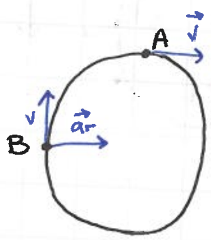
PROBLEM 4.E

$r = 6.37 \times 10^6 m$
$T = 86,400s$

$$V = \frac{2\pi r}{T} = \frac{2\pi(6.37\times10^6 m)}{86,400s} \rightarrow \boxed{V = 463 m/s}$$

$$a_r = \frac{V^2}{r} = \frac{(463 m/s)^2}{6.37\times10^6 m} \rightarrow \boxed{a_r = 3.4\times10^{-2} m/s^2}$$

↓ Too small to sense



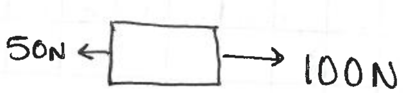
$V = 6 m/s$
$r = 3m$

$$a_r = \frac{(6 m/s)^2}{3m} = 12 m/s^2$$

||Chapter 5: Force & Motion||

Ch. 2 & 4 → looked at motion w/o studying what caused the motion

* Object accelerates because of a net force ($\Sigma\vec{F}$ or $\vec{F}_{net}$)
  ↓ Vector sum of all forces



Net force of 50N to the right
↳ The object is accelerating to the right

* An object always accelerates in the direction of the net force
  ↳ You need to know the velocity to know if it is speeding up, slowing down, or turning.

Forces:

1. A force is a push or pull
2. A force is a vector that has both magnitude & direction
3. Forces require an agent (something that does the pulling or pushing).
4. Forces can either be contact forces or long-range forces (gravity, electric, & magnetic force).

Short Catalog of forces

Gravitational Force ($\vec{F}_g$ or $\vec{w}$) ⇒ attractive force of the earth on an object.
(weight)

⇒ Direction: Always straight down towards the center of the planet

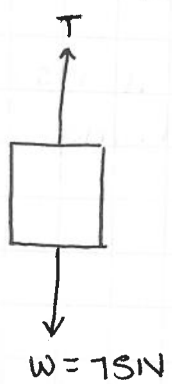
Spring Force ($\vec{F}_{sp}$) ⇒ Force excerted by a stretched or compressed spring

Direction: Always opposite direction of stretched or compression.

Tension ($\vec{T}$) ⇒ Force exerted by a taut rope or string

Direction: Is along the rope or string in the direction of pulling

C.Q.5A Problem



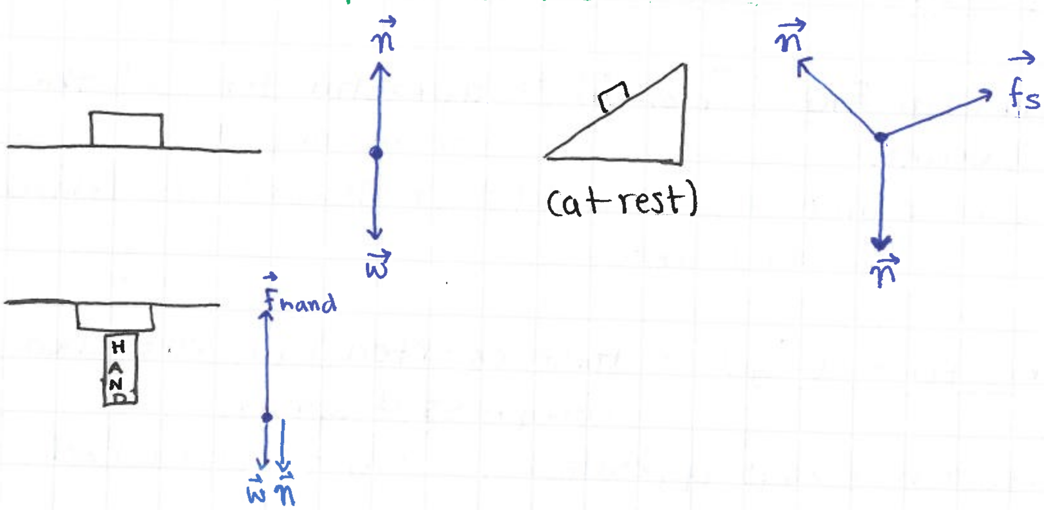
moving downward & slowing down:

$\vec{a}$ points upwards
$\vec{F}_{net}$ points upwards

$T > W$

Normal force ($\vec{n}$) ⟹ ⊥ support force provided by a surface on an object in contact with the surface
(→ means ⊥)

Direction: always ⊥ to the surface



Friction ($\vec{f}$) ⟶ **static friction ($\vec{f_s}$)**

⟶ Friction between two objects at rest relative to each other

Direction: opposite direction object would move if there was no friction

Ch. 5.

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friction ($\vec{f}$) ⟶ Kinetic friction ($\vec{f}_k$)

⟶ Friction between 2 objects in motion relative to each other

Direction: Always in the opposite direction of motion ch. 5. February 26, 2019.

friction ($\vec{f}$) ⟶ Kinetic friction ($\vec{f}_k$)

→ Friction between 2 objects in motion relative to each other

Direction: Always in the opposite direction of motion

Recap

February 28, 2019

→ Intro to forces

→ $\Sigma \vec{F}$ or $\vec{F}_{net}$

↳ vector sum of all forces

→ Acceleration always points in the direction of the net force

→ Short catalog of forces

$\vec{F}_g$ or $\vec{w}$

$\vec{F}_{sp}$

$\vec{T}$

$\vec{n}$

$\vec{f}_k$ and $\vec{f}_s$

---

drag ($\vec{D}$) → frictional force in a gas (air) or a liquid (water)

Direction: Opposite direction of motion

thrust ($\vec{F}_{thrust}$) → force from a jet or rocket expelling gas at high speeds

Direction: Opposite direction gas is expelled

Ch. 5

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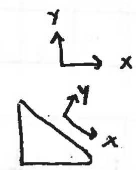
FREE BODY DIAGRAMS (FBDs) → visual way of representing all of the forces on an object.

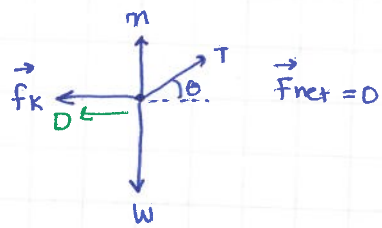
1. Identify all the forces acting on an object
2. (Draw a coordinate system) → optional if



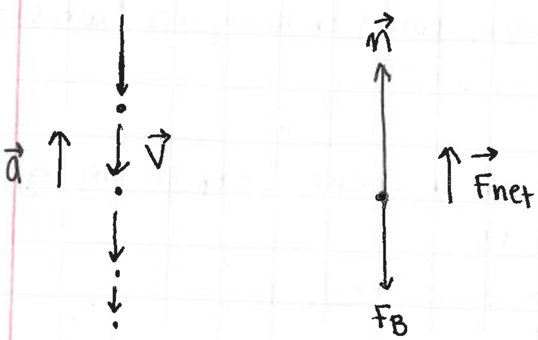
3. Represent the objects as a dot at the origin.
4. Draw vectors representing each force
   ↪ right direction approximately the right length
5. Draw & label the net force vector $\vec{F}_{net}$ (or indicate $\vec{F}_{net} = 0$)

Ex.

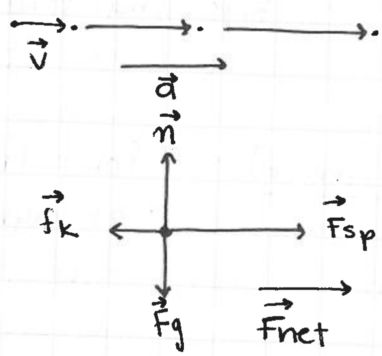
Box polled across floor across floor at constant velocity



PROBLEM 5.48



PROBLEM 5.51



Newton's First Law → in the absence of a net force ($\vec{F}_{net} = 0$), an object will continue to remain at rest or moving with a constant velocity (straight line at a constant speed)

If $\Sigma \vec{F} = 0$, then $\vec{a} = 0$
(really a special case of Newton's 2nd law)

Newton's Second (2nd) Law → $\vec{a} = \frac{\Sigma \vec{F}}{m}$

↗ $a_x = \frac{\Sigma F_x}{m}$ = $\Sigma F_x = ma_x$

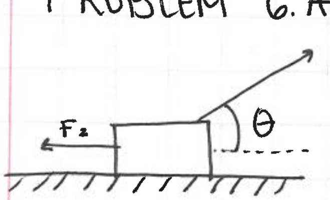
↘ $a_y = \frac{\Sigma F_y}{m}$ = $\Sigma F_y = ma_y$

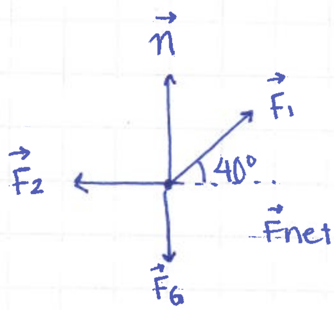
$\Sigma \vec{F} = m\vec{a}$ or $\vec{F}_{net} = m\vec{a}$

↳ $1N = 1\frac{kg\,m}{s^2}$

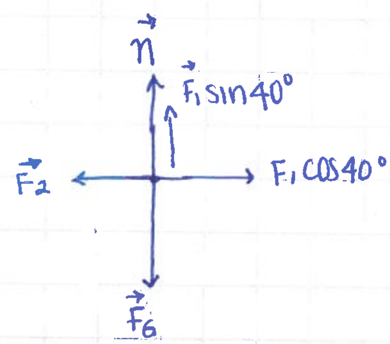
$1N \approx 0.225 lbs \approx 1/4$ pound

PROBLEM 6.A





→



$\Sigma \vec{F}_y = ma_y$　　$a_y = 0$

$\Sigma \vec{F}_y = 0$

$\vec{n} + \vec{F}_1 \sin 40° - \vec{F}_G = 0$

Note $F_G = \vec{w} = mg$

$\vec{n} + \vec{F}_1 \sin 40° - mg = 0$

$\vec{n} = mg - \vec{F}_1 \sin 40°$

$n = (50.0kg)(9.80m/s^2) - (225N)\sin 40°$

$n = 326N$