Math 4315 PDEs   Home Work 1

1. Calculate the first order derivatives u_x and u_y for the following change of coordinates (use Jacobian's on the last two)

$$
\begin{aligned}
(i) \quad & r = 2x - y, \quad s = x + y, \\
(ii) \quad & r = x\,e^y, \quad s = x\,e^{-y}, \\
(iii) \quad & x = r - s, \quad y = r + s, \\
(iv) \quad & x = r\cos\theta, \quad y = r\sin\theta,
\end{aligned}
$$

2. Solve the following first order ordinary differential equations

$$(i) \quad xy' = 3y + x^2 \qquad (ii) \quad xy' + y = x^2 y^2$$

$$(iii) \quad \frac{dy}{dx} = \frac{y^2 - 3x^2 y}{x^3 - 2xy} \qquad (iv) \quad y' = \frac{xy}{x^2 + y^2}$$

3. Solve the following systems of ODEs

$$
(i) \quad \frac{dx}{x} = \frac{dy}{y} = \frac{dz}{z}
$$

$$
(ii) \quad \frac{dx}{y} = \frac{dy}{x} = \frac{dz}{z}
$$

$$
(iii) \quad \frac{dx}{y} = \frac{dy}{x - z} = \frac{dz}{y}
$$

Due. Friday, Sept. 7, 2018