Reminders 07-16-09:

- 3rd Webassign due Tonight 11:59PM
- Hand in 3rd Assignment Problem Monday
- ***Exam 1 Chapters 1-3 Today***
- 4th Webassign Ch 4&5 Due Tuesday July 21
- Pick Up Graded Assignment in Box Outside My Office

Objectives:

- Forces
- Newton's Laws
- Free Body Diagrams
- Examples

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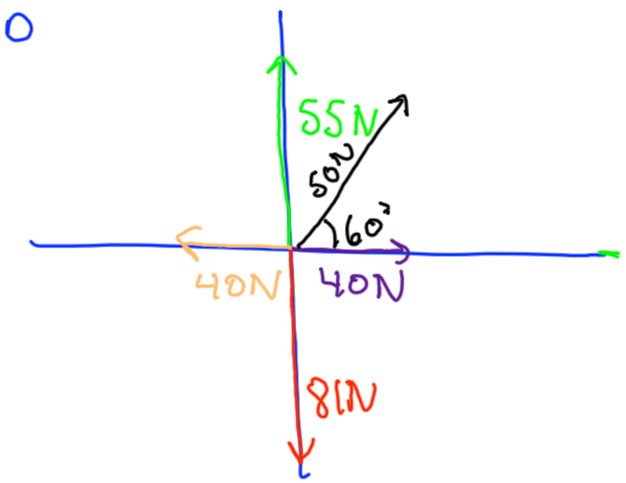
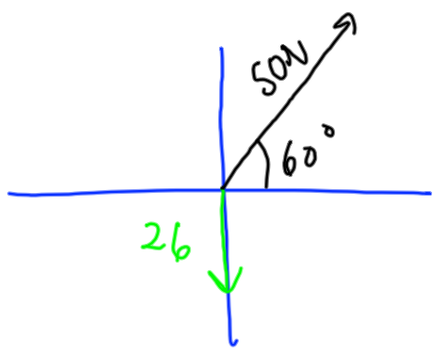




x	y
$50N\cos 60$	$50N\sin 60$
	$-26N$
$25N$	$27N$

$$\theta = \tan^{-1}\left(\frac{27}{25}\right) = 47^\circ$$

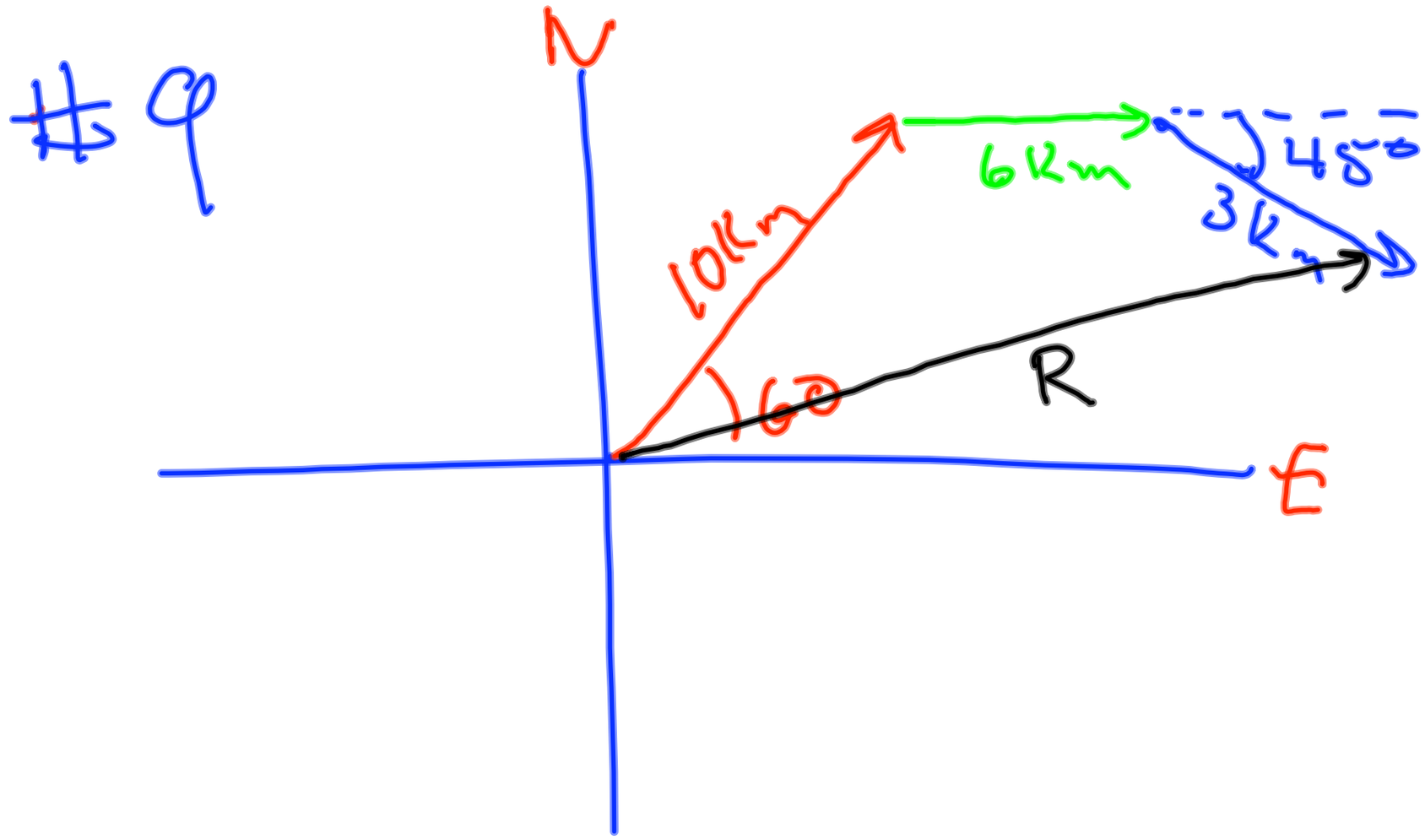
$$R = \sqrt{(25)^2 + (27)^2} = 36.8\ N$$

Equilibrant

36.8N at $(47^\circ + 180^\circ)$

36.8N at 217° from +x axis

#9



$$\arcsin(1) = \operatorname{asin}(1) = \underline{\sin^{-1}(1)}$$

Forces and Newton's Laws

- **Newton's 2nd Law**
  - Furthermore, Newton showed that when a net (unbalanced) force is acting on an object

causes $\sum \vec{F}_i = \vec{F}_{net} = m\vec{a}$ effect

  - where F_{net} is the net force acting on the object, a is the acceleration of the object, and ***m*** is a measure of the object's inertia.

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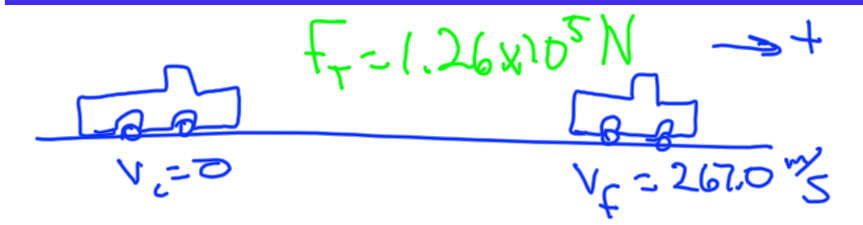
- A rocket accelerates from rest to 267.0 m/s in 6.345 s. The mass of the rocket is 2150 kg. Its average thrust is 1.26×10^5 N.
  - What is the rocket's average acceleration?
  - What is the net force acting on the rocket?
  - What is the frictional force acting on the rocket?



$$a_{avg} = \frac{\Delta v}{\Delta t} = \frac{267.0 - 0}{6.346\ s} = 42.08 \frac{m}{s^2}$$

$$F = ma = (2150 kg)\left(42.08 \frac{m}{s^2}\right)$$

$$= 9.05 \times 10^4 N$$

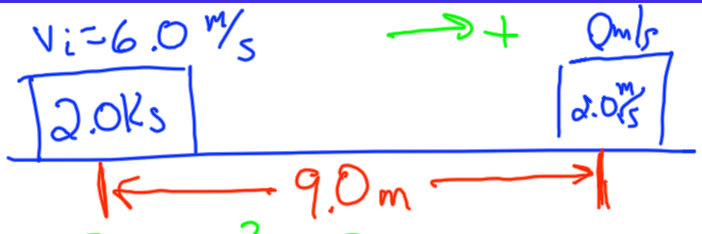
$$\underbrace{F_{THRUST} + F_{resistance}}_{Causes} = \underbrace{9.05 \times 10^4 N}_{effect}$$

$$F_{resistance} = F_{Thrust} - 9.05 \times 10^4 N$$

$$= (1.26 \times 10^5 - 9.05 \times 10^4) N$$

$$= 3.6 \times 10^4 N$$

- A 2.0 kg block is given a push such that its initial velocity is 6.0 m/s. It comes to a stop after traveling 9.0 m.
  - What is the object's acceleration?
  - What is the frictional force acting on the block?



$$v_f^2 - v_i^2 = 2a\Delta x$$

$$a = \frac{v_f^2 - v_i^2}{2\Delta x} = \frac{0 - \left(6.0\ \frac{m}{s}\right)^2}{2(9.0\ m)}$$

$$= -2.0\ m/s^2$$

If friction is only in force in horizontal dir.

then $f_f = F_{net} = ma$

$$= (2.0\ kg)\left(-2.0\ \frac{m}{s^2}\right)$$

$$= -4.0\ N$$

Examples

- A piece of paper that has not been crumpled, quickly reaches its terminal velocity. The piece of paper has a mass of 1.8 g. When it is crumpled, it falls at a rate of 8.2 m/s^2.
  - What are the forces acting on the paper?
  - What is the force of air friction when it reaches terminal velocity?
  - What is the force of air friction on the crumpled paper when its acc. is 8.2 m/s^2?

f_{air} at terminal velocity

$f_{air} - mg = 0$

$f_{air} = mg = (.0018 kg)(9.80 \frac{m}{s^2})$

$f_{air} - mg = -ma$

$f_{air} = mg - ma$

$= m(g - a)$

$= (.0018 kg)(9.80 \frac{m}{s^2} - 8.2 \frac{m}{s^2})$

$= (.0018 kg)(1.6 \frac{m}{s^2})$

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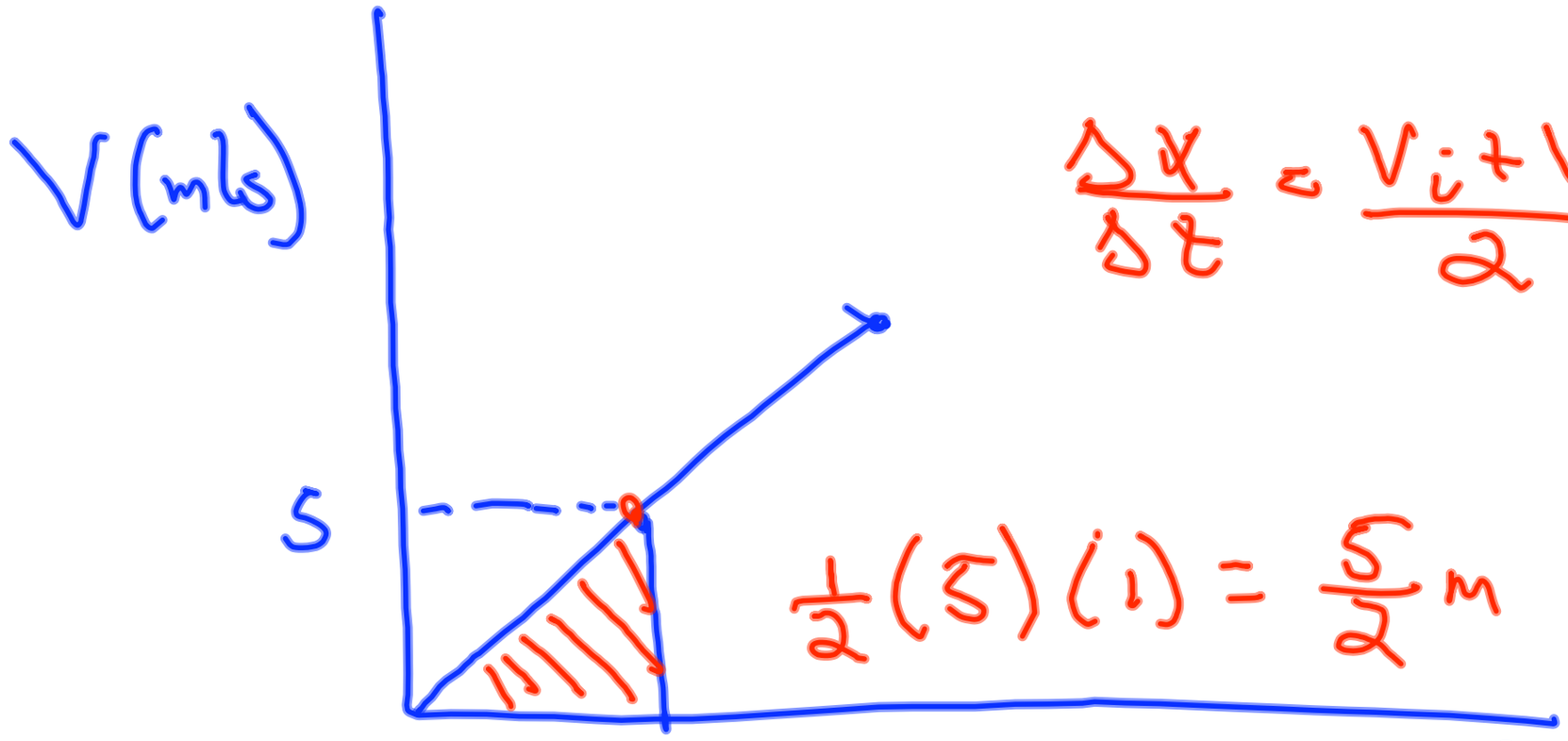

$$\frac{\Delta x}{\Delta t} = \frac{V_i + V_f}{2} = V_{avg}$$

$$\frac{1}{2}(5)(1) = \frac{5}{2}\,m$$

what is displacement from 0 to 1 s.