8. $\vec{a}(t) = 2t\,\vec{j} - 3t\,\vec{k}$, $\vec{v}(0) = 2\vec{j}$, $\vec{r}(0) = 4\vec{k}$ ($t=0$)

$$\vec{v}(t) = \int \vec{a} = \int (2t\,\vec{j} - 3t\,\vec{k})\,dt$$

$$\vec{v}(t) = t^2\vec{j} - \tfrac{3}{2}t^2\vec{k} + \vec{C}$$

PLUG IN $t=0$

$$\vec{v}(0) = 0^2\vec{j} - \tfrac{3}{2}(0)^2\vec{k} + \vec{C}$$

$$\vec{v}(0) = \vec{C}$$

$$2\vec{j} = \vec{C}$$

$$\vec{v}(t) = t^2\vec{j} - \tfrac{3}{2}t^2\vec{k} + 2\vec{j}$$

$$\boxed{\vec{v}(t) = (t^2+2)\vec{j} - \tfrac{3}{2}t^2\vec{k}}$$

$$\vec{r}(t) = \int \vec{v}(t) = \int \left[(t^2+2)\vec{j} - \tfrac{3}{2}t^2\vec{k}\right] dt$$

$$\vec{r}(t) = \left(\tfrac{1}{3}t^3 + 2t\right)\vec{j} - \tfrac{1}{2}t^3\vec{k} + \vec{C}$$

PLUG IN $t=0$

$$\vec{r}(0) = \left(\tfrac{1}{3}(0)^3 + 2(0)\right)\vec{j} - \tfrac{1}{2}(0)^3\vec{k} + \vec{C}$$

$$\vec{r}(0) = \vec{C}$$

$$4\vec{k} = \vec{C}$$

$$\vec{r}(t) = \left(\tfrac{1}{3}t^3 + 2t\right)\vec{j} - \tfrac{1}{2}t^3\vec{k} + 4\vec{k}$$

$$\boxed{\vec{r}(t) = \left(\tfrac{1}{3}t^3 + 2t\right)\vec{j} + \left(-\tfrac{1}{2}t^3 + 4\right)\vec{k}}$$

AT $t=2$

$$\vec{r}(2) = \left(\tfrac{1}{3}(2)^3 + 2(2)\right)\vec{j} + \left(-\tfrac{1}{2}(2)^3 + 4\right)\vec{k}$$

$$= \left(\tfrac{8}{3} + 4\right)\vec{j} + (-4+4)\vec{k}$$

$$= \boxed{\tfrac{20}{3}\vec{j}}$$