Math 233 - Homework 2

Name _____

February 18, 2021

Score _____

The following problems are from the suggested homework. Show all work to receive full credit. Supply explanations when necessary. This assignment is due on February 25.

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1. (1 point) Let $\vec{r}(t) = 3e^t\hat{\imath} + 2e^{-3t}\hat{\jmath} + 4e^{2t}\hat{k}$. Compute the unit tangent vector at $t = \ln 2$.

2. (2 points) The acceleration function, initial velocity, and initial position of a particle are $\vec{a}(t) = -5\cos t\,\hat{\imath} - 5\sin t\,\hat{\jmath}$, $\vec{v}(0) = 9\hat{\imath} + 2\hat{\jmath}$, and $\vec{r}(0) = 5\hat{\imath}$. Find $\vec{v}(t)$ and $\vec{r}(t)$.

3. (1 point) Locate the highest point on the curve $\vec{r}(t) = \langle 6t,\, 6t - t^2 \rangle$.

Turn over.

4. (2 points) Find the arc length of the curve $\vec{r}(t) = \langle 2\sin t,\, 5t,\, 2\cos t\rangle$ over the interval $0 \le t \le \pi$.

5. (2 points) Find the curvature of $\vec{r}(t) = \sqrt{2}\,t\,\hat{\imath} + e^t\hat{\jmath} + e^{-t}\hat{k}$ at the point $P\,(0, 1, 1)$.

6. (2 points) A projectile is fired from ground level at an angle of 8° with the horizontal. The projectile is to have a range of 50 m. Find the minimum velocity necessary to achieve this range. (Use $g = 9.8\,\mathrm{m/s^2}$.)