EE206 Assignment 1 *

Due 25th Sept.

1. Evaluate the following derivatives
   (a) $\frac{d}{dx}\ln(5x\sqrt{x+8})$
   (b) $\frac{d}{dx}\frac{\sqrt{1+2x}}{e^{3x}}$
   (c) $\frac{d}{dx}\ln(\sin(x))$
2. Evaluate the following integrals
   (a) $\int x\cot(x^2+1)dx$
   (b) $\int \frac{\sin(3\sqrt{x})}{\sqrt{x}}dx$
   (c) $\int \frac{1}{t\ln t}dt$
   (d) $\int t\cos(t)dt$
3. State whether the following differential equations are linear or nonlinear, and give the order of each equation
   (a) $(\sin\theta)y''$–$(cos\theta)y = 2y$
   (b) $x\frac{d^3y}{dx^3} - \left(\frac{dy}{dx}\right)^4 + y = 0$
   (c) $udv + (v + uv - ue^u)du = 0$
   (d) $\ddot{x} - \left(1 - \frac{\dot{x}^3}{3}\right)\dot{x} + x = 0$
4. Verify that the indicated functions are solutions to the given differential equations and state whether they are implicit or explicit solutions. Assume an appropriate interval I of definition.

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(a) $x^2y'' + xy' + y = 0, \quad y = \cos(\ln(x))$

(b) $2xydx + (x^2 - y)dy = 0, \quad -2x^2y + y^2 = 1$

5. Use the Separation of Variables technique to solve the following first order differential equations.

(a) $(1 - x^2)\dfrac{dy}{dx} + x(y - 3) = 0$

(b) $e^x y\dfrac{dy}{dx} = e^{-y} + e^{-2x-y}$ with initial condition $y(0) = 0$