Name KEY

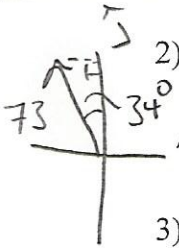
Exam 1 15 questions

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

1) A monkey hangs from a tree that is 30 meters tall. A hiker wants to give the monkey a banana and has built a gun that will shoot the banana to the monkey. The hiker knows that at the instant the gun is fired, the monkey will be startled and let go of the tree. Assume that the instant the gun is fired is the instant that the monkey lets go of the tree. The hunter should aim the gun _____.

Class notes

A) above the monkey (B) at the monkey C) below the monkey



2) The vector A has a magnitude of 73 units at an angle of 124°. Expressed in algebraic notation, the vector would be written _____.

A) $-60.5\,\hat{i}+40.8\,\hat{j}$ (B) $-40.8\,\hat{i}+60.5\,\hat{j}$ C) $-60.5\,\hat{i}-40.8\,\hat{j}$ D) $-40.8\,\hat{i}-60.5\,\hat{j}$

$-73\sin(34)$ $+73\cos(34)$

3) A car is travelling at a speed of 22 m/s when the driver sees a deer in the headlights, 100 meters away. At that instant, the driver slams on the brakes. What is the minimum magnitude of the acceleration if the car is to barely avoid hitting the deer. (To be clear: The car comes to a stop over a distance of 100 meters). Assume that the acceleration of the car is constant.

SEE LAST PAGE

A) more information is needed. (B) 2.42 m/s^2

C) 7.26 m/s^2 D) 4.55 m/s^2

4) A soccer ball is kicked up into the air and toward the goal. As it travels through the air, _____. (Neglect air resistance)

Forces cause accelerations.

(A) Its acceleration is always toward the ground.

B) Its acceleration is zero at the higherst point of its trajectroy.

C) Its acceleration is always zero.

D) Its acceleration has two parts: one toward the ground and the other toward the goal.

5) Suppose that an object is moving with a constant velocity. Which of the following can be said about its acceleration?

a vector

A) The acceleration must be constantly increasing.

B) The acceleration must be a constant, non-zero value.

C) The acceleration must be constantly decreasing.

accelerations change velocities...

(D) The acceleration must be equal to zero.

E) More information is needed.

6) An object has a position given by $\vec{r}(t) = [2.0 + 3.00\,t]\,\hat{i} + [3.0 - 2.00\,t^2]\,\hat{j}$. What is the speed of the object at time $t = 2.00$ s?

A) 5.50 m/s B) 4.65 m/s C) 5.00 m/s D) 11.0 m/s (E) 8.54 m/s ✓

$\vec{v}(t) = \frac{d}{dt}\vec{r}(t) = 3\hat{i} - 4t\hat{j}$

$\vec{v}(t=2) = 3\hat{i} - 8\hat{j}$

$|\vec{v}(t=2)| = \sqrt{3^2+8^2} = 8.54$ m/s

$\vec{D} = \vec{r}_B(t=5) - \vec{r}_A(t=5) = 5\hat{i} - 50\hat{j}$ $|\vec{D}| = \sqrt{5^2+50^2} = 50.2$

From class notes

7) Object A has a position as a function of time given by $\vec{r}_A(t) = 3.00\,t\,\hat{i} + 1.00\,t^2\,\hat{j}$. Object B has a position as a function of time given by $\vec{r}_B(t) = 4.00\,t\,\hat{i} - 1.00\,t^2\,\hat{j}$. What is the distance between object A and object B at time $t = 5.00$ s? All units are SI. $|\vec{D}|$

A) 45.0 m B) 3.46 m (C) 50.2 m ✓ D) 34.6 m E) 29.8 m

8) A ball rolls off the edge of a table. The horizontal component of the ball's velocity remains constant during its entire trajectory because _____.

A) the ball is not acted upon by any force.
B) the net force acting on the ball is zero.
C) the ball is not acted upon by a force in the vertical direction.
(D) the ball is not acted upon by a force in the horizontal direction. ✓
E) None of the other choices is correct.

Forces cause accelerations, acceleration changes velocity.

From class notes ☺

9) The acceleration of an object moving along the x axis is given by the equation $a(t) = -34 + 7t^3$. At a time t=2 seconds, its velocity is -5 m/s. What is its velocity at time t = 3.2 seconds?

A) 195 m/s B) 215 m/s (C) 110 m/s ✓ D) 75 m/s

$v(t) = \int a(t)\,dt = -34t + \frac{7t^4}{4} + \text{Constant}$

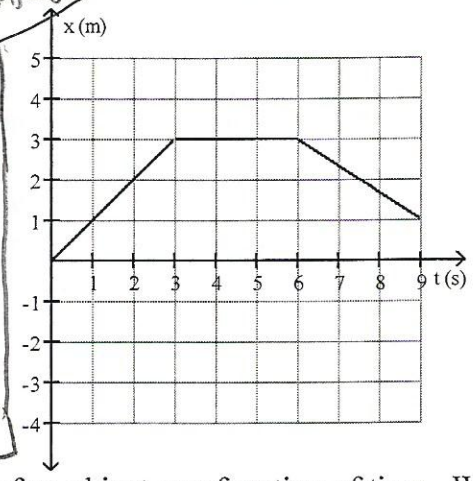
$v(t=2) = -5 = -68 + 28 + \text{Constant}$

$\therefore \text{Constant} = 35$

$\therefore v(t) = -34t + \frac{7t^4}{4} + 35$

$v(t=3.2) = 109.7$

FIGURE 2-1



10) Fig. 2-1 shows the position of an object as a function of time. When is the object at rest?

(A) The object is at rest between 3.0 s and 6.0 s. ✓
B) The object is at rest between 0.0 s and 3.0 s.
C) The object is at rest between 6.0 s and 9.0 s.
D) The object is always at rest except at the instants $t = 3.0$ s and $t = 6.0$ s.
E) The object is never at rest.

"... velocities change position."

Position is not changing from t=3 to t=6

$\vec{A} = 2\hat{i} - 5\hat{j} + 7\hat{k}$ $|\vec{A}| = \sqrt{2^2+5^2+7^2} = \sqrt{78}$

11) The point 'A' is located at (2, -5, 7). Note that this is telling you the x, y, and z coordinates in the form (x,y,z). Which of the following is a unit vector pointing from the origin toward the point 'A'?

A) $2\hat{i} - 5\hat{j} + 7\hat{k}$

B) $\frac{(2\hat{i} - 5\hat{j} + 7\hat{k})}{\sqrt{78}}$ ✓

C) $\sqrt{78}(2\hat{i} - 5\hat{j} + 7\hat{k})$

D) $\frac{(\hat{i} - \hat{j} + \hat{k})}{\sqrt{78}}$

$\hat{A} = \frac{\vec{A}}{|\vec{A}|}$

Classnotes and HW

12) If the vector **A** is 30 units at 25° and the vector **B** is 50 units at -10°, what is the magnitude of the vector **C** = 2**A** - **B** ?

A) 34.4 B) 30.7 C) 39.2 D) 10.0

13) A rock is thrown straight down from the top of building 40 meters tall. Its initial speed is 25 m/s. When does it reach a window ledge that is 10 meters above the ground? Take t = 0 to be the instant when the rock is released from the thrower's hand.

A) when t = 3.19 s B) when t = 1.54 s C) when t = 6.64 s D) when t = 1.00 s

SEE LAST PAGE

14) If $A = 2\hat{i} + 3\hat{j} - 4\hat{k}$, what is the angle between this vector and the $-\hat{j}$ coordinate axis?

A) 79° B) 124° C) 56° D) 101°

15) The magnitude of a vector _____.

A) can be negative if it is in the third or fourth quadrant.

B) can never be negative.

C) can be negative if it is in the second quadrant.

D) can be negative if it is in the second or third quadrant.

This is its length. The sign is associated w/ direction.

Look @ question 12 above. The magnitudes are 30 and 50

12.) 125° 10°

$\vec{A} = 30\cos(25)\hat{i} + 30\sin(25)\hat{j}$

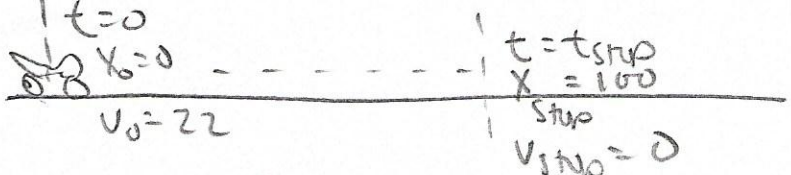
$\vec{B} = 50\cos(10)\hat{i} - 50\sin(10)\hat{j}$

$\vec{C} = 2\vec{A} - \vec{B} = [60\cos(25) - 50\cos(10)]\hat{i}$

$+ [60\sin(25) + 50\sin(10)]\hat{j}$

$\vec{C} = 5.13\hat{i} + 34\hat{j}$

$|\vec{C}| = 34.4$

13] 

$x(t) = 22t + \frac{1}{2}at^2$ (1)

$v(t) = 22 + at$ (2)

@ $t = t_{stop}$, $v_{stop} = 0$, $x_{stop} = 100$

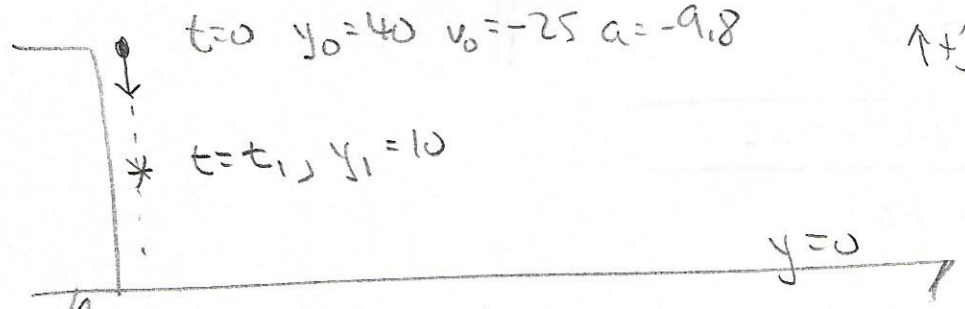
(2) $\Rightarrow 0 = 22 + a t_{stop}$

$\therefore t_{stop} = -22/a$

(1) $\Rightarrow 100 = 22\left(-\frac{22}{a}\right) + \frac{1}{2}a\left(-\frac{22}{a}\right)^2$

$100 = \frac{-484 + 242}{a}$

$a = -2.42\ m/s^2$ Ans. (asked for magnitude)

17] 

(1) $y(t) = 40 - 25t - 4.9t^2$

(2) $v(t) = -25 - 9.8t$

@ $t = t_1$, $y_1 = 10$

(1) $\Rightarrow 10 = 40 - 25t_1 - 4.9t_1^2$

$4.9t_1^2 + 25t_1 - 30 = 0$

$\therefore t_1 = \frac{-25 \pm \sqrt{25^2 + 4(4.9)(30)}}{9.8}$

✓ +1.0 second

14] $|\vec{A}| = 5.385$

$\vec{B} = -\hat{j}$, $|\vec{B}| = 1$

$\vec{A} \cdot \vec{B} = -3$

but also $\vec{A} \cdot \vec{B} = |\vec{A}||\vec{B}|\cos\theta = 5.385\cos\theta$

$\therefore -3 = 5.385\cos\theta$

$\theta = 124°$ Angle that was requested.

Was a HW problem ☺