1. $\vec{r}(t) = \underbrace{\frac{1}{t^2-4}}_{f(t)}\vec{i} + \underbrace{\frac{t}{3}}_{g(t)}\vec{j} + \underbrace{t}_{h(t)}\vec{k}$

$t^2-4=0$
$t^2=4$
$t=\pm\sqrt{4}$
$t=\pm 2$

$f(t)=\frac{1}{t^2-4}$ $(-\infty,-2)\cup(-2,2)\cup(2,\infty)$

$g(t)=\frac{t}{3}$ $(-\infty,\infty)$

$h(t)=t$ $(-\infty,\infty)$

Domain: $(-\infty,-2)\cup(-2,2)\cup(2,\infty)$

2. $\vec{r} = \vec{F}(t) \times \vec{G}(t)$

$\vec{F}(t) = \ln(t-2)\vec{i} + t\vec{j} - 6t\vec{k}$
$\vec{G}(t) = \sqrt{t+7}\,\vec{i} - t\vec{k}$

$$\vec{r} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ \ln(t-2) & t & -6t \\ \sqrt{t+7} & 0 & -t \end{vmatrix}$$

$$= \vec{i}\begin{vmatrix} t & -6t \\ 0 & -t \end{vmatrix} - \vec{j}\begin{vmatrix} \ln(t-2) & -6t \\ \sqrt{t+7} & -t \end{vmatrix} + \vec{k}\begin{vmatrix} \ln(t-2) & t \\ \sqrt{t+7} & 0 \end{vmatrix}$$

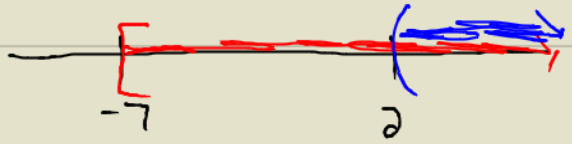
$$\vec{r} = -t^2\vec{i} + \left(-t\ln(t-2) + 6t\sqrt{t+7}\right)\vec{j} - t\sqrt{t+7}\,\vec{k}$$

$f(t) = -t^2$ $(-\infty,\infty)$

$g(t) = -t\ln(t-2) + 6t\sqrt{t+7}$ $(2,\infty)$

$h(t) = -t\sqrt{t+7}$ $[-7,\infty)$

$t-2>0$ $0\le t+7$
$t>2$ $-7\le t$



Domain: $(2,\infty)$