

Homework Set 3

DUE: FEB 2, 2017 (IN CLASS)

1. Find $\vec{r}(t)$ knowing that $\vec{r}(0) = (1, -1, 0)$, $\frac{d\vec{r}}{dt}(0) = (1, 0, 1)$ and $\frac{d^2\vec{r}}{dt^2}(t) = (t - \sin t, 2, t^2)$.
2. Let $\gamma(t) = (\sin t, \sin 2t, \cos t)$. Compute the following vector-valued functions:
 - (i) $\gamma'(t)$
 - (ii) $\gamma''(t)$
 - (iii) $\int \gamma(t) dt$
 - (iv) $\int (\int \gamma(t) dt) dt$
3. Find the component equation of the plane spanned by the tangent lines to the curves $\alpha(t) = (t + 1, t^2, -t)$ and $\beta(t) = (\cos t, \sin t, e^{2t} - 1)$ at the point $\alpha(0) = \beta(0) = (1, 0, 0)$.
4. A news helicopter is descending along the helix parametrized by $(\sin(\pi t), \cos(\pi t), 10 - t)$. At time $t = 5$ the crew turns on a powerful head light shining straight ahead in the direction of the velocity. What spot on the ground, that is, what point on the xy -plane, does this beam of light hit?
5. Compute the arc length of the curve parametrized by

$$x(t) = 2t^2, \quad y(t) = \sqrt{3}t^4, \quad z(t) = t^6,$$

for $0 \leq t \leq 2$.