PHYS 1211: Intro. Physics I
Mechanics, Waves (and Thermo)

- Corequisite: MATH 2250 (or 2250E, 2300H, 2400/H)*** also experts in Algebra, Geometry, Trigonometry**, and and familiarity with Basic Chemistry
- Not available for students with credit in PHYS 1111
- Introduction to Newtonian mechanics and wave motion using calculus for engineers and scientists
- Aims of course:

- teach you the fundamental principles/laws of physics

- teach you how to apply these principles to practical problem solving (useful in other fields)

Physics is Science

The Scientific Method was and is applied in the formulation of physics

What is the Scientific Method? (http://teacher.pas.rochester.edu/phy_labs/appendixe/appendixe.html)

1. Observation/description of natural phenomenon
2. Formulate hypothesis to explain phenomenon
3. Use hypothesis to predict other (related) phenomena
4. Perform experiment/observation to test hypothesis
5. Repeat (3) and (4) many times
6. If step (5) is all correct, then the hypothesis (2) may be regarded as a law or theory of nature
7. If (5) is incorrect, start over at (2)

What is Physics?

Definition: the science that deals with matter and energy in terms of motion and interactions

Operational definition: given some experimental observation, a theory is developed to describe it. The theory is then used to make predictions, which are then tested with further experiments or observations.

A Building-Up of Principles

Algebra -> geometry -> trigonometry -> calculus -> **kinematics -> forces -> work/energy -> waves ->** thermodynamics -> … -> optics -> electricity/magnetism -> …

Some examples: Men's Marathon (Tokyo 2020 Olympics)

Gymnastics (Tokyo 2020 Olympics)

The Classification of Physics

Classical Physics
- everyday speeds and sizes (Newton, …)

Relativistic Physics
- Very fast (Einstein, …)

Quantum Physics
- very small (Schroedinger, …)

Relativistic Quantum Physics – very small and very fast (Dirac, …)

- Quantum Electrodynamics
- Quantum Chromodynamics
- Supersymmetry
- String theory, etc.

Chapter 1: The Basics

Things you should already know or will need to learn about:

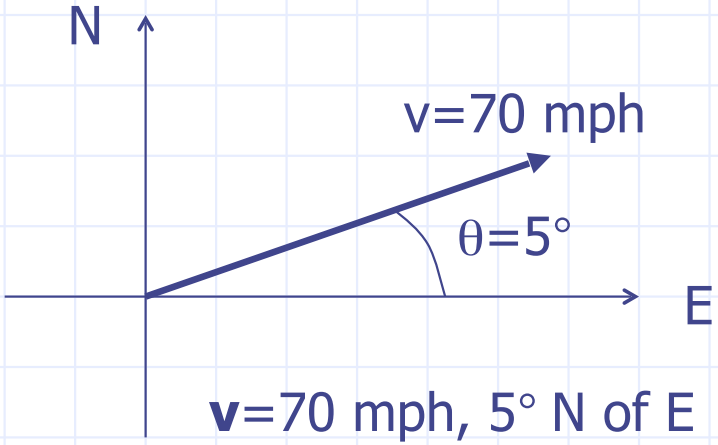
1. Units: SI will be used (mostly), British units will be used occasionally (foot, pound…)
2. Significant figures (covered in lab)
3. Dimensional analysis
4. Order-of-magnitude estimates

Vectors and Scalars

Physical Quantities:

1. Scalar – a quantity that can be completely specified by a single number or magnitude (and units); e.g., temperature, mass, speed (70 mph), energy, …
2. Vector – a quantity which has both a magnitude and a direction (and units); e.g., force, velocity, displacement, …

Physical quantities have explicit definitions



Vector Addition and Subtraction

The addition of vectors is not the same as the addition of scalars.

Consider the vectors **A** and **B**

The vector sum = resultant = **R** = **A** + **B**

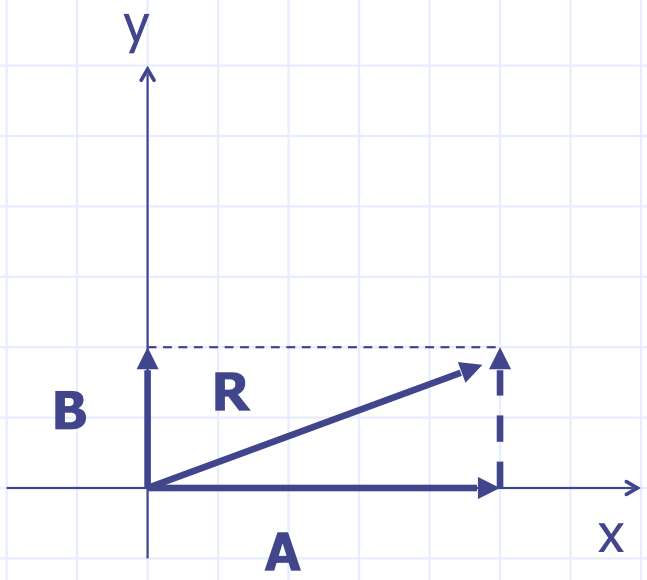
but, $R \neq A + B$

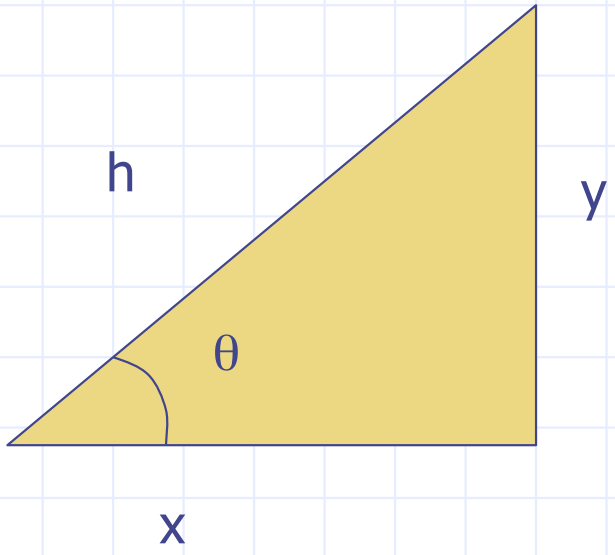
Example. A=50.0 m, B=20.0 m

$R \neq 70.0$ m

Use Pythagorean theorem

$R = \sqrt{(A^2+B^2)} = 53.9$ m





Direction?

Use trigonometric functions

$x=h\cos\theta$, $y=h\sin\theta$, $y=x\tan\theta$

Three ways:

$\theta = \tan^{-1}(B/A) = 21.8°$ <- dimensionless

$\theta = \cos^{-1}(A/R) = 21.8°$ (or 21.7° for low precision)

$\theta = \sin^{-1}(B/R) = 21.8°$

Vector: **R** = 53.9 m @ 21.8°