2.2 # 13

$$\frac{dy}{y^3} = x y^3 (1+x^2)^{-1/2} dx$$

$$\frac{1}{y^3}$$

$$\int y^{-3} dy = \int \frac{x}{(1+x^2)^{1/2}} dx$$

integration by substitution

$$\frac{y^{-2}}{-2} =$$

$$-\frac{1}{2}y^{-2} = \int \frac{x\,dx}{(1+x^2)^{1/2}}$$

Let $u = 1 + x^2$

$$\frac{du}{2} = \frac{2x\,dx}{2}$$

$$-\frac{1}{2}y^{-2} = \int \frac{du}{2u^{1/2}} = \frac{1}{2}\int u^{-1/2}\,du = u^{1/2} + C$$

$$= (1+x^2)^{1/2} + C$$

$$-2\left[-\frac{1}{2}y^{-2}\right] = \left[(1+x^2)^{1/2} + C\right]^{-2}$$

$$\left(y^{-2}\right)^{-\frac{1}{2}} = \left[-2(1+x^2)^{1/2} + C\right]^{-1/2}$$

$$\boxed{y = \left[-2(1+x^2)^{1/2} + C\right]^{-\frac{1}{2}}}$$

general soln

IVP: $y(0) = 1$: $1 = \left[-2(1+0^2)^{1/2} + C\right]^{-1/2}$

$$1 = \left[-2 + C\right]^{-1/2}$$

$$\left(\frac{1}{}\right)^{-2} = \left(\left[-2 + C\right]^{-1/2}\right)^{-2}$$

$$\frac{1}{}^{+2} = -2^{+2} + C \Rightarrow C = 3$$

IVP: $y = \left[-2(1+x^2)^{1/2} + 3\right]^{-1/2}$