

Physics 101- Chapter 4Quiz No. 2

Name: Key

ID:

Sec: 30

The velocity  $\vec{v}$  of a particle moving in the XY plane is given by  $\vec{v} = [(6t - 4t^2)\mathbf{i} + 8\mathbf{j}]$  m/s

- 1- What is the acceleration when  $t = 3$  s?
- 2- When (if ever) is the acceleration zero?
- 3- When (if ever) does the speed equal 10 m/s?

$$1- \vec{a} = \frac{d\vec{v}}{dt} = \frac{d}{dt}[(6t - 4t^2)\mathbf{i} + 8\mathbf{j}] = (6 - 8t)\mathbf{i}$$

$$\vec{a} = (6 - 8t)\mathbf{i}$$

$$\vec{a}_{t=3} = [6 - (8 \times 3)]\mathbf{i} = -18\mathbf{i} \text{ m/s}^2$$

$$2- \vec{a} = 0 \Rightarrow (6 - 8t)\mathbf{i} = 0$$

$$6 - 8t = 0 \Rightarrow t = \frac{6}{8} = \frac{3}{4} = 0.75 \text{ s}$$

3- To get the speed from the velocity:

$$v = |\vec{v}| = \sqrt{v_x^2 + v_y^2 + v_z^2} = \sqrt{(6t - 4t^2)^2 + (8)^2}$$

$$\text{Given } v = 10$$

$$\text{Therefore: } (6t - 4t^2)^2 + 64 = (10)^2$$

$$(6t - 4t^2)^2 = 36$$

$$6t - 4t^2 = \pm 6$$

$$4t^2 - 6t \pm 6 = 0$$

Using the quadratic formula:

$$t = \frac{6 \pm \sqrt{36 - (4 \times 4 \pm 6)}}{2 \times 4}$$

The real positive time is:

$$t = 2.2 \text{ s}$$