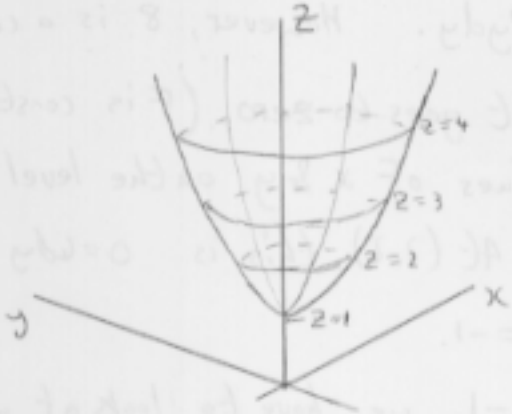
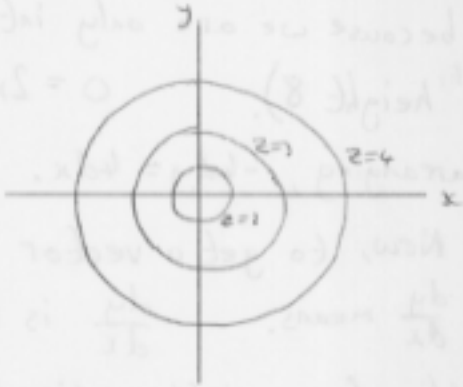
Tutorial 5

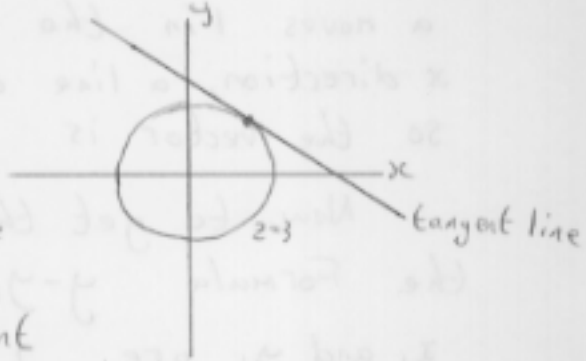
Last tutorial, we looked at the bowl shaped surface in 3 dimensions.



If we look 'down' on this surface, ie position our eye at $z=10$ $x=0$ $y=0$ and look back along the z axis towards the origin, then what we would see is



A tangent line is defined as a line parallel to a curve at a point and touching the curve at the same point. So on the $z=3$ ~~line~~ curve the tangent would look like:



Now, when the bowl shape is circular the direction that leads to the most rapid ascension of the surface is the radially outward direction. This direction is at right angles to tangent line.

This is always true, regardless of the shape of the surface. The tangent line of the level curve is perpendicular to the gradient vector.

In maths jargon 'normal' is used to mean 'perpendicular to the tangent', so the 'normal' vector will be the same as the gradient vector.

The tangent vector is a vector that goes in a direction parallel to the tangent line. To work out the tangent vector, we only need to know the gradient of the tangent line. So lets use $F=x^2+y^2$ as an example, at the point (2,2)

At (2,2) $F=8$, so on the level curve passing through (2,2), $8=x^2+y^2$.