

Part I: Multiple Choice (1 mark each)

Read and choose carefully. Please circle the letter of the best answer. You may do rough work in the margins but only the answer is marked.

1. A student is measuring the following quantities:

- I. Velocity
- II. Mass
- III. Distance
- IV. Time

Which of the quantities are best described as vectors?

- A. III only B. II, III, and IV C. I and III D. I only

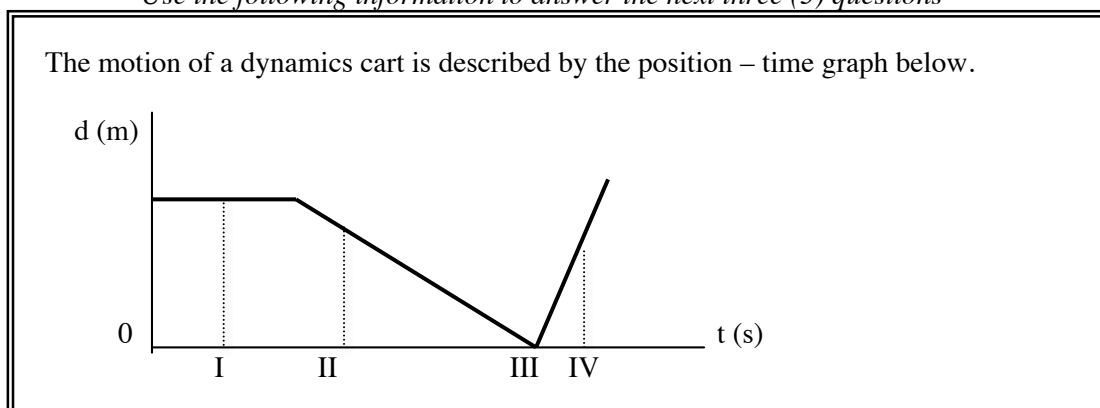
2. A ball is rolling along a level 2.0 m long table that is pushed against a wall. The ball is given a push from the end of the table and it rolls towards the wall, hits the wall and rolls back 1.0 m before coming to rest. Identify the *false* statement regarding the motion of the ball.

- A. The ball traveled a distance of 3.0 m.
- B. The change in position of the ball is 1.0 m.
- C. The change in position of the ball is 3.0 m
- D. The ball experienced a change in velocity after hitting the wall.

3. A car travels at an average speed of 100 km/h for 0.50 h, stops for a 0.50 h, and then travels at an average speed of 50 km/h for 1.00 h. The average speed for the entire trip is

- A. 50 km/h B. 53 km/h C. 63 km/h D. 75 km/h

Use the following information to answer the next three (3) questions



4. The cart is stationary at time

- A. I B. II C. III D. IV

5. The speed of the cart is the greatest at time

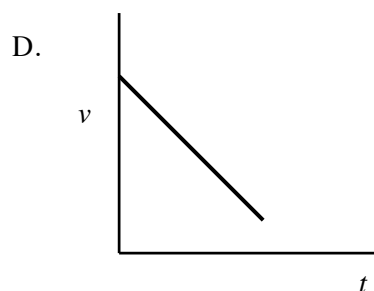
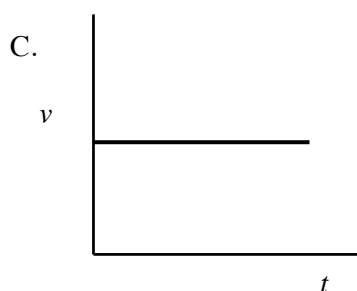
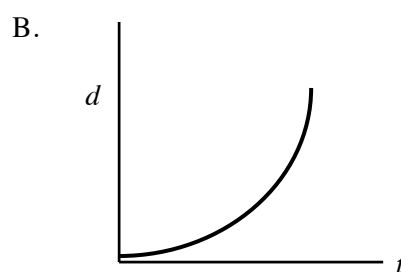
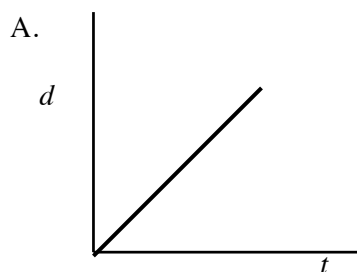
- A. I B. II C. III D. IV

6. The cart is moving *towards* the reference position at time
- A. I B. II C. III D. IV

Use the following information to answer the next question.

- I. The area bounded between the velocity-time graph and the time axis.
 II. The slope of the velocity – time graph.
 III. The change in an object’s velocity over a particular time interval.

7. The acceleration of an object can be found using method(s)
- A. III only B. II only C. I, II, and III D. II and III only
8. Which of the following graphs best represents uniform (positive) acceleration?



9. A jet plane traveling at 45 m/s lands on a runway and accelerates at a rate of -3.0 m/s^2 . The speed of the plane after it has traveled 140 m along the runway after landing is
- A. 34 m/s B. 38 m/s C. 54 m/s D. 0
10. A car accelerates from 10 m/s to 20 m/s in a time of 4.0 s. The distance traveled by the car is
- A. 20 m B. 40m C. 60 m D. 80 m
11. A student throws a rock vertically upward from the deck of a bridge with a speed of 15 m/s. How long will it take for the rock to reach its maximum height?
- A. 1.0 s B. 1.5 s C. 2.0 s D. 2.5 s

Use the following information to answer the next two (2) questions.

A boat is capable of moving at a speed of 25.0 km/h in still water. A 1.0 km wide river is flowing with a velocity of 10.0 km/h [E].

12. If the boat has a speed of 15.0 km/h relative to the shore, what is the direction that the boat is traveling?
- A. West B. East C. North D. Northeast
13. How long will it take for the boat to travel a distance of 10.0 km downstream with the current?
- A. 0.29 h B. 0.40 h C. 0.67 h D. 1.0 h

Use the following information to answer the next question.

A plane is capable of flying with an air speed of 265-km/h. The wind velocity is 88 km/h, [E].

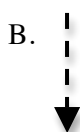
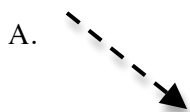
14. The heading required by the plane such that it flies due south is
- A. 18.4° west of south B. 18.4° south of west
C. 19.4° west of south D. 19.4° south of west
15. A plane is flying at 786 km/h, 261.9°. The “north-south” component of its velocity is
- A. 111 km/h [N] B. 111 km/h [S] C. 778 km/h [N] D. 778 km/h [S]

Use the following information to answer the next question.



A plane carrying emergency supplies is flying horizontally towards a group of sailors shipwrecked on a deserted island. The crew of the plane will drop the supplies and a parachute system will allow the supplies to land safely near the island.

16. In the absence of air resistance, the trajectory of the supplies as they fall to the island will most closely resemble which path?



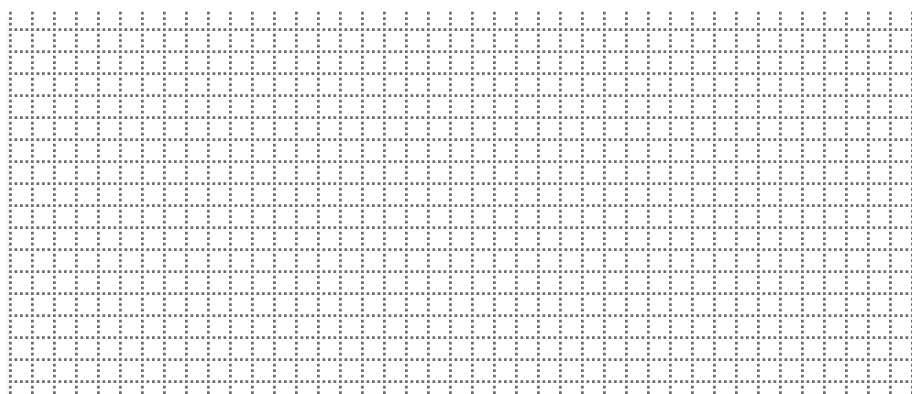
Part II: Written Response (20 marks).

Please answer the following questions in the space provided. Show all work to receive full marks. Vector diagrams must be labeled and neatly drawn.

17. A rocket cart accelerates from rest along a level track to a maximum speed of 24 m/s in a time interval of 3.0 seconds. After reaching maximum speed the rocket engine cuts out and the cart travels at a constant speed of 24 m/s for another 2.0 seconds until it reaches an inclined section of track. While traveling along the incline the cart gradually comes to a stop with an average acceleration of -4.0 m/s^2 .

a. Calculate the time for the cart to stop after it reaches the incline? (2)

b. Draw a velocity-time graph for the cart from the time it starts its engine to the time it stops on the incline. (3)



c. Use the velocity-time graph or another suitable method to determine how far the cart travels until it stops along the incline. (3)

18. A plane is flying with a ground velocity of 585 km/h, 180.0° , when it encounters a wind blowing at 82 km/h, 270.0° . Find the magnitude and direction of the relative velocity of the plane to the ground. A neat, labeled vector diagram is required as part of the solution. (4)

19. Tom and Jerry are entered in a car rally. They both start from the same checkpoint at the same time but they drive with different velocities. Tom drives with a velocity of 15 m/s $[\text{E } 25^\circ \text{ N}]$ while Jerry drives with a velocity of 20 m/s $[\text{W } 35^\circ \text{ N}]$. Who is farther north of the starting checkpoint after one hour? Justify your answer. (3)

20. A cannon is fired from the top of a castle turret and it strikes its target 345 m from the base of the turret. The muzzle velocity of the cannonball is 225 m/s and the cannon is fired horizontally.
- a. Find the elapsed time between the firing of the cannon and the striking of the target. (2)
 - b. Calculate the height of the castle turret above the target. Assume zero air resistance on the cannonball during its flight. (3)