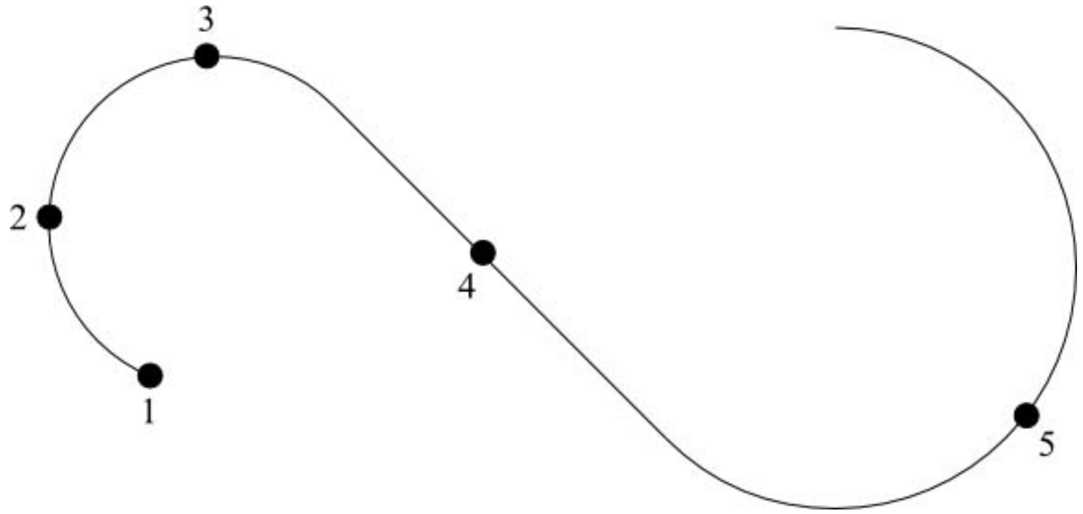
WebAssign
CH05-HW03-SP12 (Homework)

Yinglai Wang
PHYS 172-SPRING 2012, Spring 2012
Instructor: Virendra Saxena

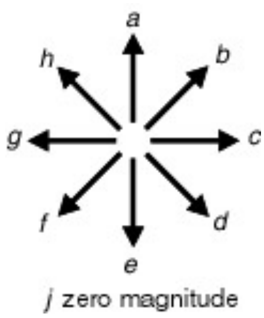
Current Score : 33 / 33 **Due :** Tuesday, February 14 2012 11:59 PM EST

1. 6/6 points | Previous Answers



A car moves along the path shown in the diagram. The position of the car at different instants in time is represented by the dots on the diagram; the car starts at point 1 and moves to point 5.

In the questions below, $\frac{d\vec{p}}{dt}$ is rate of change of the car's momentum, $\left(\frac{d\vec{p}}{dt}\right)_{\parallel}$ is the component of $\frac{d\vec{p}}{dt}$ that is parallel to the car's momentum, and $\left(\frac{d\vec{p}}{dt}\right)_{\perp}$ is the component perpendicular to the car's momentum.



Select the letter corresponding to the arrow (a-j) that best indicates the direction of the following vector quantities at each point.

At point 2, the car's speed is increasing.

What is the direction of the car's momentum at point 2? a

What is the direction of the $\left(\frac{d\vec{p}}{dt}\right)_{\parallel}$ at point 2? a

What is the direction of the $\left(\frac{d\vec{p}}{dt}\right)_{\perp}$ at point 2? c

At point 3, the car's speed is not changing.

What is the direction of the car's momentum at point 3? c

What is the direction of the $\left(\frac{d\vec{p}}{dt}\right)_{\parallel}$ at point 3? j

What is the direction of the $\left(\frac{d\vec{p}}{dt}\right)_{\perp}$ at point 3? e

At point 4, the car's speed is increasing.

What is the direction of the car's momentum at point 4? d

What is the direction of the $\left(\frac{d\vec{p}}{dt}\right)_{\parallel}$ at point 4? d

What is the direction of the $\left(\frac{d\vec{p}}{dt}\right)_{\perp}$ at point 4? j

At point 5, the car's speed is decreasing.

What is the direction of the car's momentum at point 5? b

What is the direction of the $\left(\frac{d\vec{p}}{dt}\right)_{\parallel}$ at point 5? f

What is the direction of the $\left(\frac{d\vec{p}}{dt}\right)_{\perp}$ at point 5? h

---

2. 7/7 points | Previous Answers MI3 5.6.P.048

A child of mass 29 kg swings at the end of an elastic cord. At the bottom of the swing, the child's velocity is horizontal, and the speed is 9 m/s. At this instant the cord is 3.00 m long. (Take the $+x$ direction to be horizontal and to the right, the $+y$ direction to be upward, and the $+z$ direction to be out of the page.)

(a) At this instant, what is the parallel component of the rate of change of the child's momentum?

$\frac{d|\vec{p}|}{dt}\hat{p}$ = (kg · m/s)/s

(b) At this instant, what is the perpendicular component of the rate of change of the child's momentum?

$|\vec{p}|\frac{d\hat{p}}{dt}$ = *(kg · m/s)/s*

(c) At this instant, what is the ***net*** force acting on the child?

$\vec{F}_{net}$ = N

(d) What is the magnitude of the force that the elastic cord exerts on the child? (It helps to draw a diagram of the forces.)

$|\vec{F}_{\text{due to cord}}|$ = 1067.2 N

(e) The relaxed length of the elastic cord is 2.91 m. What is the stiffness of the cord? (Use the exact value you entered in part (d) to make this calculation.)

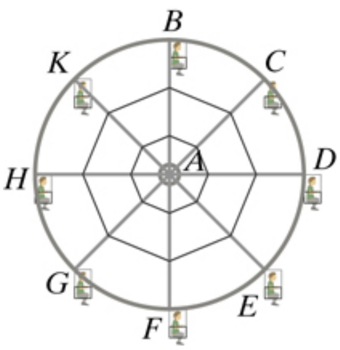
k_s = 11857.78 N/m

- *Read the eBook*
- Section 5.6

---

3. 7/7 points | Previous Answers MI3 5.6.P.055

A Ferris wheel is a vertical, circular amusement ride with radius 8 m. Riders sit on seats that swivel to remain horizontal. The Ferris wheel rotates at a constant rate, going around once in 10 s. Consider a rider whose mass is 58 kg.



At the bottom of the ride, what is the parallel component of the rate of change of the rider's momentum?

= < 0 , 0 , 0 > kg·m/s/s

At the bottom of the ride, what is the perpendicular component of the rate of change of the rider's momentum?

= < 0 , 183.43 , 0 > kg·m/s/s

At the bottom of the ride, what is the vector gravitational force exerted by the Earth on the rider?

$\vec{F}_{grav}$ = < 0 , -568.4 , 0> N

At the bottom of the ride, what is the vector force exerted by the seat on the rider?

$\vec{F}_{by\ seat}$ = < 0 , 751.83 , 0> N

Next consider the situation at the top of the ride. At the top of the ride, what is the parallel component of the rate of change of the rider's momentum?

= < 0 , 0 , 0 > kg·m/s/s

At the top of the ride, what is the perpendicular component of the rate of change of the rider's momentum?

= < 0 , -183.43 , 0 > kg·m/s/s

At the top of the ride, what is the vector gravitational force exerted by the Earth on the rider?

$\vec{F}_{grav}$ = < 0 , -568.4 , 0> N

At the top of the ride, what is the vector force exerted by the seat on the rider?

$\vec{F}_{by\ seat}$ = < 0 , 384.97 , 0> N

A rider *feels* heavier if the electric, interatomic contact force of the seat on the rider is larger than the rider's weight *mg* (and the rider sinks more deeply into the seat cushion). A rider *feels* lighter if the contact force of the seat is smaller than the rider's weight (and the rider does not sink as far into the seat cushion).

Does a rider *feel* heavier or lighter at the bottom of a Ferris wheel ride?

- (●) heavier
- ( ) lighter

Does a rider *feel* heavier or lighter at the top of a Ferris wheel ride?

- (●) lighter
- ( ) heavier

- *Read the eBook*

- Section 5.6

---

4. 9/9 points | Previous Answers MI3 5.5.P.045

In the dark in outer space, you observe a glowing ball of known mass 4.4 kg moving in the *xy* plane at constant speed in a circle of radius 8 m, with the center of the circle at the origin (< 0, 0, 0 > m). You can't see what's making it move in a circle. At time t = 0 the ball is at location < -8, 0, 0 > m and has velocity < 0, 70, 0 > m/s.

(a) On your own paper draw a diagram of the situation, showing the circle, and showing the position and velocity of the ball at time t = 0. The diagram will help you analyze the situation.

Use letters a-j to answer questions about directions (+x to the right, +y up):

(b) At time t = 0, what is the direction of the vector $\vec{p}$? a

(c) At time t = 0, what are the magnitude and direction of $\frac{d|\vec{p}|}{dt}\hat{p}$, the parallel component of $\frac{d\vec{p}}{dt}$?

magnitude = 0 kg · m/s/s

j

(d) At time t = 0, what are the magnitude and direction of $|\vec{p}|\frac{d\hat{p}}{dt}$, the perpendicular component of $\frac{d\vec{p}}{dt}$?

magnitude = 2695 kg · m/s/s

c

(e) At time t = 0, even though you can't see what's causing the motion, what can you conclude must be the direction of the vector $\vec{F}_{net}$? c

(f) At time t = 0, even though you can't see what's causing the motion, what can you conclude must be the vector $\vec{F}_{net}$?

$\vec{F}_{net}$ = N

(g) You learn that at time t = 0, two forces act on the ball, and that at this instant one of these forces is $\vec{F}_1$ = < −1078, −3638, 0 > N. What is the other force?

$\vec{F}_2$ = N

- *Read the eBook*
- Section 5.5

---

5. 4/4 points | Previous Answers MI3 5.6.P.047

In outer space a rock of mass 5 kg is attached to a long spring and swung at constant speed in a circle of radius 7.5 m. The spring exerts a force of constant magnitude 660 N. What is the speed of the rock?

$|\vec{v}|$ = 31.46 ✓ m/s

The direction of the spring force is

- ○ away from the center of the circle (radially outward).
- ○ in the direction of motion (tangential to the circle).
- ○ opposite the direction of motion (tangential to the circle).
- ◉ toward the center of the circle (radially inward).

✓

The relaxed length of the spring is 6.8 m. What is the stiffness of this spring?

k_s = 942.86 ✓ N/m

- *Read the eBook*
- Section 5.6