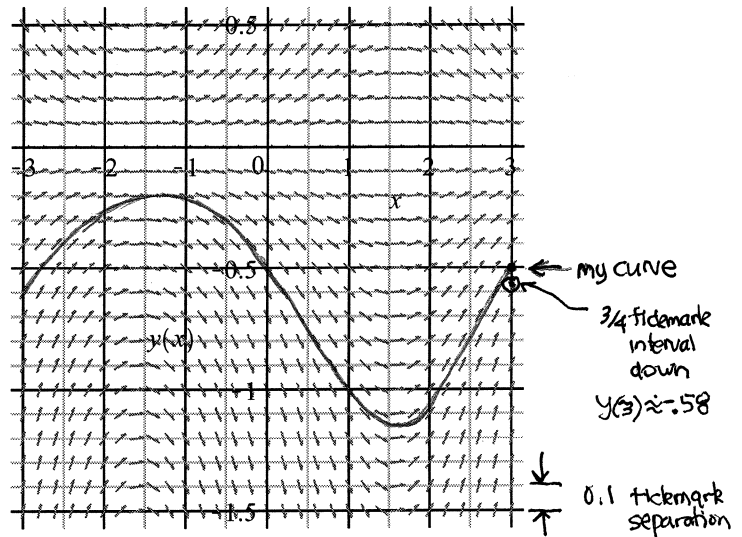


Show all work, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use equal signs and arrows when appropriate. Always SIMPLIFY expressions. BOX final short answers. LABEL parts of problem. Keep answers EXACT (but give decimal approximations for interpretation). Indicate where technology is used and what type (Maple, GC). Always justify your claims.

1.  $\frac{dy}{dx} - y \cos(x) = 0, y(0) = -\frac{1}{2}$ .

- a) Indicate the initial data point on the graph by a circled dot annotated by an arrow pointing to the point from the initial condition written to the side of the graph and roughly draw in the corresponding solution curve.
- b) Find the general solution of this separable differential equation, making sure you redefine your final constant to include the obvious missing solution from your family.
- c) Find the solution which satisfies the initial condition (no decimal point numbers!).
- d) Evaluate  $y(3)$  for this solution and mark the corresponding point on the graph by a circled dot annotated as above (arrow from  $y(3) \approx \dots$ ). Is this consistent with your approximate hand drawn solution? Explain (estimate your value from the curve, compare).



- e) Check by hand that your solution to c) solves the differential equation. [Remember, backsub everywhere in the DE eliminating  $y$ , then simplify both sides independently.]
- f) Enter the differential equation and the initial condition separated by a comma in Maple. Right click and solve. Write down exactly the form of the solution that it gives you. Does it agree with your hand solution? Explain why if so. If not, you better find your error.

► **solution**

b)  $\frac{dy}{dx} = y \cos x \rightarrow y=0$  is a soln.

$$\int \frac{dy}{y} = \int \cos x \, dx \quad \begin{matrix} \text{separate \&} \\ \text{integrate} \end{matrix}$$

lost by division by  $y$

$$\ln|y| = \sin x + C_1$$

$$|y| = e^{\ln|y|} = e^{\sin x + C_1} = e^{C_1} e^{\sin x}$$

$$y = \underbrace{\pm e^{C_1}}_{\equiv C} \sin x \rightarrow \boxed{y = C e^{\sin x}} \quad \begin{matrix} \text{gen.} \\ \text{soln.} \end{matrix}$$

d)  $y(3) = -\frac{1}{2} e^{\sin 3} \approx -0.5758$

how I plotted this on the grid at  $x=3$   $\left\{ \begin{matrix} -(0.5000 + 0.0758) \\ \approx \frac{3}{4}(0.1) \end{matrix} \right.$

My curve instead appears to have  $y(3) \approx -0.5$

A close as can be expected with this crude slope field.

c)  $y(0) = -\frac{1}{2} \Leftrightarrow x=0, y=-\frac{1}{2}$

$$-\frac{1}{2} = C e^{\sin 0} = C e^0 = C$$

$$\boxed{y = -\frac{1}{2} e^{\sin x}} \quad \begin{matrix} \text{IVP} \\ \text{soln} \end{matrix}$$