1.2 1 $\frac{dy}{dt} + y\cos t = 0$

$$\frac{\frac{dy}{dt}}{y} = -\cos t$$

Integrate both sides wrt t:

$$\ln y = -\sin t + C$$

$$y = ce^{-\sin t}$$

2 $\frac{dy}{dt} + y\sqrt{t}\sin t = 0$

$$\frac{\frac{dy}{dt}}{y} = -\sqrt{t}\sin t$$

$$\ln y = -\int \sqrt{t}\sin t\,dt + C$$

$$y = Ce^{-\int\sqrt{t}\sin t\,dt}$$

5. $\frac{dy}{dt} + \underbrace{t^2}_{a(t)} y = 1$

$$\mu(t) = e^{\int a(t)dt} = e^{\int t^2 dt} = e^{t^3/3}$$

Multiply $\mu(t)$ on both sides of eqn:

$$\mu(t)\frac{dy}{dt} + \mu(t)t^2 y = \mu(t)$$

$$\parallel$$

$$(\mu(t)y)'$$

Integrate both sides wrt t

$$\mu(t)y = e^{t^3/3}\cdot y = \int e^{t^3/3}dt + C$$

$$\Rightarrow y = e^{-t^3/3}\left(\int e^{t^3/3} + c\right)$$

8. $\frac{dy}{dt} + \sqrt{1+t^2}\,y = 0 \quad y(0) = \sqrt{5}$

$$\frac{\frac{dy}{dt}}{y} = -\sqrt{1+t^2}$$

$$\int_0^t \frac{d}{ds}\ln y\,ds = -\int_0^t \sqrt{1+s^2}\,ds$$

$$\ln y(t) - \ln y(0) = -\int_0^t \sqrt{1+s^2}\,ds$$

$$\ln y - \ln\sqrt{5} = -\int_0^t \sqrt{1+s^2}\,ds$$

$$\parallel$$

$$\ln\frac{y}{\sqrt{5}}$$

$$\Rightarrow \frac{y}{\sqrt{5}} = e^{-\int_0^t\sqrt{1+s^2}\,ds}$$

$$y = \sqrt{5}\,e^{-\int_0^t\sqrt{1+s^2}\,ds}$$