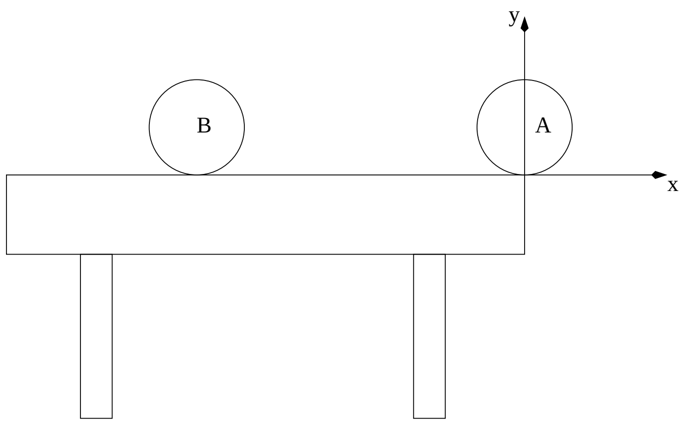
Example Test Questions – Physics 151

August 26, 2009

Example test questions for Exam 2.

1. For each of the following vectors θ is measured counter-clockwise from the positive x-axis, $\vec{A}$ has a magnitude of 4cm and $\theta_A = 30^o$, $\vec{B}$ has a magnitude of 7cm and $\theta_B = 112^o$.
   (a) Make a sketch that shows how to graphically add $\vec{A} + \vec{B} = \vec{C}$.
   (b) Find $\vec{A} + \vec{B} = \vec{C}$ analytically and express $\vec{C}$ using unit vectors.
   (c) What is the magnitude of $\vec{C}$?
   (d) What is the direction of $\vec{C}$?



2. Two identical billiard balls are labeled A and B. Maryland Fats places ball A at the very edge of the table. He places ball B at the other side. He strikes ball B with his cue so that it files across the table and off the edge. As it passes A, it just touches ball A lightly, knocking it off. The figure above shows the balls just at the instant they have left the table. Ball B is moving with a speed v_1 and ball A is essentially at rest.

   (a) Which ball do you think will hit the ground first? Explain your reasons for thinking so.

   Each graph below shows a quantity vs. time. In each case, the horizontal axis is the time axis. For each of the items below, select which graph could be a plot of that quantity vs. time. If none of the graphs are possible, write N. The time axes are taken to have $t = 0$ at the instant both balls leave the table. Use the x and y axes shown in the figure above.

   (b) The x-component of the velocity of ball B.

   (c) The y-component of the velocity of ball A.

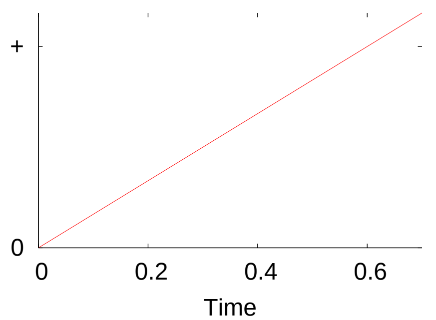
   (d) The y-component of the acceleration of ball A.

   (e) The y-component of the force on ball B.

   (f) The y-component of the force on ball A.

   (g) The x-component of the velocity of ball A.

   (h) The y-component of the acceleration of ball B.


+
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0.2
0.4
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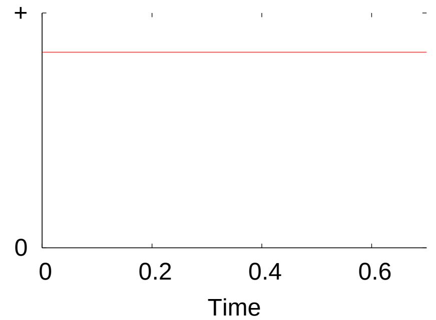
Time

A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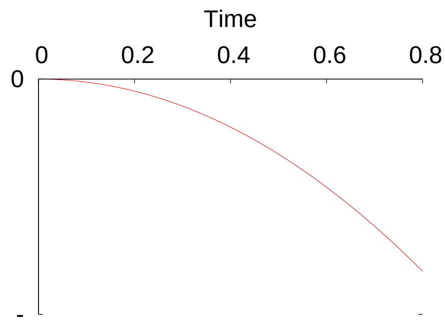
B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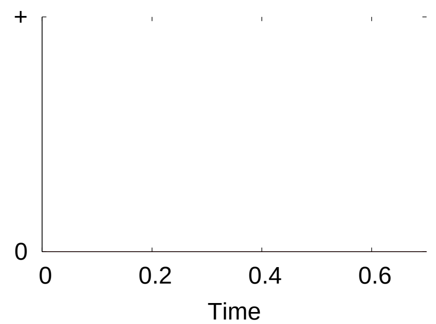
C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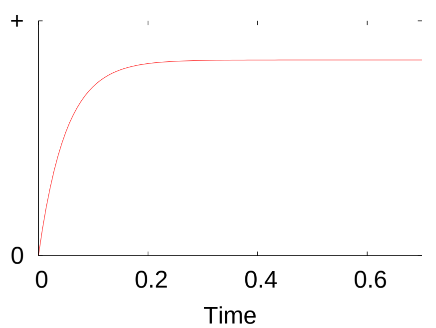
D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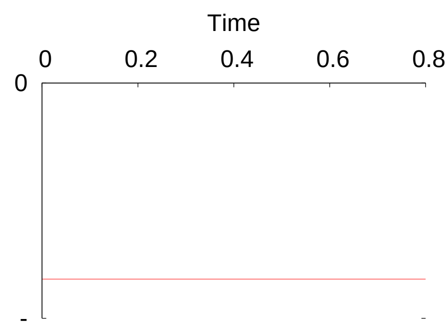
E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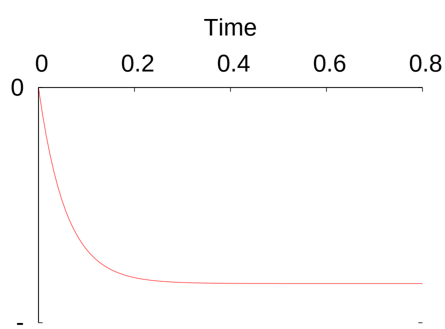
F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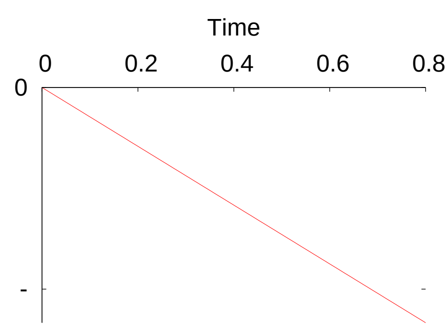
G


Time
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0.2
0.4
0.6
0.8
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H

3. A slide-loving pig slides down a certain slide (at an angle θ with the ground) in twice the time it would take to slide down a frictionless slide (which makes the same angle θ with the ground). What is the coefficient of kinetic friction between the pig and the slide? Both slides are the same length.

4. A 5.00kg block is pulled along a horizontal frictionless floor by a cord that exters a force of magnitude $|||\vec{F}|| = 12.0N$ at an angle $\theta = 25^o$ above the horizontal. Please ignore frictional effects.

   (a) What is the magnitude of the block's acceleration?

   (b) The force magnitude $||\vec{F}||$ is slowly increased. What is its value just before the block is lifted (completely) off the floor?

   (c) What is the magnitude of the block's acceleration just before it is lifted (completely)off the floor?

5. A contact force between two objects can be thought of as being composed of a normal force and a fricional force. Discuss what determines the size and direction of these foces.

6. A wheel of radius 0.30m spins clockwise at 600rpm just above the level ground (the bottom of the wheel just about brushes the ground). A chunk of rubber situated at the 11 o'clock position (imagine a clock on the wheel) breaks free and flies from the wheel.

   (a) What is the velocity of the chunk just as it breaks free from the wheel?

   (b) How long is the chunk in the air?

   (c) What is the displacement of the chunk between the time it breaks free and the time it hits the ground?