Math 2415 - 14.3

First Name_____ Last Name _____

Lab 8

If r(t) is the position vector of a particle in the plane at time t, find the indicated vector.

1) Find the velocity vector.

$\mathbf{r}(t) = (-7t^2 - 8)\mathbf{i} + \left(\frac{1}{21}t^3\right)\mathbf{j}$

A) $\mathbf{v} = (-14t)\mathbf{i} - \left(\frac{1}{7}t^2\right)\mathbf{j}$ B) $\mathbf{v} = (-14t)\mathbf{i} + \left(\frac{1}{7}t^2\right)\mathbf{j}$ C) $\mathbf{v} = (-14)\mathbf{i} + \left(\frac{2}{7}t\right)\mathbf{j}$ D) $\mathbf{v} = \left(\frac{1}{7}t^2\right)\mathbf{i} + (-14t)\mathbf{j}$

2) Find the acceleration vector.

$\mathbf{r}(t) = (\cos 3t)\mathbf{i} + (5 \sin t)\mathbf{j}$

A) $\mathbf{a} = (-3 \cos 3t)\mathbf{i} + (5 \sin t)\mathbf{j}$
B) $\mathbf{a} = (9 \cos 3t)\mathbf{i} + (-5 \sin t)\mathbf{j}$
C) $\mathbf{a} = (-9 \cos 3t)\mathbf{i} + (-25 \sin t)\mathbf{j}$
D) $\mathbf{a} = (-9 \cos 3t)\mathbf{i} + (-5 \sin t)\mathbf{j}$

The position vector of a particle is r(t). Find the requested vector.

3) The velocity at t = 3 for $\mathbf{r}(t) = (9t^2 + 4t + 7)\mathbf{i} - 5t^3\mathbf{j} + (2 - t^2)\mathbf{k}$

A) $\mathbf{v}(3) = 31\mathbf{i} - 45\mathbf{j} - 3\mathbf{k}$
B) $\mathbf{v}(3) = 58\mathbf{i} - 135\mathbf{j} - 6\mathbf{k}$
C) $\mathbf{v}(3) = 50\mathbf{i} - 135\mathbf{j} - 6\mathbf{k}$
D) $\mathbf{v}(3) = 58\mathbf{i} + 135\mathbf{j} + 6\mathbf{k}$

4) The velocity at t = 0 for $\mathbf{r}(t) = \cos(2t)\mathbf{i} + 7\ln(t - 3)\mathbf{j} - \frac{t^3}{9}\mathbf{k}$

A) $\mathbf{v}(0) = -2\mathbf{i} - \frac{7}{3}\mathbf{j}$ B) $\mathbf{v}(0) = 2\mathbf{i} - \frac{7}{3}\mathbf{j}$ C) $\mathbf{v}(0) = \frac{7}{3}\mathbf{j}$ D) $\mathbf{v}(0) = -\frac{7}{3}\mathbf{j}$

5) The acceleration at $t = \frac{\pi}{4}$ for $\mathbf{r}(t) = (4 \sin 2t)\mathbf{i} - (5 \cos 2t)\mathbf{j} + (3 \csc 2t)\mathbf{k}$

A) $\mathbf{a}\left(\frac{\pi}{4}\right) = -16\mathbf{i} - 12\mathbf{k}$ B) $\mathbf{a}\left(\frac{\pi}{4}\right) = -16\mathbf{i} + 12\mathbf{k}$ C) $\mathbf{a}\left(\frac{\pi}{4}\right) = 16\mathbf{i} + 12\mathbf{k}$ D) $\mathbf{a}\left(\frac{\pi}{4}\right) = 20\mathbf{j} + 12\mathbf{k}$

The vector r(t) is the position vector of a particle at time t. Find the angle (exact value in radians) between the velocity and the acceleration vectors at time t = 0.

6) $\mathbf{r}(t) = \sqrt{2}t\mathbf{i} + (\sqrt{2}t + \frac{\pi}{4}t^2)\mathbf{k}$

Solve the problem. Assume the x–axis is horizontal, the positive y–axis is vertical (opposite g), the ground is horizontal, and only the gravitational force acts on the objects.

7) A projectile is launched from the origin at an angle of α radians to the horizontal and an initial speed of 75 ft/sec. Find the position function **r**(t) for this projectile.

A) $\mathbf{r}(t) = (75t\cos\alpha)\mathbf{i} + (75t\sin\alpha - 16t^2)\mathbf{j}$
B) $\mathbf{r}(t) = (75t\sin\alpha)\mathbf{i} + (75t\cos\alpha - 16t^2)\mathbf{j}$
C) $\mathbf{r}(t) = (75t\sin\alpha - 16t^2)\mathbf{i} + (75t\cos\alpha)\mathbf{j}$
D) $\mathbf{r}(t) = (75t\cos\alpha - 32t^2)\mathbf{i} + (75t\sin\alpha)\mathbf{j}$

8) A projectile is fired at a speed of 800 m/sec at an angle of 34°. How long will it take to get 20 km downrange? Round your answer to the nearest whole number.

A) 32 sec B) 30 sec C) 28 sec D) Never

9) A projectile is fired with an initial speed of 585 m/sec at an angle of 45°. What is the greatest height reached by the projectile? Round your answer to the nearest tenth.

A) 85,556.3 m B) 34,920.9 m C) 84.4 m D) 8730.2 m

10) A spring gun at ground level fires a tennis ball at an angle of 33°. The ball lands 12 m away. What was the ball's initial speed? Round your answer to the nearest tenth.

A) 14.7 m/sec B) 3.6 m/sec C) 128.7 m/sec D) 11.3 m/sec

11) A projectile is fired from a height of 6.6 feet with an initial velocity of 115 ft/sec at an angle of 44° with the horizontal. Find the height of the projectile after 4 seconds. Round your answer to the nearest tenth of a foot.

A) 262.1 ft B) 330.9 ft C) 70.1 ft D) 63.5 ft

12) An athlete puts a 16–lb shot at an angle of 39° to the horizontal from 6.1 ft above the ground at an initial speed of 47 ft/sec. How far forward does the shot travel before it hits the ground? Round your answer to the nearest tenth.

A) 6.8 ft B) 2 ft C) 74.4 ft D) 227.8 ft

13) A fan in the bleachers at Wrigley Field throws an opposing player's home run baseball back onto the playing field. Assume that the fan is 30 feet above the field and that the ball is launched at an angle of 26°. When will the ball hit the ground if its initial speed is 39 ft/sec? Round your answer to the nearest tenth.

A) 4.8 sec B) 2.0 sec C) 0.9 sec D) 2.6 sec

14) What two angles of elevation will enable a projectile to reach a target 14 km downrange on the same level as the gun if the projectile's initial speed is 380 m/sec? Round your answers to the nearest hundredth of a degree.

A) 35.92° and 144.08° B) 0.03° and 89.97° C) 35.92° and 54.08° D) 71.84° and 18.16°

Answer Key
Testname: LAB 8 - 14.3

1) B
2) D
3) B
4) D
5) B
6) $\frac{\pi}{4}$
7) A
8) B
9) D
10) D
11) C
12) C
13) B
14) C