

**Sultan Qaboos University**  
**Physics Department, College of Science**  
**Physics 2107: Physics for Engineering I Fall Semester 2006 - Test I**

**Monday 2nd October 2006**

**Time: 3:00 – 4:30 pm**

ID No.:	1	2	3	4	Total
Name:					

Full Mark:40 points

Please check that your examination paper has 4 **Questions**

- 1) The position of a particle moving along the x-axis is given by the equation

$$X(t) = 20t - t^2$$

Where x is expressed in meters and t in seconds

- a) Find the maximum positive x position
- b) The average velocity in the time interval t=6 s and 14 s.
- c) Find the average speed in the time interval t=6 s and 14 s
- d) The velocity of the particle when returns to its initial position.

**(10 points)**

- 2) The following three forces are accelerating a block of mass  $m$  with an acceleration of  $5 \text{ m/s}^2$ :  $\mathbf{F}_1 = (2.0\mathbf{i} + 2.0\mathbf{j}) \text{ N}$ ;  $\mathbf{F}_2 = (6.0\mathbf{i} - 3.0\mathbf{j}) \text{ N}$ ; and  $\mathbf{F}_3 = (7.0\mathbf{j}) \text{ N}$
- Find the mass of the block
  - Write the acceleration of the block in unit vector notation and represent it graphically.
  - Assuming that the block is initially at rest, find its velocity at  $t = 2.0 \text{ s}$  in unit vector notation. Also find the magnitude and direction of the velocity.
  - Find in unit vector notation, the force needed to prevent the block from moving. On the same graph of the acceleration represent this force graphically.

**(12 points)**

- 3) a) A boy throws a ball at an angle of  $50^\circ$  above the horizontal with a speed of  $12.0 \text{ m/s}$ . The horizontal component of the ball's velocity is directed toward a car that is approaching the boy at a constant speed of  $8.00 \text{ m/s}$ . If the ball is to hit the car at the same height at which it leaves, what is the maximum distance the car can be from the boy when the ball is thrown?



- b) A train consisting of flatcars is traveling to the right at speed of  $13.0 \text{ m/s}$  relative to an observer standing on the ground. Someone is riding a motor scooter on the flatcar. What is the velocity (magnitude and direction) of the motor scooter relative to the flatcar if its velocity relative to the observer on the ground is

- a)  $18.0 \text{ m/s}$  to the right?
- b)  $3.0 \text{ m/s}$  to the left?
- c) zero?

**(3 points)**

4) Two blocks  $m_1 = 100 \text{ kg}$  and  $m_2 = 50 \text{ kg}$  rest on frictionless planes are connected with a rope passing over a frictionless pulley as shown in the figure.

- a- To which direction will the system move when the blocks are released from rest?
- b- Draw the free-body diagrams of the blocks
- c- What is the acceleration of the blocks?
- d- What is the tension in the rope?

