Graphing parametric curves on surfaces

Here we will be using the parabaloid $z = 1 - x^2 - y^2$ with domain the unit circle r = 1 in the first quadrant

Suppose in the domain we are moving from the origin on the line parameterized by:

$x(t) := t \quad y(t) := t.$

Then on the surface we induce the parameterization:

$x(t) := t \quad y(t) := t \quad z(t) := 1 - 2\cdot t^2$

We start by defining the surface and putting in the Axes

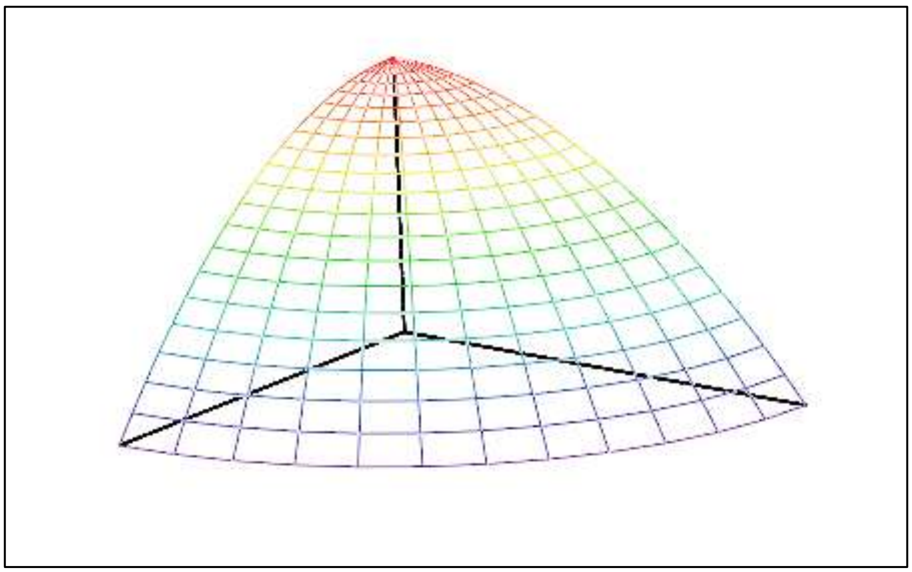
$i := 0..12 \quad \theta_i := \pi\cdot\frac{i}{24} \quad j := 0..20 \quad r_j := \frac{j}{20}$

$X_{i,j} := r_j\cdot\cos(\theta_i) \quad Y_{i,j} := r_j\cdot\sin(\theta_i) \quad Z_{i,j} := 1 - (X_{i,j})^2 - (Y_{i,j})^2$

Axes:

$m := 0..10 \quad X1_{i,m} := 0 \quad Y1_{i,m} := 0 \quad Z1_{i,m} := m\cdot.1$

for Plot 1 change weight to .5 to lighten the surface.



$(X, Y, Z), (X1, Y1, Z1), (Y1, Z1, X1), (Z1, X1, Y1)$

Now we define the curves

$s := 0..FRAME \qquad t(s) := s \cdot .02 \qquad \tau := 0..1$

Curve in the plane $\quad x_{\tau,s} := t(s) \quad y_{\tau,s} := t(s) \qquad z_{\tau,s} := 0$

Curve on the surface $\quad x_{\tau,s} := t(s) \qquad y_{\tau,s} := t(s) \quad z1_{\tau,s} := 1 - 2 \cdot t(s)^2$

For Plots 5 and 6 under the appearance tab change weight to 2 to darken the curves

To animate use 35 frames since z= 0 when $1 - 2 \cdot t^2 = 0$ when $t = \frac{1}{\sqrt{2}} = .7$

t(s) = .02s = .7 for s = 35

$(X, Y, Z), (X1, Y1, Z1), (Y1, Z1, X1), (Z1, X1, Y1), (x, y, z), (x, y, z1)$

Suppose in the domain we instead are following the curve $y = t^2$

$x(t) := t \quad y(t) := t^2.$

Then on the surface we induce the parameterization:

$x(t) := t \quad y(t) := t^2 \quad z(t) := 1 - t^2 - t^4$

$i := 0..12 \quad \theta_i := \pi \cdot \frac{i}{24} \quad j := 0..20 \quad r_j := \frac{j}{20}$

$X_{i,j} := r_j \cdot \cos(\theta_i) \quad Y_{i,j} := r_j \cdot \sin(\theta_i) \quad Z_{i,j} := 1 - (X_{i,j})^2 - (Y_{i,j})^2$

$m := 0..10 \quad X1_{i,m} := 0 \quad Y1_{i,m} := 0 \quad Z1_{i,m} := m \cdot .1$

$s := 0..FRAME \quad t(s) := s \cdot .02 \quad \tau := 0..1$

Curve in the plane $x_{\tau,s} := t(s) \quad y_{\tau,s} := t(s)^2 \quad z_{\tau,s} := 0$

Curve on the surface $x_{\tau,s} := t(s) \quad y_{\tau,s} := t(s)^2 \quad z1_{\tau,s} := 1 - t(s)^2 - t(s)^4$

To animate use 39 frames since z= 0 when $1 - 2 \cdot t^2 = 0$ when $t = \frac{1}{\sqrt{2}} = .786$

t(s) = .02s = .786 for s = 39.3

(X, Y, Z), (X1 , Y1, Z1), (Y1, Z1 , X1), (Z1 , X1 , Y1), (x, y , z), (x, y , z1)