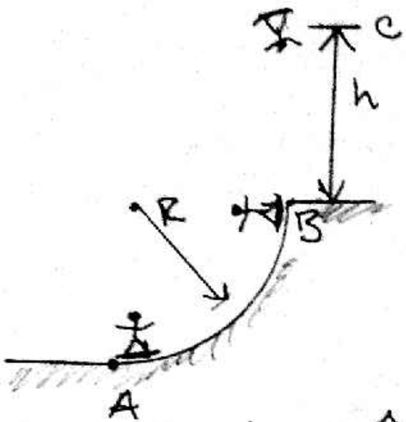


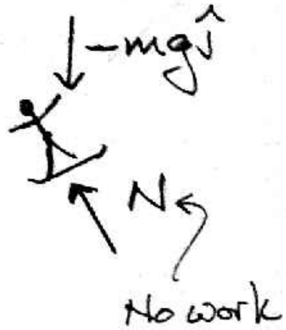
Given: R, $h = R$, m

Find: 1) Speed @ A : v_A

2) Normal force $\underset{\sim}{N}_A$ as snowboarder just passes point A

3) Normal force $\underset{\sim}{N}_B$

FBD



Work-Energy Principle

$$U_{A\to C} = T_C - T_A$$

$$-\cancel{m}g(2R) = 0 - \frac{1}{2}\cancel{m}v_A^2$$

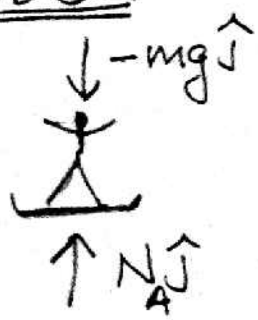
$$\Rightarrow v_A^2 = 4gR \quad (*)$$

$$\Rightarrow \boxed{v_A = 2\sqrt{gR}} \quad (1)$$

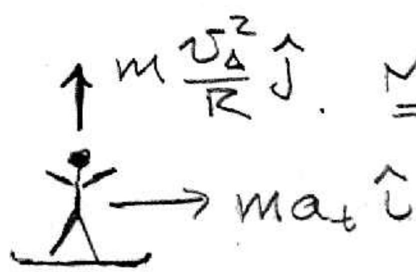
units

$$\frac{L}{T} = \sqrt{\frac{L}{T^2}\cdot L} = \sqrt{\frac{L^2}{T^2}} = \frac{L}{T} \checkmark$$

FBD@A



MAD@A



Newton $\hat{j}$: $N_A - mg = m\dfrac{v_A^2}{R}$

Subst (*)

$$N_A = m\frac{v_A^2}{R} + mg = 5mg \quad (\blacktriangle)$$

(2) $\boxed{\underset{\sim}{N}_A = 5mg\,\hat{j}}$ Units $\frac{ML}{T^2}$ ← Force ✓

The snow is pushing back with a force that is FIVE times the snowboarder's weight.

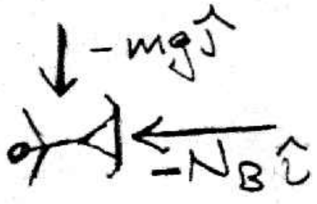
<u>Work-Energy</u> $U_{A\to B} = T_B - T_A$

$$-mgR = T_B - T_A = \frac{1}{2}mv_B^2 - \frac{1}{2}mv_A^2 \qquad \text{Subst. } (*)$$

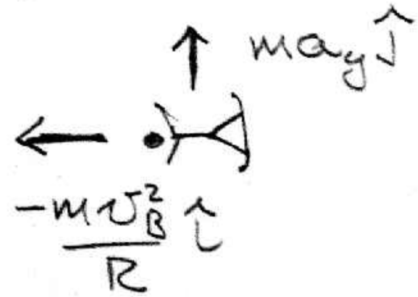
$$-mgR = \frac{1}{2}mv_B^2 - \frac{1}{2}m(4gR) = \frac{1}{2}mv_B^2 - 2mgR$$

$$\Rightarrow \frac{1}{2}\cancel{m}v_B^2 = \cancel{m}gR \Rightarrow v_B^2 = 2gR \quad (\#)$$

<u>FBD @ B</u>



<u>MAD @ B</u>



<u>Newton</u> $\hat{i}: -N_B = -\frac{mv_B^2}{R}$ (▼)

Subst (#)

$$N_B = 2mg$$

(3) $\boxed{\underset{\sim}{N}_B = -2mg\,\hat{i}}$ Units same as (2) ✓

Twice the weight

Now suppose $h_2 = 1.5R$

Then $U_{A \to C_2} = -mg(R + 1.5R) = -\frac{5}{2} mgR$

$= 0 - \frac{1}{2} m v_{A_2}^2$

$\Rightarrow v_{A_2}^2 = 5gR$ (**)

$\boxed{v_{A_2} = \sqrt{5gR}}$ —— 11.8% faster

From (▲)

$N_{A_2} = m\frac{v_A^2}{R} + mg = 6mg$; $\boxed{N_{A_2} = 6mg}$

20% more

Work Energy $U_{A \to B} = T_B - T_A$

$-mgR = \frac{1}{2} m v_{B_2}^2 - \frac{1}{2} m v_{A_2}^2$

$-\cancel{m}gR = \frac{1}{2}\cancel{m} v_{B_2}^2 - \frac{5}{2}\cancel{m}gR$

$v_{B_2}^2 = 3gR$

From (▼) $N_{B_2} = \frac{m v_{B_2}^2}{R} = 3mg$

$\boxed{N_{B_2} = -3mg\,\hat{\imath}}$ ← 50% more