CINEMÁTICA

1. $\vec{v} = \frac{d\vec{r}}{dt} = 8t^3\vec{i} + (-3t^2-1)\vec{j} + 2t\vec{k}$ (m/s)

$|\vec{v}| = \sqrt{(8t^3)^2 + (-3t^2-1)^2 + (2t)^2} = \sqrt{64t^6 + 9t^4 + 10t^2 + 1}$ (m/s)

2. $\vec{v} = \frac{d\vec{r}}{dt} = 4t\vec{i} + \vec{j} + 9t^2\vec{k}$ (m/s)

$\vec{a} = \frac{d\vec{v}}{dt} = 4\vec{i} + 18t\vec{k}$ (m/s²) ; $\vec{a}(2s) = 4\vec{i} + 36\vec{k}$ (m/s²)

$|\vec{a}| = \sqrt{4^2 + 36^2} = \sqrt{1312} = 36{,}22$ m/s²

3. $\vec{r}(1s) = (1^2+2\cdot1)\vec{i} + (3\cdot1^2-1)\vec{j} + (2\cdot1^2-3)\vec{k} = 3\vec{i} + 2\vec{j} - \vec{k}$ (m)

$\vec{r}(3s) = (3^2+2\cdot3)\vec{i} + (3\cdot3^2-1)\vec{j} + (2\cdot3^2-3)\vec{k} = 15\vec{i} + 26\vec{j} + 15\vec{k}$ (m)

$\Delta\vec{r} = \vec{r}_2 - \vec{r}_1 = (15-3)\vec{i} + (26-2)\vec{j} + (15+1)\vec{k} = 12\vec{i} + 24\vec{j} + 16\vec{k}$ (m)

4. $\vec{r}(1s) = (1^3+1)\vec{i} + (1^2-2\cdot1)\vec{j} = 2\vec{i} - \vec{j}$ (m)

$|\vec{r}| = \sqrt{2^2 + (-1)^2} = \sqrt{5}$ m

$\vec{u}_r = \frac{\vec{r}}{|\vec{r}|} = \frac{2\vec{i} - \vec{j}}{\sqrt{5}} = \frac{2}{\sqrt{5}}\vec{i} - \frac{1}{\sqrt{5}}\vec{j}$

5. $\vec{a}_m = \frac{\Delta\vec{v}}{\Delta t}$; $\Delta\vec{v} = \vec{v}_2 - \vec{v}_1$

$\vec{v}(1s) = (1^2+2\cdot1+2)\vec{i} + (2\cdot1+3)\vec{j} + (3\cdot1^2+1)\vec{k} = 5\vec{i} + 5\vec{j} + 4\vec{k}$ (m/s)

$\vec{v}(3s) = (3^2+2\cdot3+2)\vec{i} + (2\cdot3+3)\vec{j} + (3\cdot3^2+1)\vec{k} = 17\vec{i} + 9\vec{j} + 28\vec{k}$ (m/s)

$\Delta\vec{v} = (17-5)\vec{i} + (9-5)\vec{j} + (28-4)\vec{k} = 12\vec{i} + 4\vec{j} + 24\vec{k}$ (m/s)

$\vec{a}_m = \frac{\Delta\vec{v}}{\Delta t} = \frac{12\vec{i} + 4\vec{j} + 24\vec{k}}{3-1} = 6\vec{i} + 2\vec{j} + 12\vec{k}$ (m/s²)

6. $\vec{r}(1s) = (1^2+2\cdot1-4)\vec{i} + 1^3\vec{j} + (2\cdot1+1)\vec{k} = -\vec{i} + \vec{j} + 3\vec{k}$ (m)

$\vec{r}(2s) = (2^2+2\cdot2-4)\vec{i} + 2^3\vec{j} + (2\cdot2+1)\vec{k} = 4\vec{i} + 8\vec{j} + 5\vec{k}$ (m)

$\Delta\vec{r} = \vec{r}_2 - \vec{r}_1 = (4+1)\vec{i} + (8-1)\vec{j} + (5-3)\vec{k} = 5\vec{i} + 7\vec{j} + 2\vec{k}$ (m)

$\vec{v}_m = \frac{\Delta\vec{r}}{\Delta t} = \frac{5\vec{i} + 7\vec{j} + 2\vec{k}}{2-1} = 5\vec{i} + 7\vec{j} + 2\vec{k}$ (m/s)

b) $\vec{v} = \frac{d\vec{r}}{dt} = (2t+2)\vec{i} + 3t^2\vec{j} + 2\vec{k}$ (m/s)

$\vec{v}(1s) = 4\vec{i} + 3\vec{j} + 2\vec{k}$ (m/s)

$|\vec{v}| = \sqrt{4^2+3^2+2^2} = \sqrt{29}$ m/s

7.

a) $\vec{v} = \frac{d\vec{r}}{dt} = 2t\vec{i} + \vec{j} + (2t+1)\vec{k}$ (m/s)

$\vec{v}(2s) = 4\vec{i} + \vec{j} + 5\vec{k}$ (m/s)

b) $\vec{a} = \frac{d\vec{v}}{dt} = 2\vec{i} + 2\vec{k}$ (m/s²)