

# Start Your Semester Off Right

## Join us for a *FREE*

### Pre-Semester Prep Workshop Series

These interactive workshops will review all foundational material leading up to the specified course so you are better equipped to hit the ground running.

Synchronous in-person in the ESS suite  
& virtual via Zoom

*Pre-Calc/Trig Prep	Monday, August 14, 2023	10 AM - 12 PM
*Calc 1 Prep	Tuesday, August 15, 2023	10 AM - 12 PM
*Calc 2 Prep	Wednesday, August 16, 2023	10 AM - 12 PM
Calc 3 Prep	Thursday, August 17, 2023	10 AM - 12 PM
Math working session	Thursday, August 17, 2023	1 - 3 PM
Chem 1 Prep	Friday, August 18, 2023	10 AM - 12 PM
*Physics 1 Prep	Friday, August 18, 2023	1 - 3 PM

\*Attend these sessions & give feedback for access to a general knowledge exam.

RSVP is preferred but not required



[ess.unm.edu/events](https://ess.unm.edu/events) > August

or through our web-app - **succESS**



# Physics 1 Prep

## (for *PHYS 1310*)

*Presented by:*

Bryan & Paul Tice

# Semester-Long Engagement Opportunities

Many are open to pre- and full majors and have no citizenship or GPA requirements.

<https://goto.unm.edu/mentoring>

## MENTORING

- **BE a mentor**  
...to our incoming students in their transition into the University of New Mexico, the university setting, and Albuquerque.
- **HAVE a mentor\***  
...who is a STEM Professional working in the field to build your network and receive guidance and support.

*\*This program is open to UNM STEM Majors. Priority is given to Freshmen and Sophomores, but all levels are encouraged to apply.*

<https://goto.unm.edu/internships>

## INTERNSHIPS

Getting real-world experiences leads to your satisfaction with your undergraduate journey. Gain valuable hands-on experience while making professional connections.

*These programs are only open to School of Engineering Students.*

<https://goto.unm.edu/research>

## RESEARCH

- **EPICS @UNM**  
...to give back to the community, earn credit, and gain research experience all at the same time!
- **Student Research Experience Program**  
...to get hands-on research experience to understand how your courses fit in to real-world applications.

*These programs are only open to School of Engineering Students.*

 ENGINEERING STUDENT  
SUCCESS CENTER

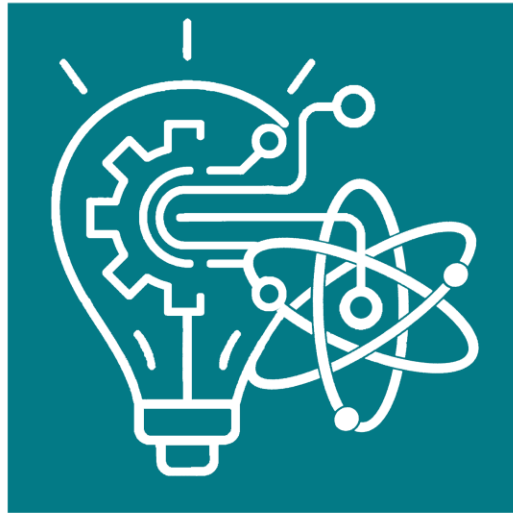
For more information, or to apply, visit:  
<https://ess.unm.edu/programs/current-students>



A tool for  
engineering your

SUCCESS

This web **APP** allows you  
to keep up to date on all  
we have to offer.



Put your learning into your own hands.



[success.unm.edu](https://success.unm.edu)

*Includes 1-click RSVP*



You are **WELCOME** to ALL events



# Fall 2023 Events

We are Student Success

## Summer Bridge Series

Covers foundational skills to help you succeed

## Pre-Semester Prep Series

Physics 1, Chem 1, Trig/Pre-Calc through Calc 3

## Semester Long Programs

Mentoring, Internships, Research

## Presentation Prep Series

What is a Conference?  
Designing Effective Presentations  
Data Visualization  
Delivering Presentations

## 1st & 2nd Year Student Events

Find Your Pack & Student Bash  
Study Skills  
Coffee Hour with Faculty - Fall Break  
How to make the most of your learning  
How to re-discover your confidence  
Manage Your Time  
Financial Fundamentals

## Spatial Visualization Series

Orthographic Views & Isometric Drawing  
One-Axis and Two-Axis Rotations  
Incl. Planes & Curved Surfaces, Reflect. Sym., & Write a Rule

## Career and Professional Development Events

Interviewing Basics  
STEM Mixer & Industry Networking Social  
Graduate School Preparation Workshop  
Landing an Internship  
Resume Critique & Mock Interviews  
Leadership in Engineering  
*...and industry site visits...*

## Lab Safety Series

Hazard Communication & Hazard Evaluation  
Hierarchy of Controls & Basics of PPE  
Chemical Waste Management

**WIN** a gift card. **GAIN** experience.  
**BUILD** your skill set. **ENHANCE** your resume.



And more! For more details, visit:  
[ess.unm.edu/events](https://ess.unm.edu/events) OR through our web-app - success



# Outline

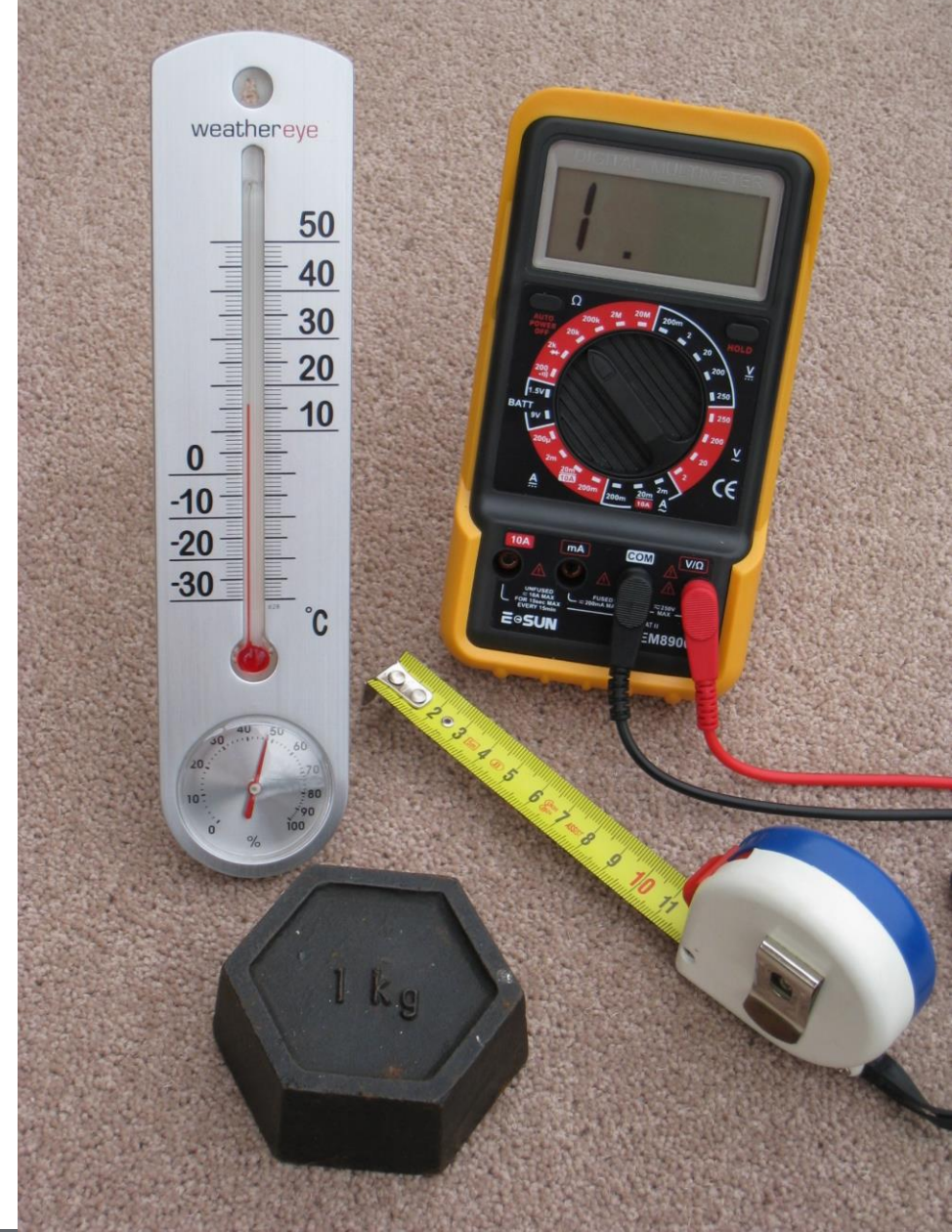
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- Units
- Graphs
- Motion
- Geometry/Trigonometry in physics
- How to approach word problems



# Units

# A standard of measurement of physical quantities



What are Units?

# Scalar

# Vector



*Volume*



*Time*



*Weight*



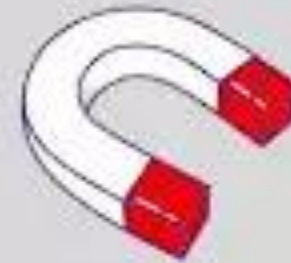
*Thrust*



*Temperature*



*Speed*

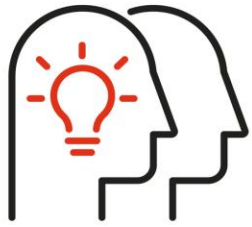


*Magnetic field*

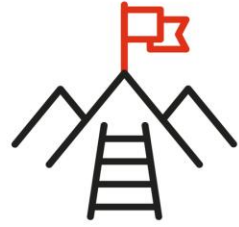


*Velocity*

What are physical quantities?



STIMULATING  
WORK



DETERMINATION



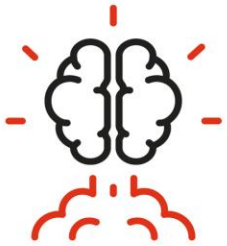
COURAGE



THOUGHTFULNESS



VISIONARY



CREATIVITY



EMPATHY



PROBLEM SOLVING



STRATEGIC  
PLANNING



COMMUNICATION



INSPIRATION



POSITIVITY



HONESTY



EXPERTISE



DISCIPLINE

What are NON-physical quantities?





What are SI units?

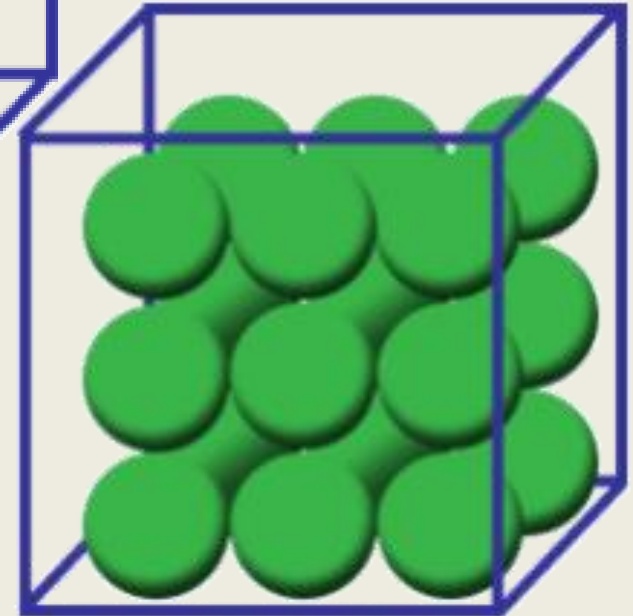
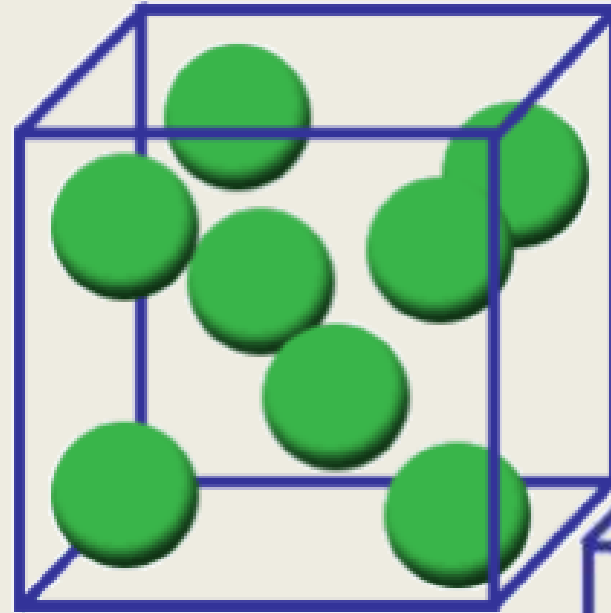
<b>Base Quantity</b>	<b>Name</b>	<b>Symbol</b>
Length	Meter	m
Mass	Kilogram	kg
Time	Second	s
Electric Current	Ampere	A
Temperature	Kelvin	K
Amount of Substance	Mole	mol
Luminous Intensity	candela	cd

Helpful Website: National Institute of Standards and Technology  
<https://physics.nist.gov/cuu/Units/units.html>

# Fundamental Base SI Units

Velocity = +25 m/s

Density = kg/m<sup>3</sup>



Derived Quantities

# Scalar

# Vector



*Volume*



*Time*



*Weight*



*Thrust*



*Temperature*



*Speed*



*Magnetic field*



*Velocity*

Scalar and Vector quantities

Is density scalar or  
vector?

Is Time (seconds)  
fundamental or  
derived?

Is Area ( $m^2$ )  
"fundamental or  
derived?"

What does 2500 m  
equal to in km?



What does 2500 m equal to in km?

What is  $10 \text{ g/cm}^3$

equal to in  $\text{kg/m}^3$  ?

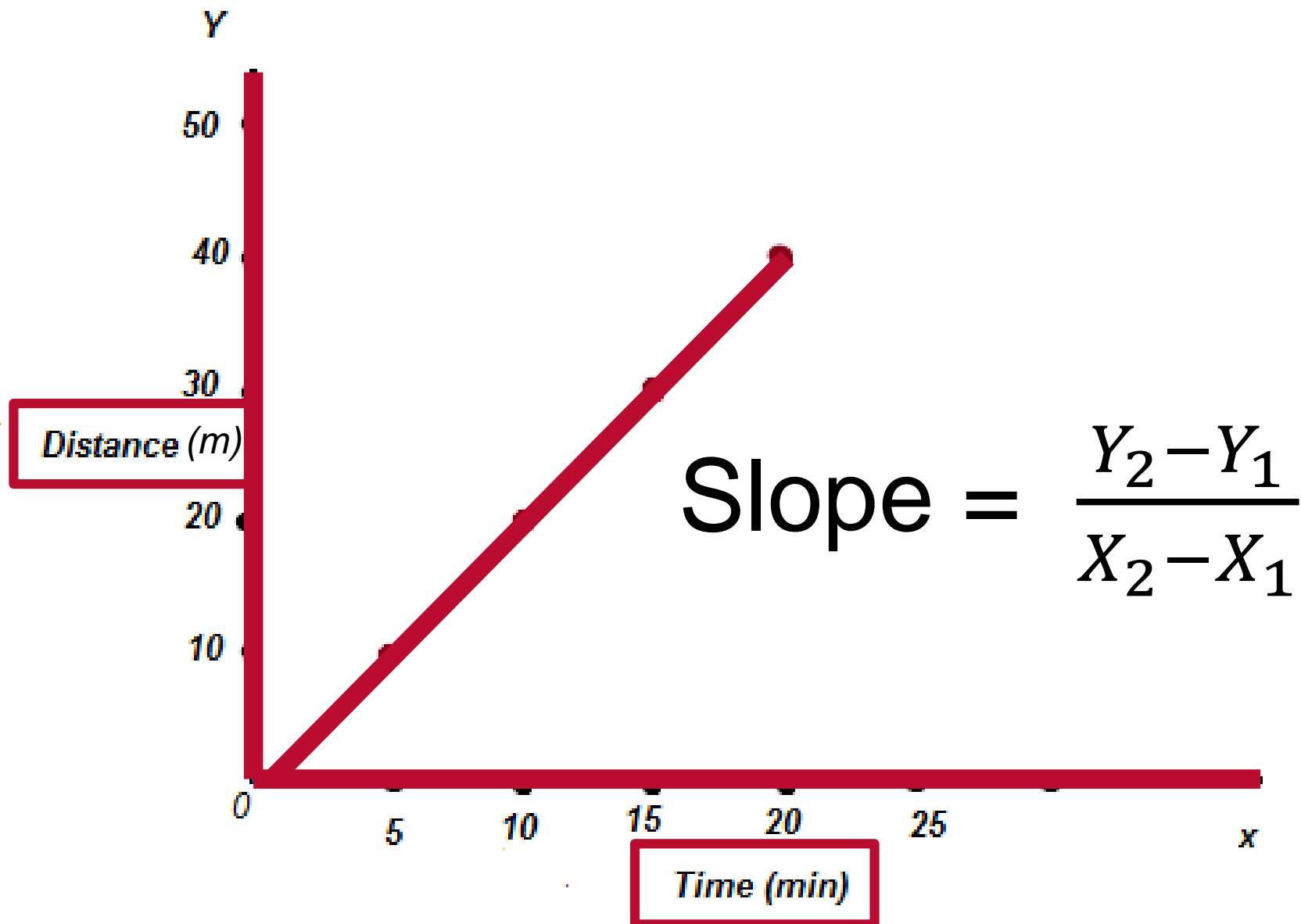
What is  $10 \text{ g/cm}^3$  equal to in  $\text{kg/m}^3$  ?



# Graphs

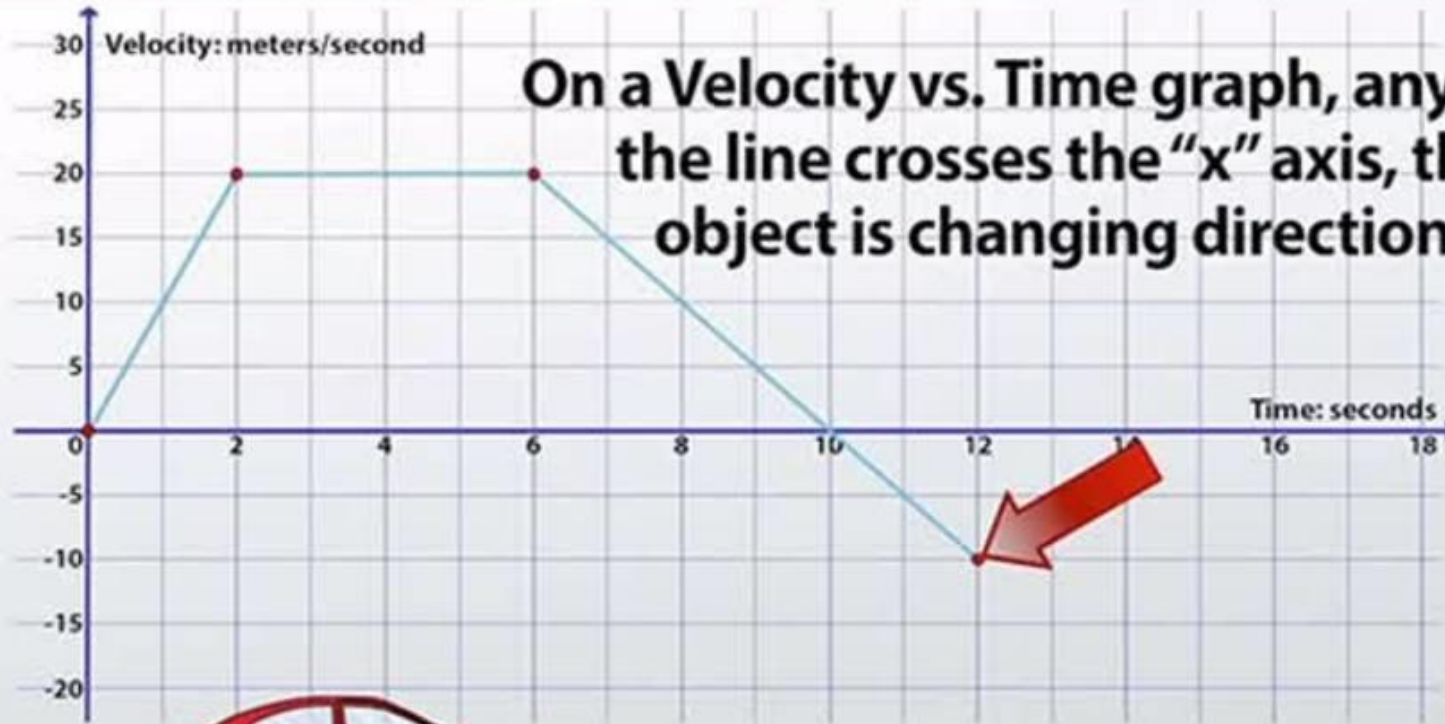
*(Independent variable) causes a change in (Dependent Variable) and it isn't possible that (Dependent Variable) could cause a change in (Independent Variable)*

The Basics



# How to read a graph

## THE SHAPE OF A VELOCITY VS. TIME GRAPH



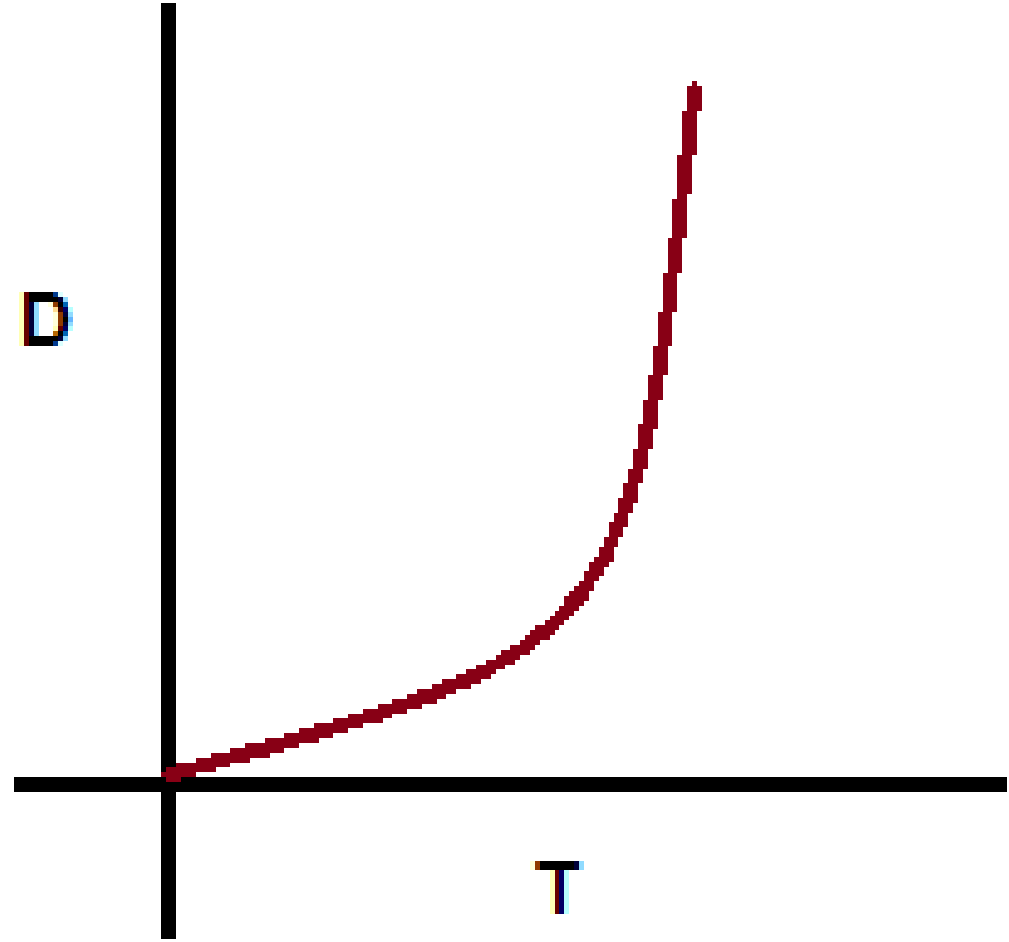
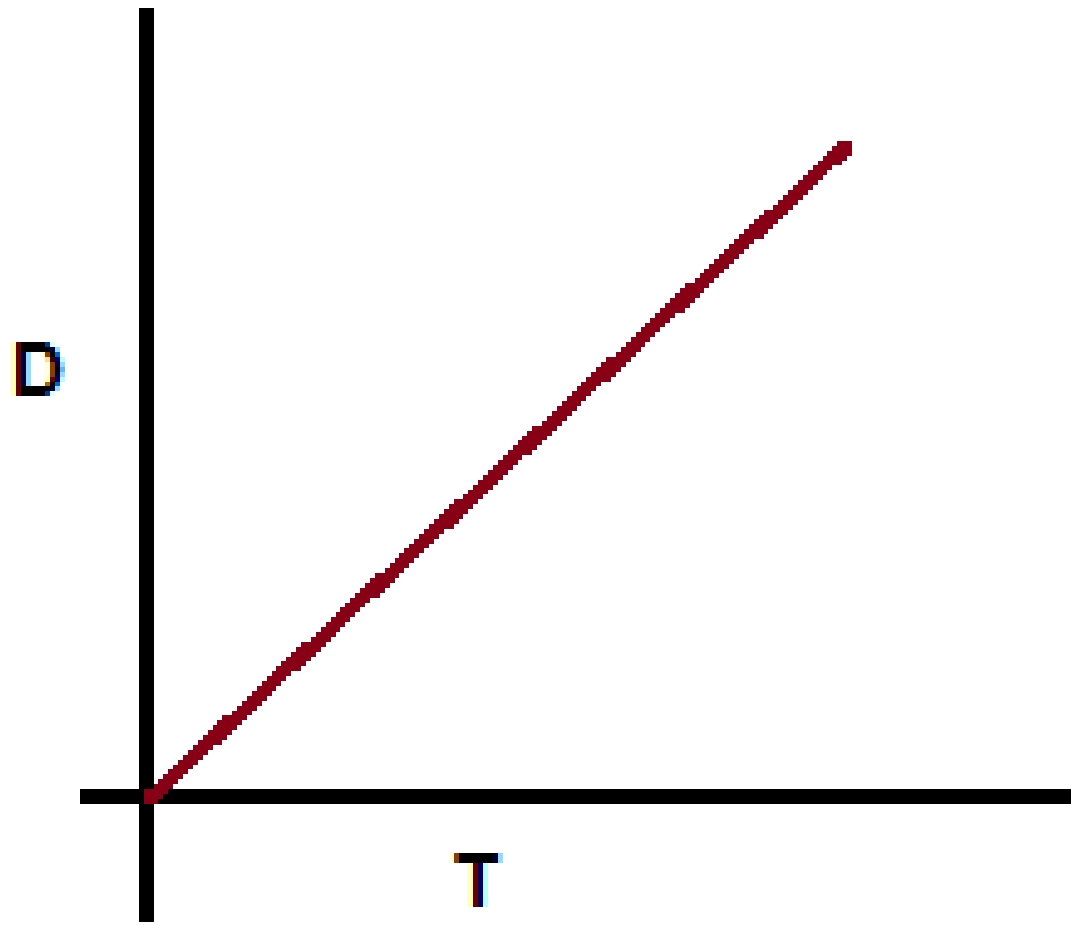
**On a Velocity vs. Time graph, any time the line crosses the "x" axis, the object is changing direction.**



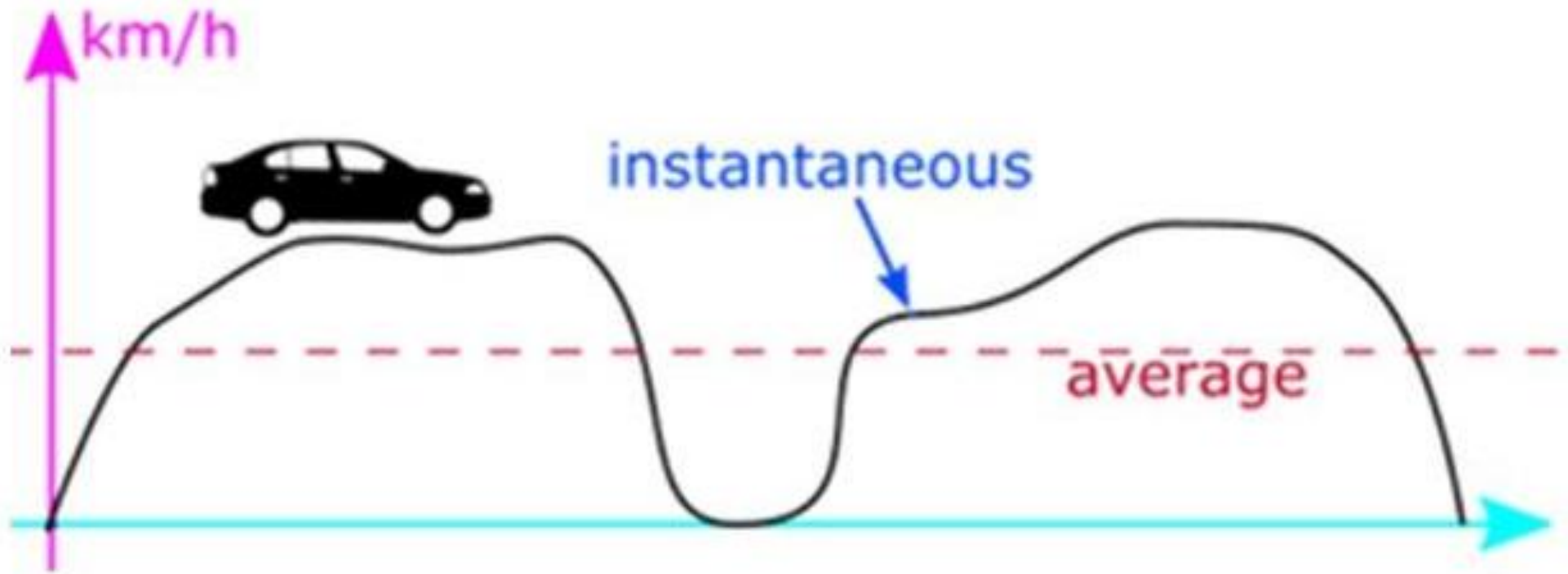
# Motion

# Distance-Time Graphs

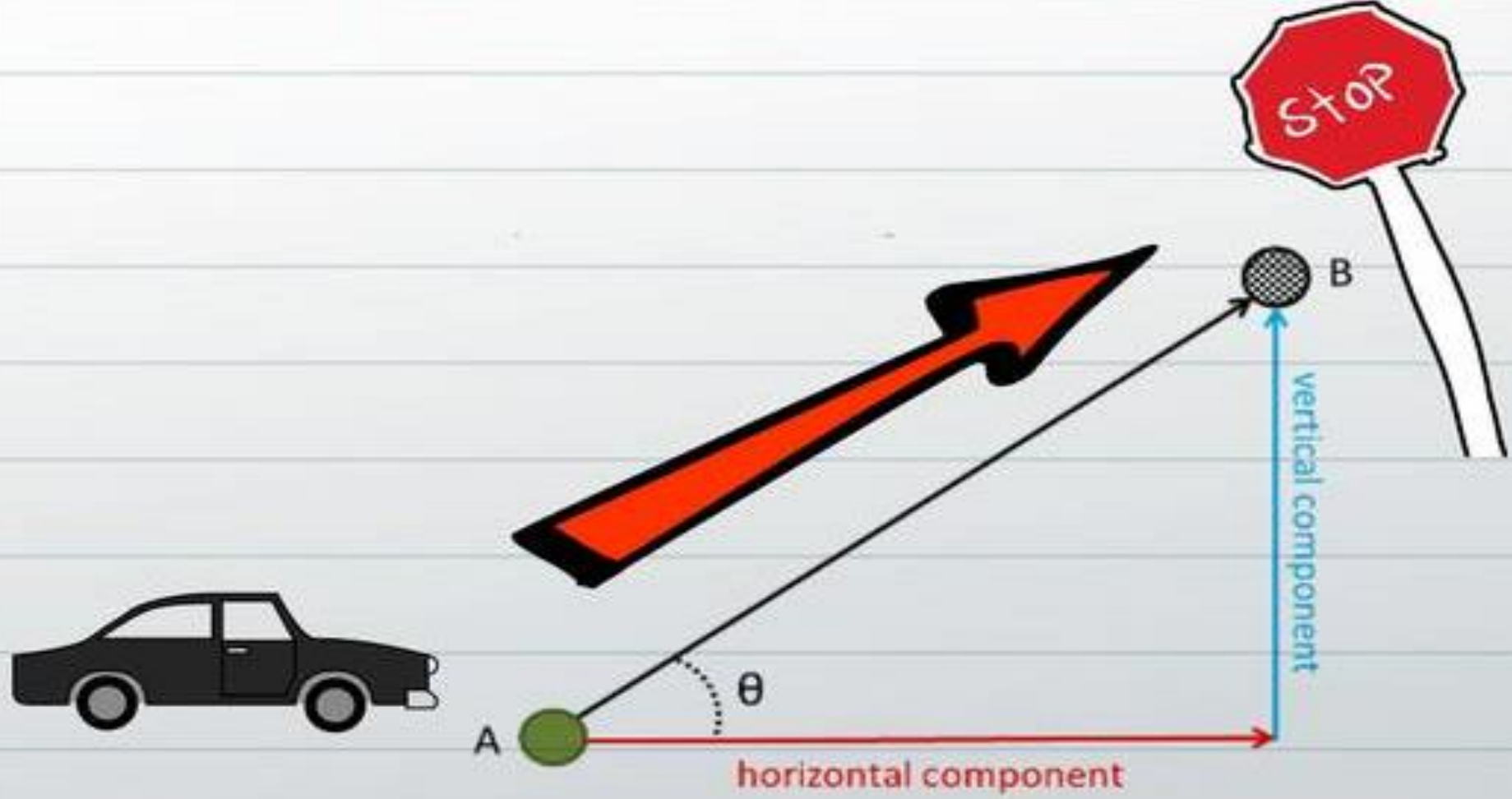




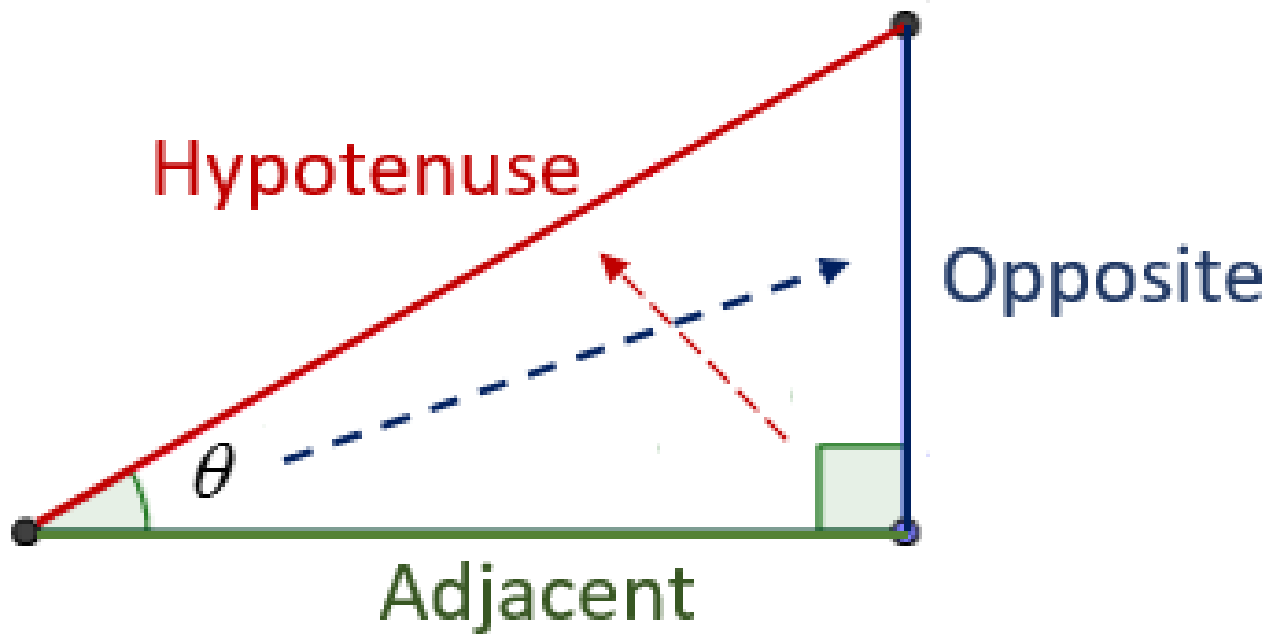
Variable Speed



Average and instantaneous speed



# Geometry & Trig in Physics



**SOH**  $\sin \theta = \frac{\text{Opposite}}{\text{Hypotenuse}}$

**CAH**  $\cos \theta = \frac{\text{Adjacent}}{\text{Hypotenuse}}$

**TOA**  $\tan \theta = \frac{\text{Opposite}}{\text{Adjacent}}$

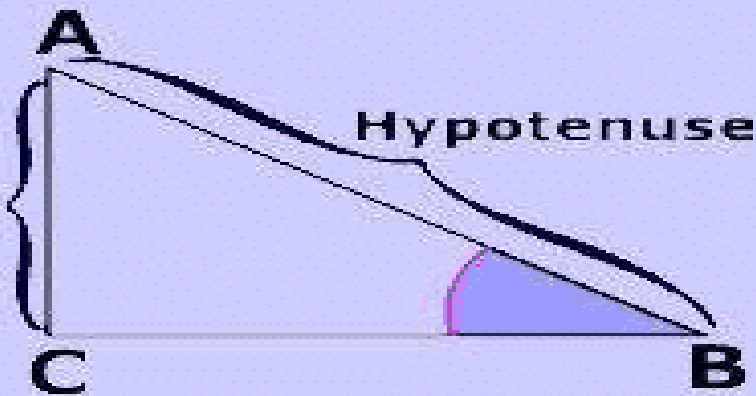
# Basic Trigonometric Functions

$$\text{Sin}(\theta) = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

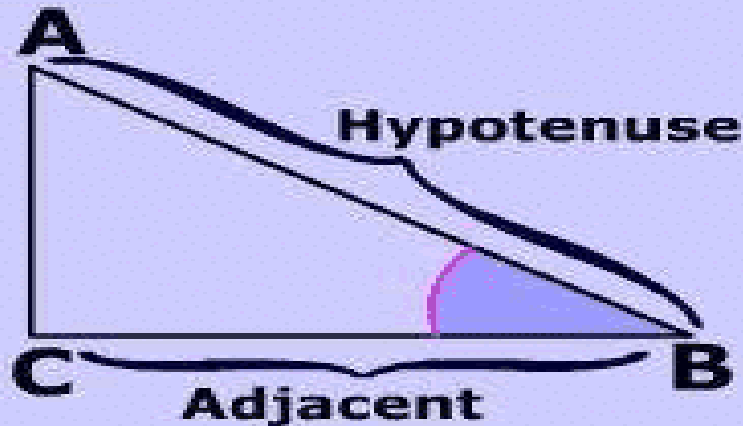
$$\text{Cos}(\theta) = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\text{Tan}(\theta) = \frac{\text{Opposite}}{\text{Adjacent}}$$

*Sine*



*Cosine*



*Tangent*



opposite  
hypotenuse

*SOH*

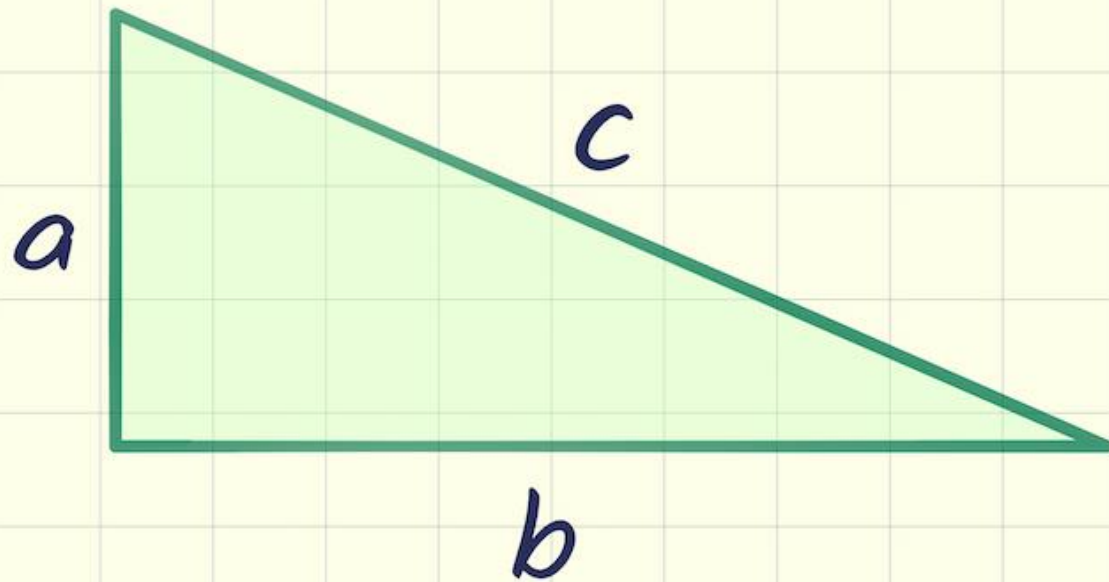
adjacent  
hypotenuse

*CAH*

opposite  
adjacent

*TOA*

SOH CAH TOA Rule

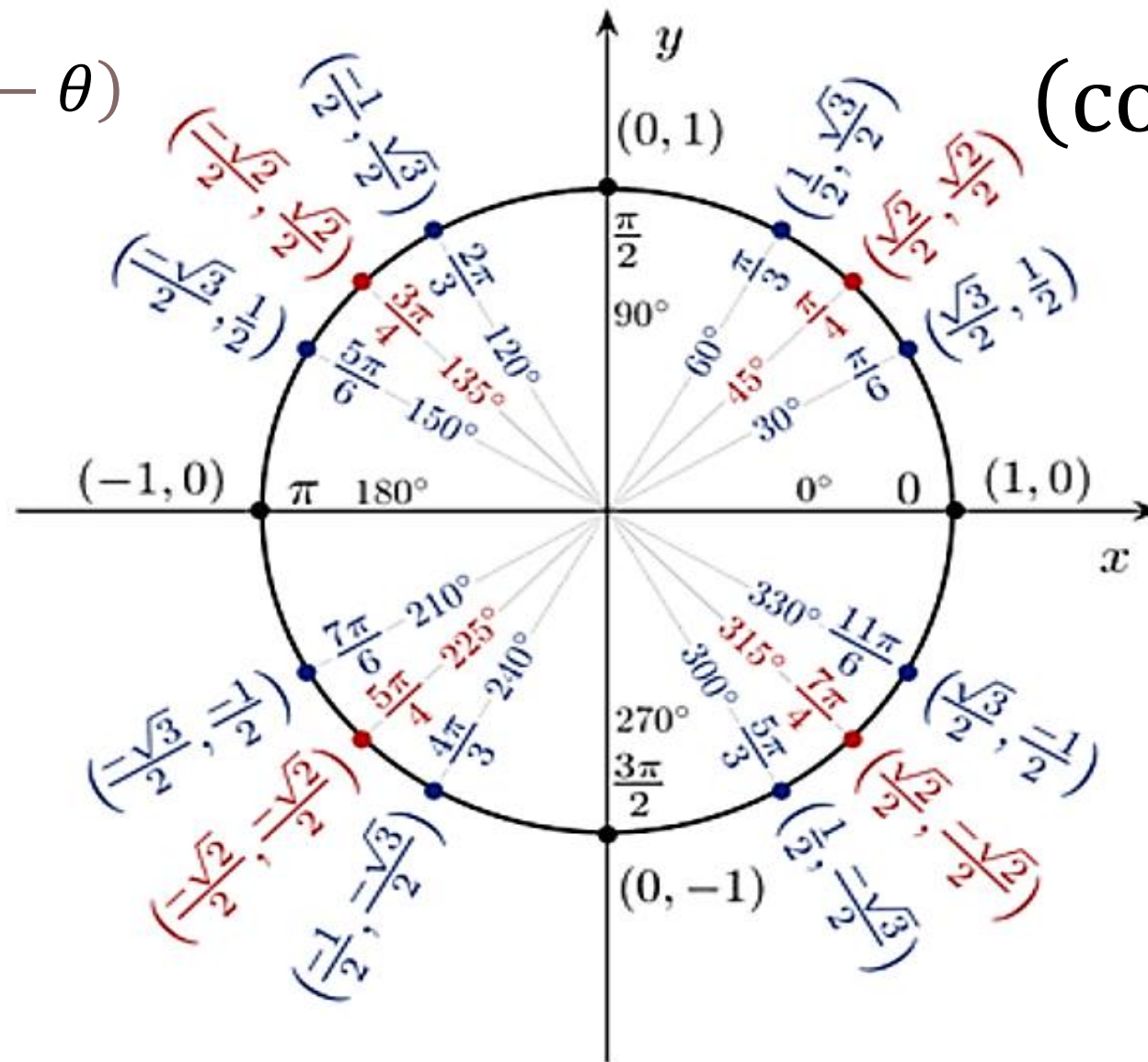


$$a^2 + b^2 = c^2$$

Pythagorean Theorem

$$\sin(\theta) = \cos(90^\circ - \theta)$$

$$(\cos(\theta), \sin(\theta))$$



Memorizing the Unit Circle. Ms. Pruitt's Left-Hand Trick. <https://youtu.be/LE6dmczMc68>

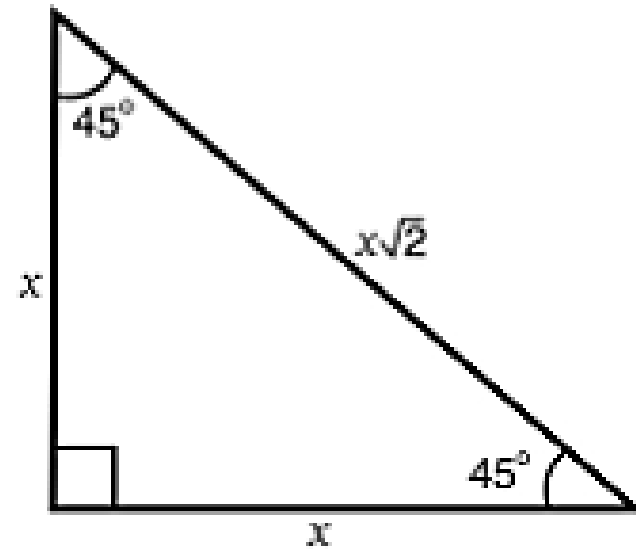
# The Unit Circle



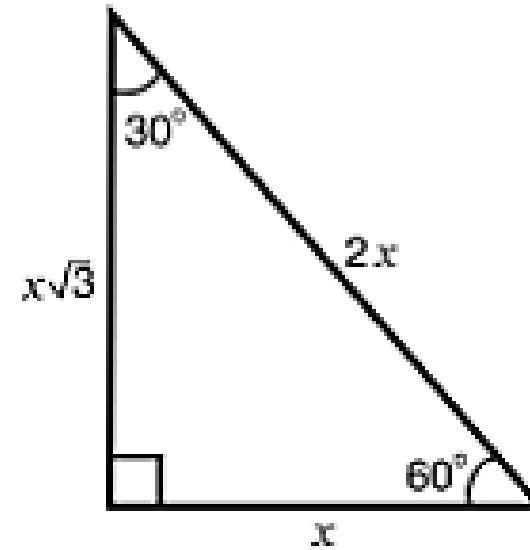
<https://youtu.be/LE6dmczMc68>



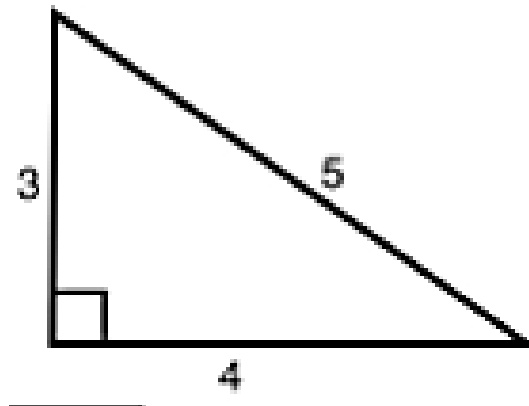
**45-45-90 Triangle**



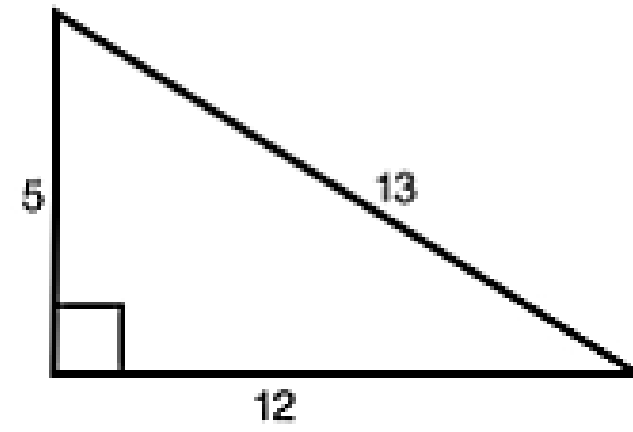
**30-60-90 Triangle**



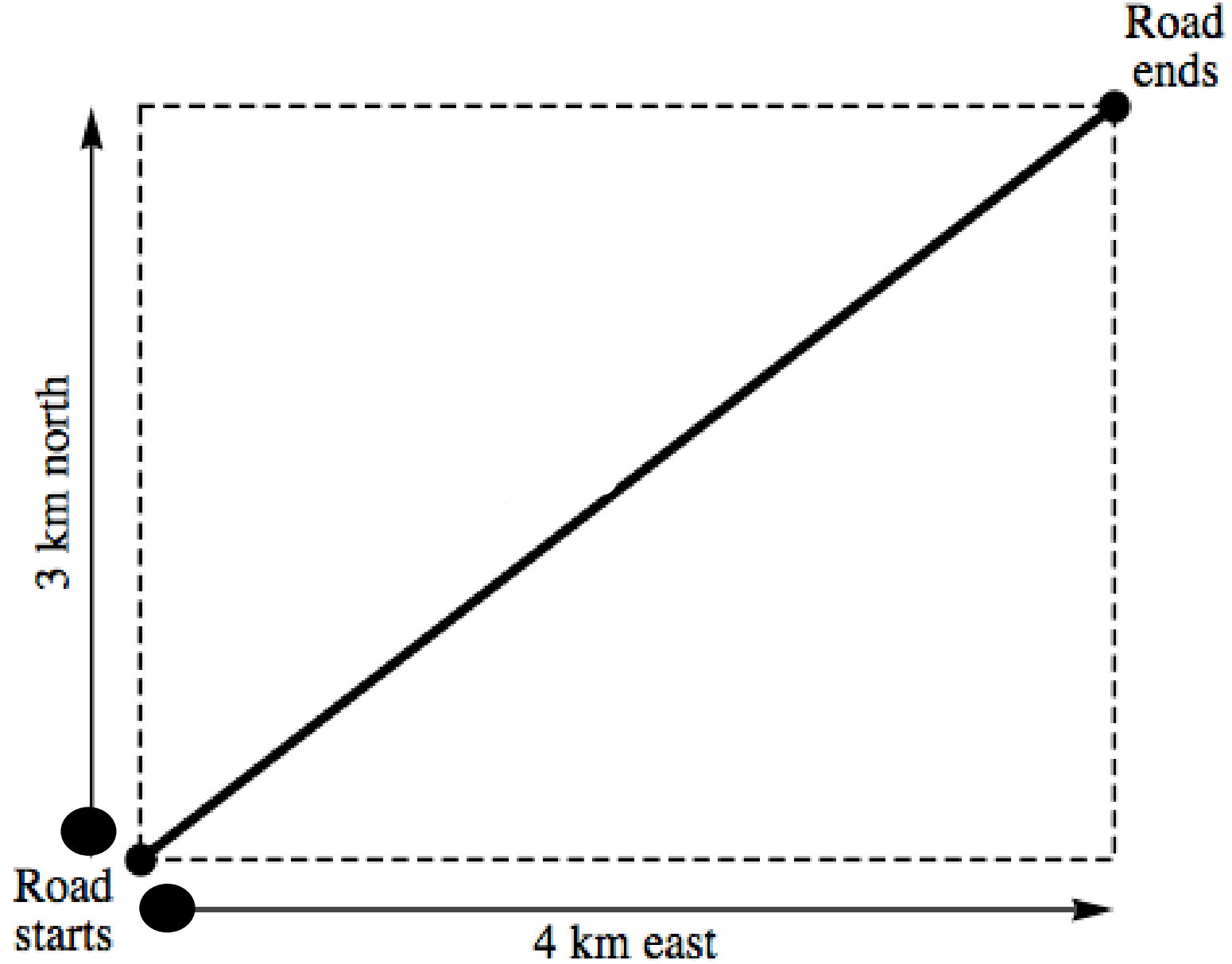
**3-4-5 Triangle**



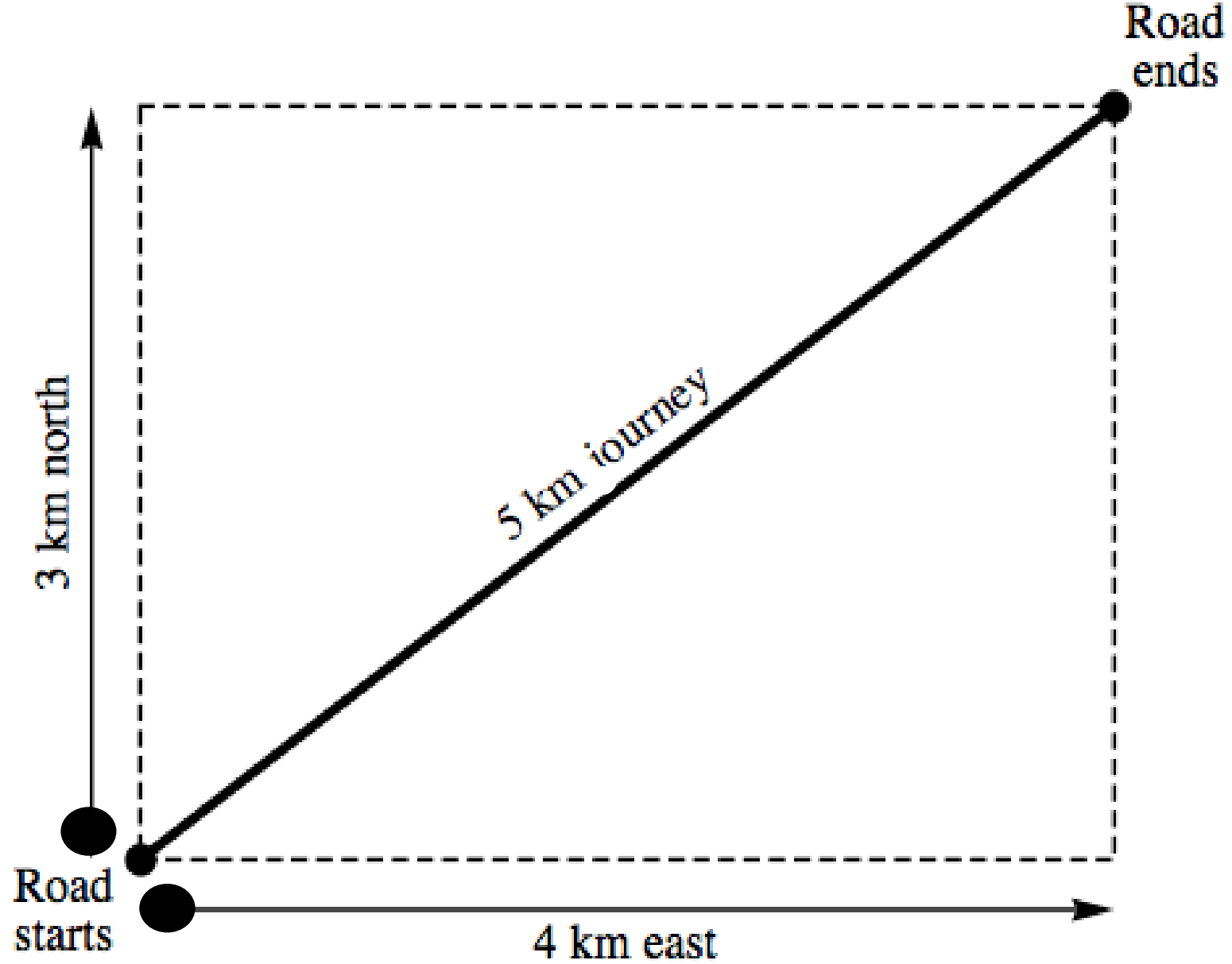
**5-12-13 Triangle**



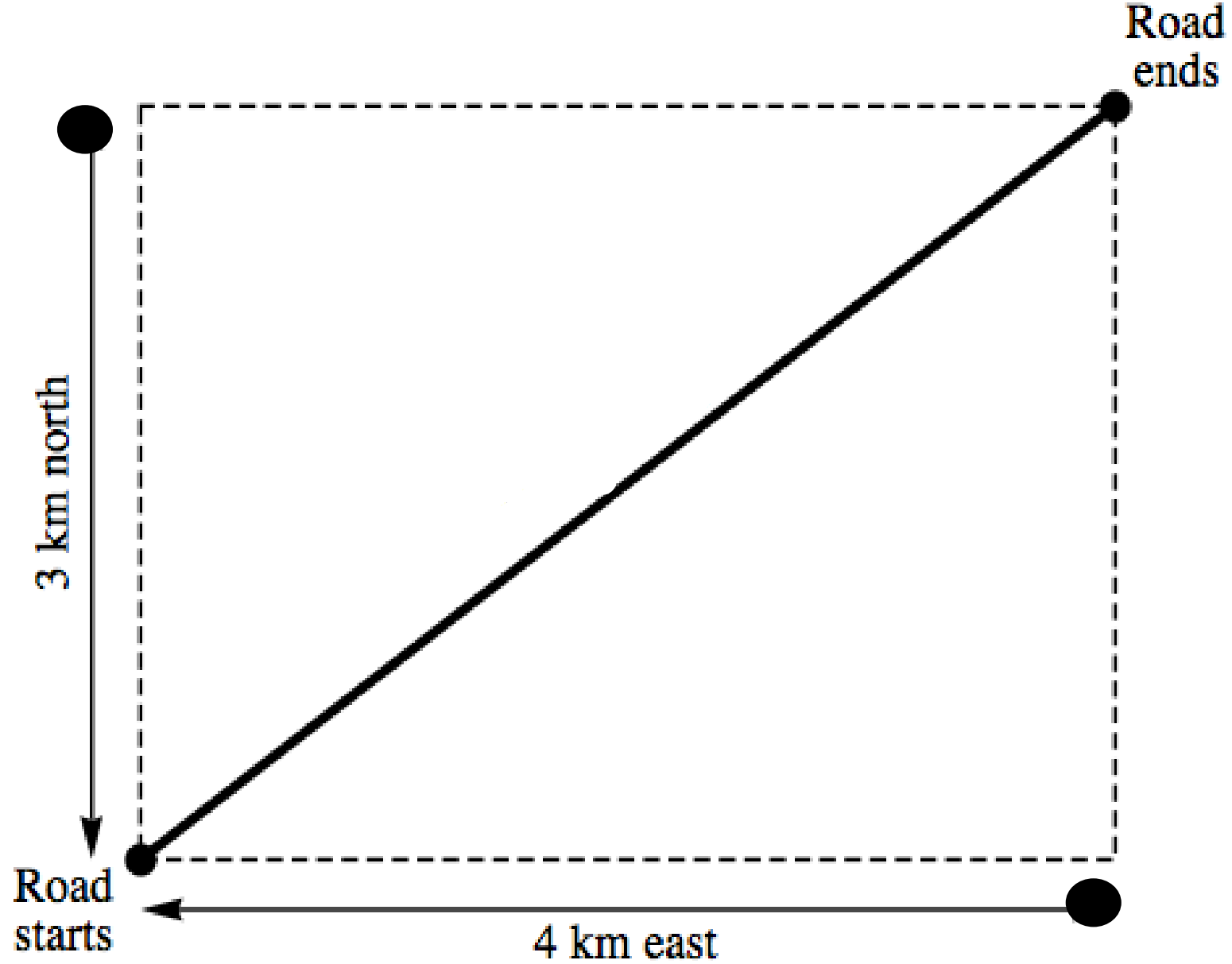
# Special Triangles



Determine the Magnitude and direction



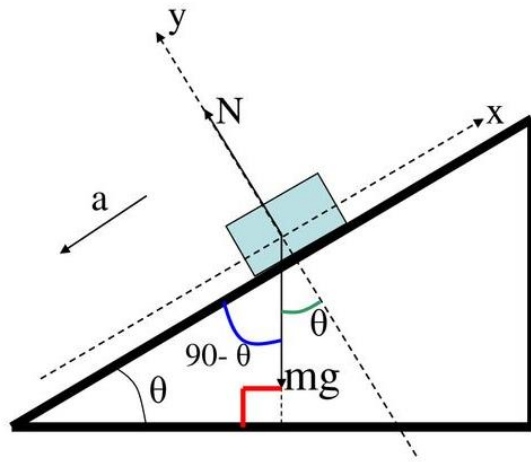
Determine the Magnitude and direction



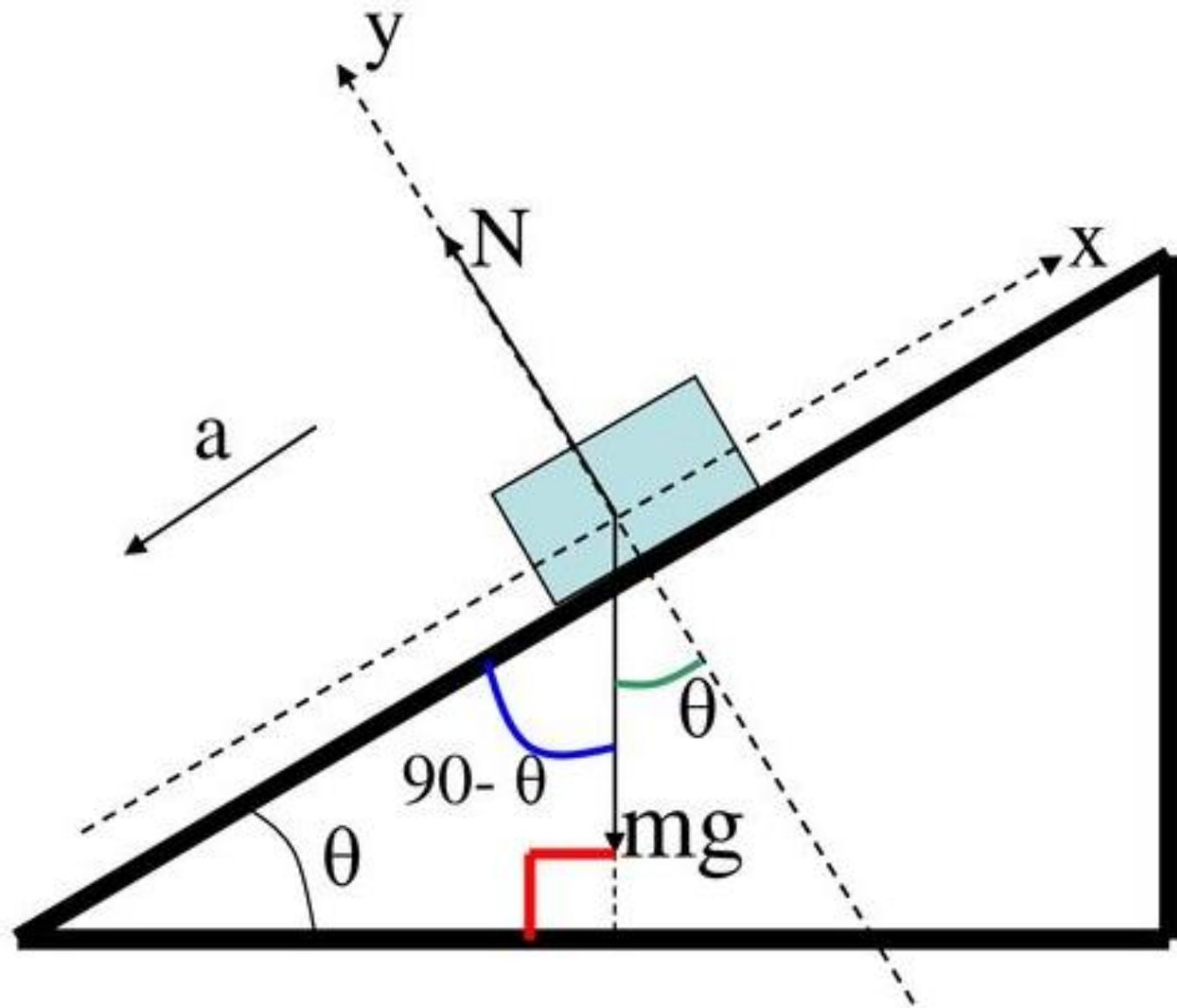
Determine the Magnitude and direction

A **Force** is a push or a pull that causes an object with mass to move faster (accelerate), or slower (decelerate), change direction, or deform.

Forces are vector quantities because they have a magnitude and direction.



Forces



Forces

# Types of Forces:

- Applied Force
  - Pull (Tension)
  - Push (Compression)
- Normal Force (Perpendicular to the Surface)
- Drag Force (Resistance to motion in Air or Water)
- Friction (Always moves opposite to motion)
- Spring Force
- Weight (  $\text{mass} * \text{acceleration}$  )





Sir Isaac Newton

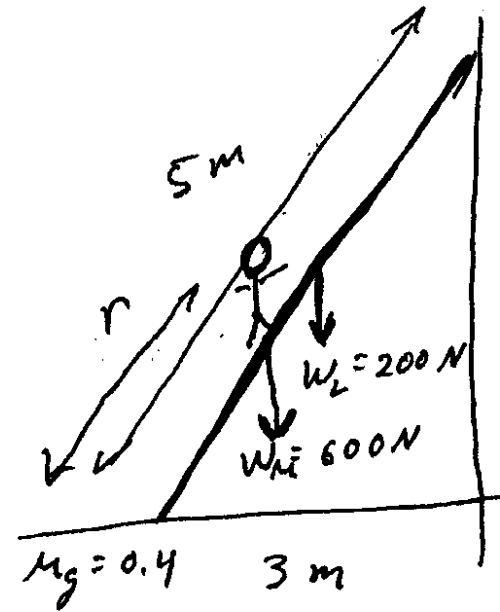
Force=Mass\*Acceleration

$$[N] = [kg] * \left[ \frac{m}{s^2} \right]$$

$$\sum \vec{F} = m\vec{a}$$

Sir Isaac Newton and Newton's Second Axiom

A uniform ladder 5 m long weighing 200 N is leaning against a smooth vertical wall with its base 3 m from the wall. The coefficient of static friction between the bottom of the ladder and the ground is 0.4. How far measured along the ladder, can a 600 N man climb before the ladder starts to slip?



# Word Problems

### Quadratic Formula

$$ax^2 + bx + c = 0$$

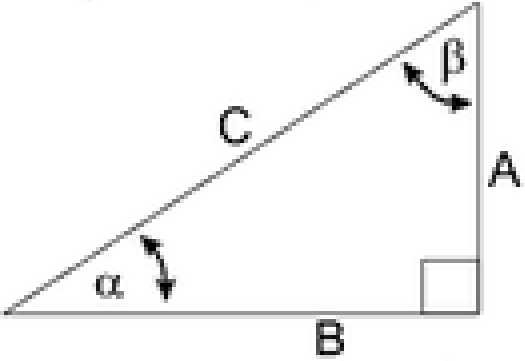
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

### Geometry

Circle: circumference= $2\pi R$ , area= $\pi R^2$

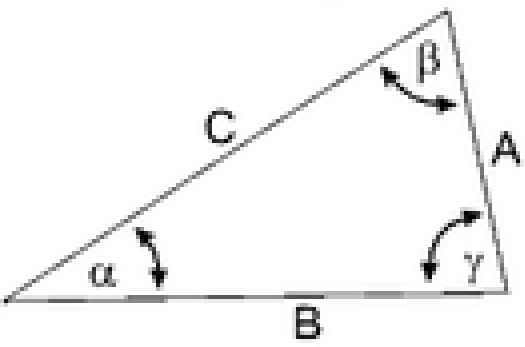
Sphere: area= $4\pi R^2$ , volume= $4\pi R^3/3$

### Trigonometry



$$\sin \alpha = \frac{A}{C}, \quad \cos \alpha = \frac{B}{C}$$

$$\tan \alpha = \frac{A}{B}$$



$$\frac{\sin \alpha}{A} = \frac{\sin \beta}{B} = \frac{\sin \gamma}{C}$$

$$A^2 + B^2 - 2AB \cos \gamma = C^2$$

### Polar Coordinates

$$PE = -G \frac{Mm}{r}, \quad \Delta PE = mgh(\text{small } h), \quad F = G \frac{Mm}{r^2} = mg$$

$$a = \frac{v^2}{r}, \quad \frac{GM}{4\pi^2} = \frac{R^3}{T^2}$$

### Rotational Motion & Gravity

$$v = \omega r = \frac{2\pi r}{T}, \quad \omega = 2\pi f = \frac{2\pi}{T}, \quad f = 1/T$$

$$\alpha = \frac{\omega_f - \omega_0}{t} = \frac{a}{r}$$

$$L = I\omega = mvr \sin \theta, \quad (\theta = \text{angle between } v \text{ and } r)$$

$$KE = \frac{L^2}{2I} = \frac{1}{2} I\omega^2$$

$$\tau = rF \sin \theta, \quad I\alpha = \tau, \quad I_{\text{point}} = mR^2$$

$$I_{\text{cyl. shell}} = mR^2, \quad I_{\text{sphere}} = \frac{2}{5} mR^2, \quad I_{\text{solid cyl.}} = \frac{1}{2} mR^2.$$

### Gases, liquids and solids

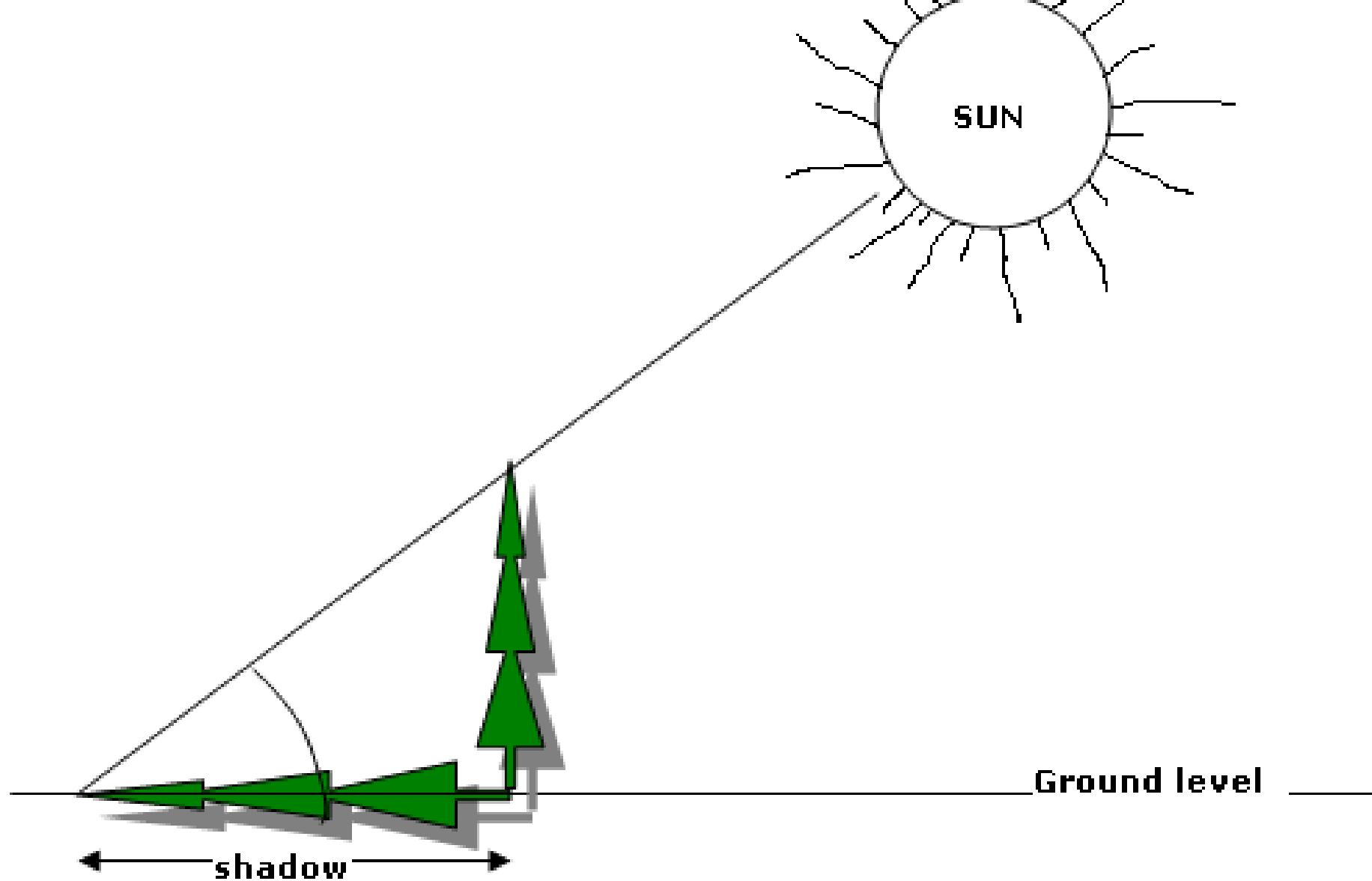
... 1, 2, 3, ...

A bus traveled on a level road for 6 hours at an average speed 20 miles per hour faster than it traveled on a winding road. The time spent on the winding road was 3 hours. Find the average speed on the level road if the entire trip was 462 miles.

$$d = rt$$

categories	rate	time
level road 6hr	$x + 20$	6 hr
winding rd. 3hr	$x$	3 hr

Step 1: Identify variables/ physical quantities



Step 2: Draw a picture

A rectangular field is to be fenced off next to a straight wall, with fencing on three sides, with the wall making the fourth side. Exactly 150 feet of fencing is to be used. Express the area of the field as a function of its width.

Given:  $P = 150 \text{ ft}$  (3 sides)  
 $x = \text{width}$   
 $y = \text{length}$

**Step 3: Identify given information**

Three coffees and two muffins cost a total of 7 dollars.  
Two coffees and four muffins cost 8 dollars. What is the individual price for a single coffee and a single muffin?

**Let  $x$  = cost of a single coffee**

**Let  $y$  = cost of a single muffin**

**Step 4: Identify the unknowns**

# CONQUER THE PROBLEM!!!

•BEFORE•

## PLAN

- \*Read & visualize
- \*Reread & code
- \*Sketch & predict

What is the problem asking?  
What would be a reasonable answer?

•DURING•

## SOLVE

- \*Show my strategies
- \*Show my thinking

Are my strategies effective and efficient?  
Is there another way to solve?

•AFTER•

## CHECK

- \*Check my work.
- \*Go back to the question.
- \*Answer in a complete sentence.

Did I answer the question?  
Does my answer make sense?

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Step 5: Begin strategizing for the answer based on the given information



What is the average velocity of the car if it travels 60 km in 1.5 hours?

What is the average velocity of the car if it travels 60 km in 1.5 hours?

Displacement:  $= x_2 - x_1 = 60 \text{ km}$

Time = 1.5 hours

Average Velocity = Displacement / Time



Word Problem 1

A plane lands at a speed of 68 m/s and slows down at a rate of  $4\text{m/s}^2$ . How much runway is needed to stop the plane?

Word Problem 2

A plane lands at a speed of 68 m/s and slows down at a rate of  $4\text{m/s}^2$ .  
How much runway is needed to stop the plane?

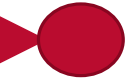
Word Problem 2

$x_{\text{initial}}$	<b>0 m</b>	$x_{\text{final}}$	
$t_{\text{initial}}$	<b>0 s</b>	$t_{\text{final}}$	
$v_{\text{initial}}$	<b><math>68 \frac{m}{s}</math></b>	$v_{\text{final}}$	<b><math>0 \frac{m}{s}</math></b>
$a_{\text{initial}}$	<b><math>4 \frac{m}{s^2}</math></b>	$a_{\text{final}}$	<b><math>4 \frac{m}{s^2}</math></b>

Word Problem 2: Write all the given quantities



$x_1$



$x_2$

## Word Problem 2

A plane lands at a speed of 68 m/s and slows down at a rate of  $4\text{m/s}^2$ . How much runway is needed to stop the plane?

$x_{\text{initial}}$	0 m	$x_{\text{final}}$	
$t_{\text{initial}}$	0 s	$t_{\text{final}}$	
$v_{\text{initial}}$	$68 \frac{\text{m}}{\text{s}}$	$v_{\text{final}}$	$0 \frac{\text{m}}{\text{s}}$
$a_{\text{initial}}$	$4 \frac{\text{m}}{\text{s}^2}$	$a_{\text{final}}$	$4 \frac{\text{m}}{\text{s}^2}$



$$x_1 = 0\text{m}$$

$$x_2$$

Word Problem 2: Write all the given quantities



A plane lands at a speed of 68 m/s and slows down at a rate of  $4\text{m/s}^2$ . How much runway is needed to stop the plane?

$x_{\text{initial}}$	0 m	$x_{\text{final}}$	578 m
$t_{\text{initial}}$	0 s	$t_{\text{final}}$	17 s
$v_{\text{initial}}$	$68 \frac{\text{m}}{\text{s}}$	$v_{\text{final}}$	$0 \frac{\text{m}}{\text{s}}$
$a_{\text{initial}}$	$4 \frac{\text{m}}{\text{s}^2}$	$a_{\text{final}}$	$4 \frac{\text{m}}{\text{s}^2}$



$$x_1 = 0\text{m}$$

$$x_2$$

Word Problem 2: Write all the given quantities

# Questions?

Give  
feedback.

Win a gift  
certificate!



[goto.unm.edu/ess-feedback](https://goto.unm.edu/ess-feedback)

Don't forget to follow up on social media.

