$y = c_1 + c_2 x^2$ solves $x y'' - y' = 0$

on $(-\infty, \infty)$

Find $c_1$ and $c_2$ that satisfy $y(0) = 1$, $y'(1) = 6$

**Solution:**

1. $1 = y(0) = c_1 + c_2(0)^2 = c_1 \Rightarrow c_1 = 1$

2. $y' = 2c_2x$ and

   $6 = y'(1) = 2c_2(1) = 2c_2 \Rightarrow c_2 = 3$

3. $y = 1 + 3x^2$ satisfies $x y'' - y' = 0$

   - $y(0) = 1$
   - $y'(1) = 6$

4. The 4.1 does not apply so no guarantees! $a_2(x) = x$ and "$a_n(x) \neq 0 \text{ on } I$" is NOT TRUE! Since $I = (-\infty, \infty)$. Also this is not an IVP, it is a BVP.