Math 233 - Quiz 6

March 5, 2026

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (6 points) A baseball is hit from a height of 2.5 ft above the ground with an initial speed of 140 ft/sec and at an angle of 22° above the horizontal. Find the maximum height reached by the baseball. Then determine whether the ball will clear a 10-ft high fence located 375 ft from home plate. (Use $g = 32\,\text{ft/sec}^2$.)

$\vec{r}(t) = 140\cos 22°\, t\,\hat{i} + (-16t^2 + 140\sin 22°\, t + 2.5)\hat{j}$

MAX HEIGHT...

$-32t + 140\sin 22° = 0$

$t = \frac{140\sin 22°}{32}$

≈ 1.639 sec

USING THIS t,

$-16t^2 + 140\sin 22°\, t + 2.5$

$\approx$ **45.476 FT**

CLEAR THE FENCE ?

$140\cos 22°\, t = 375$

$t \approx 2.889$ sec

AT THIS t,

$-16t^2 + 140\sin 22°\, t + 2.5$

$\approx$ **20.475 FT**

YES! CLEARS FENCE BY 10+ FEET.

2. (2 points) Let $\vec{r}(t) = 2t\,\hat{\imath} + (1-3t)\,\hat{\jmath} + (2+t)\,\hat{k}$. Compute a_T and a_N, the tangential and normal components of the acceleration.

$\vec{r}(t)$ IS A LINEAR FUNCTION $\Rightarrow$ $\vec{a}(t) = \vec{0}$ $\Rightarrow$ **$a_T = a_N = 0$**

$\vec{r}\,'(t) = 2\hat{\imath} - 3\hat{\jmath} + \hat{k}$

← VELOCITY IS CONSTANT. OBJECT IS NOT ACCELERATING.

3. (2 points) Consider the surface defined by the equation $4x^2 - 3y^2 + 12z^2 + 12 = 0$. Describe the cross sections along the coordinates axes.

FIX x: $-3y^2 + 12z^2 = -12 - 4x^2$ ← HYPERBOLAS

FIX y: $4x^2 + 12z^2 = 3y^2 - 12$ ← ELLIPSES (ONLY FOR BIG ENOUGH y)

FIX z: $4x^2 - 3y^2 = -12 - 12z^2$ ← HYPERBOLAS

SURFACE IS A 2-SHEET HYP.