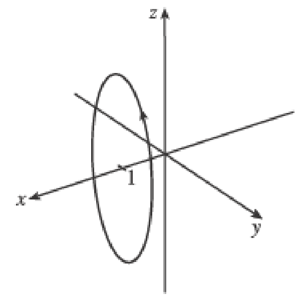
2. The component functions $\frac{t-2}{t+2}$, $\sin t$, and $\ln(9-t^2)$ are all defined when $t \neq -2$ and $9 - t^2 > 0 \quad \Rightarrow \quad -3 < t < 3$, so the domain of $\mathbf{r}$ is $(-3,-2) \cup (-2,3)$.

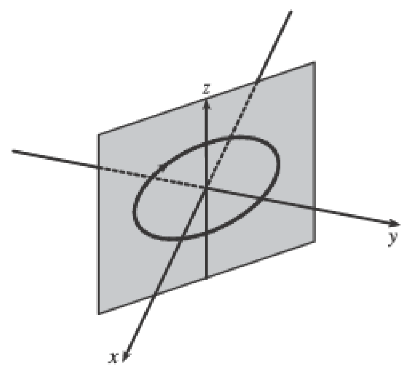
5. $\lim_{t\to 0} e^{-3t} = e^0 = 1$, $\lim_{t\to 0} \frac{t^2}{\sin^2 t} = \lim_{t\to 0} \frac{1}{\frac{\sin^2 t}{t^2}} = \frac{1}{\lim_{t\to 0} \frac{\sin^2 t}{t^2}} = \frac{1}{\left(\lim_{t\to 0} \frac{\sin t}{t}\right)^2} = \frac{1}{1^2} = 1$

and $\lim_{t\to 0} \cos 2t = \cos 0 = 1$. Thus the given limit equals $\mathbf{i} + \mathbf{j} + \mathbf{k}$.

11. The corresponding parametric equations are $x = 1$, $y = \cos t$, $z = 2\sin t$. Eliminating the parameter in y and z gives $y^2 + (z/2)^2 = \cos^2 t + \sin^2 t = 1$ or $y^2 + z^2/4 = 1$. Since $x = 1$, the curve is an ellipse centered at $(1, 0, 0)$ in the plane $x = 1$.



14. If $x = \cos t$, $y = -\cos t$, $z = \sin t$, then $x^2 + z^2 = 1$ and $y^2 + z^2 = 1$, so the curve is contained in the intersection of circular cylinders along the x- and y-axes. Furthermore, $y = -x$, so the curve is an ellipse in the plane $y = -x$, centered at the origin.



20. $x = t$, $y = t^2$, $z = e^{-t}$. At any point on the curve, $y = x^2$. So the curve lies on the parabolic cylinder $y = x^2$. Note that y and z are positive for all t, and the point $(0, 0, 1)$ is on the curve (when $t = 0$). As $t \to \infty$, $(x, y, z) \to (\infty, \infty, 0)$, while as $t \to -\infty$, $(x, y, z) \to (-\infty, \infty, \infty)$, so the graph must be II.

24. $x = \cos t$, $y = \sin t$, $z = \ln t$. $x^2 + y^2 = \cos^2 t + \sin^2 t = 1$, so the curve lies on a circular cylinder with axis the z-axis. As $t \to 0$, $z \to -\infty$, so the graph is III.