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1. Determine the order, linearity and type of  $8x^5 \frac{d^4 y}{dx^4} - \cos x \frac{dy}{dx} + 10xy = \ln(3x^2)$

Order: 4th

This equation is linear because  $y$  and its derivatives ~~and~~ only have the independent variable  $x$  in the coefficient.

This equation is ordinary because there are no partial derivatives.

2. Verify  $y = x^2 \sin x + 3x^2$  is a solution to  $\frac{1}{x} y' - \frac{2y}{x^2} = x \cos x$ .

~~$$y' = x^2 \sin x + 3x^2$$~~

$$y' = 2x \sin x + x^2 \cos x + 6x$$

$$\frac{2x \sin x + x^2 \cos x + 6x}{x} - \frac{2(x^2 \sin x + 3x^2)}{x^2} = x \cos x$$

$$2 \sin x + x \cos x + 6 - 2 \sin x - 6 = x \cos x$$

$$x \cos x = x \cos x$$

$y = x^2 \sin x + 3x^2$  is a solution