

Math 204

Review Problems for chapter 2

(I) Solve the following differential equations:

1. $(x + \sin y)dx + (x \cos y - 2y)dy = 0$

Answer: $\frac{1}{2}x^2 + x \sin y - y^2 = c$

2. $y' = \frac{2y^4 + x^4}{xy^3}$

Answer: $y^4 = cx^8 - x^4$

3. $x^2 \frac{dy}{dx} = y - xy$

Answer: $y = \frac{e^{c - \frac{1}{x}}}{x}$

4. $\frac{dy}{dx} + \frac{2}{10+2x}y = 4$

Answer: $y = \frac{40x + 4x^2 + c}{10 + 2x}$

5. $\frac{dy}{dx} = \frac{2 + ye^{xy}}{2y - xe^{xy}}$

Answer: $2x + e^{xy} - y^2 = c$

6. $y' + xy = xy^2$

Answer: $y = \frac{1}{ce^{x^2/2} + 1}$

7. $6xydx + (4y + 9x^2)dy = 0$

Answer: $3x^2y^3 + y^4 = c$

8. $-ydx + (x + \sqrt{xy})dy = 0$

Answer: $4x = y(\ln|y| - c)^2$ or $y = ce^{2\sqrt{\frac{x}{y}}}$

9. $x^2y' + x(x + 2)y = e^x$

Answer: $y = \frac{1}{2}x^{-2}e^x + cx^{-2}e^{-x}$

10. $y^{-1}dy + ye^{\cos x} \sin x dx = 0$

Answer: $y = \frac{1}{c - e^{\cos x}}$

11. $\frac{dy}{dx} = (x + y + 1)^2$

Answer: $y = -x - 1 + \tan(x + c)$

12. $(x^2 + 4)dy = (2x - 8xy)dx$

Answer: $y = \frac{1}{4} + c(x^2 + 4)^{-4}$

13. $(y^2 + 1)dx = y \sec^2 x dy$

Answer: $2x + \sin 2x = 2 \ln(y^2 + 1) + c$