PRACTICE TEST FOR TEST III

(1.) Consider the DEq^n $\frac{dY}{dx} = YX$.

a.) find the equilbrium sol^n's.
b.) find the general sol^n.
c.) find the specific sol^n with $Y(0) = 1$.
d.) find the orthogonal trajectory that also passes through $(0, 1)$.

(2.) For each of the DEq^n's below find the general sol^n then verify that your answer is correct. That is show your sol^n is indeed a sol^n.

a.) $\frac{d^2Y}{d\theta^2} + 2\frac{dY}{d\theta} + Y = 0$

b.) $Y'' + 5Y' + 6Y = 0$ $\left(\text{let } Y' = \frac{dY}{dx}\right)$

c.) $Y'' + Y' + Y = 0$ $\left(\text{let } Y' = \frac{dY}{dt}\right)$

(3.) Find the general sol^n to the DEq^n below,

$$\boxed{Y'' + 4Y = \sin(2x) + x}$$

(4.) Let $Y'' + 5Y' + 6Y = g(x)$. Set up the correct particular sol^n Y_p for each case below

a.) $g(x) = x^3$
b.) $g(x) = e^{-3x} + \sin(x)$
c.) $g(x) = e^x \cos(x) + xe^{-2x} + 3$
d.) $g(x) = 6\cos(2x) + \sin(5x)$

(5.) Consider Newton's 2nd Law $F_{net} = ma = m\frac{d^2x}{dt^2}$ where $F_{net} = -kx + F_{ext}$. Then

$$\boxed{m\frac{d^2x}{dt^2} = -kx + F_{ext.}}$$

note: spring breaks if $x(t) \to \infty$ as $t \to \infty$

If $F_{ext} = \sin(\omega t)$ then what choice of ω will break the spring? Explain your choice.