Math 271 - Quiz #1   Score: _____ out of 10.

Name: _____ (key) _____

| Show all work clearly and in order. Please box your answers. 10 minutes. |

1. Fill in the following table with the missing classification information:

DE	order	linear/nonlinear
$xy'' - y' + 2y = x$	2	linear
$\tan(x)y^{(10)} + \ln(x)y'' = \cot(x)$	10	linear
$\dfrac{d^5y}{dx^5} + xy^4 = \sin(x)$	5	nonlinear

2. Verify that $y = \sin(3x)$ is a solution to the differential equation $y'' + 9y = 0$.

$$y = \sin(3x)$$
$$y' = 3\cos(3x)$$
$$y'' = -9\sin(3x)$$

$$\Bigg\} \longrightarrow$$

$$y'' + 9y = 0$$
$$-9\sin(3x) + 9\sin(3x) = 0$$
$$0 = 0 \checkmark$$

3. Find the value(s) of m so that $y = x^m$ is a solution to the differential equation $xy'' + 2y' = 0$.

$$y' = mx^{m-1}$$
$$y'' = m(m-1)x^{m-2}$$

$$xy'' + 2y' = 0$$
$$x\, m(m-1)x^{m-2} + 2mx^{m-1} = 0$$
$$m(m-1)x^{m-1} + 2mx^{m-1} = 0$$
$$(m^2 - m + 2m)x^{m-1} = 0$$
$$(m^2 + m)x^{m-1} = 0 \qquad \text{if } x \neq 0 \text{ then}$$
$$m^2 + m = 0$$
$$m(m+1) = 0 \qquad \longrightarrow \boxed{m = 0 \quad \underline{OR} \quad m = -1}$$