

10. $x = y^3 + cy$

11. $x = \sin^{-1} y - 1 + ce^{-\sin^{-1} y}$

12. $xy^{-2} = c - e^{-y}$

13. $xe^{\tan^{-1} y} = \tan^{-1} y + c$

14. $xe^y = c + \tan y$.

Problems 11.6, page 439

1. $y^{-1} \sec x = \tan x + c$

2. $1/r = \sin \theta + c \cos \theta$

3. $x^2 + (4x^5 + c)y^4 = 0$

4. $1/y = x^2 - 2 + ce^{-x^2/2}$

5. $y^2 = x^2 + cx - 1$

6. $y/x = \log y + c$

7. $\sin y = (1 + x)(e^x + c)$

8. $e^{x+y} = \frac{1}{2}e^{2x} + c$

9. $\tan y = x^3 - 3x^2 + 6x - 6 + ce^{-x}$

10. $\cos y = \cos x (\sin x + c)$

11. $\sqrt{x} = \sqrt{y}(\log \sqrt{y} + c)$

12. $y^{-1} = \frac{1}{2} \log x + \frac{1}{4} + cx^2$.

Problems 11.7, page 442

1. $x^3 + y^3 - 3axy = c$

2. $x^4 + 2x^2y^2 - y^4 - 2a^2x^2 - 2b^2y^2 = c$

3. $x^3 - 6x^2y - 6xy^2 + y^3 = c$

4. $\frac{x^5}{5} - x^2y^2 + xy^4 + \cos y = c$

5. $e^{xy} + y^2 = c$

6. $x^5 + x^3y^2 - x^2y^3 - y^5 = c$

7. $x^3 + 3x^2y^2 + y^4 = c$

8. $x^2 - y^2 = cy^3$

9. $3y \cos 2x + 6y + 2y^3 = c$

10. $e^x = \sec x \tan y + c$

11. $x^2y + xy - x \tan y + \tan y = c$.

Problems 11.8, page 445

1. $ax + \tan^{-1} y/x = c$

2. $x^2 + y^2 - 2a^2 \tan^{-1} (y/x) = c$

3. $y + cx + \log x + 1 = 0$

4. $3 \log x - (y/x)^3 = c$

5. $\log (y/x) + \frac{1}{2}x^2y^2 = c$

6. $xy + \log (x/y) - (1/xy) = c$

7. $(y + 2/y^2)x + y^2 = c$

8. $4x^4y + 4x^3y^2 - x^4 = c$

9. $2 \cos (xy) + x^{-2} = c$

10. $\log (x/y) = c + xy$

11. $(x/y) + e^{x^3} = c$

12. $4(xy)^{1/3} - \frac{2}{3}(x/y)^{3/2} = c$

13. $4y \log x = y^2 + c$.

Problems 11.9, page 446

1. $(x - y + c)(x^2 + y^2 + c) = 0$

2. $(2y - x^2 + c)(y + x + ce^{-x} - 1) = 0$

3. $x^2 + y^2 = cx$

4. $(y - cx)(y^2 - x^2 - c) = 0$

5. $(y - c)(y + x^2 - c)(xy + cy + 1) = 0$.

Problems 11.10, page 448

1. $x + c = \frac{a}{2} \left[\log \frac{p-1}{\sqrt{1+p^2}} - \tan^{-1} p \right]$, with the given relation

2. $xy = c^2x + c$

3. $y = 2\sqrt{xc} + c^2$

4. $2cy = c^2x^2 + 1$

5. $x = (\log p - p + c)(p - 1)^2$, with the given relation

6. $x = \sin p + c$, with the given relation.

Problems 11.11, page 449

1. $y = c(x - c)^2$

2. $y^2 = 2cx + c^3$

3. $(y + ap)\sqrt{(p^2 - 1)} + a \cosh^{-1} p = c$, with the given relation

4. $y + (1 + p^2)^{-1} = c$, with the given relation.

Problems 11.12, page 450

1. (i) Gen. sol. : $y = cx + a/c^2$; Singular sol. : $2ax^2 = (2ac + x)^3$
 (ii) Gen. sol. : $c = \log(cx - y)$; Singular sol. : $y = x(\log x - 1)$
 (iii) Gen. sol. $y = cx + \sqrt{(a^2c^2 + b^2)}$; Singular sol. $y + \sqrt{1 - x^2} = 0$
 (iv) Gen. sol. $y = cx - \sin^{-1} c$; Singular sol. $y = \sqrt{x^2 - 1} - \sin^{-1} \frac{\sqrt{x^2 - 1}}{x}$
2. $y = cx + (c - 2c^2)$
3. $(y - cx)(c - 1) = c$
4. $(y - cx)(c + 1) + ac^2 = 0$
5. $y^2 = cx^2 + c^2$ [Hint : Put $x^2 = u, y^2 = v$]
6. $xy = cy - c^2$ [Hint : Put $u = y, v = xy$]
7. $y^2 = cx^2 - \frac{2c}{1 + c}$

Problems 11.13, page 450

1. (i)
2. (ii)
3. (iii)
4. (i)
5. $\log y + c = x^2/2y^2$
6. $yx^2 = x^3 + c$
7. $e^x + x^2y + cy = 0$
8. (iii)
9. $x^2 + y^2 + 2 \tan^{-1} y/x = c$
10. $\log x + c = y^3/3x^3$
11. (i)
12. $y^2 + 1/x + ce^{-y^2/2} = 2$
13. $y = cx + a/c^2$
14. $c = \log(cx - y)$
15. $xy = c$ or $x^2 - y^2 = c$
16. 2
17. $xy = c$
18. (b)
19. (b)
20. $(1 + x^2)^{3/2} + (1 + y^2)^{3/2} = c$
21. $y = 5e^{-x}$
22. $x + y = u$
23. x^{-5}
24. § 11.11 (3)
25. $5x^4y^2 + 2(x^5 + y^5) = c$
26. $\sin(y/x) = cx$
27. (a)
28. (c)
29. $x + y \, dy/dx = 0$
30. $e^{-x^2} + 2 \cos y = c$
31. (c)
32. False
33. False.

Problems 12.1, page 454

1. (i) $9y + 4x^2 = 0$; (ii) $3(x + 3y) = 2(1 - e^{3x})$
2. $y + 1 = 2e^{x^2/2}$
3. $x^2 + y^2 = cx$
4. $y = \sqrt{(a^2 - x^2)} + a \log \left(\frac{\alpha - \sqrt{a^2 - x^2}}{x} \right) + c$
5. $y^2 = 4x$
6. $y = ae^{cx}$
7. $y = ax + b$
8. $x = 3y^2$
9. (i) $r(\theta - \alpha) = c$; (ii) $r = a + b \cos \theta$
10. $r^2 = a^2 \sin 2\theta$
11. $c^2x^2 = 2cy + 1$
12. $r = ae^{\theta \cot \alpha}$

Problems 12.2, page 457

1. $2x^2 + y^2 = c$
2. $x^2 + 2y^2 = c^2$
3. $3y^2 + 2x^2 = c^2$
4. $x^2 + y^2 + 2\mu y - c = 0$
5. This system is self-orthogonal
6. $r = c(1 - \cos \theta)$
7. $r = b(\cos \theta - \sin \theta)$
8. $r = 2b/(1 - \cos \theta)$
9. $r^2 = c^2 \sin 2\theta$
10. $r^n n \sin \theta = b$
13. $x^2 + y^2 + cx + 1 = 0$
14. $y = cx$

Problems 12.3, page 462

1. $V = \sqrt{\left(\frac{mg}{k}\right)} \tanh\left(\frac{9k}{m}t + c\right)$
3. $\frac{1}{k} \log_e 2$
5. $2\sqrt{v_0/k}$
6. $v^2 = 2gx - \frac{\lambda}{m} x^2$
10. $y = (\sqrt{150} - 0.001328t)^2$; $t_1 = 45 \text{ min. } 1 \text{ sec.}$, $t_2 = 1 \text{ hr. } 16 \text{ min. } 51 \text{ sec.}$, $t_3 = 1 \text{ hr. } 38 \text{ min. } 13 \text{ sec}$
11. 17 min. 4 sec.