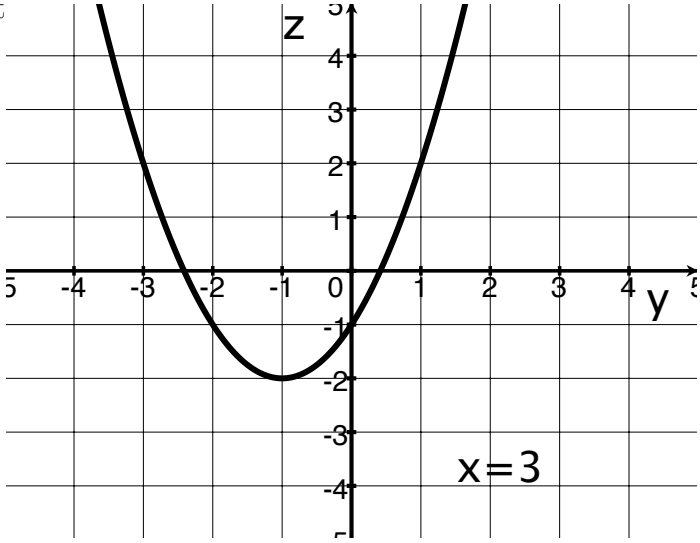
3D Parametric Equations

While working in a group make sure you:

- Expect to make mistakes but be sure to reflect/learn from them!
- Are civil and are aware of your impact on others.
- Assume and engage with the strongest argument while assuming best intent.

1. Find a set of parametric equations that represents the graph to the right. Note that the graph is given parallel to the yz plane when $x = 3$.



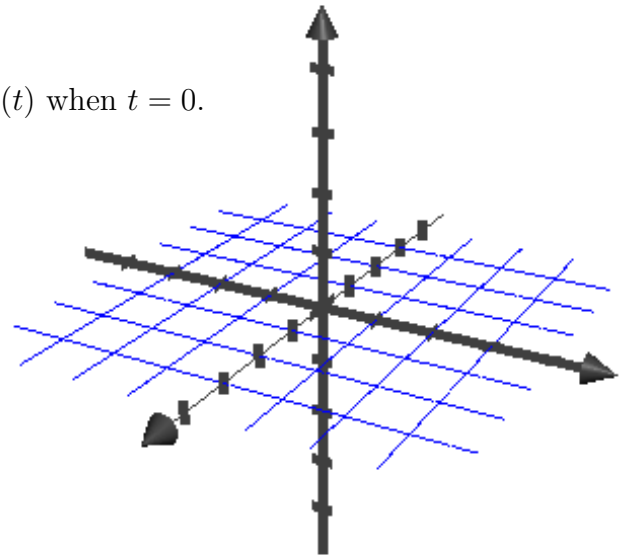
2. Find a function to describe the intersection of the surface $\frac{x^2}{12} + \frac{y^2}{24} + \frac{z^2}{4} = 1$ and the parabolic cylinder $y = x^2$.

Let $\vec{r}(t) = f(t)\,\vec{i} + g(t)\,\vec{j} + h(t)\,\vec{k}$. Let $\vec{u}(t)$ also be a vectored value function, then

- $\lim\limits_{t\to a} \vec{r}(t) = \left(\lim\limits_{t\to a} f(t)\right)\,\vec{i} + \left(\lim\limits_{t\to a} g(t)\right)\,\vec{j} + \left(\lim\limits_{t\to a} h(t)\right)\,\vec{k}$
- $\vec{r}(t)$ is continuous at a if $\lim\limits_{t\to a} \vec{r}(t) = \vec{r}(a)$
- $\vec{r}\,'(t) = \lim\limits_{\Delta t\to 0} \dfrac{\vec{r}(t+\Delta t) - \vec{r}(t)}{\Delta t} = f'(t)\,\vec{i} + g'(t)\,\vec{j} + h'(t)\,\vec{k}$
- $\dfrac{d}{dt}(\vec{r}(t)\cdot\vec{u}(t)) = \vec{r}(t)\cdot\vec{u}\,'(t) + \vec{r}\,'(t)\cdot\vec{u}(t)$
- $\dfrac{d}{dt}(\vec{r}(t)\times\vec{u}(t)) = \vec{r}(t)\times\vec{u}\,'(t) + \vec{r}\,'(t)\times\vec{u}(t)$

3D Calculus with Parametric Equations

3. Consider the parametric equation $\overrightarrow{r}(t)$ defined by: $x(t) = 1 + t^4$, $y(t) = te^{-t}$, and $z(t) = \sin(2t)$.



   (a) Find the line tangent to the curve $\overrightarrow{r}(t)$ when $t = 0$.

   (b) Find $\overrightarrow{r}''(t)$.

   (c) Find $\overrightarrow{r}'(t) \cdot \overrightarrow{r}(t)$.

4. We know $\overrightarrow{w}'(t) = \sec^2(t)\,\overrightarrow{i} + \dfrac{1}{1+t^2}\,\overrightarrow{j} + 0\,\overrightarrow{k}$. We also know $\overrightarrow{w}(0) = 3\,\overrightarrow{k}$. Find $\overrightarrow{w}(t)$.