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**DIRECTIONS:** To receive full credit, you must provide complete legible solutions to the following problems in the space provided.

1. Determine the order and whether the equation is linear or nonlinear.

a.  $\sqrt{1+(y')^2} = x$                       Ans \_\_\_\_\_

b.  $xy''' + 2y = \sin x$                       Ans \_\_\_\_\_

c.  $y' + \cos y = 1 + x$                       Ans \_\_\_\_\_

2. Consider the differential equation  $z' + 2e^{t+z} = 0$

a. Find the general solution to the differential equation.                      Ans \_\_\_\_\_

b. Find a particular solution that satisfies the given IC.  
 $y(0)=0$

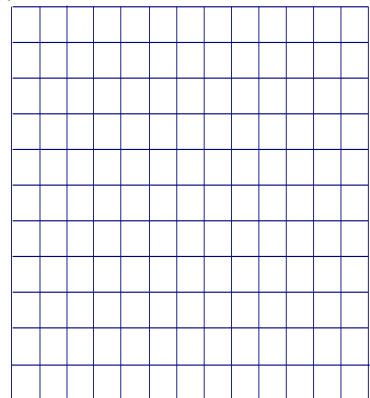
Ans \_\_\_\_\_

3. Find the solution of the differential equation that satisfies the given initial condition.

$\frac{dy}{dx} = xy, y(0) = -8$                       Ans \_\_\_\_\_

4. Find a function  $f(x)$  such that  $f'(x) = f(x)(1 - f(x))$  and satisfies the initial condition  $f(0) = 1/10$       Ans \_\_\_\_\_

5. Consider the family of plane curves  $x^2 + 2y^2 = k^2$       Ans \_\_\_\_\_  
a. Find the orthogonal trajectories of the family of curves above.



- a. Use a graphing device to draw several members of each family on a common screen then transfer the graphs to the given grid.

6. An integral equation is an equation that contains an unknown function  $y(x)$  and an integral that involves  $y(x)$ . Solve the given integral equation. [Note that  $y(1) = 2$ ]

$$y(x) = 2 + \int_1^x [t - ty(t)] dt$$