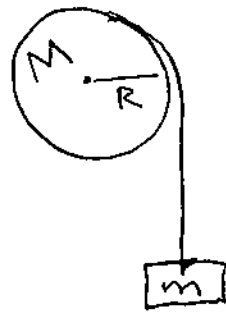
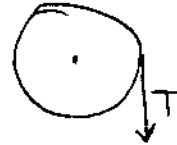


WRITTEN HW WEEK 12 SOLUTIONS



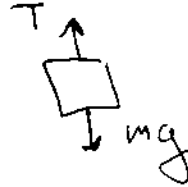
Free-body diag:

Cylinder:
(rotation only)



$$\tau = -TR$$

Block:



What we know: $\alpha = \frac{\tau}{I} = \frac{-TR}{\frac{1}{2}MR^2} = \frac{-2T}{MR}$

Accel. of block: $a = \frac{F_{\text{net}}}{m} = \frac{T - mg}{m}$

Relation b/w. acceleration of block and ang. acc. of cylinder:

$$a_{\text{blk}} = a_{\text{tangent}} = R\alpha$$

So we have 3 eqns:

$$\alpha = R\alpha$$

$$a = \frac{T - mg}{m} \rightarrow$$

$$\alpha = \frac{-2T}{MR}$$

substitute for a: $R\alpha = \frac{T - mg}{m}$

Solve for T: $mR\alpha = T - mg$
 $T = m(R\alpha + g)$

Substitute T

$\alpha = \frac{-2m}{MR}(R\alpha + g)$ now solve for α :

$$\alpha + \frac{2mR\alpha}{MR} = -g \Rightarrow \alpha \left(1 + \frac{2m}{M}\right) = -g \Rightarrow \alpha = \boxed{\frac{-g}{\left(1 + \frac{2m}{M}\right)}}$$