

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

1. (3 points) Circle all of the following expression which are ordinary differential equations.

(i) $\ln(y')y + x^2y = 1$

(iv) $e^{y''} - y' + y - 1 = 0$

(ii) $\frac{\partial f}{\partial x} + \frac{\partial f}{\partial y} - x^2y = 0$

(v) $\sin\left(\frac{\partial g}{\partial x}\right) - \frac{\partial f}{\partial y} = e^{x^2+y^2}$

(iii) $x^2 \frac{d^3 f}{dx^3} + \frac{df}{dx} + \cos(x) = \frac{d^2 f}{dx^2}$

(vi) $y^{(2)} + y' - y = 0$

2. (3 points) Circle all of the following expression which are linear differential equations.

(i) $\cos(y')y + y = e^x$

(iv) $e^{y'} - y'' + y - 1 = 0$

(ii) $\sin(x) \frac{d^4 f}{dx^4} + \frac{df}{dx} + x^3 + \frac{d^2 f}{dx^2} = 0$

(v) $(y')^3 + y = 0$

(iii) $y^{(3)}y' - y = 3$

(vi) $g(t) \left(\frac{dg}{dt}\right) - g(t) = 0$

3. (3 points) State the order of the following differential equations.

(i) $e^{y'}y + y = x$

Order: _____

(ii) $\frac{d^5 g}{dt^5} - \frac{dg}{dt} + g(t) = 0$

Order: _____

(iii) $\left(\frac{df}{dx}\right)^3 + \frac{df}{dx} + \cos(x) = \frac{d^2 f}{dx^2}$

Order: _____

(iv) $e^{y'''} - y' + y - 1 = 0$

Order: _____

(v) $(y'')y + yx^2 = 0$

Order: _____

(vi) $y^{(4)} + y' - y^2 = 0$

Order: _____

4. (1 point) Provide an example of a nonlinear partial differential equation.