LINEAR DIFFERENTIAL EQUATIONS

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

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

where $P(x)$ is any antiderivative of $p(x)$ (any function so that $P'(x) = p(x)$).

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

1. This problem deals with the differential equation $(1 + x^2)y' = 2xy$.

a) Find the general solution

b) Check that your solution really works

c) Find the particular solution with $y(1) = 4$.

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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 $y' + p(x)y = 0$

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

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