Assignment # 1

I. Please review *parametrized curves* and *curvature* from your calculus III textbook as follows:

(1) {*There is no need to write for this part, but it is worthwhile to try to remember what you knew once, before starting the more serious stuff...*} Find definitions/descriptions of
- parameterized curve
- unit tangent vector
- unit normal vector (for curves in the plane)
- arclength parameterization
- curvature
- osculating circle
- torsion.

Compare the situations for 2D (in the plane) and 3D (in space) and try to identify concepts which are basically the same regardless of the dimension

(2) {*You need to write for the remaining portions of the assignment!*} State the *definition* of the curvature of a curve. Give at least two formulas which allow you to calculate the curvature in different situations—state what situations these are.

(3) What quantity for a curve makes sense in 3D but not in 2D? Explain.

II. Please also review familiar surfaces by sketching the graphs of the following:

(1) the cone $z = \sqrt{x^2 + y^2}$
(2) the paraboloid $z = 4x^2 + y^2$
(3) the hyperbolic paraboloid $z = x^2 - y^2$
(4) the hyperboloid of one sheet $z^2 + 1 = x^2 + y^2$
(5) the surface $3x^2 + 3y^2 + z^2 - 2xy - 2x - 2y = 3$.

1–2 Exercise # 2. (page 5)

1–2 Exercise # 3.

1–2 Exercise # 5.

1–3 Exercise # 1. (page 7)

1–3 Exercise # 4.