

Exam 1

**P201 Fall 2006,
Instructor: Prof. Abanov**

09/19/06

Name _____

Section _____

(print)

Your grade:

Problem 1.

An object is moving along a straight line with constant acceleration $a = -5\text{m/s}^2$. Its initial velocity is 16m/s .

What will be the velocity of the object in 3 seconds? _____

What will be the velocity of the object in 5 seconds? _____

What time will it take the object before it changes the direction of the motion? _____

What distance the object travels before it changes the direction of the motion? _____

Problem 2.

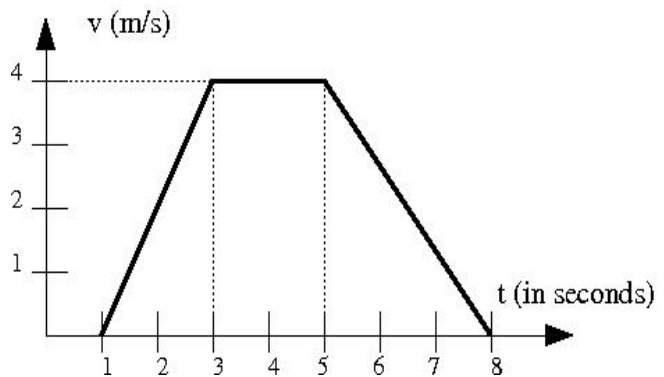
The figure shows the velocity vs. time for a car moving along a straight line.

What is the largest speed the car has had? _____

What distance did it travel during the first two seconds of its motion? _____

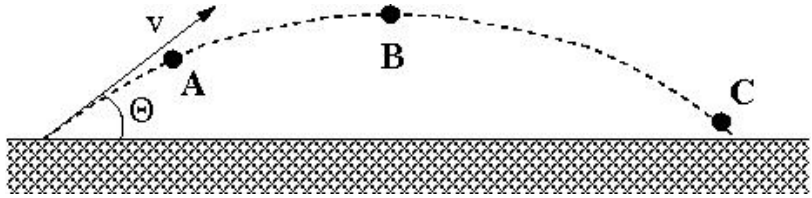
What total distance did it travel? _____

What was the average speed of the car during all time it was moving? _____



Problem 3.

A ball has been thrown from the ground level with initial velocity $v = 10\text{m/s}$ at the initial angle $\theta = 30^\circ$.



$\theta = 30^\circ$. Point B is the top of the trajectory, point C is right before the ball hits the ground.

What is the ball's acceleration at points A, B, and C? A _____, B _____, C _____

What is horizontal component of the velocity at points B and C? B _____, C _____

What is vertical component of the velocity at points B and C? B _____, C _____

What time does it take for the ball to reach the points B and C? B _____, C _____

What is the height of the trajectory at the point B? _____

What is the distance from the initial point to the point C? _____

What would the height of the trajectory at the point B be if you doubled the initial velocity? _____

What would the distance from the initial point to the point C be if you doubled the initial velocity? _____

Problem 4.

There are two cities A and B 1200km apart. The wind of 30km/h is blowing from the city B towards the city A. An airplane can fly with the speed 120km/h with respect to the air.

How long will it take for a plane to fly from the city A to the city B? _____

How long will it take for a plane to fly from the city B to the city A? _____

How long will it take for a plane to fly from City A to City B if the wind changes its direction by 90°? _____

Problem 5.

A car goes around the circle of radius $R=8\text{m}$ with constant speed $v=10\text{m/s}$

What is the acceleration of the car? _____

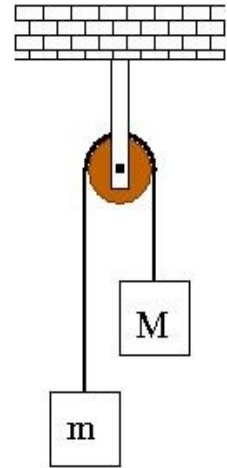
What would be the acceleration if you double the radius? _____

What velocity should the car have to make the acceleration two times smaller? _____

Name the force that causes this acceleration of the car? _____

Problem 6.

Two bricks with masses $M = 10\text{kg}$ and $m = 8\text{kg}$ are hanging on a frictionless pulley as shown on the figure.



What is the acceleration of the bricks m and M ? M _____, m _____

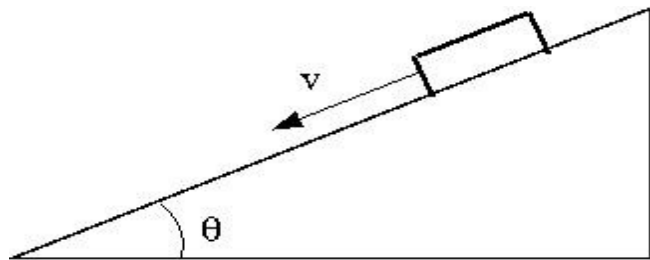
What is the tension T of the rope? _____

What additional vertical force one has to apply to the brick M to have zero acceleration? _____

Problem 7.

A brick of mass $M = 2\text{kg}$ on a slope of the angle $\theta = 20^\circ$ initially has a velocity $v = 1\text{m/s}$

The friction coefficient between the brick and the slope is $\mu = 0.4$



What is the friction force which acts on the brick? $F =$ _____ (show the direction on the figure)

What is the acceleration of the brick? _____

How much time will it take the brick to stop? _____

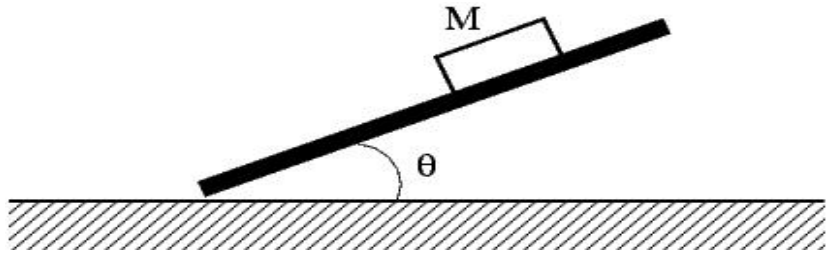
What distance will the brick move until it stops? _____

Problem 8.

The coefficient of the friction between the plywood sheet and the brick M is

$$\mu = 0.8 \text{ .}$$

At what angle θ can the brick slide without acceleration? _____



How will the answer to the previous question change if you put one more brick on top of the brick M? _____

Problem 9.

A brick of mass 3kg is suspended on a spring of the force constant $k = 150\text{N/m}$.

How much does the spring stretch? _____

How much would it stretch if we were doing this experiment on the moon? _____

(acceleration of free fall on the moon is $1/6^{\text{th}}$ of that on the earth)

Problem 10.

Two bricks with masses $M = 10\text{kg}$ and $m = 8\text{kg}$ are hanging on a weightless frictionless pulley as shown on the figure.

The spring's force constant $k = 120\text{N/m}$

What is the stretch of the spring?_____

(hint use tension T found in the Problem 6)

