PHY131 F Fall 2020
Class 13

Today:
- Circular Motion

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Poll

Crazy Friday: Let's Choose a Zoom-Filter my face today

What Studio Filter would you prefer on my face today?

A. Pig snout and ears

B. Chevron Mustache

C. Goatie: Blaze Royale

D. Goatie: Circle

E. Red lipstick

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PRA Schedule

Week:	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Practical: Day of Practical	PRA 2b	PRA 3a	PRA 3b	PRA 4a	PRA 4b	PRA 5a	PRA 5b
Friday	Oct 16	Oct 23	Oct 30	Nov 6	Nov 20	Nov 27	Dec 4
Monday	Oct 19	Oct 26	Nov 2	Nov 16	Nov 23	Nov 30	Dec 7
Tuesday	Oct 20	Oct 27	Nov 3	Nov 17	Nov 24	Dec 1	Dec 8
Wednesday	Oct 14	Oct 21	Oct 28	Nov 4	Nov 18	Nov 25	Dec 2
Thursday	Oct 15	Oct 22	Oct 29	Nov 5	Nov 19	Nov 26	Dec 3

- This is a little tricky.
- Friday PRA students used to be “first”, and Thursday was “last”.
- But starting next week, Wednesday PRA students will be “first”, and Tuesday will be “last”.
- Bottom line:
- No Practicals today, or next week on Monday ***or*** Tuesday.

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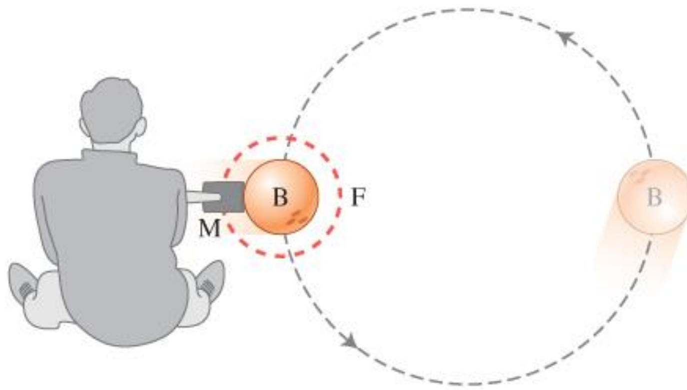
5.1 Circular Motion

Observational experiment

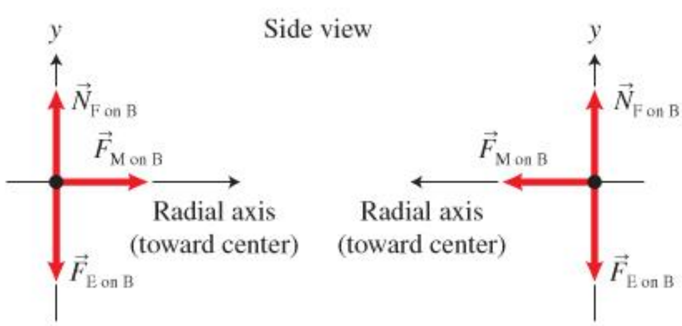
Experiment 1. A bowling ball is rolled toward you over a smooth floor. You are asked to tap it with a mallet to make the ball roll in a circle with constant speed. You find that directing the mallet taps along the desired circular path doesn't work; the ball rolls wide. The only thing that works is to tap *directly toward the center of the desired circle.*



5.1 Circular Motion

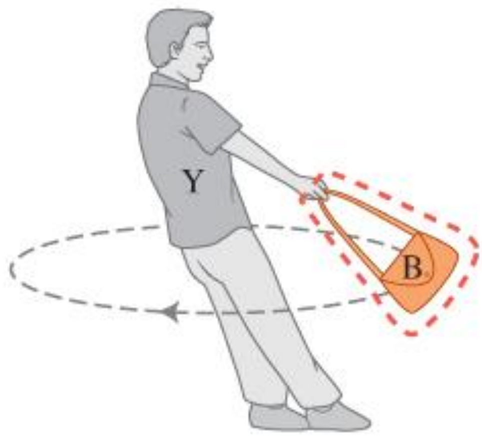
Analysis

There are three objects interacting with the bowling ball: Earth, the floor, and the mallet. We assume that the force exerted by the floor is perpendicular to the floor's surface. The force diagrams for the ball at two locations are shown below. We see that at each location the sum of the forces points toward the center of the circle.



5.1 Circular Motion

Experiment 2. You hold a bag by the handle and swing it in a horizontal circle at constant speed. You observe that your arms pulling the bag are angled down with respect to the horizontal.



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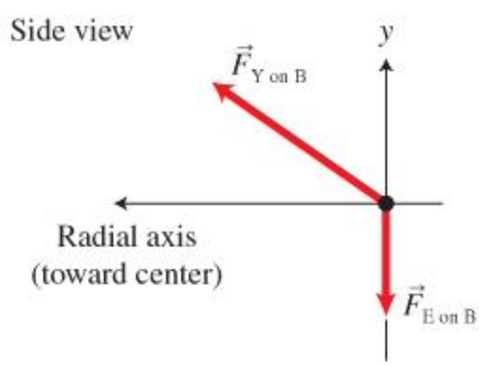
5.1 Circular Motion

Two forces are exerted on the bag as it moves around the circle: Earth pulls downward, and you pull at an angle with the vertical. The vertical component of the force that you exert on the bag must balance the force that Earth exerts on it because the bag does not accelerate in the vertical direction. Consequently, the sum of these two forces again points toward the center of the circle.



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5.1 Qualitative Dynamics of Circular Motion

Hypothesis: When an object is moving in a circle, the sum of all the forces exerted on it by other objects is directed toward the center of the circle (we assume the speed of the object is constant).

Testing: Let's test the hypothesis.

If you remove inward forces, does an object cease to go on a circular path?

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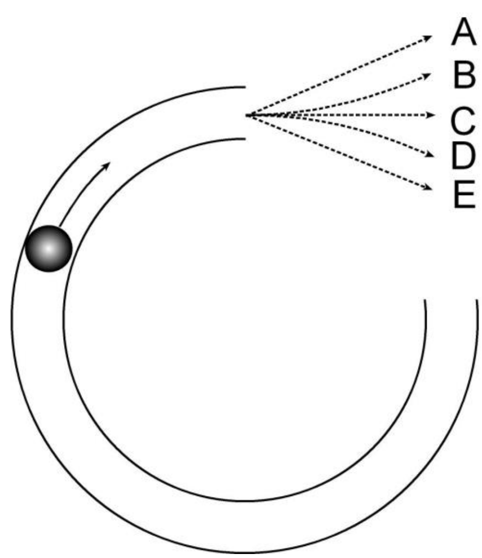
A ball rolls along a frictionless track on a horizontal table, as seen from above in the figure. The track is curved in ¾ of a circle. The ball rolls clockwise around this track and then emerges onto the flat, frictionless table. Which dashed line most closely represents the path of the ball when it emerges from the track?



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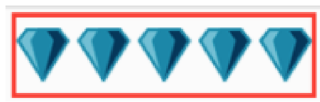
TeamUp Time!!

- Please keep this zoom-call open, but go to Microsoft Teams and someone (most recent Facilitator) should place a video call to all 3 or 4 members of your Pod-Chat.
- The first step is to decide who will be the TeamUp **Driver**



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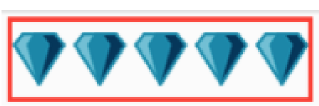
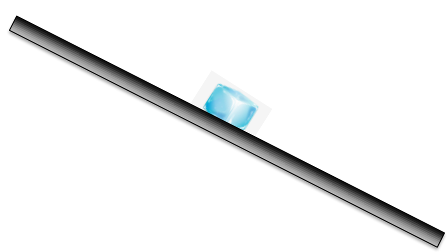


TeamUp Time!!

Question 1

- An ice cube slides down a frictionless ramp. How does N, the magnitude of the normal force exerted by the ramp on the ice cube, compare to $F_{\text{g E on C}}$, the magnitude of the gravitational force exerted by the Earth on the ice cube?

A. $N = 0 < F_{\text{g E on C}}$
B. $0 < N < F_{\text{g E on C}}$
C. $N = F_{\text{g E on C}}$
D. $N > F_{\text{g E on C}}$



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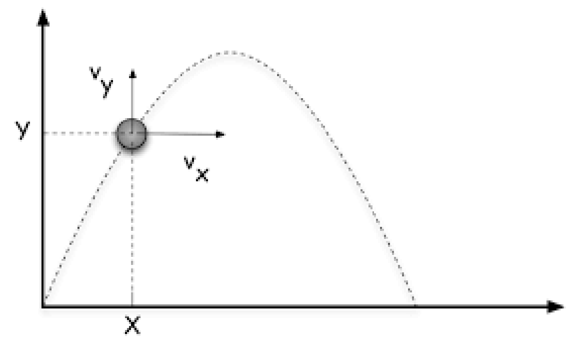
TeamUp Time!!

Question 2

- For projectile motion with no air resistance, the horizontal component of a projectile's velocity

A. remains zero.
B. remains a non-zero constant, generally not zero.
C. continuously increases.
D. continuously decreases.



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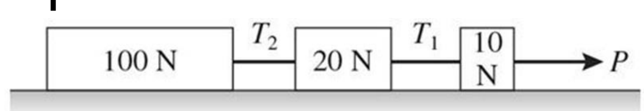

Question 3

- Earth exerts gravitational forces as shown in the figure on three boxes, which are pulled along a horizontal frictionless floor by a constant horizontal force P. The boxes are connected by light horizontal strings, having tensions T_1 and T_2. Which of the following statements about the tensions is correct?

A. $T_1 = P$
B. $T_1 + T_2 = P$
C. $T_2 > T_1$
D. $T_1 > T_2$

Now: TeamUp! You have 10 minutes

- Please keep this zoom-call open, but go to Microsoft Teams and someone (most recent Facilitator) should place a **video call** to all 3 or 4 members of your Pod-Chat.
- The first step is to decide who will be the TeamUp **Driver**
- All students must log-in to Quercus [You will now have three windows open: my zoom lecture, Microsoft Teams, and Quercus]
- **Non-drivers**: Wait!
- **Driver**: Go to the TeamUp Quiz in this module, click Go to Tool, then Create a Group. Let everyone in the Breakout Room know the session ID. Then WAIT – don't drive off alone!
- **Non-drivers**: Once you get the session ID, go to the TeamUp Quiz in this module, click Go to Tool, then Join Session and type the ID you were given.
- Once everyone in your room arrives in TeamUp, start going through the questions. Please **achieve consensus** before the driver submits. The more you get incorrect, the more points you lose!

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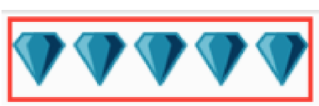

TeamUp Quick Review..

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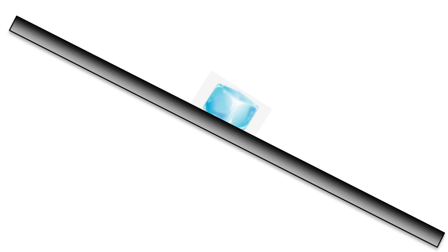

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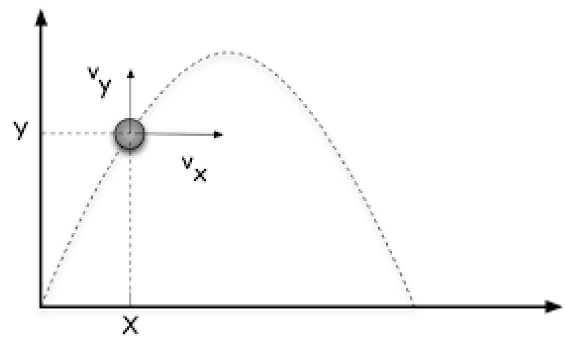
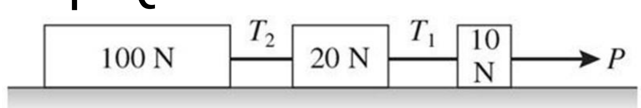


TeamUp Quick Review..



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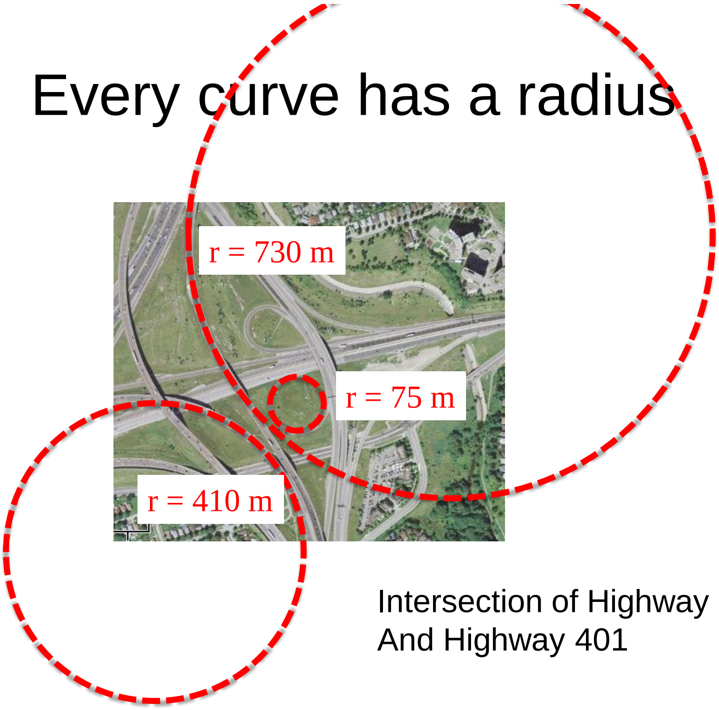
Every curve has a radius



Intersection of Highway 427
And Highway 401

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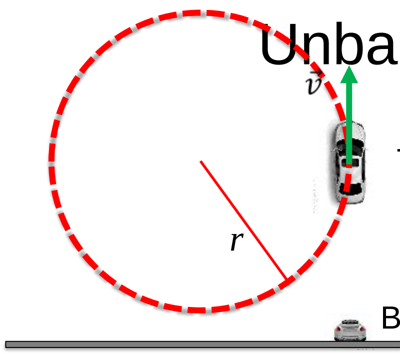
Clicker Question

Unbanked Curve



Top View

Back View

What horizontal force acts on the car to keep it on the curved path?

A. Gravity
B. Normal
C. Kinetic Friction
D. Static Friction
E. Rolling Friction

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Analyzing the acceleration vector

- An object's acceleration can be decomposed into components parallel and perpendicular to the velocity.
- If you set the x-axis to be in the direction of $\vec{v}$, then:
- $\vec{a}_x$ is the piece of the acceleration that causes the object to change **speed**
- $\vec{a}_y$ is the piece of the acceleration that causes the object to change **direction**
- An object changing direction *always* has a component of acceleration perpendicular to the direction of motion.

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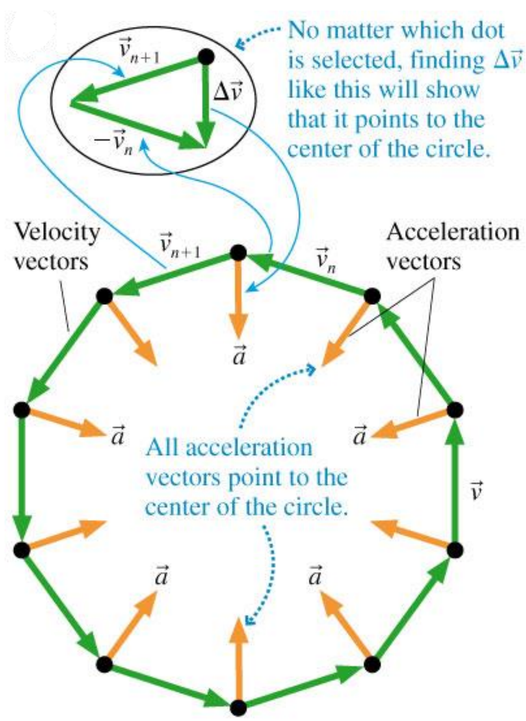
Uniform Circular Motion

Speed is constant.

$$v = \frac{2\pi r}{T}$$

where T = Period [s]



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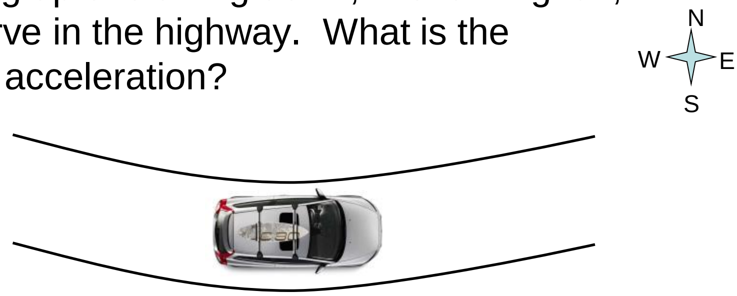
Clicker Question

A car is traveling East at a constant speed of 100 km/hr. Without speeding up of slowing down, it is turning left, following the curve in the highway. What is the **direction** of the acceleration?



A. North
B. East
C. North-East
D. North-West
E. None; the acceleration is zero.

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Midterm Assessment 2

- There will be two problems you must solve using the 4-step method.
- The solutions must be in your handwriting and written upon an Answer Template Sheet or something very similar.
- You will see both problems at once, starting on Tue. Oct. 13 at 8:10pm Toronto time. Both problems are from Chapter 4.
- You have 30 minutes to write out your solutions to both.
- There is an additional 5 minutes which you should allow for uploading the file. (You can practice with the format at the Ch.4 Pre-Quiz New Format.)
- All uploads must be complete by 8:45pm, 30 minutes after the start time.
- You may upload both solutions as a single PDF if you wish, or 2 PDFs, or 2 JPEG images.
- Please be aware of your file sizes, which should be measured in KB, not MB. (A single page should never be more than 2MB)

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Announcement from April Seeley

- The Quercus Administrators say:
  Each student has 52 MB of file capacity, if you are having problems uploading you are near capacity, run a check on you file storage for Quercus, to do this go to your "Account" in the blue navigation bar then click on "Files" at the bottom of the files tool, will tell you how much you have used out of the 52 MB allotted for each course.
- If you are running out of storage then you have to:
- delete unnecessary files.

OR
- move these files to OneDrive and when submitting choose OneDrive and select the file from there

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Before Class 14 next Wednesday

- Don’t forget to do the quiz on Tuesday evening!
- No class on Monday; no Practicals Tuesday, we resume the normal schedule Wed. Oct. 14.
- Before then, please read:
- 5.3 Radial Acceleration: $a = v^2/r$
- 5.4 Solving Circular Motion Problems

- Happy Thanksgiving!

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