13.1, number 7: **The position vector of an object at time t is $\vec{\boldsymbol{r}}(t) = e^t\,\vec{\boldsymbol{i}} + \frac{2}{9}e^{2t}\,\vec{\boldsymbol{j}}$. Eliminate t and find an equation involving only x and y which gives the path of the object. Find the object's velocity and acceleration vectors at time $t = \ln 3$.**

Answer: We are given $x = e^t$, $y = \frac{2}{9}e^{2t}$. We drop the first equation into the second equation: $\boxed{y = \frac{2}{9}x^2}$. We compute

$$\vec{\boldsymbol{v}}(t) = \vec{\boldsymbol{r}}\,'(t) = e^t\,\vec{\boldsymbol{i}} + \frac{4}{9}e^{2t}$$

and

$$\vec{\boldsymbol{a}}(t) = \vec{\boldsymbol{v}}\,'(t) = e^t\,\vec{\boldsymbol{i}} + \frac{8}{9}e^{2t}.$$

We conclude that

$$\vec{\boldsymbol{v}}(\ln 3) = e^{\ln 3}\,\vec{\boldsymbol{i}} + \frac{4}{9}(e^{\ln 3})^2\,\vec{\boldsymbol{j}} = \boxed{3\,\vec{\boldsymbol{i}} + 4\,\vec{\boldsymbol{j}}}$$

and

$$\vec{\boldsymbol{a}}(\ln 3) = e^{\ln 3}\,\vec{\boldsymbol{i}} + \frac{8}{9}(e^{\ln 3})^2 = \boxed{3\,\vec{\boldsymbol{i}} + 8\,\vec{\boldsymbol{j}}}.$$