Welcome to Physics 211!

General Physics I

Physics 215 – Honors & Majors

- Are you interested in becoming a physics major?
- Do you have a strong background in physics and math?
- Are you willing to put in extra effort to get a flavor of more advanced topics beyond the standard Mechanics curriculum?
  - *evidence for dark matter in the universe*
  - *physics at the nanoscale*
  - *…*

Contact Prof. Plourde this week (email: bplourde@syr.edu) with your answers to these questions and we can evaluate if Physics 215 will be a good match for you

- Meets at the same time as PHY211 in room 208
- ~20 students in lecture

Phys 221 is a different course!

- Questions? Contact the Lab Manager directly: Sam Sampere, smsamper@syr.edu

Course staff:

- Me*:* Prof. Jack Laiho (jwlaiho@syr.edu)
- Recitation instructors*:*

  Francesco Serafin

  Mahesh Gandikota

  Derek Davis

Course website

- Everything is here:

  https://jwlaiho.expressions.syr.edu/

- Links to things you need to do this week:
  - Electronic clicker registration
  - Mastering Physics HW registration

Course Information

- Books
  - *Physics for Scientists and Engineers, Vol. 1, 3rd edition*, R.D. Knight
  - *Mastering Physics registration code*
- Turning Point electronic clicker is required

- Also on the website:
  - Syllabus
  - Announcements/reminders of exams and homework assignments
  - Course calendar
  - Lecture slides, practice exams, exam solutions

Objectives

Objectives for this course:

- Develop good understanding of a few important concepts
- Reason qualitatively and quantitatively
- Learn to apply methods to unfamiliar situations

Course Outline

- Weeks 1-4: Motion (Kinematics)
- Weeks 5-8: Newton's Laws (Dynamics)
- Weeks 9-11: Energy, momentum
- Weeks 11-12: Extended objects, rotations
- Week 13: Thanksgiving break
- Week 14: Angular Momentum
- Weeks 15: Gravity

Lectures

- Finish reading assignment *beforehand!*
- Short prelecture assignment due a half hour before class (10:30 am Tu/Th)

- During lecture, we will...
  - Discuss key concepts
  - Observe demonstrations
  - Work through sample problems in small groups
  - Consider conceptual questions
  - Ask a Physicist: email me questions about physics, I will take 5 min. to answer them in lecture

Electronic clickers and participation

- 10 % of your grade will come from in-class participation
  - 5% workshop attendance
  - 5% clicker question participation in class
- About 5 clicker questions per lecture (150 questions in the semester)
  - Only participation (not the right answer)
  - You must register your clicker via the link on the class website to get credit
  - 20 questions (about four classes) will be automatically excused in case of absences, broken clickers, etc.
  - It is your responsibility to check your grades and make sure you are getting credit for clicker questions.

Recitations

- Graduate teaching assistant
- During workshops you will work in groups of 2 or 3 students
- TA is there to help you but **not** to lecture
- Hands-on learning experience!
- Attendance is required (counts towards class participation grade). Bring your Knight textbook with you. You must show up within the first five minutes for your attendance to count.

Exams

- 4 Exams during semester
  - Two pairs of exams. Think of it as two shots at exam on the material covered in the first month and two shots at exam on material covered in the first two months.
  - 80-minutes each, during lecture period
  - Solutions posted online after each exam is graded
  - *Exam 1* -- Sept. 29
- Final exam
  - Cumulative
  - 2 hours -- Wednesday 12/16/2015 3:00-5:00pm

Homework

- *Weekly homework*
  - Typically due Friday afternoon at 5pm
  - Assigned at least one week before due date
    - On Mastering Physics website
    - Listed on “Assignments” calendar on class website
  - Two types: prelectures worth 5% of total grade
  - Homework assignments due on Fridays

  Handed in online (entire assignment must be submitted or MP doesn’t count it. Tip: if you are close to the deadline and want partial credit for completed work, click through everything to submit.)

  (worth 20% of your total grade)
- Reminders of assignments on Mastering Physics site
- ***No late homework will be accepted***

Grades

- Exams 1-4

(1 of each pair is dropped) 40%

- Final exam 25%
- Homework (drop lowest 2) 25%
- Class participation 10%

(drop 2 workshops and 20 clicker questions)

The grades are normalized such that the average course grade is a B- or better, depending on the performance of the class as a whole.

Your grades will be posted regularly on blackboard (link from the class website). You are responsible for checking your grades and ensuring they are recorded correctly. Contact your TA immediately if there is a mistake.

Assignments due this week (on assignments calendar on class website and on Mastering Physics)

- Due Thursday Sep 3rd 10:30 am
  - 1-2 Prelecture assignment on Mastering Physics
- Due Friday Sep 4th at 5 pm
  - HW #1 on Mastering Physics – introduction to Mastering Physics

Converting units

Convert 1 km/hr to microns (micrometers) per second:

Clicker test: Enter Channel ___

Channel Setting for the

ResponseCard® RF

1. Press and release the "Ch" button.
2. While the light is flashing red and green Enter 2 digit code. (ie. channel 1=01, channel 21=21).
3. After the second digit is entered, Press and release the "Ch" button.

LED Color Description:
Red - Response was not received
Green - Response was received
Yellow (Multiple Flash) - In the process of sending
Yellow (Single Flash) - Polling not open

There are two ways to set the channel on the ResponseCard NXT. One way is to use the Find Channels tool in the toolbox, as described in the previous section "The Toolbox," or you can manually set the channel. The steps below describe how to manually set the channel.

1. Press the Channel button.
2. Use the number pad to enter the new channel number.
3. Once the channel number has been entered, press the ⬭ button.

You must do this for EVERY lecture

Clicker test: Channel __

- What is today's date?

1. Sept 3rd
2. August 31st
3. August 28th
4. Sept 1st

Clicker question 1-1.1

- Convert 400 inches^2/min to m^2/s. Use the fact that 2.54 cm = 1 in.

1. $3.3 * 10^{-3}$ m^2/s
2. $4.3*10^{-3}$ m^2/s
3. $1.69*10^{-1}$ m^2/s
4. $1.69*10^{-3}$ m^2/s
5. None of the above

Kinematics--
describing motion

1D

The Particle Model

- Often motion of the object *as a whole* is not influenced by details of the object's size and shape.
- We only need to keep track of a single point on the object.
- So we can treat the object *as if* all its mass were concentrated into a single point.
- A mass at a single point in space is called a **particle**.
- Particles have no size, no shape, and no top, bottom, front or back.
- On the projector I draw the motion diagram of a car stopping, using the **particle model**.

Motion diagram of a rocket launch

Clicker question 1-1.2

Three motion diagrams are shown. Which is a dust particle settling to the floor at constant speed, which is a ball dropped from the roof of a building, and which is a descending rocket slowing to make a soft landing on Mars?

A.(a) is dust, (b) is ball, (c) is rocket.

B.(a) is ball, (b) is dust, (c) is rocket.

C.(a) is rocket, (b) is dust, (c) is ball.

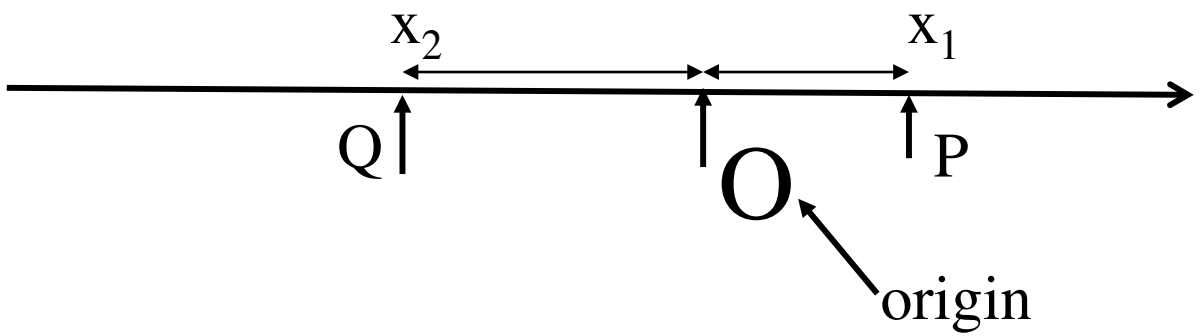
D.(a) is rocket, (b) is ball, (c) is dust.

E.(a) is ball, (b) is rocket, (c) is dust.

Position and Displacement

- Neglect shape of object and represent by point moving in space (1D)
- Position may be specified by giving distance to origin – x coordinate
- Choice of origin arbitrary! – many choices to describe same physical situation.
- Hence x-coordinate not unique

Displacement = change in position



- Displacement (P→Q) = $x_2 - x_1 = \Delta x$
- Displacement does NOT depend on origin!

Displacement

- Displacement is ‘distance and direction’
- Displacement Δx is a vector quantity – change in position (vector) of object
- In one dimension, this amounts to a sign
  - Displacement towards increasing x – *positive*
  - Displacement towards decreasing x – *negative*

Velocity

- *Definition:*

  Average velocity in some time interval Δt is given by

$$v_{av} = (x_2 - x_1)/(t_2 - t_1) = \Delta x/\Delta t$$

- Displacement Δx can be positive or negative – so can velocity – it is a vector, too

- **Average speed** is not a vector, just

  (distance traveled)/Δt

Discussion

- Average velocity is that quantity which when multiplied by a time interval yields the net displacement
- For example, driving from Syracuse → Ithaca

Instantaneous velocity

- But there is another type of velocity which is useful – **instantaneous velocity**
- Measures how fast my position (displacement) is changing at some **instant** of time
- Example -- nothing more than the reading on my car's speedometer and my direction

Describing motion

- Average velocity (for a time interval):

$$v_{\text{average}} =$$

- Instantaneous velocity (at an instant in time)

$$v_{\text{instant}} = v =$$

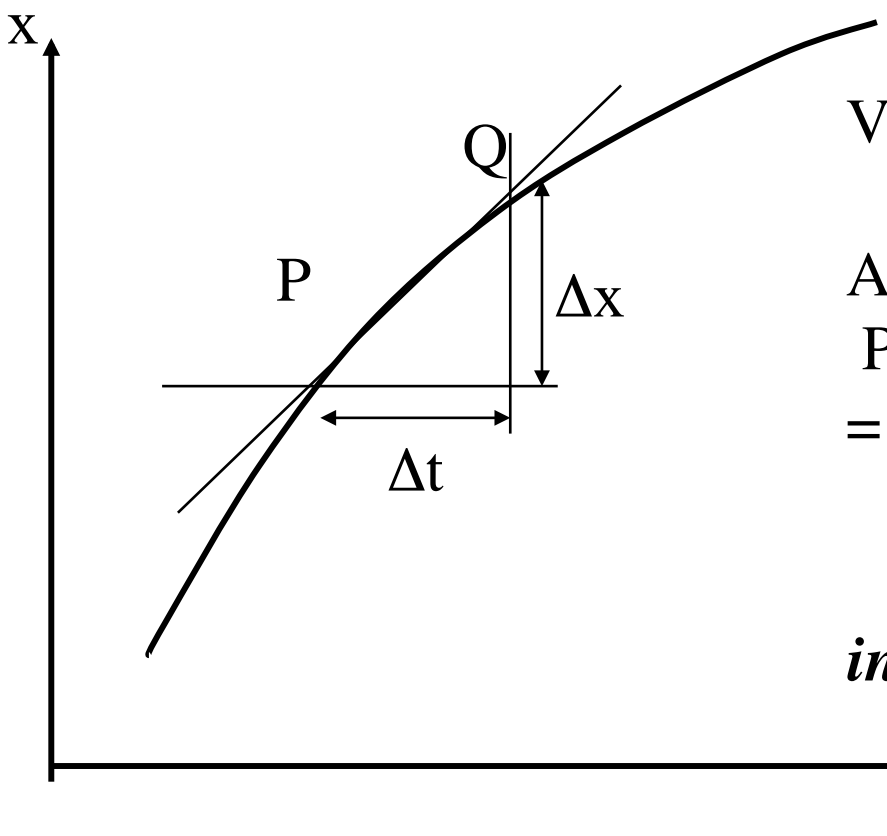
- Instantaneous speed

$$|v|$$

Instantaneous velocity

- Velocity at a single instant of time
- Tells how fast the position (vector) is changing at some instant in time
- Note while Δx and Δt approach zero, their ratio is finite!
- Subject of calculus was invented precisely to describe this limit – **derivative** of x with respect to t

Velocity from graph



$V_{av} = \Delta x/\Delta t$

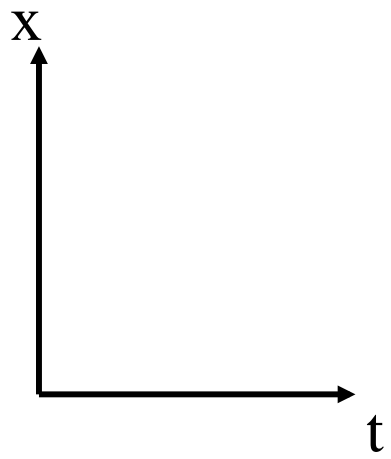
As Δt gets small, Q approaches P and $v \rightarrow dx/dt$

= slope of tangent at P

instantaneous velocity

Interpretation

- Slope of x(t) curve reveals v_{inst} (= v)
- Steep slope = large velocity
- Upwards slope from left to right = positive velocity
- Average velocity = instantaneous velocity only for motions where velocity is constant



When does $v_{av} = v_{inst}$?

- When x(t) curve is a **straight line**
  - Tangent to curve is same at all points in time

- We say that such a motion is a constant velocity motion
  - we'll see that this occurs when no **forces** act

Summary of terms

- Positions: $x_{initial}$, x_{final}
- Displacements: $\Delta x = x_{final} - x_{initial}$
- Instants of time: $t_{initial}$, t_{final}
- Time intervals: $\Delta t = t_{final} - t_{initial}$
- Average velocity: $v_{av} = \Delta x/\Delta t$
- Instantaneous velocity: $v = dx/dt$
- Instantaneous speed: $|v| = |dx/dt|$

Reading assignment

- Kinematics and graphs
- Chapter 1 and 2.1 - 2.3 in textbook