ANSWERS

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

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

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

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

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

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

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

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

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

22. A

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

39. B

EXERCISE 7.3

1. $\dfrac{x}{2} - \dfrac{1}{8} \sin(4x+10) + C$

2. $-\dfrac{1}{14} \cos 7x + \dfrac{1}{2} \cos x + C$

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

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

5. $\dfrac{1}{6}\cos^6 x - \dfrac{1}{4}\cos^4 x + C$

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

7. $\dfrac{1}{2}\left[\dfrac{1}{4}\sin 4x - \dfrac{1}{12}\sin 12x\right] + C$

8. $2\tan\dfrac{x}{2} - x + C$

9. $x - \tan\dfrac{x}{2} + C$

10. $\dfrac{3x}{8} - \dfrac{1}{4}\sin 2x + \dfrac{1}{32}\sin 4x + C$

11. $\dfrac{3x}{8} + \dfrac{1}{8}\sin 4x + \dfrac{1}{64}\sin 8x + C$

12. $x - \sin x + C$

13. $2(\sin x + x\cos\alpha) + C$

14. $-\dfrac{1}{\cos x + \sin x} + C$

15. $\dfrac{1}{6}\sec^3 2x - \dfrac{1}{2}\sec 2x + C$

16. $\dfrac{1}{3}\tan^3 x - \tan x + x + C$

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

18. $\tan x + C$

19. $\log|\tan x| + \dfrac{1}{2}\tan^2 x + C$

20. $\log|\cos x + \sin x| + C$

21. $\dfrac{\pi x}{2} - \dfrac{x^2}{2} + C$

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

23. A

24. B

EXERCISE 7.4

1. $\tan^{-1} x^3 + C$

2. $\dfrac{1}{2}\log\left|2x + \sqrt{1+4x^2}\right| + C$

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

5. $\dfrac{3}{2\sqrt{2}}\tan^{-1}\sqrt{2}\,x^2+C$ **6.** $\dfrac{1}{6}\log\left|\dfrac{1+x^3}{1-x^3}\right|+C$

7. $\sqrt{x^2-1}-\log\left|x+\sqrt{x^2-1}\right|+C$ **8.** $\dfrac{1}{3}\log\left|x^3+\sqrt{x^6+a^6}\right|+C$

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. $\dfrac{1}{6}\tan^{-1}\left(\dfrac{3x+1}{2}\right)+C$ **12.** $\sin^{-1}\left(\dfrac{x+3}{4}\right)+C$

13. $\log\left|x-\dfrac{3}{2}+\sqrt{x^2-3x+2}\right|+C$ **14.** $\sin^{-1}\left(\dfrac{2x-3}{\sqrt{41}}\right)+C$

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

16. $2\sqrt{2x^2+x-3}+C$ **17.** $\sqrt{x^2-1}+2\log\left|x+\sqrt{x^2-1}\right|+C$

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

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

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

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

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

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

24. B   **25.** B

<div align="center">

EXERCISE 7.5

</div>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

22. B

23. A

EXERCISE 7.6

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

23. A

24. B

EXERCISE 7.7

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

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

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

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

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

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

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

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

10. A   **11.** D

EXERCISE 7.8

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

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

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

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

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

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

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

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

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EXERCISE 7.9

</div>

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

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

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

10. B

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EXERCISE 7.10

</div>

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

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

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

12. π **13.** 0 **14.** 0 **15.** 0

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

21. C

MISCELLANEOUS EXERCISE ON CHAPTER 7

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

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

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

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

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

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

7. $\sin a\log|\sin(x-a)|+x\cos a+C$ 8. $\dfrac{x^3}{3}+C$

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

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

11. $\dfrac{1}{\sin(a-b)}\log\left|\dfrac{\cos(x+b)}{\cos(x+a)}\right|+C$ 12. $\dfrac{1}{4}\sin^{-1}(x^4)+C$

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

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

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

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

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

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

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

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

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

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

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

24. $e^{\frac{\pi}{2}}$

25. $\dfrac{\pi}{8}$

26. $\dfrac{\pi}{6}$

27. $2\sin^{-1}\dfrac{(\sqrt{3}-1)}{2}$

28. $\dfrac{4\sqrt{2}}{3}$

29. $\dfrac{1}{40}\log 9$

30. $\dfrac{\pi}{2}-1$

31. $\dfrac{19}{2}$

38. A

39. B

40. D

EXERCISE 8.1

1. 12π **2.** 6π **3.** A   **4.** B

Miscellaneous Exercise on Chapter 8

1. (i) $\dfrac{7}{3}$ (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. $y = 2\tan\dfrac{x}{2} - x + C$

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

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

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

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

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

23. A

EXERCISE 9.4

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

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

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

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

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

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

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

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

9. $cy = \log \left| \dfrac{y}{x} \right| - 1$

10. $ye^{\frac{x}{y}} + x = C$

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

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

13. $\cot \left(\dfrac{y}{x} \right) = \log |ex|$

14. $\cos \left(\dfrac{y}{x} \right) = \log |ex|$

15. $y = \dfrac{2x}{1 - \log |x|} (x \neq 0, \ x \neq e)$

16. C

17. D

EXERCISE 9.5

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

3. $xy = \dfrac{x^4}{4} + C$

4. $y(\sec x + \tan x) = \sec x + \tan x - x + C$

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

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

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

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

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

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

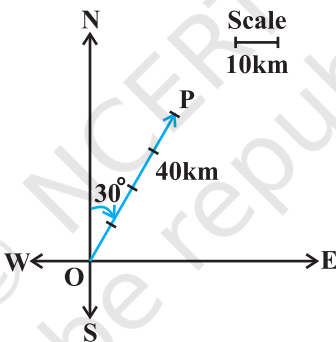**17.** $y = 4 - x - 2\, e^x$ **18.** C   **19.** D

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.** $\dfrac{1}{\sqrt{6}}\hat{i} + \dfrac{1}{\sqrt{6}}\hat{j} + \dfrac{2}{\sqrt{6}}\hat{k}$

8. $\dfrac{1}{\sqrt{3}}\hat{i} + \dfrac{1}{\sqrt{3}}\hat{j} + \dfrac{1}{\sqrt{3}}\hat{k}$ **9.** $\dfrac{1}{\sqrt{2}}\hat{i} + \dfrac{1}{\sqrt{2}}\hat{k}$

10. $\dfrac{40}{\sqrt{30}}\hat{i} - \dfrac{8}{\sqrt{30}}\hat{j} + \dfrac{16}{\sqrt{30}}\hat{k}$ **12.** $\dfrac{1}{\sqrt{14}}, \dfrac{2}{\sqrt{14}}, \dfrac{3}{\sqrt{14}}$

13. $-\dfrac{1}{3}, -\dfrac{2}{3}, \dfrac{2}{3}$ **15.** (i) $-\dfrac{1}{3}\hat{i} + \dfrac{4}{3}\hat{j} + \dfrac{1}{3}\hat{k}$ (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. $\dfrac{\pi}{4}$ **2.** $\cos^{-1}\left(\dfrac{5}{7}\right)$ **3.** 0

4. $\dfrac{60}{\sqrt{114}}$ **6.** $\dfrac{16\sqrt{2}}{3\sqrt{7}}, \dfrac{2\sqrt{2}}{3\sqrt{7}}$ **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.** $\dfrac{-3}{2}$

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

15. $\cos^{-1}\left(\dfrac{10}{\sqrt{102}}\right)$ **18.** (D)

EXERCISE 10.4

1. $19\sqrt{2}$ **2.** $\pm\dfrac{2}{3}\hat{i} \quad \dfrac{2}{3}\hat{j} \quad \dfrac{1}{3}\hat{k}$ **3.** $\dfrac{\pi}{3}; \dfrac{1}{2}, \dfrac{1}{\sqrt{2}}, \dfrac{1}{2}$

5. $3, \dfrac{27}{2}$ **6.** Either $|\vec{a}| = 0$ or $|\vec{b}| = 0$

8. No; take any two nonzero collinear vectors

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

Miscellaneous Exercise on Chapter 10

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

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

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

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

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

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

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

EXERCISE 11.1

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

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

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

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

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

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

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

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

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

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

Miscellaneous Exercise on Chapter 11

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

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 $Z = \dfrac{235}{19}$ at $\left(\dfrac{20}{19}, \dfrac{45}{19}\right)$

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

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. $P(E|F) = \dfrac{2}{3}, P(F|E) = \dfrac{1}{3}$

2. $P(A|B) = \dfrac{16}{25}$

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

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

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

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

7. (i) 1   (ii) 0

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

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

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

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

EXERCISE 13.2

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

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

6. E and F are not independent

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

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

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

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

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

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

17. D   18. B

EXERCISE 13.3

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

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

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

13. A   14. C

Miscellaneous Exercise on Chapter 13

1. (i) 1   (ii) 0

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

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

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

5. $\dfrac{2}{7}$

6. $\dfrac{1}{15}, \dfrac{2}{5}, \dfrac{8}{15}$

7. $\dfrac{14}{29}$

8. $\dfrac{3}{16}$

9. (i) 0.5   (ii) 0.05

10. $\dfrac{16}{31}$

11. A

12. C

13. B

— ❖ —

Notes