Physics 231. Mechanics of Solids

Exam-like questions - Ch. 3. Vectors and 2D motion

1. **What is the length of the vector** $-6.0\hat{i} + 12\hat{j}$ **m?**

   (a) 6.0 m   (b) 9.0 m   (c) 12 m   (d) 13 m   (e) 18 m

2. **What is the direction (in degrees CCW of the x-axis) of the vector** $-6.0\hat{i} + 12\hat{j}$**?**

   (a) $117°$ (b) $-60°$ (c) $60°$ (d) $136°$ (e) $45°$

3. **If the equation of motion of a "thingy" is** $\vec{r}(t) = at^3\hat{i} + bt^2\hat{j} + ct\hat{k}$**, then write an expression for:** $\vec{v}(t) =$ _____.

   (a) $3at^3\hat{i} + 2bt^2\hat{j} + ct\hat{k}$

   (b) $2at^2\hat{i} + bt\hat{j} + c\hat{k}$

   (c) $3at\hat{i} + 2b\hat{j} + 0\hat{k}$

   (d) $3at^2\hat{i} + bt\hat{j} + c\hat{k}$

   (e) $3at^2\hat{i} + 2bt\hat{j} + c\hat{k}$

4. **If the equation of motion of a "thingy" is** $\vec{r}(t) = at^3\hat{i} + bt^2\hat{j} + ct\hat{k}$**, then write an expression for:** $\vec{a}(t) =$ _____

   (a) $9at^2\hat{i} + 4bt\hat{j} + c\hat{k}$

   (b) $6at\hat{i} + 2b\hat{j} + 0\hat{k}$

   (c) $4at\hat{i} + b\hat{j} + 0\hat{k}$

   (d) $3a\hat{i} + 0\hat{j} + 0\hat{k}$

   (e) $6at\hat{i} + b\hat{j} + c\hat{k}$

5. **A car moves so that its position (in meters) is** $\vec{r}(t) = 3t\hat{i} + t^3\hat{j}$**. What is its position at t=3?** $\vec{r}(3\text{sec}) =$ _____

   (a) $2\hat{i} + 8\hat{j}$ (b) $9\hat{i} + 27\hat{j}$ (c) $9\hat{i} + 9\hat{j}$ (d) $3\hat{i} + 12\hat{j}$ (e) $6\hat{i} + 27\hat{j}$

6. **A car moves so that its position (in meters) is** $\vec{r}(t) = 3t\hat{i} + t^3\hat{j}$**. When does the car reach y=8?** $t =$ _____

   (a) 2.0 sec   (b) 2.23 sec   (c) 2.83 sec   (d) 3.0 sec   (e) 3.2 s

7. **A car moves so that its position (in meters) is** $\vec{r}(t) = 3t\hat{i} + t^3\hat{j}$**. What is the magnitude of the acceleration at t=3sec?** a=_____

   (a) 1.0 m/s^2 (b) 4.33 m/s^2 (c) 6.0 m/s^2 (d) 12 m/s^2
   (e) 18 m/s^2

8. A car moves so that its position (in meters) is $\vec{r}(t) = 3t\hat{i} + t^3\hat{j}$. Does the car ever reach x=-2 for $t > 0$s? (y or n) _____

   (a) yes   (b) no

9. A projectile is fired with initial speed v_i at an altitude of 30 degrees such that it's range is 200 meters. At which other angle can that projectile be fired at v_i to acheive the same range?

   (a) 15°   (b) 40°   (c) 50°   (d) 60°   (e) 75°

10. Two seconds after being shot from ground level, a projectile is displaced 40 m horizontally and 60 m vertically above its point of projection. What are the horizontal and vertical components of the initial velocity of the projectile, respectively?

    (a) 14 and 8 m/s   (b) 20 and 30 m/s   (c) 30 and 40 m/s
         (d) 20 and 40 m/s   (e) 30 and 50 m/s