

## Review of PHY2053

### How do you review all this material?

#### Chapter 1 Introduction

##### Why study physics?

- Physics is a fundamental science. Knowledge of physics will help your understanding in other fields.
- Technology relies on physics. Think of all the places in your life impacted by technology.
- Studying physics helps your analytical reasoning ability. Applying physical principles to a vast array of different situations develops your problem solving ability.
- A good understanding of science will make you a better citizen.
- Physics reveals some the beauty and grandeur of the universe. It is also cool and fun.

##### Talking Physics

Physics uses common words in specific ways: force, energy, work, power, impulse, momentum, stress, strain, mass, etc.

##### Use of Mathematics

Math is a very important part of physics, but this is not a math class.

##### Units

Measurements must be expressed with units. There are few dimensionless parameters:  $\mu$  and  $\theta$  (in radians) but you need units. We mostly used SI units.

##### Problem Solving (p. 13)

1. Read the problem *carefully* and *all the way through*. Identify the goal of the problem: What are you trying to find?
2. Reread the problem one sentence at a time and draw a sketch or diagram to help you visualize what is happening. If the problem involves motion or change, sketch it at different times (especially the initial and final situations).
3. Write down and organize the given information. Some of the information can be written in labels on the diagram. Be sure that the labels are unambiguous. Identify in the diagram the object, the position, the instant of time, or the time interval to which the quantity applies. Sometimes information might be usefully written in a table beside the diagram. Look at the wording of the problem again for information that is implied or stated indirectly. Decide on algebraic symbols to stand for each quantity and make sure your notation is clear and unambiguous.
4. Identify the units appropriate for the answer. If possible, make an estimate to determine the order of magnitude of the answer. This estimate is useful as a check on the final result to see if it is reasonable.

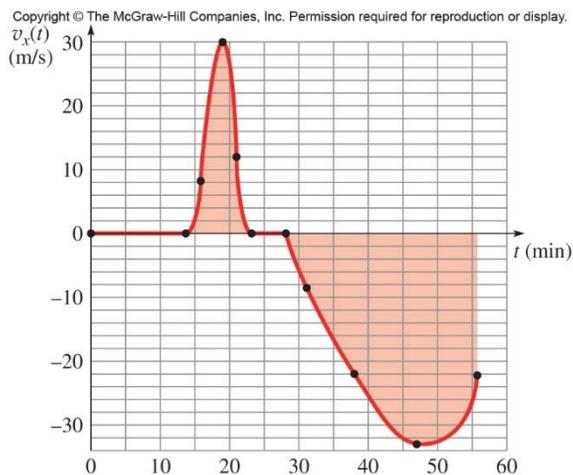
5. Think about how to get from the given information to the final desired information. Do not rush this step. Which principles of physics can be applied to the problem? Which will help get to the solution? How are the known and unknown quantities related? Are all of the known quantities relevant, or might some of them not affect the answer? Which equations are *relevant* and may lead to the solution to the problem?
6. Frequently, the solution involves more than one step. Intermediate quantities might have to be found first and then used to find the final answer. Try to map out a path from the given information to the solution. Whenever possible, a good strategy is to divide a complex problem into several simpler subproblems.
7. Perform algebraic manipulations with algebraic symbols (letters) as far as possible. Substituting the numbers in too early has a way of hiding mistakes.
8. Finally, if the problem requires a numerical answer, substitute the known numerical quantities, *with their units*, into the appropriate equation. Leaving out the units is a common source of error. Writing the units shows when a unit conversion needs to be done—and also may help identify an algebra mistake.
9. Once the solution is found, don't be in a hurry to move on. Check the answer—is it reasonable? Try to think of other ways to solve the same problem. Many problems can be solved in several different ways. Besides providing a check on the answer, finding more than one method of solution deepens our understanding of the principles of physics and develops problem-solving skills that will help solve other problems.

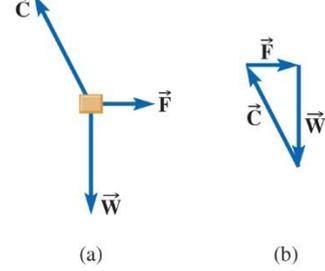
### Approximations

This can be very helpful to see if the solution is correct. It can also guide you to the solution.

### Graphs

A picture is worth a thousand words.





Along the way we talked about causes and effects.

Cause	Effect	Name	Equation
Force	Acceleration	Newton's 2 <sup>nd</sup>	$\sum \vec{F} = m\vec{a}$
Work	Change in mechanical energy	Work-Energy Theorem	$W_{nc} = \Delta K + \Delta U$
Torque	Angular acceleration	Newton's 2 <sup>nd</sup> for rotational motion	$\sum \tau = I\alpha$
Impulse	Change in linear momentum	Impulse-momentum theorem	$\Delta \vec{p} = \vec{F}_{ave} \Delta t$
Rotational impulse	Change in angular momentum		$\Delta L = \tau \Delta t$
Stress	Strain	Hooke's Law	Stress $\propto$ Strain $\vec{F} = -k\vec{x}$

We talked about idea situations

- Frictionless surfaces
- No air resistance
- Massless ropes
- Massless pulleys
- Massless springs
- Ideal springs
- Elastic collisions
- Rigid bodies
- Ideal fluids

There are

- Particles – objects with no structure that follow definite trajectories
- Waves – a disturbance through a medium that can interfere, diffract, et al.

There were two main mathematical systems.

### Scalars

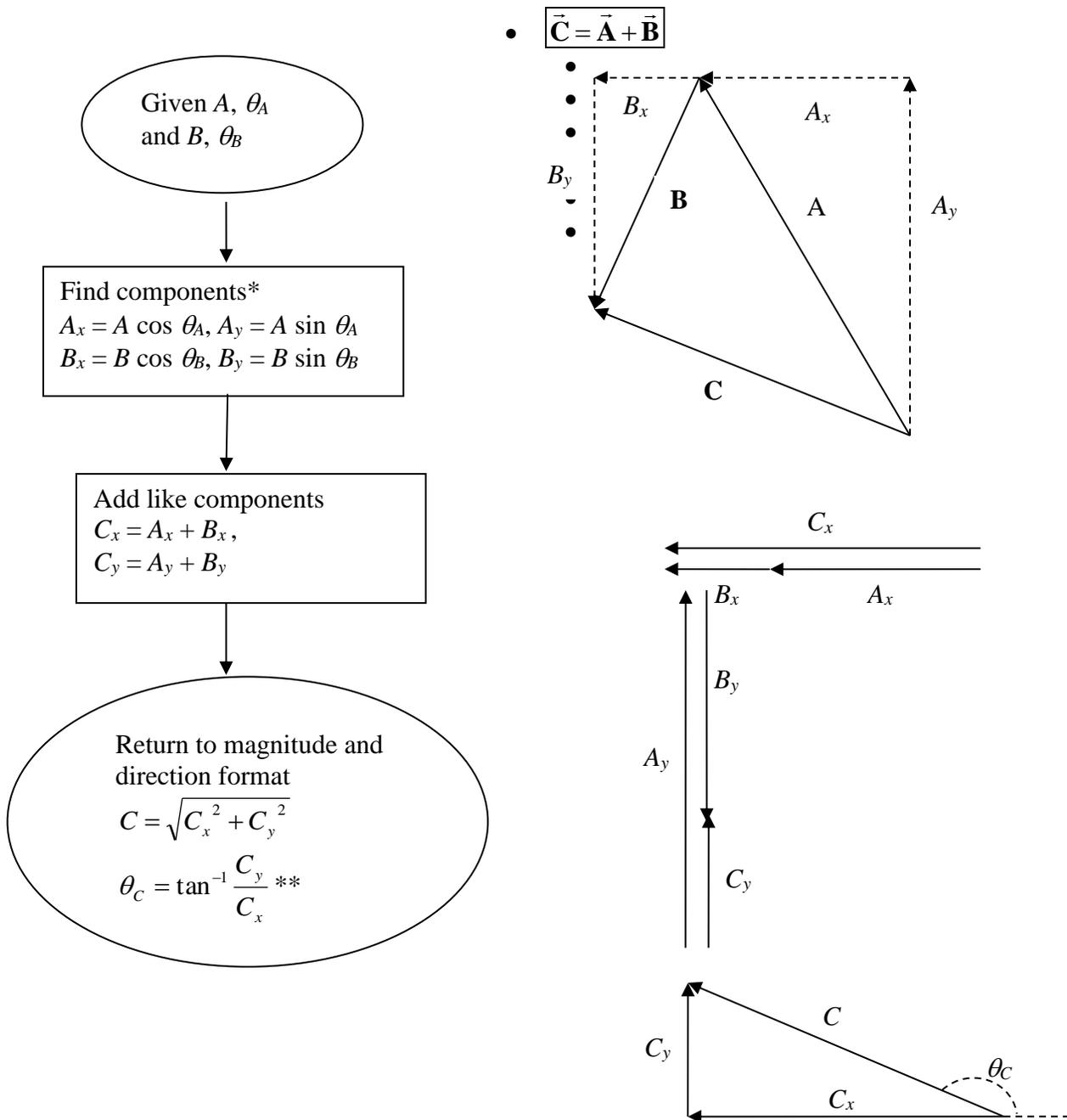
- We use our familiar methods of mathematics.

**Vectors** “The first thing we learn; the last thing we want to do.”

- Never deal with vectors. We deal with their components.

**We do not deal with vectors, we deal with their components.**

Here is an algorithm for adding vectors. The diagram is Figure 3.9 on page 61.



\*Be careful with the angles given. The equations hold for angles measured counterclockwise from the  $+x$ -axis.

\*\*Be careful with  $\tan^{-1}$  function on your calculator. If the  $x$ -component is negative, add  $180^\circ$  to the value found by your calculator.

## **Chapters**

1. Introduction
2. Motion along a line
3. Motion in a plane
4. Force and Newton's laws of motion
5. Circular motion
6. Conservation of energy
7. Linear momentum
8. Torque and angular momentum
9. Fluids
10. Elasticity and oscillations
11. Waves
12. Sound

We did many demonstrations in lecture. Hopefully they helped you to see the application of many physical principles. Combined with your experience, you can see physics around you.

What were your favorite demos?

## **A basketball travels through physics.**

### **Final Exam Topics**

1. Vectors
2. Equations of uniformly accelerated motion
3. Newton's Second Law
4. Uniform circular motion
5. Projectiles
6. Work-energy theorem
7. Impulse-momentum theorem
8. Equilibrium
9. Newton's second law for rotational motion and rotational kinematics
10. Rotational inertia and conservation of angular momentum
11. Pressure with depth and Archimedes' principle
12. Equation of continuity and Bernoulli's equation
13. Simple harmonic motion
14. Traveling waves
15. Standing waves

I hope you are ready for PHY2054. I think you are.

**Preach it man!!**