

**Math 233 - Quiz 3**  
September 23, 2021

Name \_\_\_\_\_

Score \_\_\_\_\_

Show all work to receive full credit. Supply explanations when necessary. This quiz is due September 28.

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1. (3 points) Find the vector-valued function  $\vec{r}(t)$  such that

$$\vec{r}'(t) = \frac{5}{t^2 + 1}\hat{i} - \frac{3t}{(t^2 + 1)^2}\hat{j} + e^{2t}\hat{k}, \quad \vec{r}(0) = -\hat{i} + 3\hat{j} + 2\hat{k}.$$

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

*Turn over.*

3. (2 points) Reparameterize the position vector below in terms of the arc length parameter.

$$\vec{r}(t) = (1 - 3t)\hat{i} + (7 + 6t)\hat{j} - 8t\hat{k}, \quad 0 \leq t \leq 5$$

4. (3 points) The parametric equations below describe an ellipse in the plane. Draw a rough sketch of the ellipse (showing the orientation). Then use your intuition to determine a point where the curvature is greatest. Finally, compute the curvature at that point.

$$x = 2 \cos t, \quad y = 5 \sin t; \quad 0 \leq t < 2\pi$$