



# Question #1

- Point  $P$  is moving along a straight-line path. The speed of point  $P$  is given by  $v(t) = 3t^2$  m/s the units associated with "3" are:

- (a) m
- (b) m/s
- (c) m/s<sup>3</sup>
- (d) m/s<sup>2</sup>

$$v \left[ \frac{m}{s} \right]$$

$$\frac{m}{s} = x \cdot s^2$$

$$[x] = \frac{m}{s^3}$$

$$\frac{m}{s^3} \cdot s^2 = \frac{m}{s} \checkmark$$

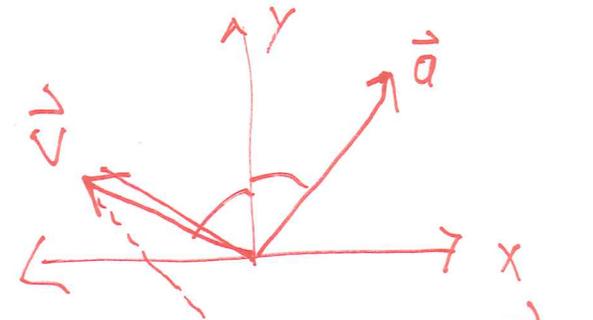


# Question #2

$$\vec{a} = \dot{v} \hat{e}_t + \frac{v^2}{r} \hat{e}_n$$

A particle P moves with a velocity  $\vec{v}$  and acceleration  $\vec{a}$ . These vectors are expressed in terms of the Cartesian components of:  $\vec{v} = (-40\hat{i} + 30\hat{j})m/s$  and  $\vec{a} = (12\hat{i} + 10\hat{j})m/s^2$ . Indicate below the most accurate description of the rate of change in speed of P:

- (a) P is increasing in speed
- (b) P is moving at a constant speed
- (c) P is decreasing in speed
- (d) More information is needed



$$v = 50 = \sqrt{40^2 + 30^2}$$

$$\vec{v} = v \hat{e}_t \Rightarrow \hat{e}_t = \frac{\vec{v}}{v}$$

$$\dot{v} = \hat{e}_t \cdot \vec{a} = \frac{1}{50} [(-40)(12) + (30)(10)] = \text{negative number}$$

$$\dot{v} = \hat{e}_t \cdot \vec{a} = -\frac{4}{5}(12) + 10\left(\frac{3}{5}\right) = \text{negative number}$$

$$\hat{e}_t = \frac{-40\hat{i} + 30\hat{j}}{50} = \frac{-4}{5}\hat{i} + \frac{3}{5}\hat{j}$$

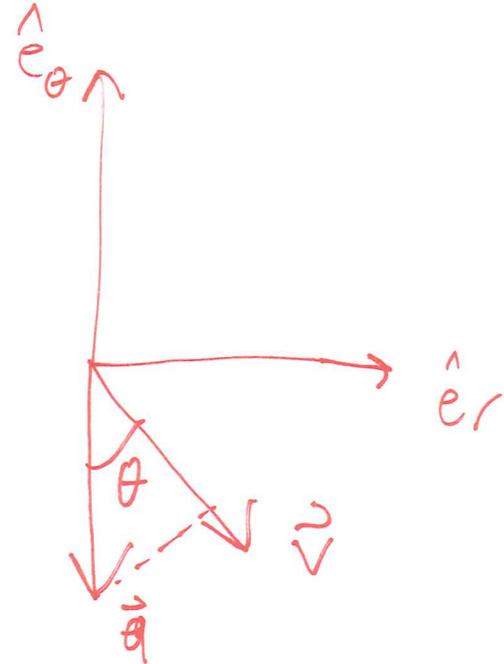


# Question #3

- A particle P moves with a velocity  $\vec{v}$  and acceleration  $\vec{a}$ . These vectors are expressed in terms of the polar components of:  $\vec{v} = (18\hat{e}_R - 24\hat{e}_\theta)ft/s$  and  $\vec{a} = (-6\hat{e}_\theta)ft/s^2$ . Indicate below the most accurate description of the rate of change in speed of P:

- (a) P is increasing in speed
- (b) P is moving at a constant speed
- (c) P is decreasing in speed
- (d) More information is needed

$$\theta < 90^\circ$$

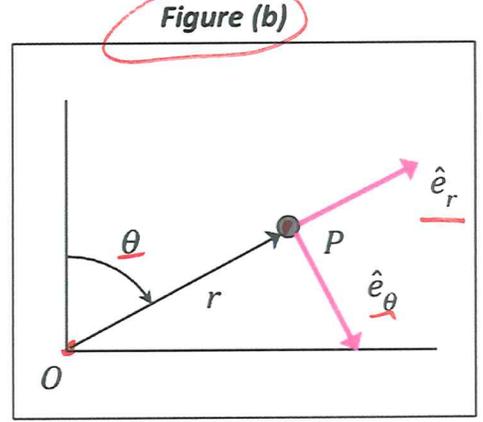
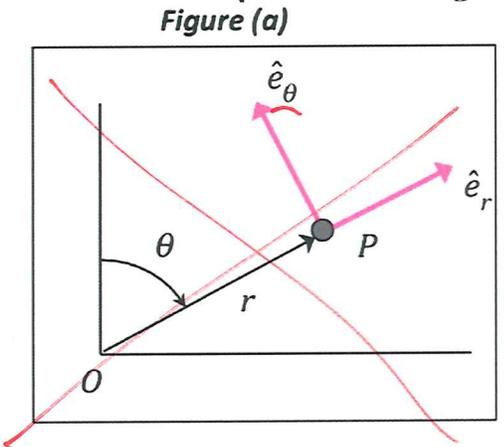




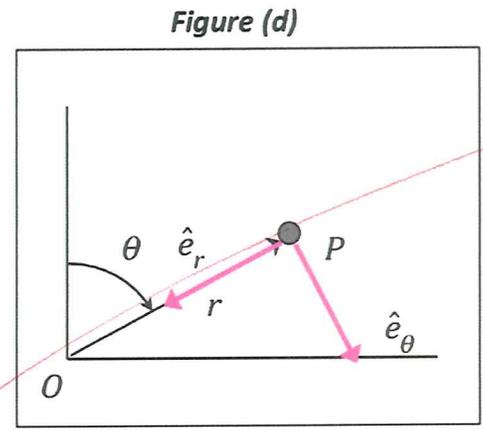
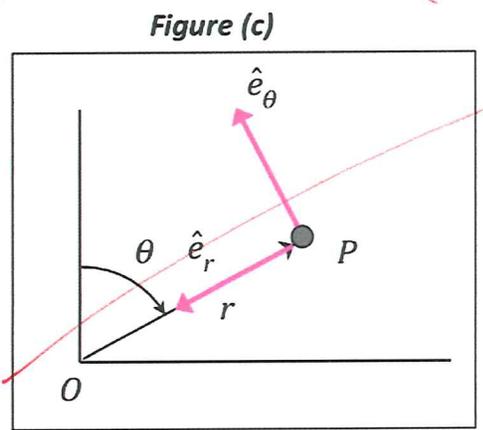
# Question #4

- The motion of point P is to be represented in terms of polar coordinates  $r$  and  $\theta$  shown, and with an origin at point O. Let  $\hat{e}_r$  and  $\hat{e}_\theta$  be the unit vector for these polar coordinates. Choose the figure below that accurately represents the correct orientations of the  $\hat{e}_r$  and  $\hat{e}_\theta$  unit vectors.

- (a)
- (b)
- (c)
- (d)



$\hat{e}_\theta$  is in positive  $\theta$  dir





# Question #5

$$\vec{v} = \dot{r} \hat{e}_r + r \dot{\theta} \hat{e}_\theta$$

The motion of point P is to be represented in terms of polar coordinates  $r$  and  $\theta$  shown. The velocity of P for one instant is also shown. What is the value of  $\dot{r}$ ?

- (a)  $\dot{r} > 0$
- (b)  $\dot{r} < 0$
- (c)  $\dot{r} = 0$
- (d) Not enough info

