Math 2255, Quiz #16, Spring 2013 Name KEY

Instructions: Show all work. Give at least 4 terms for each coefficient a_0, a_1 for the solution to the series.

1. Solve the differential equation using series solution methods $xy'' - y = 0$ centered at $x_0 = 0$. Use the form $y = \sum_{n=0}^{\infty} a_n x^{n+r}$ to solve the equation.

$$x\sum_{n=2}^{\infty} a_n (n+r)(n+r-1)x^{n+\cancel{r}-2} - \sum_{n=0}^{\infty} a_n x^{n+\cancel{r}} = 0$$

$$\sum_{n=2}^{\infty} a_n (n+r)(n+r-1)x^{n-1} - \sum_{n=0}^{\infty} a_n x^n = 0$$

$$\sum_{n=1}^{\infty} a_{n+1} (n+r+1)(n+r)x^n - \sum_{n=0}^{\infty} a_n x^n = 0$$

$$\sum_{n=1}^{\infty} a_{n+1} (n+r+1)(n+r)x^n - \sum_{n=1}^{\infty} a_n x^n + a_0 x^0 = 0$$

no condition on r

$\Rightarrow a_0 = 0$

$$\sum_{n=1}^{\infty} [a_{n+1} (n+\cancel{r}+1)(n+\cancel{r}) - a_n] x^n = 0$$

$$a_{n+1} = \frac{a_n}{(n+1)(n)}$$

$$y = 0$$