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1. (1 point) Are the following functions homogeneous? (You have only one attempt! Submit all answers at the same time)

(a)
- Choose
- Homogeneous
- Not Homogeneous

$f(x,y) = x^3y^5$.

(b)
- Choose
- Homogeneous
- Not Homogeneous

$f(x,y) = x\sin(y)$.

(c)
- Choose
- Homogeneous
- Not Homogeneous

$f(x,y) = x + y^2$.

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2. (1 point)

Determine whether the differential equation is homogeneous or not. If it is homogeneous, provide the degree of x^2y^4 and x^6+y^6. If it is not homogeneous, put -1 as the degree. (Note: This is the first definition of homogeneous DE we saw!)

$$\left(x^2y^4\right)\,dx + \left(x^6+y^6\right)\,dy = 0$$

(a) The degree is _____.

(b) The equation is
- Choose
- Homogeneous
- Not Homogeneous

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3. (1 point) Use substitution to find the general solution of the differential equation $(7x-y)\,dx + x\,dy = 0$.

(Use C to denote the arbitrary constant and $\ln|$ input $|$ if using ln.)
$y =$ __________ help (formulas)

Solve the differential equation $\left(y^2+xy\right)\,dx - x^2\,dy = 0$.

- A. $y = \dfrac{x}{xC + \ln|x|}$
- B. $y = C - \ln|x|$
- C. $y = \dfrac{x}{C - \ln|x|}$
- D. $y = C + \ln|x|$

Solve the homogeneous differential equation $-y\,dx + \left(x+\sqrt{xy}\right)\,dy = 0$. (Note: Some algebraic manipulation goes into putting your answer into the form below.)

- A. $y = x\left(\ln|x| - C\right)^2$
- B. $y\left(\ln|y| - C\right)^2 = 4x$
- C. $\sqrt{yx}\ln|y| = C\sqrt{x}$

Which of the following is a solution to the IVP consisting of the homogeneous differential equation $-y\,dx + \left(x+\sqrt{xy}\right)\,dy = 0$ with the initial condition $y(4) = 1$. (Note: Some algebraic manipulation goes into putting your answer into the form below.)

- A. $\sqrt{yx}\ln|y| = 4\sqrt{x}$
- B. $y = x\left(\ln|x| + 4\right)^2$
- C. $y\left(\ln|y| + 4\right)^2 = 4x$

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7. (1 point) Note that $y = c_1e^{4x} + c_2e^{-x}$ is a general solution for the second-order differential equation $y'' - 3y' - 4y = 0$ on the interval $(-\infty,\infty)$. Find values c_1 and c_2 so that y is a solution to the second-order IVP consisting of the differential equation $y'' - 3y' - 4y = 0$ and the initial condition $y(0) = 3$, $y'(0) = 7$. The values are $c_1 =$ _____ and $c_2 =$ _____.

8. (1 point) Note that $y = c_1 x + c_2 x \ln(x)$ is a general solution for the second-order differential equation $x^2 y'' - xy' + y = 0$ on the interval $(0, \infty)$. Find values c_1 and c_2 so that y is a solution to the second-order IVP consisting of the differential equation $x^2 y'' - xy' + y = 0$ and the initial condition $y(1) = 2$, $y'(1) = 7$. The values are $c_1 =$ _____ and $c_2 =$ _____.

We have that $y = c_1 + c_2 x^2$ is a two-parameter family of solutions for the differential equation $xy'' - y' = 0$ on the interval $(-\infty, \infty)$. Does there exist values c_1 and c_2 so that y satisfies the initial conditions $y(0) = 0$ and $y'(0) = 1$?

- A. No
- B. Yes

Why does you answer above not violate the theorem in class concerning the existence of a unique solution?

- A. The coefficients are continuous on the interval.
- B. The highest order derivative is two.
- C. The coefficent of the y'' term is 0.
- D. The differential equation is linear.

Consider the initial value problem $(x-8)y'' + 3y = x$ with initial conditions $y(0) = 3$ and $y'(0) = 1$. Which of the following is an interval containing 0 for which this IVP has a unique solution on?

- A. $(-\infty, 8)$
- B. $(-8, \infty)$
- C. $(-\infty, -8)$
- D. $(-\infty, 3)$