

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Physics

Physics 8.01

Spring 2005

WEEKLY QUIZ 1
Friday, February 4, 2005

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FAMILY (LAST) NAME

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GIVEN (FIRST) NAME

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STUDENT ID NUMBER

Please check (✓) your class

	L01	MTW 11:00	Walter Lewin
	L02	MTW 11:00	Walter Lewin
	L03	MTW 2:00	Min Chen
	L04	MTW 3:00	Min Chen

INSTRUCTIONS:

1. FORMULA SHEET is in the back of this exam. You may tear it off. There is also a BLANK PAGE in case you need it.
2. This is a closed book exam. CALCULATORS, BOOKS, and NOTES are NOT ALLOWED.
3. Unless otherwise stated, to earn full credit you must show a valid DERIVATION and/or EXPLANATION of your answer, and you must express it in terms of the GIVEN VARIABLES.

Problem	Maximum	Score	Grader
1	20		
2	30		
3	30		
4	20		
TOTAL	100		

Problem 1: Unit conversions (*20 points*)

- (a) (*10 points*) Suppose the speed of bullet is 1000 feet per second. Using $1 \text{ mile} \approx 5000$ feet, what is the speed in miles per hour?

- (b) (*10 points*) A piece of aluminum foil has a mass per area equal to 0.01 g/cm^2 . What is its mass per area in kg/m^2 .

Problem 2: Two runners on a circular track (30 points)

Two runners start simultaneously from the same point on a circular track of circumference ℓ , and run in the same direction. The first runs at a constant speed v_1 , and the second runs at a constant speed v_2 , which is faster.

- (a) (5 points) After a time t , how much distance has the first runner traveled?
- (b) (15 points) When will the faster runner overtake (“lap”) the slower one?
- (c) (5 points) When the faster runner overtakes the slower one, how much distance has the faster runner traveled?

Problem 3: Average velocity, instantaneous velocity, and distance (30 points)

A toy train is moving along a linear track. Its distance from the start of the track at time t is given by

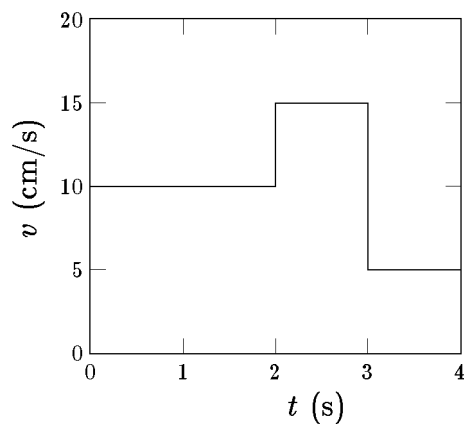
$$x(t) = At + Bt^2 + Ct^5 ,$$

where A , B , and C are constants.

(a) (10 points) At time t_1 , what is the instantaneous velocity of the train?

(b) (10 points) Between time $t = 0$ and $t = t_1$, what is the average velocity of the train?

(c) (10 points) Now suppose instead that the train has a velocity $v(t)$ given by the following graph:



How far has the train traveled between $t = 0$ and $t = 4$ s?

Problem 4: Seconds of Life (*20 points*)

A typical human lifespan is 70 years. To one significant figure, how many seconds does a typical person live?

Name _____

QUIZ 1
FORMULA SHEET
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$$v_{\text{av}} = \frac{\Delta x}{\Delta t} \quad \text{Average velocity;}$$

$$v = \frac{dx}{dt} \quad \text{Instantaneous velocity;}$$