $0.8 = \frac{F_N}{mg} \Rightarrow$

$F_N = [0.8]mg$

$$mg - 0.8mg = \frac{mv^2}{R}$$

$$0.2\cancel{m}g = \frac{\cancel{m}v^2}{R}$$

$$\boxed{v = \sqrt{0.2Rg}}$$

In general we can replace $F_n = [\#g]mg$ in Newton's second law $\Rightarrow$

$$mg - F_N = m\frac{v^2}{R} \Rightarrow mg - [\#g]mg = m\frac{v^2}{R}$$

$$g[1-\#g] = \frac{v^2}{R} \Rightarrow \boxed{v = \sqrt{[1-\#g]gR}}$$

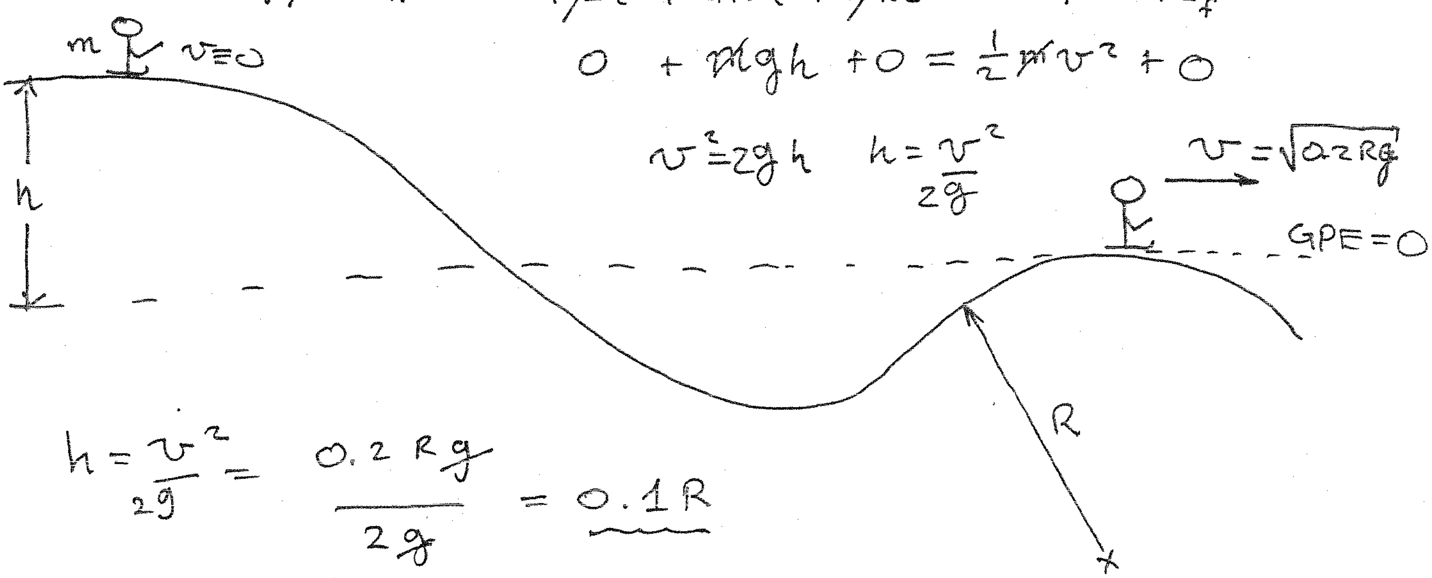
Back to a skier experiencing 0.8 g's at the top of the hill $\Longrightarrow$ $v = \sqrt{0.2RG}$

Now use WORK-ENERGY to determine how high the hill should be so that this is the speed at the bottom of the run when he crosses the second hill:

Work-Energy Thm. $\Rightarrow$ $KE_i^{\,0} + GPE_i + W_{NC}^{\,0} = KE_f + GPE_f$

$$0 + mgh + 0 = \frac{1}{2}mv^2 + 0$$

$$v^2 = 2gh \quad h = \frac{v^2}{2g}$$



$$h = \frac{v^2}{2g} = \frac{0.2Rg}{2g} = 0.1R$$

$$\boxed{h = 0.1R}$$

In general $\boxed{h = \frac{[1-\#g]}{2}R}$