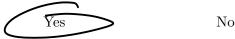
Please show and explain your work where necessary. Good luck!!

1. (3 points)

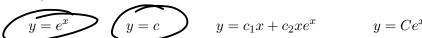
(i) Is the function e^x a solution to the differential equation y' - y = 0? (Circle your answer.)



(ii) Circle the following that is most likely to be a trivial solution to a DE.

$$y = e^x$$
 $y = c$ $y = 0$ $y = Ce^x$

(iii) Circle the following that is most likely to be a particular solution to a DE. $(C, c_1, c_2, k$ are arbitrary constants.)



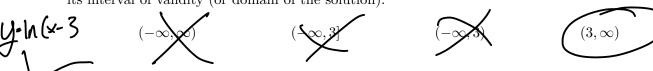
(iv) Circle the following that is most likely to be a 2-parameter family of solutions to a DE. $(C, c_1, c_2, k \text{ are arbitrary constants.})$

$$y = e^x$$
 $y = c$ $y = c_1 x + c_2 x e^x$ $y = Ce^x$

(v) Circle the following that is most likely to be a general solution to a DE. (C, c_1, c_2, k) are arbitrary constants.)

$$y = e^x$$
 $y = c_1x + c_2xe^x$ $y = cos(x)$

(vi) Suppose $y = \ln(x - 3)$ is a solution to a DE. Circle the following which would best represent its interval of validity (or domain of the solution).



2. (2 points) Suppose $y = \frac{1}{x-3}$ is a solution to a differential equation. Is $(-\infty,3) \cup (3,\infty)$ the interval of validity for the solution (or the domain of the solution)? If so, explain why. If not, provide a possible domain.

Yes; for, the interval is 3 non-inclusive. When X=3 the denom. is Zero.

(There is another problem on the next page!)

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3. (5 points) Consider the function $f = c_1 \cos(3t) + c_2 \sin(3t)$, where c_1 and c_2 are arbitrary constants. We are given that $f = c_1 \cos(3t) + c_2 \sin(3t)$ is a 2-parameter family of solutions to the differential equation f'' + f = 0. Find a solution to the IVP consisting of this differential equation and the following initial conditions:

and the following intrial conditions:
$$\frac{f(\frac{\pi}{3}) = \sqrt{2}, \quad f'(\frac{\pi}{3}) = \sqrt{3}.}{\text{In}(i+i) \text{M} \ conditions}$$

$$\sqrt{2} = f(\frac{\pi}{3}) = C_1 \cos(3(\frac{\pi}{3})) + C_2 \sin(\frac{\pi}{3})$$

$$\sqrt{2} = C_1(-1) + C_2(0)$$

$$\therefore \sqrt{2} = -C_1 / C_1 = -\sqrt{2}$$

$$f' = C_1 - \sin(3t) \left[3t\right]' + \cos(3t) \left[3t\right]' + \cos(3t) \left[3t\right]'$$

$$\Rightarrow C_1 = -3\sin(3t) C_1 + 3\cos(3t)$$

$$\Rightarrow J_3 = f'(\frac{\pi}{3}) = -3\sin(3(\frac{\pi}{3})) C_1 + 3\cos(3(\frac{\pi}{3})) C_2$$

$$\Rightarrow J_3 = -3\sin(\pi) C_1 + 3\cos(3(\frac{\pi}{3})) C_2$$