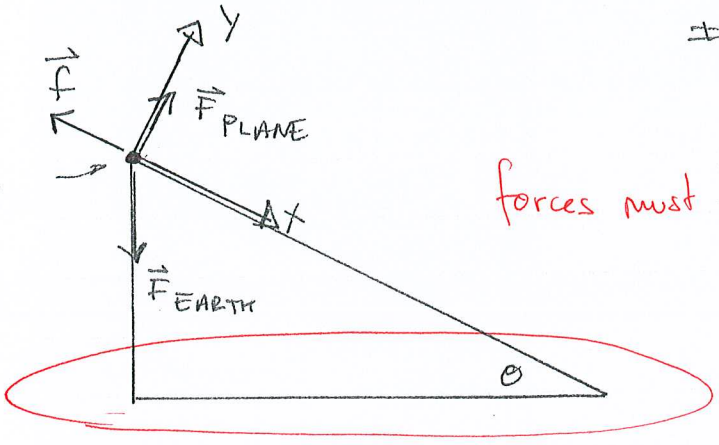
CHOICE OF ORIGIN

~~#1~~

A.



3 pts: coordinates
3 pts: 1 per force.

forces must be drawn and labeled.

not necessary as not specified in q to draw plane.

~~-1 FOR EACH VECTOR OMITTED~~

B. FOR POINT PARTICLE:

2pts → $$\Delta E_{\text{POINT PARTICLE}} = \Delta K_{\text{TRANS}} = \int_i^f \vec{F}_{NET} \cdot d\vec{r}_{CM}$$

$d\vec{r}_{cm} = \hat{x}\, dx$ 1pt for correct differential

~~-1 if some form of this statement is omitted~~

$\vec{F}_{NET} = \vec{F}_E + \vec{F}_p + \vec{f}$ 1pt for correctly filling-in forces as described in diagram above

$= \left(Mg\sin\theta\, \hat{x} - Mg\cos\theta\, \hat{y}\right) + \left|\vec{F}_p\right| \hat{y} - f\,\hat{x}$

2pts. $$\cancel{\Delta K_{\text{TRANS}}} \; K_f = L\left[Mg\sin\theta - f\right]$$

For all sections: give full credit if final answer correct,
EXCEPTION: deduct for missing fundamental principles.
(but e.g., not necessary to start w/ result from previous part.).

C. REAL SYSTEM

~~$\Delta E_{sys} = \Delta K_{TRANS} + \Delta K_{ROT} = W_{EXT}$~~ −1 IF OMITTED

~~$W_{EXT} = Mgh = Mgl\sin\theta$~~

$\Delta E_{sys} = W_{ext} + Q$ +2 pts

$\Delta K_{trans} + \Delta K_{rot} = \vec{F}_g \cdot \Delta \vec{r}_{cm}$ +2

$K_{t,f} + K_{r,f} = Mgh$ +2

D. $\Delta K_{TRANS} + \Delta K_{ROT} = Mgh$ +2 pts for starting w/ result of part C.

$$\frac{1}{2}MV^2 + \frac{1}{2}I\left(\frac{V}{R}\right)^2 = Mgh$$

$$V^2\left[1 + \frac{I}{MR^2}\right] = 2gh$$

+2 for correct algebra

$$V = \left[\frac{2gh}{1 + \frac{I}{MR^2}}\right]^{1/2}$$

+2 for final answer.

E. $$V = \sqrt{\frac{2gh}{1+\beta}}$$

+2 for starting w/ result of part D.

+4 for correct subst. & final answer.

INDEPENDENT OF MASS M + RADIUS R.