**Theorem.** The general solution to the homogeneous linear differential equation $y' + p(x)y = 0$ is

$$\boxed{y = ce^{-P(x)}}$$

where $P'(x) = p(x)$.

Note that applying the theorem requires that $p(x)$ be integrable; thus there are situations in which the theorem doesn't help.

**1.** Find the general solution to the differential equation $(1 + x^2)y' = 2xy$.

**Theorem.** The general solution to the linear differential equation $y' + p(x)y = f(x)$ is $\boxed{y = uy_1}$ where

a) $y_1$ is any particular solution to the complementary equation $y' + p(x)y = 0$ and

b) $u = \displaystyle\int \frac{f(x)}{y_1(x)}dx$ (add a constant here).

**2.** Solve the IVP: $y' + 2xy = x$, $y(1) = 1$.