Math2204: Written HW 11 (Due Friday 4/25, 5pm)

No calculator or other electronic devices for written HWs.

Include a formula you use in the write-up of that problem.

Hand in **ALL WORK AND REASONING** for the following problems.

- **Section 13.1**: 39.

- **Section 13.2**: 3, 8. For 3 and 8: First find an equation in x and y that represents the curve. Then sketch the xy-curve.

- **Section 13.2**: 25, 39.

- **Section 13.3**: 4, 17, 25.

- **Section 13.4**: 8, 15, 21.

A) Let $\boldsymbol{r}(t) = \langle \sin t, \mathrm{e}^t, \cos t \rangle$. Compute

    1. the **unit** tangent vector $\boldsymbol{T}(t)$.

    2. an equation of the tangent line to $\boldsymbol{r}(t)$ at $(0, 1, 1)$.

B) Let $\boldsymbol{r}_1(t) = \langle t^2,\ 1 - t^2,\ t + 1 \rangle$ and $\boldsymbol{r}_2(t) = \langle 1 - t^2,\ t,\ t \rangle$.

    1. Find all points at which the curves $\boldsymbol{r}_1$ and $\boldsymbol{r}_2$ intersect.

    2. If two particles travel along these two curves, do they collide?

C) Compute the length of the curve $\boldsymbol{r}(t) = \langle 10 \sin t,\ -6 \cos t,\ 8 \cos t \rangle$ with $0 \le t \le \pi/2$.

D) Let $\boldsymbol{r}(t) = \langle t + \mathrm{e}^{-t},\ t\mathrm{e}^t,\ t^2 + t^3 \rangle$. Compute the curvature of $\boldsymbol{r}(t)$ at the point $(1, 0, 0)$.

E) A baseball player hits a ball at $t = 1$ at ground level with a velocity $5\boldsymbol{i} + 5\boldsymbol{k}$. The ball has mass $m = 1$ and is subject to gravity (take $g = 10$) and to a wind force $2\boldsymbol{j}$. Compute the velocity of the ball when it hits the ground?