Framing the Active Learning Classroom

Clicker Questions

To motivate students to engage in active learning

About this project

This is one items in a set of materials is compiled for instructors to draw upon in order to frame non-traditional modes of classroom teaching. Our hope is that these materials can enhance student enthusiasm for and reduce student resistance to such techniques, thus improving the experience of instructors and students and supporting student learning. These materials are not research-tested; rather, they represent the wisdom and experience of practitioners who are using research-based instructional techniques. These materials have been shared by members of the science education community, primarily in physics. If you re-use these materials, please be sure to attribute the author (see License, previous slide).

You can find the rest of these materials (slides, activities, etc.) at http://colorado.edu/sei/fac-resources.

For more information, contact Stephanie Chasteen, stephanie.chasteen@colorado.edu.

http://colorado.edu/sei

Clickers:
Why study this course?

These questions are aimed to motivate students to engage in the course

What do you think about physics?

A) I love it. I wish I could take more physics classes!

B) I find it interesting and am looking forward to this term.

C) I am ambivalent.

D) I dislike physics

E) I despise physics (can I go now?)

Can I be excused, my brain is full.

Courtesy Steven Pollock, University of Colorado Boulder

Do you *like* math?

1. Massively!
2. Yeah, kinda.
3. Eh.
4. Not really.
5. Yuck!

Courtesy of Ian Beatty, UNC Greensboro

A tennis racket and can of balls (together) costs $110.
The tennis racket alone costs $100 more than the can of balls alone.
How much does the can of balls alone cost?

A) $5
B) $10
C) $11
D) $100
E) None of these/not sure

Courtesy Steven Pollock, University of Colorado Boulder. Inspired by Kahnemann, "Thinking Fast and Slow," 2011.

2 socks are observed to attract each other.
Which, if any, of the first 3 statements MUST be true?
(emphasis on MUST)

A) The socks both have a non-zero net charge of the same sign.
B) The socks both have a non-zero net charge of opposite sign.
C) Only one sock is charged; the other is neutral.
D) None of the preceding statements MUST be true.

Courtesy Steven Pollock, University of Colorado Boulder

If this class helps you discover that some things you've believed for a long time are not true, how would you feel?

A. Pleased to change my opinion.
B. Irritated.
C. Initially irritated, but eventually pleased.
D. Some other feeling or not sure.

Courtesy Douglas Duncan, University of Colorado Boulder

Does “knowing fluid mechanics” mean:

A B C D E

Getting the right answer Understanding concepts

Jean Hertzberg, Mechanical Engineering, University of Colorado Boulder

Why are you in this class?

a) I'm interested in learning more modern physics - not required
b) I'm interested, but it's also required
c) Only because the class is required
d) I'm not really interested but I heard this class was better than *Deal or No Deal*
e) Other / multiple reasons

Courtesy Noah Finkelstein, University of Colorado Boulder

Clickers:

How do you learn?

Learning from listening?

How much do students, on average, learn (measured by performance on conceptual survey) in traditional physics classes?

a) 90% or more of material

b) 75% of material

c) 50% of material

d) 25% of material

e) 10 % or less of material

Courtesy Douglas Duncan, and Noah FInkelstien University of Colorado Boulder

In a lecture class with an interesting, clear, engaging teacher, what fraction of the material presented during the semester does a student typically learn **well**? (well enough to explain to someone else)

A. 90%
B. 70%
C. 50%
D. 25%
E. 15%

Courtesy Douglas Duncan, University of Colorado Boulder

Thinking of what you want to get out of your college education and this course, which of the following is most important to you?

A. Acquiring information (facts, principles, concepts)
B. Learning how to use information and knowledge in new situations
C. Developing lifelong learning skills

First Day Questions for a Learner Centered Classroom, Gary A. Smith, National Teaching & Learning Forum, 17(5), 2008.

All three of these goals are clearly important. However, let's think for a moment of how best to accomplish these goals. Learning is not a spectator sport—it takes work; that includes work in the classroom and work that you do outside of the classroom.

So, which of these do you think you can make headway on outside of class (by doing your own reading and studying)?

A. Acquiring information (facts, principles, concepts)
B. Learning how to use information and knowledge in new situations
C. Developing lifelong learning skills

First Day Questions for a Learner Centered Classroom, Gary A. Smith, National Teaching & Learning Forum, 17(5), 2008.

All three of these goals are clearly important. However, let's think for a moment of how best to accomplish these goals. Learning is not a spectator sport—it takes work; that includes work in the classroom and work that you do outside of the classroom.

Which of these would be best achieved in class, working with your classmates and me?

A. Acquiring information (facts, principles, concepts)
B. Learning how to use information and knowledge in new situations
C. Developing lifelong learning skills

First Day Questions for a Learner Centered Classroom, Gary A. Smith, National Teaching & Learning Forum, 17(5), 2008.

How to Learn

What matters most for learning? Why?

a. start intelligent

b. think about, test understanding, discuss.

c. spend a lot of time reviewing notes and book

d. work out problems

Clickers:
Metacognition and reflecting on learning

How do my clicker questions compare, on the average, to other classes you've taken that use clickers ?

a. Similar
b. Easier
c. Harder
d. Not necessarily easier or harder, but really different.
e. I've never taken a clicker class before.

Courtesy of Robert Parson, University of Colorado Boulder

Which activity best corresponds to a what people with real jobs do ?

a. Multiple choice exams.
b. CAPA or WebAssign electronic homework.
c. Clicker questions.
d. Working with others in small groups to solve problems that aren't usually clearly stated.

Courtesy of Robert Parson, University of Colorado Boulder

Which statement best describes your reaction to the way we do Recitation ?

a. I've done something like this in another class (at CU or elsewhere.)
b. I've never had a class period like this, but I like it.
c. I've never had a class period like this, and I didn't like it.

Courtesy of Robert Parson, University of Colorado Boulder

Questions from Ian Beatty

- These questions are from Ian Beatty, UNC Greensboro
- While they are content questions, they all include some “meta discussion” of what learning physics is about
- These are used throughout the term, not just on the first day
- In the Powerpoint version of these slides, notes about the usage of the questions is in the “notes” area.

The exam was…

1. very easy.
2. easy.
3. about the right level of difficulty.
4. difficult.
5. very difficult.
6. not sure yet — I’m still in shock.

Courtesy of Ian Beatty, UNC Greensboro

Which of the following overall statements about the exam do you agree with?

1. Questions were easy
2. Questions were challenging but reasonable
3. Questions were too hard
4. Content was appropriate for what we'd covered
5. Content was inappropriate for what we'd covered.
6. Exam was reasonable length
7. Exam was too long

Courtesy of Ian Beatty, UNC Greensboro

What did you think of the group portion of the exam?

1. It rocked.
2. I kinda liked it.
3. Eh. Could take it or leave it.
4. I kinda disliked it.
5. I never ever want to live through something like that again.

Courtesy of Ian Beatty, UNC Greensboro

Did you do the workbook (26.1–4) for today?

1. Darn right I did!
2. Hey, I got through most of it.
3. I tried some.
4. Well, no, but you see, I'm really busy right now and we've got this take-home exam to do by Monday, plus there's this other thing

Courtesy of Ian Beatty, UNC Greensboro

Do you *like* math?

1. Massively!
2. Yeah, kinda.
3. Eh.
4. Not really.
5. Yuck!

Courtesy of Ian Beatty, UNC Greensboro

Which of the following are you least comfortable using to solve problems?

1. Kinematics.
2. Newton's laws.
3. The work-energy theorem.
4. The impulse-momentum theorem.
5. The angular momentum-angular impulse theorem.

Courtesy of Ian Beatty, UNC Greensboro

How comfortable are you with the concept and use of electric forces?

1. Clueless.
2. I sorta kinda think I get it, a little.
3. Doin' pretty well.
4. Rock solid.

Courtesy of Ian Beatty, UNC Greensboro

How comfortable are you with the concept and use of electric fields?

1. Clueless.
2. I sorta kinda think I get it, a little.
3. Doin' pretty well.
4. Rock solid.

Courtesy of Ian Beatty, UNC Greensboro

How comfortable are you with the concept and use of electric potential?

1. Clueless.
2. I sorta kinda think I get it, a little.
3. Doin' pretty well.
4. Rock solid.

Courtesy of Ian Beatty, UNC Greensboro

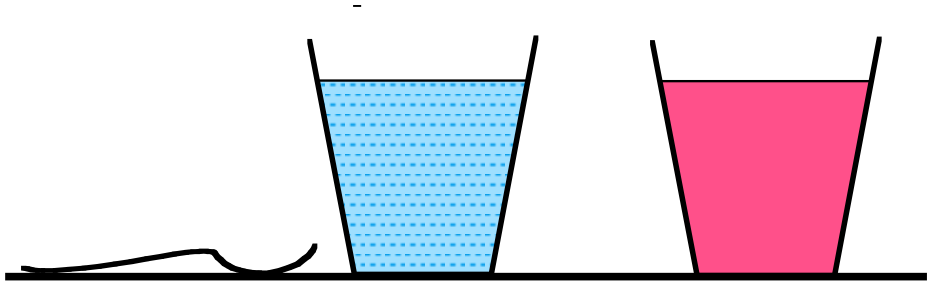
At 6 AM, a hiker starts up a mountain from the trailhead. At 6 PM she reaches a cabin on the top, and spends the night. At 6 AM the next day she leaves the cabin and descends by a different path, returning to the base at 6 PM.

Is there a time on the second day when she is at the same altitude she was at on the first day at the same time?

1) Yes, there is always at least one time.
2) Yes, there is possibly one time.
3) No, there is never a time.
4) Not enough information.

Courtesy of Ian Beatty, UNC Greensboro. Originally by Bill Gerace, AFAIK

We start with one cup of water and one cup of wine.



One teaspoon of water is moved to the wine.

Then one teaspoon of the mixture is returned to the water.

Is there more water in the wine, or more wine in the water?

Input your answer. Be prepared to explain it.

(1) There's more water in the wine.

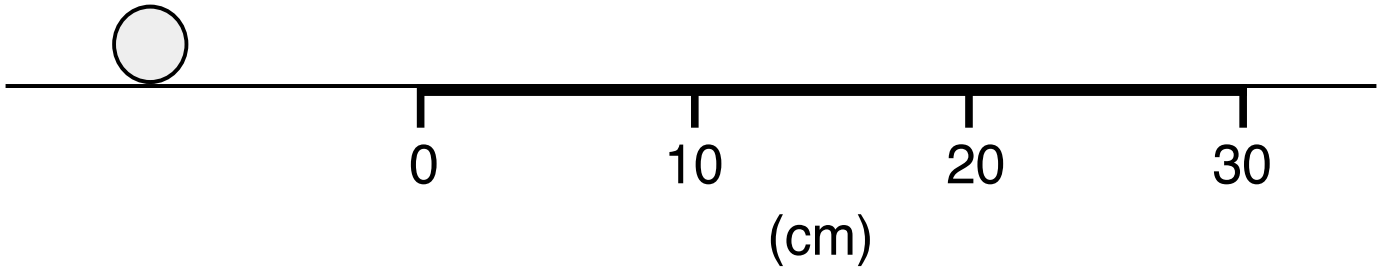
(2) There's more wine in the water.

(3) Neither; they are the same.

(4) I don't know.

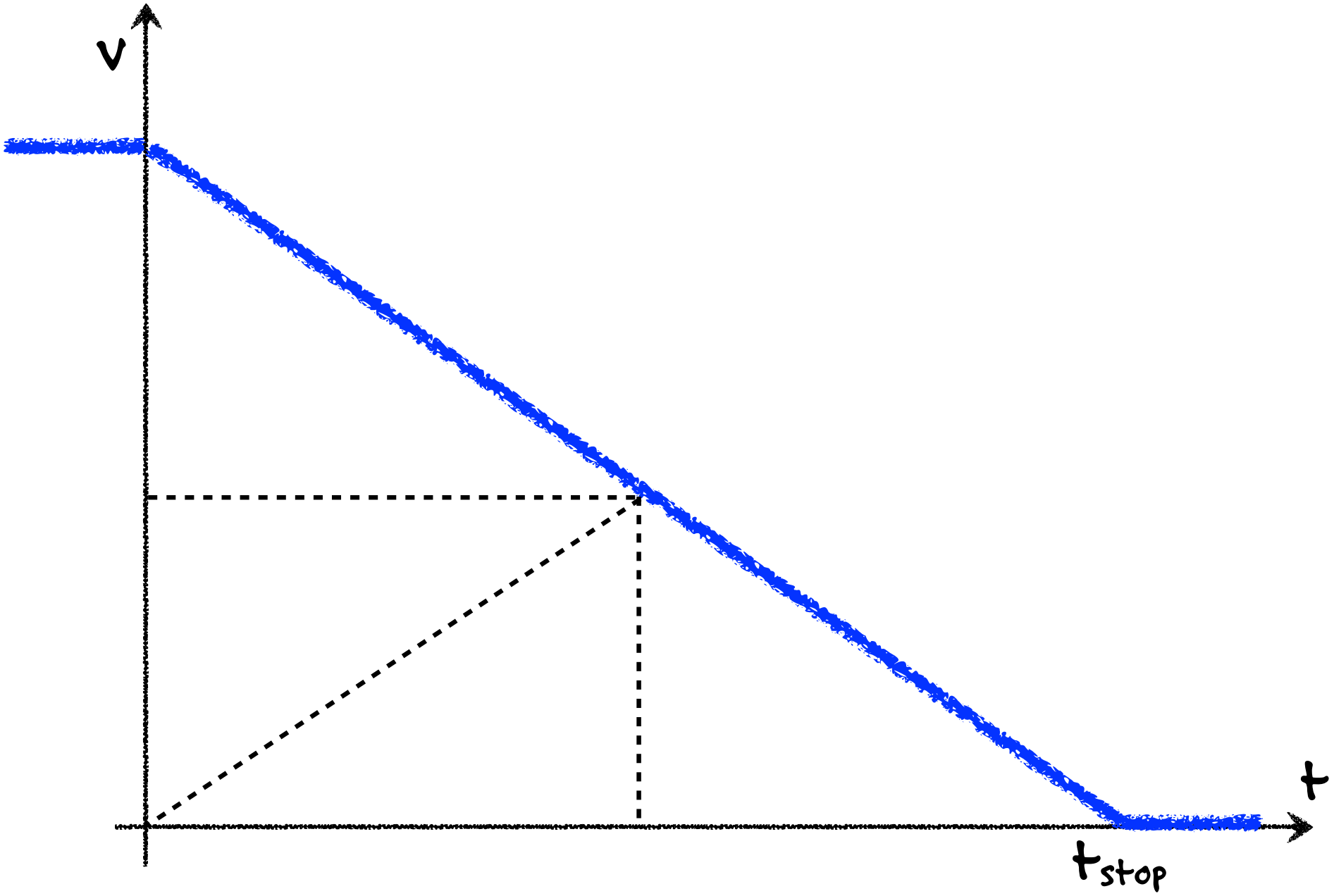
Courtesy of Ian Beatty, UNC Greensboro. Originally by Bill Gerace, AFAIK

A marble rolls onto a piece of felt 30cm long. 20 cm in, its speed has dropped to half its initial value. Assuming constant acceleration on the felt, which is true?



1. The marble will stop on the felt.
2. The marble will go past the end of the felt.
3. Cannot be determined.

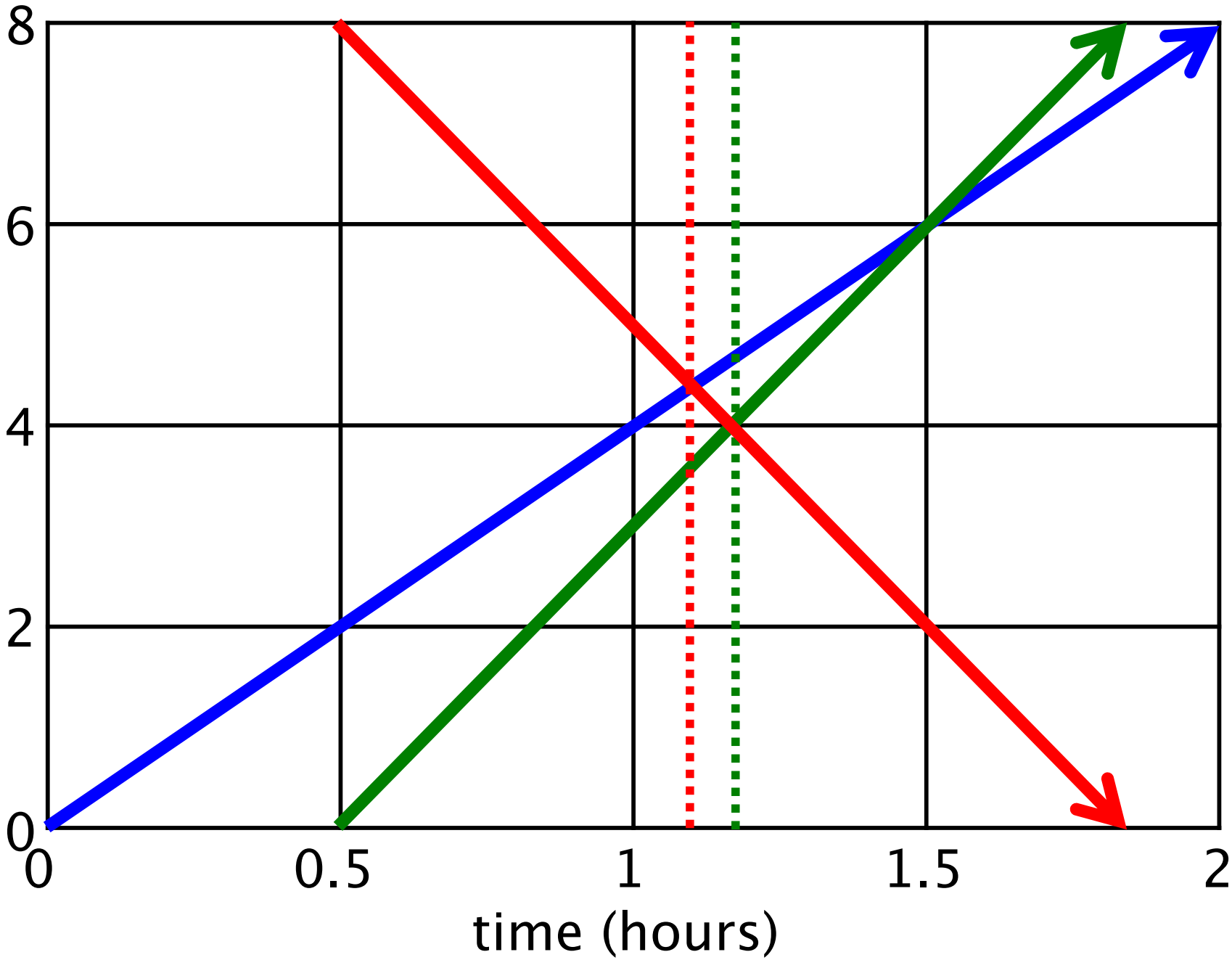
Courtesy of Ian Beatty, UNC Greensboro. Originally by Bill Gerace, AFAIK


v
t
t_{stop}

Runner A runs clockwise around an 8-mile oval track at 4 mph. A half-hour later, runner B starts at the same point and and wants to intercept runner A as soon as possible. If B can run at 6 mph, which way should she head?

1. Also clockwise.
2. Counter-clockwise.

Courtesy of Ian Beatty, UNC Greensboro. Originally by Bill Gerace, AFAIK



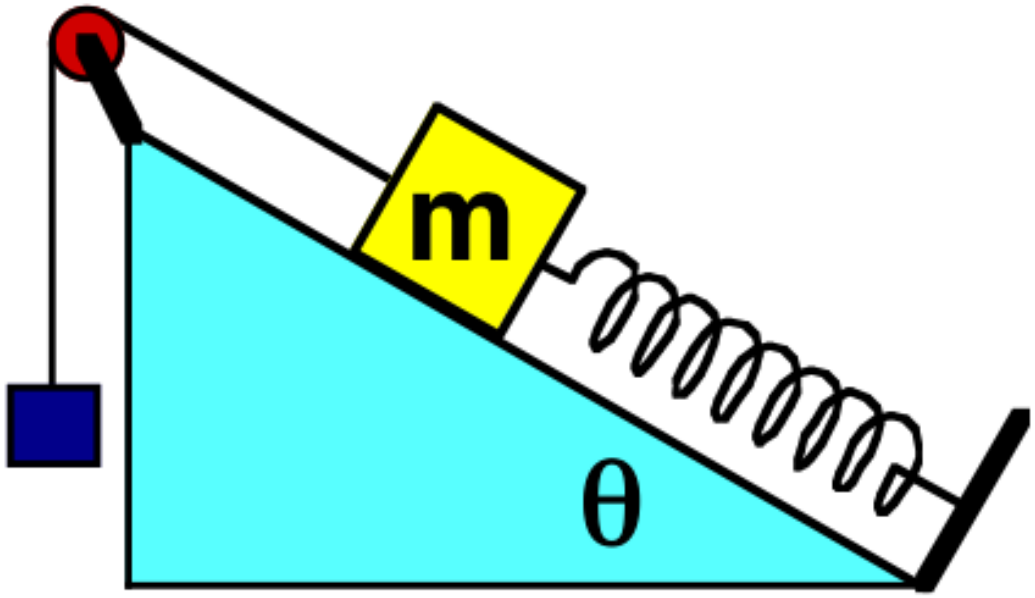
Courtesy of Ian Beatty, UNC Greensboro

Two bicyclists ride towards each other. One travels at 8 mph, and the other at 12 mph. A bee flies back and forth between them. If it starts when they are 2 miles apart, how far has the bee flown when the cyclists meet?

Enter a number with two digits of precision.

Courtesy of Ian Beatty, UNC Greensboro. Originally by Bill Gerace, AFAIK

How many forces act on the mass m?



1. Three forces.
2. Four forces.
3. Five forces.
4. Six forces.
5. None of the above.
6. Too many to count.
7. Cannot be determined.

Courtesy of Ian Beatty, UNC Greensboro

An object of mass m_1 moving with speed v_1 in the $+x$-direction collides with an object of mass m_2 at rest. What are the speeds and directions of the objects after the collision?

Is this problem solvable?

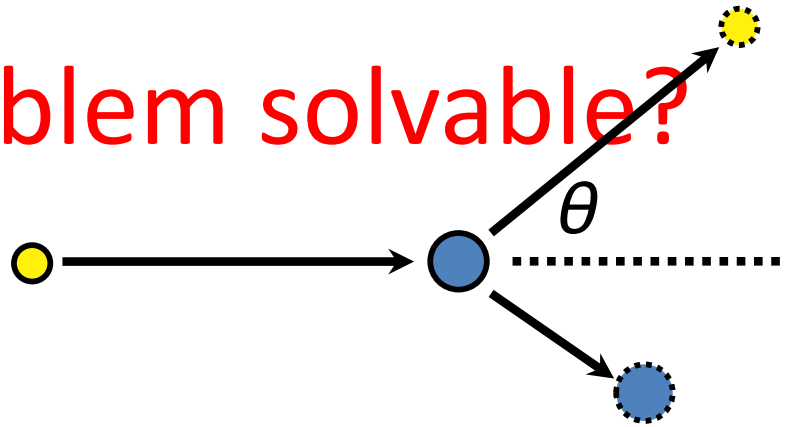
1. Yes.
2. No.

Courtesy of Ian Beatty, UNC Greensboro

An object of mass m_1 moving with speed v_1 in the $+x$-direction collides with an object of mass m_2 at rest. The collision is elastic, and m_1 scatters at an angle ϑ. What are the speeds and directions of the objects after the collision?

Is this problem solvable?

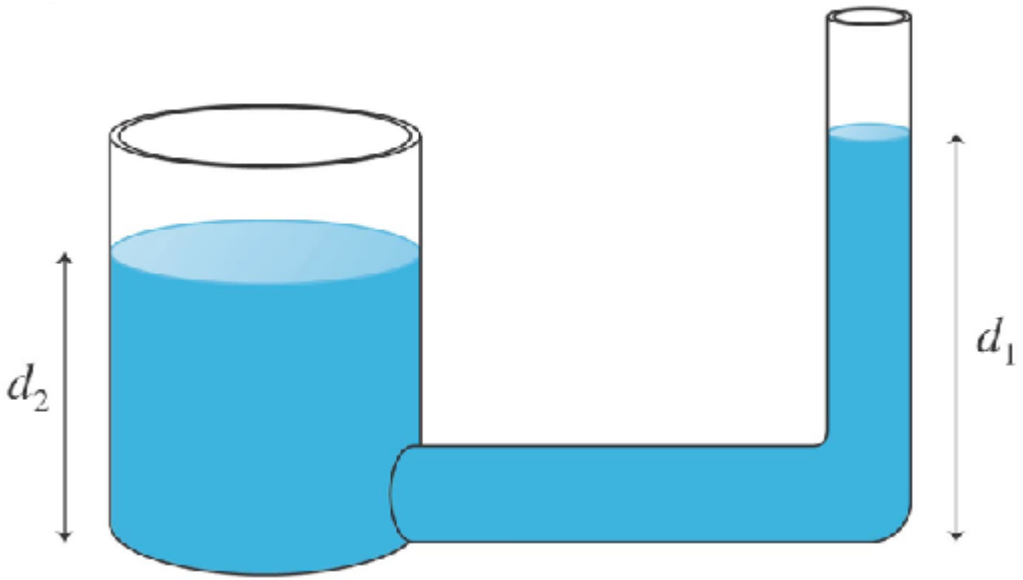
1. Yes.
2. No.



Courtesy of Ian Beatty, UNC Greensboro

How high will the water in the narrow tube rise?

1. $d_1 < d_2$
2. $d_1 = d_2$
3. $d_1 > d_2$
4. It will overflow.



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