

MATH 115 Problem Set 5

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1. Change the following equations into separable differential equations and find the general solutions:

(a) $xyy' = y^2 - x^2$,

(b) $\frac{dy}{dx} = \frac{x-y}{x+y}$.

2. Show that the following differential equations are exact and find the general solutions:

(a) $(2xy - \cos x)dx + (x^2 - 1)dy = 0$,

(b) $(2x + e^y)dx + xe^y dy = 0$.

3. Solve the following differential equations by first finding an integrating factor:

(a) $2(y^3 - 2)dx + 3xy^2 dy = 0$,

(b) $(y + x^4)dx - xdy = 0$.

4. Find the general solutions of the following first-order linear differential equations:

(a) $y' + y = x$,

(b) $xy' + (1 + x)y = e^{-x}$.

5. Find the specific solutions of the following first-order linear differential equations:

(a) $y' - y = 1 - x$, $y(0) = 1$,

(b) $y' + \frac{1}{x}y = 3x^2$, $y(1) = 5$.

6. The RL circuit is described by the equation

$$L \frac{di}{dt} + Ri = A \cos t, \quad i(0) = 0,$$

where i is current. Find the current i as a function of time t .

7. Find the general solution of the following homogeneous second-order differential equations:

$$y'' - k^2y = 0.$$

8. Find the general solution of the following non-homogeneous second-order differential equations:

$$y'' - k^2y = a.$$