

PHYS 101 Midterm examination #1 (vers. 1D)

18 Oct., 2002

Name \_\_\_\_\_

Time: 50 minutes

Student No. \_\_\_\_\_

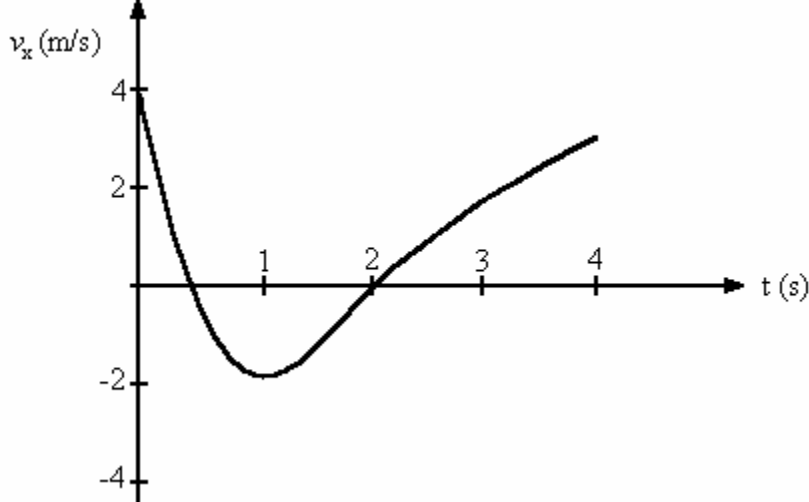
For questions 2 and 3, please show complete solutions and explain your reasoning, stating any principles that you have used.

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1<sub>(10 marks)</sub>. For each of the following five questions, please circle one answer only.

- (i) The figure below represents the velocity of a particle as it travels along the x axis. What is the average acceleration of the particle between  $t = 1$  second and  $t = 4$  seconds?

- (a)  $0.33 \text{ m/s}^2$
- (b)  $1.0 \text{ m/s}^2$
- (c)  $2.0 \text{ m/s}^2$
- (d)  $2.5 \text{ m/s}^2$
- (e)  $1.7 \text{ m/s}^2$



- (ii) A vector **A** has components  $A_x = 12 \text{ m}$  and  $A_y = 5 \text{ m}$ . What is the angle that vector **A** makes with the x axis?

- (a)  $22.6^\circ$
- (b)  $12.6^\circ$
- (c)  $32.6^\circ$
- (d)  $6.6^\circ$
- (e)  $13^\circ$

- (iii) A boy kicks a football with an initial velocity of  $20 \text{ m/s}$  at an angle of  $25^\circ$  above the horizontal. Ignore the air resistance. The acceleration of the ball while it is in flight is

- (a)  $18 \text{ m/s}^2$
- (b)  $20 \text{ m/s}^2$
- (c)  $9.8 \text{ m/s}^2$
- (d)  $0$
- (e)  $8.5 \text{ m/s}^2$

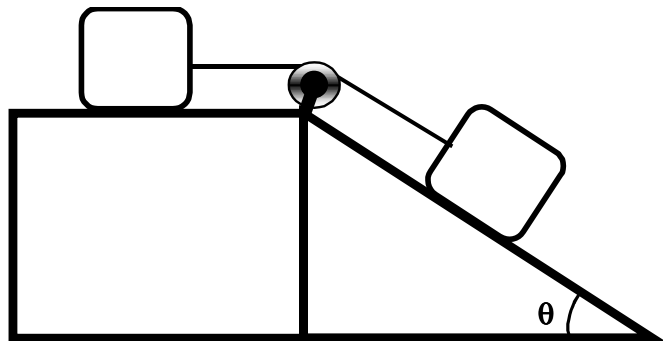
(iv) A satellite is moving uniformly in a circular orbit around the earth. Which statement is NOT true?

- (a) The gravitational force is perpendicular to the velocity of the satellite.
- (b) The speed of the satellite is unchanged.
- (c) The velocity of the satellite varies.
- (d) The gravitational force equals the centripetal force.
- (e) The acceleration is zero.

(v) On a horizontal frictionless road, a car crashes into a minivan. Immediately after the collision, the two vehicles remain tangled together but free to coast. Consider the total momentum and the total kinetic energy of the two vehicles before and after the collision.

- (a) Both the total momentum and total kinetic energy are conserved.
- (b) The total momentum is conserved but the total kinetic energy is not conserved.
- (c) Neither the total momentum nor the total kinetic energy is conserved.
- (d) The total kinetic energy is conserved but the total momentum is not conserved.
- (e) The change in total momentum equals the change in total kinetic energy.

2<sub>(4 marks)</sub>. As shown in the figure below, the two boxes have identical masses of 40 kg. The angle of inclination is  $\theta = 35^\circ$ . Ignore the mass of the tie cord and all the frictional forces. Find the acceleration of the boxes and the tension in the tie cord.



3<sub>(6 marks)</sub>. As shown in the figure below, a 0.012-kg bullet is fired horizontally into a 1.5-kg block. The bullet sticks in the block. The coefficient of kinetic friction between the block and the table is 0.25. Compute the speed of the bullet if the impact causes the block to move 0.60 m.

