

## Exam I

Spring 2003  
Serway, Chapters 1-5

### Part I: Qualitative

*Write the letter of the correct answer on the answer sheet.*

**NO PARTIAL CREDIT: SUBMIT ONE ANSWER ONLY.**

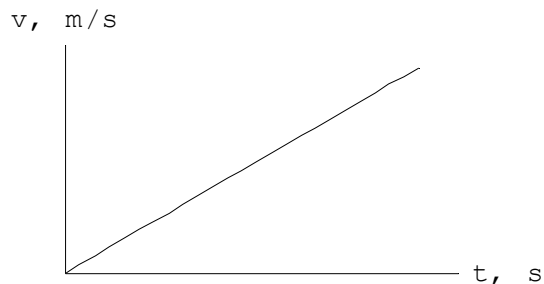
*Note that in qualitative multiple-choice questions, sometimes one answer is clearly correct, while the others are clearly incorrect. However, with some questions you must choose the best or most complete answer.*

**Note also that even though this section is qualitative, the formula sheet may prove useful for some questions.**

**20 questions at 3 points each = 50 % of test**

- Which of the following statements is **true**?
  - Scalar quantities have direction only
  - Vector quantities have direction only
  - Scalar quantities have both magnitude and direction
  - Vector quantities have both magnitude and direction
- Which of the following is **NOT** a vector quantity?
  - Time
  - Force
  - Velocity
  - Acceleration
- Suppose that two vectors are added to form a third vector:  $\vec{A} + \vec{B} = \vec{C}$ . Suppose also that the **magnitudes** happen to obey this equation:  $A + B = C$ . What can you conclude?
  - The two vectors  $\vec{A}$  and  $\vec{B}$  must be force vectors.
  - The two vectors  $\vec{A}$  and  $\vec{B}$  must point in the same direction.
  - The two vectors  $\vec{A}$  and  $\vec{B}$  must be at right angles.
  - The two vectors  $\vec{A}$  and  $\vec{B}$  must have equal magnitudes.

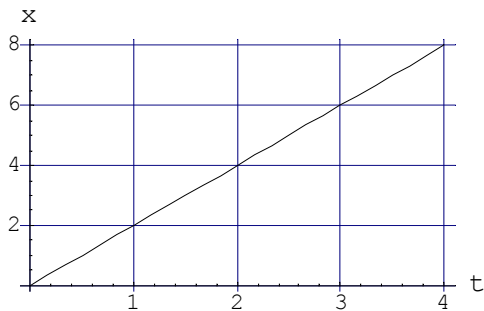
4. Unit vectors are
- vectors that represent quantities that have units.
  - vectors that represent quantities that do not have units.
  - mathematical objects that were used prior to the development of modern vector analysis.
  - unitless vectors whose magnitudes equal 1.
5. Consider some path from point  $A$  to point  $B$ . When will the path length equal the magnitude of the displacement vector from point  $A$  to point  $B$ ?
- Always.
  - Never.
  - Only if the path from  $A$  to  $B$  is a straight line.
  - Only if the path from  $A$  to  $B$  is a circular arc.
6. On a graph of velocity vs. time for one-dimensional motion, a straight line sloping upward to the right corresponds to motion at



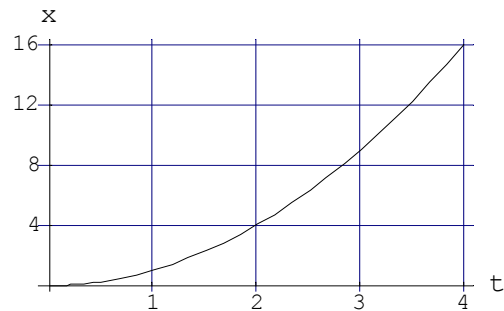
- increasing acceleration.
  - decreasing acceleration.
  - constant but non-zero acceleration.
  - zero acceleration.
7. In which of the following situations does a car have a westward acceleration?
- It travels westward at constant speed.
  - It travels eastward and speed up.
  - It travels westward and slows down.
  - It travels eastward and slows down.
8. A man is standing on the edge of a cliff. He throws one stone straight up with an initial speed " $u$ ". He also throws another stone straight down with the same initial speed. Neglecting air resistance, which stone has the larger speed when it hits the ground below the cliff?
- The stone thrown up.
  - The stone thrown down.
  - They both have the same speed.
  - Either might have the larger speed, depending on which has the larger mass.

9. On an  $x-t$  graph, the motion of a car traveling along a straight, level road with a constant acceleration of  $2 \text{ m/s}^2$  would appear as follows:

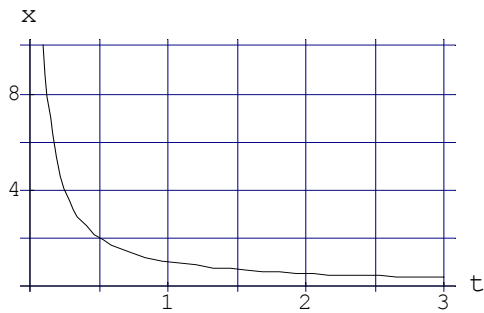
(a)



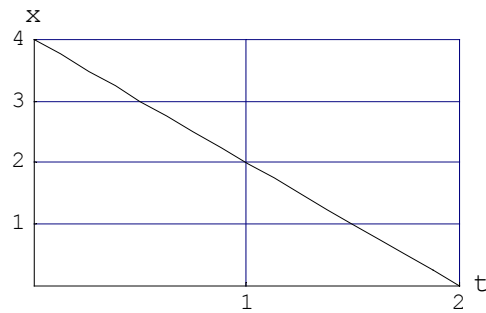
(b)



(c)



(d)



10. In two or three dimensional motion, the velocity vector is

- (a) always tangent to the path.
- (b) always perpendicular to the path.
- (c) can have both a tangential and perpendicular component to the path.
- (d) always points in the same direction as the acceleration vector.

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12. Two rowers who row at the same speed set off across a river at the same time. One heads straight across and is pulled downstream somewhat by the current. The other heads slightly upstream at just the right angle so as to arrive at a point on the other shore directly across from his starting point. Which of the rowers reaches the other side first?

- (a) The rower heading straight across but pulled downstream.
- (b) The rower heading at an angle to arrive directly across from his starting point.
- (c) Both reach the opposite shore at the same time.
- (d) Which reaches the opposite shore first depends on the velocity of the stream.

13. The weight of a body
- (a) is the quantity of matter it contains.
  - (b) refers to its inertia.
  - (c) is basically the same as its mass but expressed in different units.
  - (d) is the force with which it is attracted to the earth.
14. Mass is a quantitative measure of
- (a) Inertia
  - (b) Force
  - (c) Weight
  - (d) Acceleration
15. Which of the following terms is used to indicate the natural tendency of matter to remain at rest or in motion with constant velocity?
- (a) Acceleration
  - (b) Force
  - (c) Inertia
  - (d) Equilibrium
16. In the traditional way to state Newton's 3rd law of motion, the word *action* refers to
- (a) Velocity
  - (b) Acceleration
  - (c) Force
  - (d) Friction
17. To a good approximation, the frictional force between two surfaces in contact does **NOT** depend on
- (a) the normal force holding them together
  - (b) the areas of the surfaces in contact
  - (c) whether the surfaces are stationary or in relative motion
  - (d) whether a lubricant is used
18. A **normal** force
- (a) refers to a force that is usual and customary in a given situation.
  - (b) is a force exerted by a surface on an object residing on that surface.
  - (c) is zero in any problem involving friction between surfaces.
  - (d) is a force always opposite to the direction of an object's weight.
19. With friction present, to start an object in motion on a surface usually requires
- (a) less force than to keep it in motion.
  - (b) more force than to keep it in motion.
  - (c) the same force that is needed to keep it in motion.
  - (d) only as much force as needed to overcome inertia.
20. You are holding a rope from which a rock is suspended. You pull straight up on the rope so that the rock is accelerating upward.
- (a) The tension in the rope is greater than the weight of the rock.
  - (b) The tension in the rope is less than the weight of the rock.
  - (c) The tension in the rope is equal to the weight of the rock.
  - (d) The tension in the rope is equal to the mass of the rock.

## Part II: Quantitative

Write the letter of the correct answer on the answer sheet. Use the backs of these test pages for scratch work.

**PARTIAL CREDIT POSSIBLE:** Select one (1), two (2), or three (3) choices.

6 points for the single correct answer

4 points if correct answer is among two choices

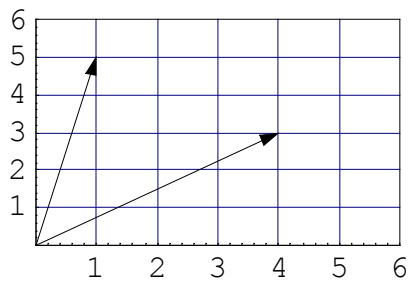
2 points if correct answer is among three choices

0 if correct answer not present or of more than 3 answers are submitted

10 questions at 6 points each = 50 % of test

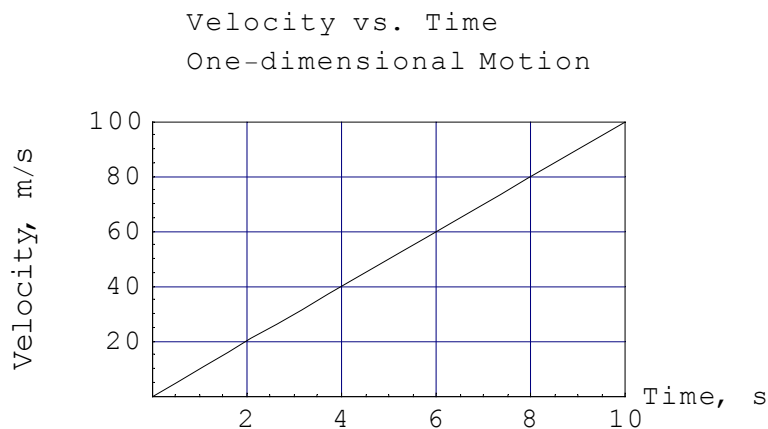
21. Suppose a box is at the origin. Two ropes are tied to it and forces  $\vec{A}$  and  $\vec{B}$  are applied, as shown in the vector diagram. Find the magnitude of  $\vec{A} + \vec{B}$ .

Force Vectors in newtons



- (a) 8.62 N  
(b) 9.43 N  
(c) 10.1 N  
(d) 11.6 N  
(e) 12.3 N
22. A car starts from rest and accelerates at a constant rate of  $2.5 \text{ m/s}^2$ . How far will the car travel in 12 s?
- (a) 180 m      (b) 120 m      (c) 30 m      (d) 15 m      (e) 4.8 m
23. A ball is projected vertically upward from ground level at 25 m/s. How much time will elapse before it hits the ground?
- (a) 2.6 s  
(b) 5.1 s  
(c) 7.5 s  
(d) 10 s  
(e) 12 s

24. Consider the  $v$ - $t$  graph shown for one-dimensional motion, where  $v$  is in m/s and  $t$  is in seconds.



Find how far the object traveled during the first 10 seconds of motion.

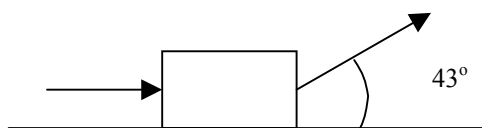
- (a) 10 m  
(b) 100 m  
(c) 500 m  
(d) 1000 m  
(e) 1500 m
25. A cannon is fired horizontally from the edge of a vertical cliff 80 m high. The cannon ball strikes the ground 1330 m from the base of the cliff. What is the speed of the ball when it hits the ground? (**Hint:** You will need the Pythagorean theorem.)
- (a) 4.0 m/s  
(b) 9.8 m/s  
(c) 82 m/s  
(d) 170 m/s  
(e) 330 m/s
26. Suppose the position vector in meters for a certain object in two-dimensional motion is given by  $\vec{r} = 3.00t^2 \hat{i} - 2.00t^3 \hat{j}$ . Determine the magnitude of the **acceleration** at  $t = 2.00$  s.
- (a) 6.00 m/s<sup>2</sup>  
(b) 11.4 m/s<sup>2</sup>  
(c) 24.7 m/s<sup>2</sup>  
(d) 26.8 m/s<sup>2</sup>  
(e) 31.4 m/s<sup>2</sup>

27. A particle moves along a circular path of radius 2.0 m. At an instant when the speed of the particle is equal to 3.0 m/s and changing at the rate of  $5.0 \text{ m/s}^2$ , what is the magnitude of the total acceleration of the particle?

- (a)  $7.5 \text{ m/s}^2$
- (b)  $6.0 \text{ m/s}^2$
- (c)  $5.4 \text{ m/s}^2$
- (d)  $6.7 \text{ m/s}^2$
- (e)  $4.5 \text{ m/s}^2$

28. Two forces act on a block of mass 4.5 kg resting on a frictionless, horizontal surface, as shown. The horizontal force is 3.7 N; the other force of 5.9 N acts at an angle of  $43^\circ$  from the horizontal. What is the magnitude of the acceleration of the block?

- (a)  $0.82 \text{ m/s}^2$
- (b)  $1.2 \text{ m/s}^2$
- (c)  $1.8 \text{ m/s}^2$
- (d)  $3.2 \text{ m/s}^2$
- (e)  $8.9 \text{ m/s}^2$



29. A 1000-kg elevator is accelerated upward at  $1.00 \text{ m/s}^2$ . Find the tension in the cable.

- (a) 800 N
- (b) 1000 N
- (c) 8800 N
- (d) 9800 N
- (e) 10,800 N

30. If the coefficient of kinetic friction between the floor and a crate is 0.450. If the crate has a mass of 25.0 kg, how much force is required to move the crate at a steady speed across the floor?

- (a) 11.0 N
- (b) 110 N
- (c) 130 N
- (d) 250 N
- (e) 245 N