ANSWERS

EXERCISE 7.1

1. $-\frac{1}{2}\cos 2x$ **2.** $\frac{1}{3}\sin 3x$ **3.** $\frac{1}{2}e^{2x}$

4. $\frac{1}{3a}(ax+b)^3$ **5.** $-\frac{1}{2}\cos 2x-\frac{4}{3}e^{3x}$ **6.** $\frac{4}{3}e^{3x}+x+C$

7. $\frac{x^3}{3}-x+C$ **8.** $\frac{ax^3}{3}+\frac{bx^2}{2}+cx+C$ **9.** $\frac{2}{3}x^3+e^x+C$

10. $\frac{x^2}{2}+\log|x|-2x+C$ **11.** $\frac{x^2}{2}+5x+\frac{4}{x}+C$

12. $\frac{2}{7}x^{\frac{7}{2}}+2x^{\frac{3}{2}}+8\sqrt{x}+C$ **13.** $\frac{x^3}{3}+x+C$

14. $\frac{2}{3}x^{\frac{3}{2}}-\frac{2}{5}x^{\frac{5}{2}}+C$ **15.** $\frac{6}{7}x^{\frac{7}{2}}+\frac{4}{5}x^{\frac{5}{2}}+2x^{\frac{3}{2}}+C$

16. $x^2-3\sin x+e^x+C$ **17.** $\frac{2}{3}x^3+3\cos x+\frac{10}{3}x^{\frac{3}{2}}+C$

18. $\tan x + \sec x + C$ **19.** $\tan x - x + C$

20. $2\tan x - 3\sec x + C$ **21.** C

22. A

EXERCISE 7.2

1. $\log(1+x^2)+C$ **2.** $\frac{1}{3}(\log|x|)^3+C$ **3.** $\log|1+\log x|+C$

4. $\cos(\cos x)+C$ **5.** $-\frac{1}{4a}\cos 2(ax+b)+C$

6. $\frac{2}{3a}(ax+b)^{\frac{3}{2}}+C$ **7.** $\frac{2}{5}(x+2)^{\frac{5}{2}}-\frac{4}{3}(x+2)^{\frac{3}{2}}+C$

8. $\frac{1}{6}(1+2x^2)^{\frac{3}{2}}+C$ **9.** $\frac{4}{3}(x^2+x+1)^{\frac{3}{2}}+C$ **10.** $2\log\left|\sqrt{x}-1\right|+C$

11. $\frac{2}{3}\sqrt{x+4}(x-8)+C$

12. $\frac{1}{7}(x^3-1)^{\frac{7}{3}}+\frac{1}{4}(x^3-1)^{\frac{4}{3}}+C$ **13.** $-\frac{1}{18(2+3x^3)^2}+C$

14. $\frac{(\log x)^{1-m}}{1-m}+C$ **15.** $-\frac{1}{8}\log|9-4x^2|+C$ **16.** $\frac{1}{2}e^{2x+3}+C$

17. $-\frac{1}{2e^{x^2}}+C$ **18.** $e^{\tan^{-1}x}+C$ **19.** $\log(e^x+e^{-x})+C$

20. $\frac{1}{2}\log(e^{2x}+e^{-2x})+C$ **21.** $\frac{1}{2}\tan(2x-3)-x+C$

22. $-\frac{1}{4}\tan(7-4x)+C$ **23.** $\frac{1}{2}(\sin^{-1}x)^2+C$

24. $\frac{1}{2}\log\left|2\sin x+3\cos x\right|+C$ **25.** $\frac{1}{(1-\tan x)}+C$

26. $2\sin\sqrt{x}+C$ **27.** $\frac{1}{3}(\sin 2x)^{\frac{3}{2}}+C$ **28.** $2\sqrt{1+\sin x}+C$

29. $\frac{1}{2}(\log\sin x)^2+C$ **30.** $-\log\left|1+\cos x\right|+C$ **31.** $\frac{1}{1+\cos x}+C$

32. $\frac{x}{2}-\frac{1}{2}\log\left|\cos x+\sin x\right|+C$ **33.** $\frac{x}{2}-\frac{1}{2}\log\left|\cos x-\sin x\right|+C$

34. $2\sqrt{\tan x}+C$ **35.** $\frac{1}{3}(1+\log x)^3+C$ **36.** $\frac{1}{3}(x+\log x)^3+C$

37. $-\frac{1}{4}\cos(\tan^{-1}x^4)+C$ **38.** D

39. B

EXERCISE 7.3

1. $\frac{x}{2}-\frac{1}{8}\sin(4x+10)+C$ **2.** $-\frac{1}{14}\cos 7x+\frac{1}{2}\cos x+C$

3. $\frac{1}{4}\left[\frac{1}{12}\sin 12x+x+\frac{1}{8}\sin 8x+\frac{1}{4}\sin 4x\right]+C$

4. $-\frac{1}{2}\cos(2x+1)+\frac{1}{6}\cos^3(2x+1)+C$ **5.** $\frac{1}{6}\cos^6 x-\frac{1}{4}\cos^4 x+C$

6. $\frac{1}{4}\left[\frac{1}{6}\cos 6x-\frac{1}{4}\cos 4x-\frac{1}{2}\cos 2x\right]+C$

7. $\frac{1}{2}\left[\frac{1}{4}\sin 4x-\frac{1}{12}\sin 12x\right]+C$ **8.** $2\tan\frac{x}{2}-x+C$

9. $x-\tan\frac{x}{2}+C$ **10.** $\frac{3x}{8}-\frac{1}{4}\sin 2x+\frac{1}{32}\sin 4x+C$

11. $\frac{3x}{8}+\frac{1}{8}\sin 4x+\frac{1}{64}\sin 8x+C$ **12.** $x-\sin x+C$

13. $2(\sin x+x\cos\alpha)+C$ **14.** $-\frac{1}{\cos x+\sin x}+C$

15. $\frac{1}{6}\sec^3 2x-\frac{1}{2}\sec 2x+C$ **16.** $\frac{1}{3}\tan^3 x-\tan x+x+C$

17. $\sec x-\operatorname{cosec} x+C$ **18.** $\tan x+C$

19. $\log|\tan x|+\frac{1}{2}\tan^2 x+C$ **20.** $\log|\cos x+\sin x|+C$

21. $\frac{\pi x}{2}-\frac{x^2}{2}+C$ **22.** $\frac{1}{\sin(a-b)}\log\left|\frac{\cos(x-a)}{\cos(x-b)}\right|+C$

23. A **24.** B

EXERCISE 7.4

1. $\tan^{-1}x^3+C$ **2.** $\frac{1}{2}\log\left|2x+\sqrt{1+4x^2}\right|+C$

3. $\log\left|\frac{1}{2-x+\sqrt{x^2-4x+5}}\right|+C$

4. $\frac{1}{5}\sin^{-1}\frac{5x}{3}+C$

5. $\frac{3}{2\sqrt{2}}\tan^{-1}\sqrt{2}\,x^2+C$

6. $\frac{1}{6}\log\left|\frac{1+x^3}{1-x^3}\right|+C$

7. $\sqrt{x^2-1}-\log\left|x+\sqrt{x^2-1}\right|+C$

8. $\frac{1}{3}\log\left|x^3+\sqrt{x^6+a^6}\right|+C$

9. $\log\left|\tan x+\sqrt{\tan^2 x+4}\right|+C$

10. $\log\left|x+1+\sqrt{x^2+2x+2}\right|+C$

11. $\frac{1}{6}\tan^{-1}\left(\frac{3x+1}{2}\right)+C$

12. $\sin^{-1}\left(\frac{x+3}{4}\right)+C$

13. $\log\left|x-\frac{3}{2}+\sqrt{x^2-3x+2}\right|+C$

14. $\sin^{-1}\left(\frac{2x-3}{\sqrt{41}}\right)+C$

15. $\log\left|x-\frac{a+b}{2}+\sqrt{(x-a)(x-b)}\right|+C$

16. $2\sqrt{2x^2+x-3}+C$

17. $\sqrt{x^2-1}+2\log\left|x+\sqrt{x^2-1}\right|+C$

18. $\frac{5}{6}\log\left|3x^2+2x+1\right|-\frac{11}{3\sqrt{2}}\tan^{-1}\left(\frac{3x+1}{\sqrt{2}}\right)+C$

19. $6\sqrt{x^2-9x+20}+34\log\left|x-\frac{9}{2}+\sqrt{x^2-9x+20}\right|+C$

20. $-\sqrt{4x-x^2}+4\sin^{-1}\left(\frac{x-2}{2}\right)+C$

21. $\sqrt{x^2+2x+3}+\log\left|x+1+\sqrt{x^2+2x+3}\right|+C$

22. $\frac{1}{2}\log\left|x^2-2x-5\right|+\frac{2}{\sqrt{6}}\log\left|\frac{x-1-\sqrt{6}}{x-1+\sqrt{6}}\right|+C$

23. $5\sqrt{x^2+4x+10}-7\log\left|x+2+\sqrt{x^2+4x+10}\right|+C$

24. B **25.** B

EXERCISE 7.5

1. $\log\frac{(x+2)^2}{|x+1|}+C$ **2.** $\frac{1}{6}\log\left|\frac{x-3}{x+3}\right|+C$

3. $\log|x-1|-5\log|x-2|+4\log|x-3|+C$

4. $\frac{1}{2}\log|x-1|-2\log|x-2|+\frac{3}{2}\log|x-3|+C$

5. $4\log|x+2|-2\log|x+1|+C$ **6.** $\frac{x}{2}+\log|x|-\frac{3}{4}\log|1-2x|+C$

7. $\frac{1}{2}\log|x-1|-\frac{1}{4}\log(x^2+1)+\frac{1}{2}\tan^{-1}x+C$

8. $\frac{2}{9}\log\left|\frac{x-1}{x+2}\right|-\frac{1}{3(x-1)}+C$ **9.** $\frac{1}{2}\log\left|\frac{x+1}{x-1}\right|-\frac{4}{x-1}+C$

10. $\frac{5}{2}\log|x+1|-\frac{1}{10}\log|x-1|-\frac{12}{5}\log|2x+3|+C$

11. $\frac{5}{3}\log|x+1|-\frac{5}{2}\log|x+2|+\frac{5}{6}\log|x-2|+C$

12. $\frac{x^2}{2}+\frac{1}{2}\log|x+1|+\frac{3}{2}\log|x-1|+C$

13. $-\log|x-1|+\frac{1}{2}\log(1+x^2)+\tan^{-1}x+C$

14. $3\log|x+2|+\frac{7}{x+2}+C$ **15.** $\frac{1}{4}\log\left|\frac{x-1}{x+1}\right|-\frac{1}{2}\tan^{-1}x+C$

16. $\frac{1}{n}\log\left|\frac{x^n}{x^n+1}\right|+C$ **17.** $\log\left|\frac{2-\sin x}{1-\sin x}\right|+C$

18. $x+\frac{2}{\sqrt{3}}\tan^{-1}\frac{x}{\sqrt{3}}-3\tan^{-1}\frac{x}{2}+C$ **19.** $\frac{1}{2}\log\left(\frac{x^2+1}{x^2+3}\right)+C$

20. $\frac{1}{4}\log\left|\frac{x^4-1}{x^4}\right|+C$

21. $\log\left(\frac{e^x-1}{e^x}\right)+C$

22. B

23. A

EXERCISE 7.6

1. $-x\cos x+\sin x+C$

2. $-\frac{x}{3}\cos 3x+\frac{1}{9}\sin 3x+C$

3. $e^x(x^2-2x+2)+C$

4. $\frac{x^2}{2}\log x-\frac{x^2}{4}+C$

5. $\frac{x^2}{2}\log 2x-\frac{x^2}{4}+C$

6. $\frac{x^3}{3}\log x-\frac{x^3}{9}+C$

7. $\frac{1}{4}(2x^2-1)\sin^{-1}x+\frac{x\sqrt{1-x^2}}{4}+C$

8. $\frac{x^2}{2}\tan^{-1}x-\frac{x}{2}+\frac{1}{2}\tan^{-1}x+C$

9. $(2x^2-1)\frac{\cos^{-1}x}{4}-\frac{x}{4}\sqrt{1-x^2}+C$

10. $\left(\sin^{-1}x\right)^2 x+2\sqrt{1-x^2}\sin^{-1}x-2x+C$

11. $-\sqrt{1-x^2}\cos^{-1}x+x+C$

12. $x\tan x+\log|\cos x|+C$

13. $x\tan^{-1}x-\frac{1}{2}\log(1+x^2)+C$

14. $\frac{x^2}{2}(\log x)^2-\frac{x^2}{2}\log x+\frac{x^2}{4}+C$

15. $\left(\frac{x^3}{3}+x\right)\log x-\frac{x^3}{9}-x+C$

16. $e^x\sin x+C$

17. $\frac{e^x}{1+x}+C$

18. $e^x\tan\frac{x}{2}+C$

19. $\frac{e^x}{x}+C$

20. $\frac{e^x}{(x-1)^2}+C$

21. $\frac{e^{2x}}{5}(2\sin x-\cos x)+C$

22. $2x\tan^{-1}x-\log(1+x^2)+C$

23. A

24. B

EXERCISE 7.7

1. $\frac{1}{2}x\sqrt{4-x^2}+2\sin^{-1}\frac{x}{2}+C$ **2.** $\frac{1}{4}\sin^{-1}2x+\frac{1}{2}x\sqrt{1-4x^2}+C$

3. $\frac{(x+2)}{2}\sqrt{x^2+4x+6}+\log\left|x+2+\sqrt{x^2+4x+6}\right|+C$

4. $\frac{(x+2)}{2}\sqrt{x^2+4x+1}-\frac{3}{2}\log\left|x+2+\sqrt{x^2+4x+1}\right|+C$

5. $\frac{5}{2}\sin^{-1}\left(\frac{x+2}{\sqrt{5}}\right)+\frac{x+2}{2}\sqrt{1-4x-x^2}+C$

6. $\frac{(x+2)}{2}\sqrt{x^2+4x-5}-\frac{9}{2}\log\left|x+2+\sqrt{x^2+4x-5}\right|+C$

7. $\frac{(2x-3)}{4}\sqrt{1+3x-x^2}+\frac{13}{8}\sin^{-1}\left(\frac{2x-3}{\sqrt{13}}\right)+C$

8. $\frac{2x+3}{4}\sqrt{x^2+3x}-\frac{9}{8}\log\left|x+\frac{3}{2}+\sqrt{x^2+3x}\right|+C$

9. $\frac{x}{6}\sqrt{x^2+9}+\frac{3}{2}\log\left|x+\sqrt{x^2+9}\right|+C$

10. A **11.** D

EXERCISE 7.8

1. 2 **2.** $\log\frac{3}{2}$ **3.** $\frac{64}{3}$

4. $\frac{1}{2}$ **5.** 0 **6.** $e^4\,(e-1)$

7. $\frac{1}{2}\log 2$ **8.** $\log\left(\frac{\sqrt{2}-1}{2-\sqrt{3}}\right)$ **9.** $\frac{\pi}{2}$

10. $\frac{\pi}{4}$ **11.** $\frac{1}{2}\log\frac{3}{2}$ **12.** $\frac{\pi}{4}$

13. $\frac{1}{2}\log 2$ **14.** $\frac{1}{5}\log 6+\frac{3}{\sqrt{5}}\tan^{-1}\sqrt{5}$

15. $\frac{1}{2}(e-1)$ **16.** $5-\frac{5}{2}\left(9\log\frac{5}{4}-\log\frac{3}{2}\right)$

17. $\frac{\pi^4}{1024}+\frac{\pi}{2}+2$ **18.** 0 **19.** $3\log 2+\frac{3\pi}{8}$

20. $1+\frac{4}{\pi}-\frac{2\sqrt{2}}{\pi}$ **21.** D **22.** C

EXERCISE 7.9

1. $\frac{1}{2}\log 2$ **2.** $\frac{64}{231}$ **3.** $\frac{\pi}{2}-\log 2$

4. $\frac{16\sqrt{2}}{15}(\sqrt{2}+1)$ **5.** $\frac{\pi}{4}$ **6.** $\frac{1}{\sqrt{17}}\log\frac{21+5\sqrt{17}}{4}$

7. $\frac{\pi}{8}$ **8.** $\frac{e^2(e^2-2)}{4}$ **9.** D

10. B

EXERCISE 7.10

1. $\frac{\pi}{4}$ **2.** $\frac{\pi}{4}$ **3.** $\frac{\pi}{4}$ **4.** $\frac{\pi}{4}$

5. 29 **6.** 9 **7.** $\frac{1}{(n+1)(n+2)}$

8. $\frac{\pi}{8}\log 2$ **9.** $\frac{16\sqrt{2}}{15}$ **10.** $\frac{\pi}{2}\log\frac{1}{2}$ **11.** $\frac{\pi}{2}$

12. π **13.** 0 **14.** 0 **15.** 0

16. $-\pi\log 2$ **17.** $\frac{a}{2}$ **18.** 5 **20.** C

21. C

Miscellaneous Exercise on Chapter 7

1. $\frac{1}{2}\log\left|\frac{x^2}{1-x^2}\right|+C$

2. $\frac{2}{3(a-b)}\left[(x+a)^{\frac{3}{2}}-(x+b)^{\frac{3}{2}}\right]+C$

3. $-\frac{2}{a}\sqrt{\frac{(a-x)}{x}}+C$

4. $-\left(1+\frac{1}{x^4}\right)^{\frac{1}{4}}+C$

5. $2\sqrt{x}-3x^{\frac{1}{3}}+6x^{\frac{1}{6}}-6\log(1+x^{\frac{1}{6}})+C$

6. $-\frac{1}{2}\log|x+1|+\frac{1}{4}\log(x^2+9)+\frac{3}{2}\tan^{-1}\frac{x}{3}+C$

7. $\sin a\log|\sin(x-a)|+x\cos a+C$

8. $\frac{x^3}{3}+C$

9. $\sin^{-1}\left(\frac{\sin x}{2}\right)+C$

10. $-\frac{1}{2}\sin 2x+C$

11. $\frac{1}{\sin(a-b)}\log\left|\frac{\cos(x+b)}{\cos(x+a)}\right|+C$

12. $\frac{1}{4}\sin^{-1}(x^4)+C$

13. $\log\left(\frac{1+e^x}{2+e^x}\right)+C$

14. $\frac{1}{3}\tan^{-1}x-\frac{1}{6}\tan^{-1}\frac{x}{2}+C$

15. $-\frac{1}{4}\cos^4 x+C$

16. $\frac{1}{4}\log(x^4+1)+C$

17. $\frac{[f(ax+b)]^{n+1}}{a(n+1)}+C$

18. $\frac{-2}{\sin\alpha}\sqrt{\frac{\sin(x+\alpha)}{\sin x}}+C$

19. $-2\sqrt{1-x}+\cos^{-1}\sqrt{x}+\sqrt{x-x^2}+C$

20. $e^x\tan x+C$

21. $-2\log|x+1|-\frac{1}{x+1}+3\log|x+2|+C$

22. $\frac{1}{2}\left[x\cos^{-1}x-\sqrt{1-x^2}\right]+C$

23. $-\frac{1}{3}\left(1+\frac{1}{x^2}\right)^{\frac{3}{2}}\left[\log\left(1+\frac{1}{x^2}\right)-\frac{2}{3}\right]+C$

24. $e^{\frac{\pi}{2}}$ **25.** $\frac{\pi}{8}$

26. $\frac{\pi}{6}$ **27.** $2\sin^{-1}\frac{(\sqrt{3}-1)}{2}$

28. $\frac{4\sqrt{2}}{3}$ **29.** $\frac{1}{40}\log 9$

30. $\frac{\pi}{2}-1$ **31.** $\frac{19}{2}$

38. A **39.** B

40. D

EXERCISE 8.1

1. 12π **2.** 6π **3.** A **4.** B

Miscellaneous Exercise on Chapter 8

1. (i) $\frac{7}{3}$ (ii) 624.8

2. 9 **3.** 4 **4.** D **5.** C

EXERCISE 9.1

1. Order 4; Degree not defined **2.** Order 1; Degree 1

3. Order 2; Degree 1 **4.** Order 2; Degree not defined

5. Order 2; Degree 1 **6.** Order 3; Degree 2

7. Order 3; Degree 1 **8.** Order 1; Degree 1

9. Order 2; Degree 1 **10.** Order 2; Degree 1

11. D **12.** A

EXERCISE 9.2

11. D **12.** D

EXERCISE 9.3

1. $y = 2\tan\frac{x}{2} - x + C$

2. $y = 2 \sin (x + C)$

3. $y = 1 + Ae^{-x}$

4. $\tan x \tan y = C$

5. $y = \log (e^x + e^{-x}) + C$

6. $\tan^{-1} y = x + \frac{x^3}{3} + C$

7. $y = e^{cx}$

8. $x^{-4} + y^{-4} = C$

9. $y = x \sin^{-1} x + \sqrt{1 - x^2} + C$

10. $\tan y = C (1 - e^x)$

11. $y = \frac{1}{4}\log\left[(x+1)^2 (x^2+1)^3\right] - \frac{1}{2}\tan^{-1} x + 1$

12. $y = \frac{1}{2}\log\left(\frac{x^2-1}{x^2}\right) - \frac{1}{2}\log\frac{3}{4}$

13. $\cos\left(\frac{y-2}{x}\right) = a$

14. $y = \sec x$

15. $2y - 1 = e^x (\sin x - \cos x)$

16. $y - x + 2 = \log (x^2 (y + 2)^2)$

17. $y^2 - x^2 = 4$

18. $(x + 4)^2 = y + 3$

19. $(63t + 27)^{\frac{1}{3}}$

20. 6.93%

21. Rs 1648

22. $\frac{2\log 2}{\log\left(\frac{11}{10}\right)}$

23. A

EXERCISE 9.4

1. $(x - y)^2 = Cx\, e^{\frac{-y}{x}}$

2. $y = x \log|x| + Cx$

3. $\tan^{-1}\left(\frac{y}{x}\right) = \frac{1}{2}\log(x^2 + y^2) + C$

4. $x^2 + y^2 = Cx$

5. $\frac{1}{2\sqrt{2}}\log\left|\frac{x+\sqrt{2}y}{x-\sqrt{2}y}\right| = \log|x| + C$

6. $y + \sqrt{x^2 + y^2} = Cx^2$

7. $xy \cos\left|\frac{y}{x}\right| = C$

8. $x\left[1 - \cos\left(\frac{y}{x}\right)\right] = C\sin\left(\frac{y}{x}\right)$

9. $cy = \log\left|\frac{y}{x}\right| - 1$ **10.** $ye^{\frac{x}{y}} + x = C$

11. $\log(x^2 + y^2) + 2\tan^{-1}\frac{y}{x} = \frac{\pi}{2} + \log 2$

12. $y + 2x = 3x^2 y$ **13.** $\cot\left(\frac{y}{x}\right) = \log|ex|$

14. $\cos\left(\frac{y}{x}\right) = \log|ex|$ **15.** $y = \frac{2x}{1 - \log|x|}\ (x \neq 0,\ x \neq e)$

16. C **17.** D

EXERCISE 9.5

1. $y = \frac{1}{5}(2\sin x - \cos x) + C\, e^{-2x}$ **2.** $y = e^{-2x} + Ce^{-3x}$

3. $xy = \frac{x^4}{4} + C$ **4.** $y(\sec x + \tan x) = \sec x + \tan x - x + C$

5. $y = (\tan x - 1) + Ce^{-\tan x}$ **6.** $y = \frac{x^2}{16}(4\log|x| - 1) + Cx^{-2}$

7. $y\log x = \frac{-2}{x}(1 + \log|x|) + C$ **8.** $y = (1+x)^{-1}\ \log|\sin x| + C(1+x^2)^{-1}$

9. $y = \frac{1}{x} - \cot x + \frac{C}{x\sin x}$ **10.** $(x + y + 1) = C\, e^y$

11. $x = \frac{y^2}{3} + \frac{C}{y}$ **12.** $x = 3y^2 + Cy$

13. $y = \cos x - 2\cos^2 x$ **14.** $y(1 + x^2) = \tan^{-1} x - \frac{\pi}{4}$

15. $y = 4\sin^3 x - 2\sin^2 x$ **16.** $x + y + 1 = e^x$

17. $y = 4 - x - 2e^x$ **18.** C **19.** D

Miscellaneous Exercise on Chapter 9

1. (i) Order 2; Degree 1 (ii) Order 1; Degree 3

(iii) Order 4; Degree not defined

4. $\sin^{-1}y + \sin^{-1}x = C$

6. $\cos y = \dfrac{\sec x}{\sqrt{2}}$

7. $\tan^{-1} y + \tan^{-1}(e^x) = \dfrac{\pi}{2}$

8. $e^{\frac{x}{y}} = y + C$

9. $\log |x - y| = x + y + 1$

10. $y e^{2\sqrt{x}} = (2\sqrt{x} + C)$

11. $y \sin x = 2x^2 - \dfrac{\pi^2}{2}$ $(\sin x \neq 0)$

12. $y = \log \left| \dfrac{2x+1}{x+1} \right|, x \neq -1$

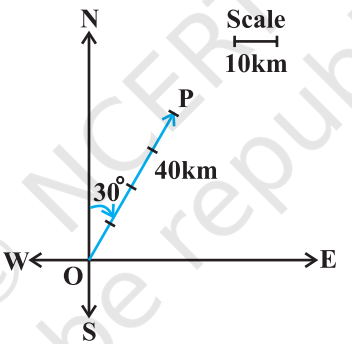
13. C

14. C

15. C

EXERCISE 10.1

1. In the adjoining figure, the vector $\overrightarrow{OP}$ represents the required displacement.



2. (i) scalar (ii) vector (iii) scalar (iv) scalar (v) scalar (vi) vector

3. (i) scalar (ii) scalar (iii) vector (iv) vector (v) scalar

4. (i) Vectors $\vec{a}$ and $\vec{b}$ are coinitial

(ii) Vectors $\vec{b}$ and $\vec{d}$ are equal

(iii) Vectors $\vec{a}$ and $\vec{c}$ are collinear but not equal

5. (i) True (ii) False (iii) False (iv) False

EXERCISE 10.2

1. $|\vec{a}| = \sqrt{3}, |\vec{b}| = \sqrt{62}, |\vec{c}| = 1$

2. An infinite number of possible answers.

3. An infinite number of possible answers.

4. $x = 2, y = 3$

5. -7 and 6; $-7\hat{i}$ and $6\hat{j}$

6. $-4\hat{j}-\hat{k}$

7. $\frac{1}{\sqrt{6}}\hat{i}+\frac{1}{\sqrt{6}}\hat{j}+\frac{2}{\sqrt{6}}\hat{k}$

8. $\frac{1}{\sqrt{3}}\hat{i}+\frac{1}{\sqrt{3}}\hat{j}+\frac{1}{\sqrt{3}}\hat{k}$

9. $\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{k}$

10. $\frac{40}{\sqrt{30}}\hat{i}-\frac{8}{\sqrt{30}}\hat{j}+\frac{16}{\sqrt{30}}\hat{k}$

12. $\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}}$

13. $-\frac{1}{3}, -\frac{2}{3}, \frac{2}{3}$

15. (i) $-\frac{1}{3}\hat{i}+\frac{4}{3}\hat{j}+\frac{1}{3}\hat{k}$ (ii) $-3\hat{i}+3\hat{k}$

16. $3\hat{i}+2\hat{j}+\hat{k}$

18. (C)

19. (B), (C), (D)

EXERCISE 10.3

1. $\frac{\pi}{4}$

2. $\cos^{-1}\left(\frac{5}{7}\right)$

3. 0

4. $\frac{60}{\sqrt{114}}$

6. $\frac{16\sqrt{2}}{3\sqrt{7}}, \frac{2\sqrt{2}}{3\sqrt{7}}$

7. $6|\vec{a}|^2+11\vec{a}.\vec{b}-35|\vec{b}|^2$

8. $|\vec{a}|=1, |\vec{b}|=1$

9. $\sqrt{13}$

10. 8

12. Vector $\vec{b}$ can be any vector

13. $\frac{-3}{2}$

14. Take any two non-zero perpendicular vectors $\vec{a}$ and $\vec{b}$

15. $\cos^{-1}\left(\frac{10}{\sqrt{102}}\right)$

18. (D)

EXERCISE 10.4

1. $19\sqrt{2}$

2. $\pm\frac{2}{3}\hat{i}$ $\frac{2}{3}\hat{j}$ $\frac{1}{3}\hat{k}$

3. $\frac{\pi}{3}; \frac{1}{2}, \frac{1}{\sqrt{2}}, \frac{1}{2}$

5. $3, \frac{27}{2}$

6. Either $|\vec{a}|=0$ or $|\vec{b}|=0$

8. No; take any two nonzero collinear vectors

9. $\frac{\sqrt{61}}{2}$ **10.** $15\sqrt{2}$ **11.** (B) **12.** (C)

Miscellaneous Exercise on Chapter 10

1. $\frac{\sqrt{3}}{2}\hat{i}+\frac{1}{2}\hat{j}$

2. $x_2-x_1, y_2-y_1, z_2-z_1; \sqrt{(x_2-x_1)^2+(y_2-y_1)^2+(z_2-z_1)^2}$

3. $\frac{-5}{2}\hat{i}+\frac{3\sqrt{3}}{2}\hat{j}$

4. No; take $\vec{a}$, $\vec{b}$ and $\vec{c}$ to represent the sides of a triangle.

5. $\pm\frac{1}{\sqrt{3}}$ **6.** $\frac{3}{2}\sqrt{10}\,\hat{i}+\frac{\sqrt{10}}{2}\hat{j}$ **7.** $\frac{3}{\sqrt{22}}\hat{i}-\frac{3}{\sqrt{22}}\hat{j}+\frac{2}{\sqrt{22}}\hat{k}$

8. 2 : 3 **9.** $3\vec{a}+5\vec{b}$ **10.** $\frac{1}{7}(3\hat{i}-6\hat{j}+2\hat{k})$; $11\sqrt{5}$

12. $\frac{1}{3}(160\hat{i}-5\hat{j}+70\hat{k})$ **13.** $\lambda = 1$ **16.** (B)

17. (D) **18.** (C) **19.** (B)

EXERCISE 11.1

1. $0, \frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ **2.** $\pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}, \pm\frac{1}{\sqrt{3}}$ **3.** $\frac{-9}{11}, \frac{6}{11}, \frac{-2}{11}$

5. $\frac{-2}{\sqrt{17}}, \frac{-2}{\sqrt{17}}, \frac{3}{17}$; $\frac{-2}{\sqrt{17}}, \frac{-3}{\sqrt{17}}, \frac{-2}{\sqrt{17}}$; $\frac{4}{\sqrt{42}}, \frac{5}{\sqrt{42}}, \frac{-1}{\sqrt{42}}$

EXERCISE 11.2

4. $\vec{r} = \hat{i} + 2\hat{j} + 3\hat{k} + \lambda(3\hat{i} + 2\hat{j} - 2\hat{k})$, where λ is a real number

5. $\vec{r} = 2\hat{i} - \hat{j} + 4\hat{k} + \lambda(\hat{i} + 2\hat{j} - \hat{k})$ and cartesian form is

$$\frac{x-2}{1} = \frac{y+1}{2} = \frac{z-4}{-1}$$

6. $\frac{x+2}{3} = \frac{y-4}{5} = \frac{z+5}{6}$

7. $\vec{r} = (5\hat{i} - 4\hat{j} + 6\hat{k}) + \lambda(3\hat{i} + 7\hat{j} + 2\hat{k})$

8. (i) $\theta = \cos^{-1}\left(\frac{19}{21}\right)$ (ii) $\theta = \cos^{-1}\left(\frac{8}{5\sqrt{3}}\right)$

9. (i) $\theta = \cos^{-1}\left(\frac{26}{9\sqrt{38}}\right)$ (ii) $\theta = \cos^{-1}\left(\frac{2}{3}\right)$

10. $p = \frac{70}{11}$ **12.** $\frac{3\sqrt{2}}{2}$ **13.** $2\sqrt{29}$

14. $\frac{3}{\sqrt{19}}$ **15.** $\frac{8}{\sqrt{29}}$

Miscellaneous Exercise on Chapter 11

1. 90° **2.** $\frac{x}{1} = \frac{y}{0} = \frac{z}{0}$ **3.** $k = \frac{-10}{7}$

4. 9 **5.** $\vec{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$

EXERCISE 12.1

1. Maximum Z = 16 at (0, 4)

2. Minimum Z = – 12 at (4, 0)

3. Maximum $Z = \frac{235}{19}$ at $\left(\frac{20}{19}, \frac{45}{19}\right)$

4. Minimum Z = 7 at $\left(\frac{3}{2}, \frac{1}{2}\right)$

5. Maximum Z = 18 at (4, 3)

6. Minimum Z = 6 at all the points on the line segment joining the points (6, 0) and (0, 3).

7. Minimum Z = 300 at (60, 0);

Maximum Z = 600 at all the points on the line segment joining the points (120, 0) and (60, 30).

8. Minimum Z = 100 at all the points on the line segment joining the points (0, 50) and (20, 40);

Maximum Z = 400 at (0, 200)

9. Z has no maximum value

10. No feasible region, hence no maximum value of Z.

EXERCISE 13.1

1. $P(E|F)=\frac{2}{3}, P(F|E)=\frac{1}{3}$ **2.** $P(A|B)=\frac{16}{25}$

3. (i) 0.32 (ii) 0.64 (iii) 0.98

4. $\frac{11}{26}$

5. (i) $\frac{4}{11}$ (ii) $\frac{4}{5}$ (iii) $\frac{2}{3}$

6. (i) $\frac{1}{2}$ (ii) $\frac{3}{7}$ (iii) $\frac{6}{7}$

7. (i) 1 (ii) 0

8. $\frac{1}{6}$ **9.** 1 **10.** (a) $\frac{1}{3}$, (b) $\frac{1}{9}$

11. (i) $\frac{1}{2}, \frac{1}{3}$ (ii) $\frac{1}{2}, \frac{2}{3}$ (iii) $\frac{3}{4}, \frac{1}{4}$

12. (i) $\frac{1}{2}$ (ii) $\frac{1}{3}$ **13.** $\frac{5}{9}$

14. $\frac{1}{15}$ **15.** 0 **16.** C **17.** D

EXERCISE 13.2

1. $\frac{3}{25}$ **2.** $\frac{25}{102}$ **3.** $\frac{44}{91}$

4. A and B are independent **5.** A and B are not independent

6. E and F are not independent

7. (i) $p = \frac{1}{10}$ (ii) $p = \frac{1}{5}$

8. (i) 0.12 (ii) 0.58 (iii) 0.3 (iv) 0.4

9. $\frac{3}{8}$ **10.** A and B are not independent

11. (i) 0.18 (ii) 0.12 (iii) 0.72 (iv) 0.28

12. $\frac{7}{8}$ **13.** (i) $\frac{16}{81}$, (ii) $\frac{20}{81}$, (iii) $\frac{40}{81}$

14. (i) $\frac{2}{3}$, (ii) $\frac{1}{2}$ **15.** (i), (ii) **16.** (a) $\frac{1}{5}$, (b) $\frac{1}{3}$, (c) $\frac{1}{2}$

17. D **18.** B

EXERCISE 13.3

1. $\frac{1}{2}$ **2.** $\frac{2}{3}$ **3.** $\frac{9}{13}$ **4.** $\frac{12}{13}$

5. $\frac{22}{133}$ **6.** $\frac{4}{9}$ **7.** $\frac{1}{52}$ **8.** $\frac{1}{4}$

9. $\frac{2}{9}$ **10.** $\frac{8}{11}$ **11.** $\frac{5}{34}$ **12.** $\frac{11}{50}$

13. A **14.** C

Miscellaneous Exercise on Chapter 13

1. (i) 1 (ii) 0

2. (i) $\frac{1}{3}$ (ii) $\frac{1}{2}$

3. $\frac{20}{21}$

4. $1-\sum_{r=7}^{10} {}^{10}C_r (0.9)^r (0.1)^{10-r}$ **5.** $\frac{2}{7}$

6. $\frac{1}{15}, \frac{2}{5}, \frac{8}{15}$ **7.** $\frac{14}{29}$ **8.** $\frac{3}{16}$

9. (i) 0.5 (ii) 0.05 **10.** $\frac{16}{31}$

11. A **12.** C **13.** B

Notes