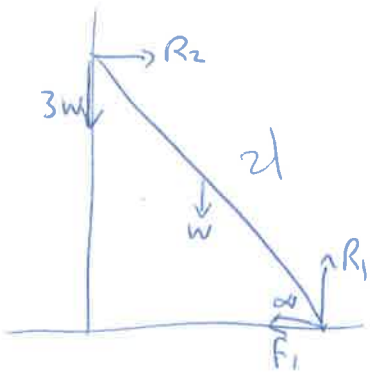
2010

7a



μ

$\mu > \frac{7}{8\tan\alpha}$ - show ladder wont slip

$\uparrow\downarrow$: $R_1 = 4W$

$\rightleftarrows$: $R_2 = F_1$ $\quad (R_2 = \mu R_1 \cdot \quad R_2 = \mu 4W)$

$\circlearrowleft$ base : $W(l\cos\alpha) + 3W(2l\cos\alpha) = R_2(2l\sin\alpha)$

$W + 6W = 2R_2\tan\alpha$

$\frac{7W}{2\tan\alpha} = R_2$

$\frac{7W}{2\tan\alpha} = F_1$

$\therefore F_1 = \mu R_1 = \mu 4W$ — for no slipping

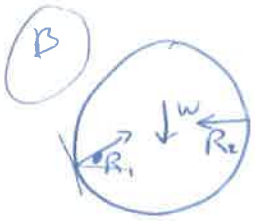
to not slip : limiting Friction > Friction ie $\mu R_1 > \frac{7W}{2\tan\alpha}$

$F_1 \leq \mu R_1$

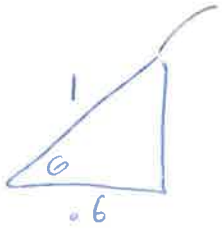
$\frac{7W}{2\tan\alpha} \leq 4\mu W$

$\frac{7}{8\tan\alpha} < \mu$

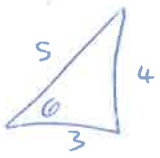
2010
7b



Δ on Diagram in paper



$\cos\theta = \frac{.6}{1} = \frac{3}{5}$



$\sin\theta = \frac{4}{5}$

ii) B ↑↓ $R_1 \sin\theta = W$

$R_1 =$ $R_1 \frac{4}{5} = W$ $R_1 = \frac{5W}{4}$

ii) $R_3 =$

A ↑↓ $R_3 = W + R_1 \sin\theta$

$R_3 = W + W = 2W$