1. Use the formula $y=v(t) e^{2 t}$ to express the differential equation $y^{\prime}-2 y=t$ as a differential equation in terms of $t$ and $v(t)$.

2. For what value of the constant $k$ will the change of variables formula $y=v(t) e^{k t}$ transform the differential equation $y^{\prime}+3 y=e^{t}$ into a differential equation that contains no $v(t)$ term?

3. Use the formula $y=v(t) e^{2 t}$ to express the differential equation $y^{\prime \prime}-y^{\prime}-2 y=0$ as a differential equation in terms of $t$ and $v(t)$.
4. Use the formula $y=v(t) t$ to express the differential equation $t^{2} y^{\prime \prime}-t y^{\prime}+y=0$ as a differential equation in terms of $t$ and $v(t)$.
5. Use the formula $v(t)=y^{\prime}(t)$ to express the differential equation $y^{\prime \prime}=t y^{\prime}$ as a differential equation in terms of $t$ and $v(t)$.
6. Use the formula $v(y)=y^{\prime}(t)$ to express the differential equation $y^{\prime \prime}=y^{\prime} / y^{2}$ as a differential equation in terms of $y$ and $v(y)$.
