1. Assuming the first row of pictures is labeled I and II, the second is III and IV, and the third is V and VI:

\[ z = \frac{2}{15}e^{-x-y} \]: III. This is the only graph which increases rapidly in Quadrant III (where \(-x - y\) is positive, so \(e^{-x-y}\) is large) and very small in Quadrant I (where \(-x - y < 0\).

\[ z = \frac{7}{1+(x+y)^2} \]: II. This is the only surface which has a height of 7 above every point on the line \(y = -x\).

\[ z = \frac{6 \sin(2(x^2+y^2))}{x^2+y^2} \]: V. The radial symmetry narrows it down to graph V or VI. The cross sections \(x = 0\) or \(y = 0\) in V are consistent with the function \(f(u) = \frac{6 \sin(2u)}{u}\).

\[ z = 5 \sin(3x) + 5 \cos(3y) \]: IV. The cross sections \(y = k\) are consistent with the graph of \(f(u) = 5 \sin(3x) + C\), where \(C\) is a constant. Similar arguments hold for the cross sections \(x = k\).

2. The limit of \(\frac{x^3}{x^2+y^2}\) does not exist as \((x, y) \to (0, 0)\). If you approach along the curve \(y = x^3\), the limit is 1/2. If you approach along \(y = -x^3\), the limit is \(-1/2\).

Conversely, the limit of \(\frac{x^3}{x^2+y^2+z^2}\) as \((x, y, z) \to (0,0,0)\) does exist. If we switch to spherical coordinates, the limit becomes

\[
\lim_{(x,y,z) \to (0,0,0)} \frac{x^3}{x^2+y^2+z^2} = \lim_{\rho \to 0} \frac{\rho^3 \cos^3 \theta \sin^3 \phi}{\rho^2} = \lim_{\rho \to 0} \rho \cos^3 \theta \sin^3 \phi = 0
\]

3. In order,

(i) A particle traveling along the curve will approach the origin as \(t \to 0^-\). At \(t = 0\) the particle will be at the origin, and as \(t\) increases further, the particle will “turn around” and retrace its path.

(ii) \(\mathbf{r}'(t) = \langle t, \sqrt{2}t^3, t^5 \rangle\). As \(t \to 0\), this approaches \(\langle 0, 0, 0 \rangle\). As \(t \to \infty\), this diverges to infinity.

(iii) \(\mathbf{T}(t) = \frac{\mathbf{r}'(t)}{|\mathbf{r}'(t)|} = \langle t, \sqrt{2}t^3, t^5 \rangle/(t + t^5)\). The limit of \(\mathbf{T}(t)\) as \(t \to 0\) does not exist because the limit is \(\langle 1, 0, 0 \rangle\) as \(t \to 0^+\), and \(\langle -1, 0, 0 \rangle\) as \(t \to 0^-\). If \(t \to \infty\), then the limit converges to \(\langle 0, 0, 1 \rangle\).

(iv) \(\mathbf{T}(1) = \langle 1/2, 1/\sqrt{2}, 1/2 \rangle\). To find \(\mathbf{N}(1)\), we begin by calculating \(\mathbf{T}'(t)\) and \(\mathbf{T}'(1)\). This is a bit messy, but it’s \(\mathbf{T}'(1) = \langle -1, 0, 1 \rangle\). Now \(\mathbf{N}(1) = \mathbf{T}'(1)/|\mathbf{T}'(1)|\), which is \(\langle -1/\sqrt{2}, 0, 1/\sqrt{2} \rangle\).

(v) One possible equation of the osculating plane is

\[
\mathbf{p}(u,v) = \mathbf{r}(1) + u\mathbf{T}(1) + v\mathbf{N}(1) = \langle 1/2, 1/2\sqrt{2}, 1/6 \rangle + u\langle 1/2, 1/\sqrt{2}, 1/2 \rangle + v\langle -1/\sqrt{2}, 0, 1/\sqrt{2} \rangle
\]
4. Here’s a computer generated contour graph of the surface. Lighter shades indicate greater values of $z$.

5. Here are pictures of the grid curves and the surface itself. (You would have to do some more labeling, such as which grid curve is which.)