P.8 Math 2280 Due. 1/19/06 Nobunari Isono

.1.12 **Statment:**

Verify Sub. that each given $f^{\underline{n}}$ is a sol. of the given diff. eq. Primes denate derivatives w/ resp. to x

$$x^2y'' - xy' + 2y = 0$$

$$x^2y''$$
$$-xy'$$
$$+2y = 0 \cdots (1)$$

$$y_1 = x\cos(\ln x) \cdots (2)$$

$$y_1' = \cos(\ln x) + x\{-\sin(\ln x)\}\frac{1}{x}$$
$$= \cos(\ln x) - \sin(\ln x) \cdots (3)$$

$$y_1'' = -\sin(\ln x)\left(\tfrac{1}{x}\right) - \cos(\ln x)\left(\tfrac{1}{x}\right)$$
$$= -\frac{1}{x}\{\sin(\ln x) + \cos(\ln x)\} \cdots (4)$$

Plug (2),(3),(4) into (1):

$$x^2\left(-\tfrac{1}{x}\right)\{\sin(\ln x) + \cos(\ln x)\}$$
$$-x\{\cos(\ln x) - \sin(\ln x)\}$$
$$+2x\cos(\ln x)$$

$$= -x\sin(\ln x) - x\cos(\ln x)$$
$$-x\cos(\ln x) + x\sin(\ln x)$$
$$+2x\cos(\ln x)$$

$$= -x\sin(\ln x) - x\cos(\ln x)$$
$$+x\sin(\ln x) - x\cos(\ln x)$$
$$+2x\cos(\ln x)$$

$$= 0$$

$$y_2 = x\sin(\ln x) \cdots (5)$$

$$y_2' = \sin(\ln x) + x\cos(\ln x)\frac{1}{x}$$
$$= \sin(\ln x) + \cos(\ln x) \cdots (6)$$

$$y_2'' = \frac{1}{x}\cos(\ln x) - \frac{1}{x}\sin(\ln x)$$
$$= \frac{1}{x}\{\cos(\ln x) - \sin(\ln x)\} \cdots (7)$$

Plug (7),(8),(9) into (1)

$$x^2\left(\tfrac{1}{x}\right)\{\cos(\ln x) - \sin(\ln x)\}$$
$$-x\{\sin(\ln x) + \cos(\ln x)\}$$
$$+2x\sin(\ln x)$$

$$= x\cos(\ln x) - x\sin(\ln x)$$
$$-x\cos(\ln x) - x\sin(\ln x)$$
$$+2x\sin(\ln x)$$

$$= 0$$

$\therefore$ y_1 & y_2 are sol. of the diff. eq.