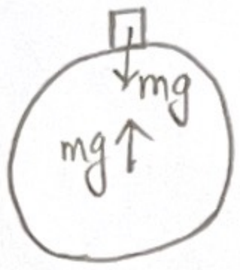
Solutions

PHYS-205A-002 Midterm Exam 02 Fall 2022.

## Problem 1

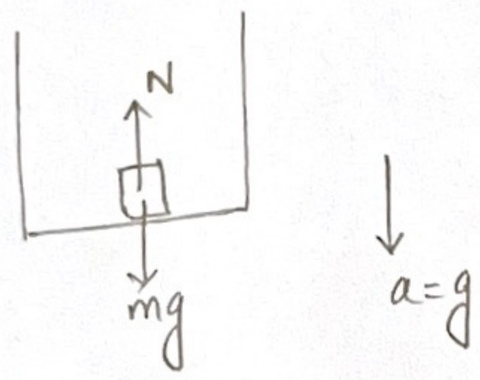



Reaction force is exerted by m on M.

magnitude = mg

direction : from center of Earth to m.

## Problem 2




$-ma = +N - mg$

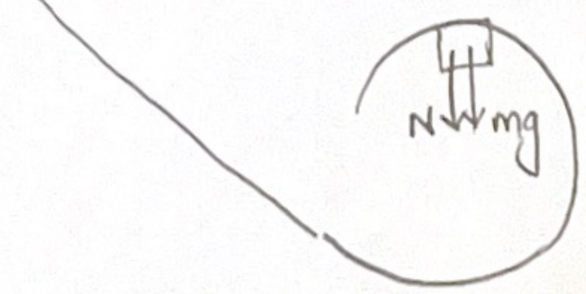
$-mg = N - mg$

$N = 0$ reads 0.

## Problem 3

radially inward

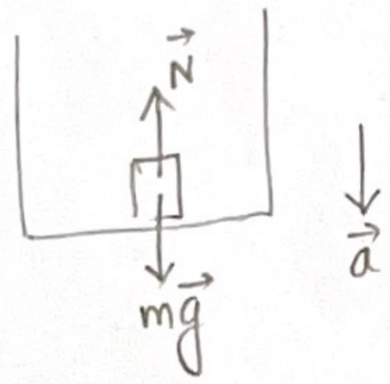
## Problem 4




forces: $m\vec{g} + \vec{N}$

both pointing down.

## Problem 5



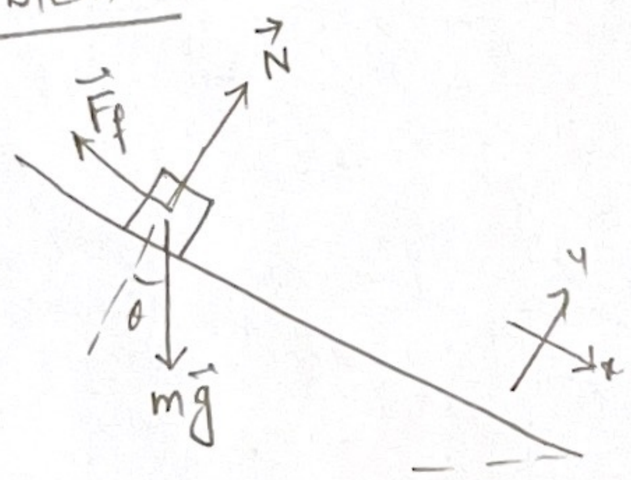

$$m\vec{a} = m\vec{g} + \vec{N}$$

$$-ma = -mg + N$$

$$N = mg - ma$$

$$= 75(9.8 - 2.0) = 590 \text{ Newtons}$$

## Problem 6




$$m\vec{a} = m\vec{g} + \vec{N} + \vec{F}_f$$

$x$: $ma = mg\sin\theta - F_f$ — (i)

$y$: $0 = -mg\cos\theta + N + 0$

$$ma = mg\sin\theta - F_f \quad \text{— (i)}$$

$$N = mg\cos\theta \quad \text{— (ii)}$$

$$F_f \leq \mu_s N = \mu_s mg\cos\theta$$

$$= (0.80)(10.0)(9.8)\cos 30^\circ$$

$$= 68 \text{ Newtons}$$

$$mg\sin\theta = (10.0)(9.8)\sin 30^\circ$$

$$= 49 \text{ Newtons}$$

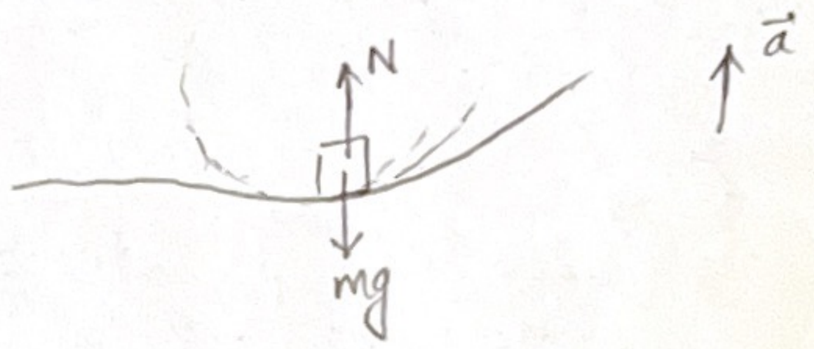
Since $mg\sin\theta > \mu_s N$ the force of friction will be less than $\mu_s N$, that is,

$$F_f = 49 \leq \mu_s N \quad \Rightarrow \quad ma = mg\sin\theta - F_f = 0$$

Thus, the mass does not move. $a = 0$.

## Problem 7

$$m\vec{a} = m\vec{g} + \vec{N}$$




$$m\frac{v^2}{R} = -mg + N$$

$$N = mg + \frac{mv^2}{R}$$

$$= (75)(9.8) + (75)\frac{(30.0)^2}{150}$$

$$= 740 + 450$$

$$= 1200 \text{ Newtons}$$