190

7. (8 points) What are the equations of the line tangent to the curve which is parameterized by $\vec{r}(t) = (2t + 4t^2)\,\vec{i} + 6t\,\vec{j} + 2t^2\,\vec{k}$ at $(20, 12, 8)$?

the curve hits the given point when $t=2$ because $4+16=20$ $6\cdot 2=12$ and $2\cdot 4=8$.

$\vec{r}\,'(t) = (2+8t)\,\vec{i} + 6\vec{j} + 4t\,\vec{k}$

$\vec{r}\,'(2) = 18\vec{i} + 6\vec{j} + 8\vec{k}$

$$\frac{x-20}{18} = \frac{y-12}{6} = \frac{z-8}{8}$$

8. (8 points) Find the equation of the plane tangent to the surface $z = 3x^2 + y^3$ at the point where $x = 3$ and $y = -1$.

gradients are $\perp$ to level sets. Our surface is the level set $0 = 3x^2 + y^3 - z$

$\vec{\nabla}(RHS) = 6x\,\vec{i} + 3y^2\,\vec{j} - \vec{k}$

$\vec{\nabla}(RHS)\big|_{(3,-1)} = 18\vec{i} + 3\vec{j} - \vec{k}$

$z = 3(3)^2 - 1 = 26$

$$18(x-3) + 3(y+1) - (z-26) = 0$$