ConcepTests During Lectures
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- Mini-lecture on a topic for 10 minutes
  - Challenging multiple-choice question, examples today
- Two rounds per question
  - 1st round, each student answers individually, commits
  - 2nd round, discuss in group, then recommit
- Citations:
  - Johnson, Johnson, and Smith (1991), *Cooperative Learning: Increasing College Faculty Instructional Productivity*.
  - Mazur E. (1997), *Peer instruction: a user's manual.*

Advantages of Class-Discussions

- Commit, then discussion => all participate
  - Brings ideas out into open
  - Learn, often by just explaining
  - Students receive feedback on their understanding
  - Energizes classes, allows students to catchup
- Prof immediately knows level of understanding

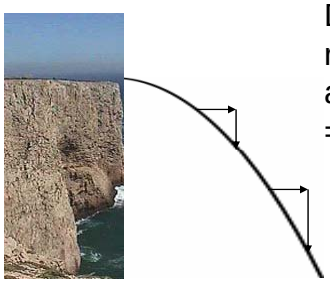
Motion in 1-Dimension

- Force in one direction changes velocity in that direction
- E.g. drop rock from top of cliff, gravity accelerates downwards
  - rock's downward velocity increases, rock accelerates

Larger velocity =>
Increase in distance traveled in a time period

Motion in 2-Dimensions

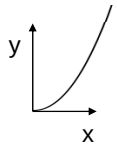
- Velocity in one direction unaffected by force in another direction
- Throw a rock horizontally off a cliff
  - Vertical velocity increases due to gravity, rock accelerates
  - Horizontal velocity unchanged during fall

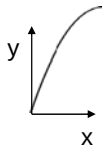


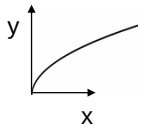
During two identical time intervals
rock moves same distance horizontally
and further vertically
=> trajectory is a parabola

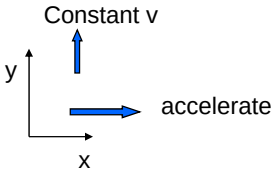
Question: Trajectory of Drifting Shuttle, 1st round

Space shuttle is drifting in the y-direction. Captain fires the side-boosters. so that the shuttle accelerates in the x-direction. Which is the correct trajectory of the shuttle?

1. 

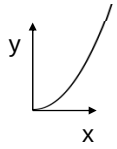
2. 

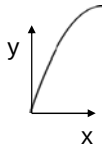
3. 

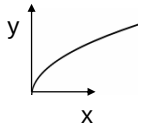


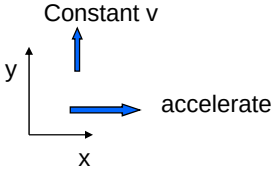
Question: Trajectory of Drifting Shuttle, 2nd round

Space shuttle is drifting in the y-direction. Captain fires the side-boosters. so that the shuttle accelerates in the x-direction. Which is the correct trajectory of the shuttle?

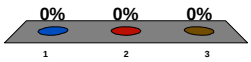
1. 

2. 

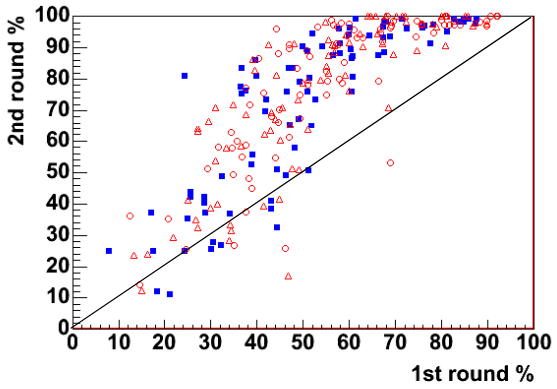
3. 



For each time interval, shuttle moves same distance y larger distances in x.



Improvement During 2nd Round



Red: swivel seats
Blue: regular theater

To be published
Journal College
Science Teaching

Metastudy: Using concepTests compared to lectures
=> improved understanding of core concepts
R. Hake Am. J. Phys. 66, 64- 74 (1998).

Mechanics of Two Rounds

- Posted on “tips” web-site
  - Create 2nd round slide with solution, graph, answer etc.
  - Insert duplicate slide using Powerpoint toolbar
  - Delete, solution, graph, answer from 1st round slide
  - Rearrange slides
  - Use TP’s comparative link under “tools”
- Approximately 10% of the time, software freezes during a round
  - Bug?
  - Stop slide show, reset current slide, continue

Summary

- Use challenging conceptual questions that pushes students to apply the topic of the mini-lecture
  - Two rounds, individual commits, discuss, commit
- Have used broad range of questions
  - Problem-solving
    - What would you do next?
    - What strategic mistake did the student make?
  - Prediction
    - Start of material, instead of after mini-lecture
    - What will happen in a demo?