

5. What are the equations of the line tangent to the curve which is parameterized by $\vec{r}(t) = (3t^2 + 2)\vec{i} + 6t\vec{j} + (4t^3 + 2t)\vec{k}$ at $t = 1$?

$$\vec{r}(1) = (3+2)\vec{i} + 6\vec{j} + 6\vec{k}$$

$$\vec{r}'(t) = 6t\vec{i} + 6\vec{j} + (12t+2)\vec{k}$$

$$\vec{r}'(1) = 6\vec{i} + 6\vec{j} + 14\vec{k}$$

The line through $(5, 6, 6)$ // to $6\vec{i} + 6\vec{j} + 14\vec{k}$:

$$\frac{x-5}{6} = \frac{y-6}{6} = \frac{z-6}{14}$$

6. Find the equation of the plane tangent to the surface $z = x^2 + 2y^3$ at the point where $x = 2$ and $y = -2$.

The z coordinate is $z = 4 + 2(-8) = -12$

$\vec{\nabla}$ + level sets

View the surface as $0 = x^2 + 2y^3 - z$

$$\vec{\nabla}(\text{RHS}) = 2x\vec{i} + 6y^2\vec{j} - \vec{k}$$

$$\vec{\nabla}(\text{RHS})|_{(2, -2, -12)} = 4\vec{i} + 24\vec{j} - \vec{k}$$

The Tan. Plane is $4(x-2) + 24(y+2) - (z+12) = 0$