

Lecture 15: Tangent spaces

- 1 Lets compute the tangent line at $(\pi, 0)$ to the curve $y = \sin(x)$ directly by determining the slope and making sure the line goes through the point.
- 2 Look at $f(x, y) = y - \sin(x) = 0$. Find the gradient $\nabla f(\pi, 0) = [a, b]$ of f at $(\pi, 0)$. Now find the tangent line again.
- 3 Find the tangent plane to the surface $x^2 - y^2 + z^2 = -1$ at the point $(2, 3, 2)$.
- 4 Find a line perpendicular to the surface $x^2 - y^2 + z^2 = -1$ at the point $(2, 3, 2)$

- 5 The heart problem (done in class):
Find the tangent plane to the heart

$$(20x^2 + y^2 + z^2 - 1)^3 - (x^2 + y^2)z^3 = 0$$

at the point $(0, 1, 1)$.

