Miami Dade College - Wolfson Campus
PHY1025 - Spring 2015
Exam-1

Name: Key

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) If $\vec{A} + \vec{B} = \vec{C}$ and their magnitudes are given by $A + B = C$, then the vectors $\vec{A}$ and $\vec{B}$ are oriented — 1) C
   A) antiparallel to each other (in opposite directions).
   B) perpendicular relative to one other.
   C) parallel to each other (in the same direction).
   D) It is impossible to know from the given information.

2) Vectors $\vec{M}$ and $\vec{N}$ obey the equation $\vec{M} + \vec{N} = 0$. These vectors satisfy which one of the following statements? — 2) B
   A) Vectors $\vec{M}$ and $\vec{N}$ are at right angles to each other.
   B) The magnitude of $\vec{M}$ is the negative of the magnitude of $\vec{N}$.
   C) Vectors $\vec{M}$ and $\vec{N}$ point in the same direction.
   D) Vectors $\vec{M}$ and $\vec{N}$ have the same magnitudes.

3) The magnitude of a vector an only zero if *all* of its components are zero. — 3) A
   A) True B) False

4) If a vector $\vec{A}$ has components $A_x > 0$, and $A_y < 0$, then the angle that this vector makes with the positive x-axis must be in the range — 4) B
   A) 180° to 270°
   B) 270° to 360°
   C) 0° to 90°
   D) 90° to 180°
   E) cannot be determined without additional information

5) When is the average velocity of an object equal to the instantaneous velocity? — 5) D
   A) never
   B) only when the velocity is increasing at a constant rate
   C) only when the velocity is decreasing at a constant rate
   D) when the velocity is constant
   E) always

6) If the velocity of an object is zero at some point, then its acceleration must also be zero at that point. — 6) B
   A) True B) False

7) Suppose that an object is moving with a constant velocity. Which statement concerning its acceleration must be correct? 7) B

A) The acceleration is a constant non-zero value.
B) The acceleration is equal to zero.
C) The acceleration is constantly decreasing.
D) The acceleration is constantly increasing.

8) Suppose a ball is thrown straight up and experiences no appreciable air resistance. What is its acceleration just before it reaches its highest point? 8) B

A) slightly less than g
B) exactly g
C) zero
D) slightly greater than g

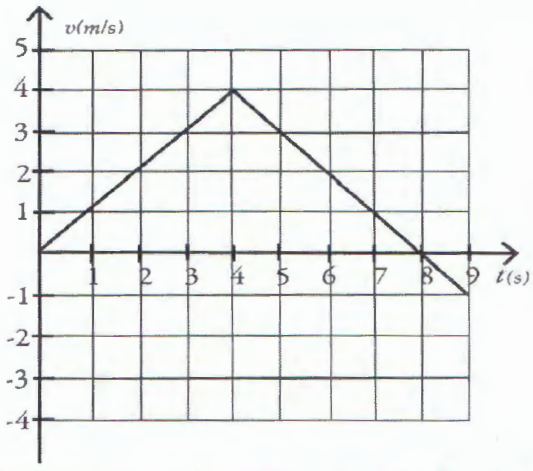
9) A 10-kg rock and a 20-kg rock are thrown upward with the same initial speed v_0 and experience no significant air resistance. If the 10-kg rock reaches a maximum height h, what maximum height will the 20-kg ball reach? 9) E

A) $h/2$ B) $2h$ C) $4h$ D) $h/4$ E) h

10) If the position versus time graph of an object is a horizontal line, the object is 10) C

A) moving with constant non-zero speed.
B) moving with constant non-zero acceleration.
C) at rest.
D) moving with increasing speed.

QUESTION 2 (15)



The figure shows the velocity of an object moving along a straight line as a function of time. Determine:

a) The displacement of the object for the first 9 seconds.

$\Delta x = \frac{1}{2}(8)(4) - \frac{1}{2}(1)(1) = 16 - 0.5 = 15.5\,m$ (3)

b) The object's average velocity from t = 0 s to t = 9 s.

$v_{Avg} = \frac{15.5\,m}{9} = 1.7\,m/s$ (3)

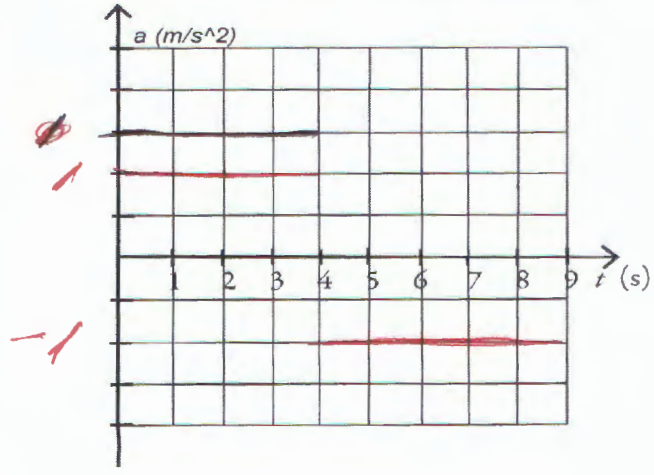
c) The object's average acceleration from t = 0 to t = 5 seconds.

$a = \frac{\Delta v}{\Delta t} = \frac{3-0}{5} = 0.6\,m/s^2$ (3)

c) The acceleration of the object at t =8 seconds.

$a = \text{Slope} = \frac{0-4}{8-4} = -1\,m/s^2$ (3)

d) On the axis shown, **sketch** (don't specify exact values for the acceleration) a graph of acceleration as a function of time



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Section II: Free Response.

Write your responses on the space provided after each question. You must show all your work to receive credit.

QUESTION 1

A car increases its forward velocity uniformly from 40 m/s to 80 m/s while traveling a distance of 200 m.

a) What is its acceleration during this time?

$$v^2 = v_0^2 + 2a\Delta x$$

$$\Delta x = \frac{v^2 - v_0^2}{2a} = \frac{(80)^2 - (40)^2}{2(200)} = \frac{4800}{400} = \boxed{12\ m/s^2}$$

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(b) How much time does it take to the car to reach 80 m/s?

$$v = v_0 + at$$

$$t = \frac{v - v_0}{a} = \frac{80 - 40}{12} = \boxed{3.3\ s}$$

3

(c) Calculate the average velocity of the car for the time interval calculated in part (b).

$$v_{Avg} = \frac{\Delta x}{\Delta t} = \frac{200}{3.3} = \boxed{60\ m/s}$$

3

(d) What is the speed of the car 20 seconds after it was moving at 80 m/s?

$$v_f = v_0 + at$$

$$= 80 + 12(20)$$

$$= 80 + 240 = \boxed{320\ m/s}$$

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MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Two displacement vectors have magnitudes of 5.0 m and 7.0 m, respectively. If these two vectors are added together, the magnitude of the sum 1) D
   A) is equal to 8.6 m.
   B) is equal to 2.0 m.
   C) is equal to 12 m.
   D) could be as small as 2.0 m or as large as 12 m.

2) The sum of two vectors of fixed magnitudes has the greatest magnitude when the angle between these two vectors is 2) B
   A) 60° B) 0° C) 270° D) 90° E) 180°

3) If a vector's components are all negative, then the magnitude of the vector is negative. 3) B
   A) True B) False

4) If a vector $\vec{A}$ has components $A_x < 0$, and $A_y > 0$, then the angle that this vector makes with the positive x-axis must be in the range 4) D
   A) 0° to 90°
   B) 270° to 360°
   C) 180° to 270°
   D) 90° to 180°
   E) It cannot be determined without additional information.

5) Suppose that an object travels from one point in space to another. Make a comparison between the magnitude of the displacement and the distance traveled by this object. 5) D
   A) The displacement can be either greater than, smaller than, or equal to the distance traveled.
   B) The displacement is always equal to the distance traveled.
   C) The displacement is either greater than or equal to the distance traveled.
   D) The displacement is either less than or equal to the distance traveled.

6) If the acceleration of an object is zero, then that object cannot be moving. 6) B
   A) True B) False

7) Suppose that a car traveling to the west begins to slow down as it approaches a traffic light. Which of the following statements about its acceleration is correct? 7) D
   A) Since the car is slowing down, its acceleration must be negative.
   B) The acceleration is toward the west.
   C) The acceleration is zero.
   D) The acceleration is toward the east.

8) When a ball is thrown straight up with no air resistance, the acceleration at its highest point 8) E

A) is zero
B) is upward
C) reverses from downward to upward
D) reverses from upward to downward
E) is downward

9) A ball is thrown straight up, reaches a maximum height, then falls to its initial height. Which of the following statements about the direction of the velocity and acceleration of the ball as it is *going up* is correct? 9) C

A) Its velocity points downward and its acceleration points upward.
B) Both its velocity and its acceleration point upward.
C) Its velocity points upward and its acceleration points downward.
D) Both its velocity and its acceleration points downward.

10) An object is moving with constant non-zero velocity in the $+x$ direction. The velocity versus time graph of this object is 10) A

A) a horizontal straight line.
B) a vertical straight line.
C) a straight line making an angle with the time axis.
D) a parabolic curve.

Section II – Free-Response

Directions: Read each question carefully and write your responses on the space provided after each question. You must show your work to receive credit.

QUESTION 1

A car with good tires on a dry road can **decelerate** at about 5.0 m/s^2 when braking. Suppose a car is initially traveling at 50 m/s.

(a.) How much time does it take the car to stop? $a = -5.0\ m/s^2$

$v = v_0 + at$

$0 = 50 - 5t$

$t = \frac{-50}{-5} = 10s$ (3)

(b) What is the car's stopping distance?

$\Delta x = v_0 t + \frac{1}{2} a t^2$ (3)

$= (50)(10) + \frac{1}{2}(-5)(10)^2 = 500 - 250$

$= 250m$

(c) Calculate the car's average velocity.

$v_{Avg} = \frac{\Delta x}{\Delta t} = \frac{250}{10} = 25\ m/s$ (3)

(c) What is the speed of the car half way of its braking?

$\Delta x = 125m$ (3)

$v^2 = v_0^2 + 2a\Delta x$

$v^2 = (50)^2 + 2(-5)(125) = 2500 - 1250$

$v = \sqrt{1250} = 35.3\ m/s$

QUESTION 2

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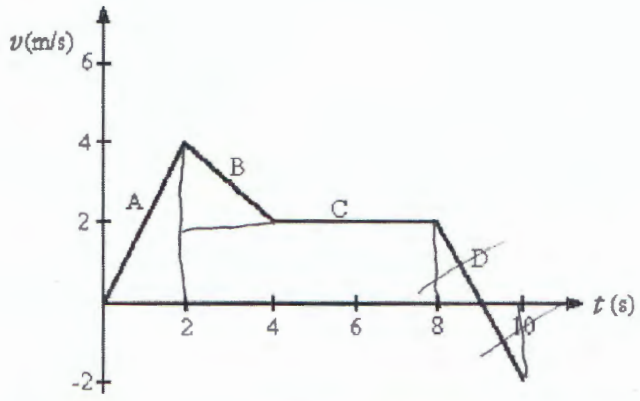

The figure shows a graph of the velocity as a function of time for a basketball player traveling up and down the court in a straight-line path. The player is at $x = 0$ meters at time $t = 0$ seconds .Determine:

a) The displacement of the player for the first 10 seconds.

$$\Delta x = \frac{1}{2}(2)(4) + \frac{1}{2}(2)(2) + 6 \times 2$$

$$= 4 + 2 + 12 = 18\,m$$

3

b) The player's average velocity from t = 0 s to t = 10 s.

$$v_{Avg} = \frac{18}{10} = 1.8\,m/s$$

3

c) The player's average acceleration from t = 0 to t=4 seconds.

$$a = \frac{2 - 0}{4} = 0.5\,m/s^2$$

3

d) The players acceleration at t = 9 seconds.

$$a = Slope = \frac{0 - 2}{9 - 8} = -2\,m/s^2$$

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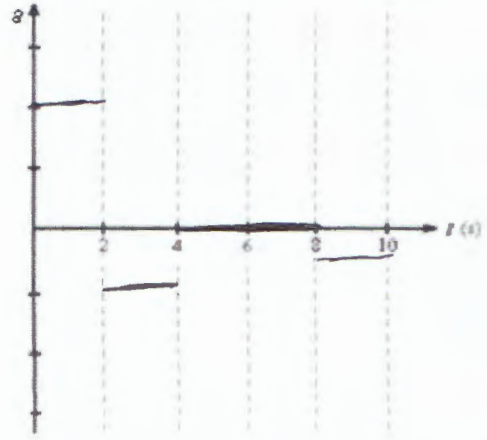
e) On the axis shown, sketch a graph of acceleration as a function of time. You don't need to specify values for the acceleration.



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