Question

A particle moves along the curve $\mathbf{r} = (t^2+1)\mathbf{i} + (3t-2)\mathbf{j} + (2t^3-4t^2)\mathbf{k}$. Find the velocity, acceleration, speed and magnitude of the acceleration at $t = 2$.

Answer

$$
\begin{aligned}
\mathbf{r} &= (t^2+1)\mathbf{i} + (3t-2)\mathbf{j} + (2t^3-4t^2)\mathbf{k} \\
\mathbf{v} = \dot{\mathbf{r}} &= 2t\mathbf{i} + 3\mathbf{j} + (6t^2-8t)\mathbf{k} \\
\mathbf{v} &= 4\mathbf{i} + 3\mathbf{j} + 8\mathbf{k} \qquad \text{at } t = 2 \\
\mathbf{a} = \ddot{\mathbf{r}} &= 2\mathbf{i} + (12t-8)\mathbf{k} \\
&= 2\mathbf{i} + 16\mathbf{k} \qquad \text{at } t = 2
\end{aligned}
$$