Section and/or TA: _____

1. (2 points) A particle follows a path given by $\mathbf{r}(t) = \langle t^2 + t, t^2 - t, t^3 \rangle$. Find its velocity and speed at time t = 2.

Solution: We have

$$\mathbf{r}'(t) = \langle 2t+1, 2t-1, 3t^2 \rangle.$$

Thus

 $\mathbf{v}(2) = \mathbf{r}'(2) = \langle 5, 3, 12 \rangle, \quad v(2) = |\mathbf{v}(2)| = \sqrt{25 + 9 + 144} = \sqrt{178}.$

2. (2 points) Find the domain for the function $f(x, y, z) = \ln(1+x) + \sqrt{4 - x^2 - y^2 - z^2}$.

Solution: For f(x, y, z) to be defined, we need x > -1 and $x^2 + y^2 + z^2 \le 2$. The second inequality describes a ball of radius 2 centered at the origin. Removing the plane x = -1 leaves two pieces of this ball. The domain of f(x, y, z) is the largest of the two pieces. See picture below:

