Name: $\qquad$ Section and/or TA: $\qquad$

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

Solution: We have

$$
\mathbf{r}^{\prime}(t)=\left\langle 2 t+1,2 t-1,3 t^{2}\right\rangle
$$

Thus

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

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 $x^{2}+y^{2}+z^{2} \leq 2$. 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:


