ANSWERS

EXERCISE 7.1

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

EXERCISE 7.2

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.** $-\dfrac{1}{8}\log|9-4x^2|$ **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.** $-\log(1+\cos x)$ **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. $\dfrac{x}{2}-\dfrac{1}{8}\sin(4x+10)+\mathrm{C}$

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

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

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

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

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

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

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

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

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

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

12. $x-\sin x+\mathrm{C}$

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

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

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

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

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

18. $\tan x+\mathrm{C}$

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

20. $\log|\cos x+\sin x|+\mathrm{C}$

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

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

23. A

24. B

EXERCISE 7.4

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

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

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

EXERCISE 7.5

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

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

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. $\dfrac{1}{2}(b^2-a^2)$ 2. $\dfrac{35}{2}$ 3. $\dfrac{19}{3}$

4. $\dfrac{27}{2}$ 5. $e-\dfrac{1}{e}$ 6. $\dfrac{15+e^8}{2}$

EXERCISE 7.9

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

EXERCISE 7.10

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

EXERCISE 7.11

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

19. $\dfrac{2(2x-1)}{\pi}\sin^{-1}\sqrt{x}+\dfrac{2\sqrt{x-x^2}}{\pi}-x+\mathrm{C}$

20. $-2\sqrt{1-x}+\cos^{-1}\sqrt{x}+\sqrt{x-x^2}+C$

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

22. $-2\log|x+1|-\dfrac{1}{x+1}+3\log|x+2|+C$

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

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

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

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

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

28. $2\sin^{-1}\dfrac{(\sqrt{3}-1)}{2}$

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

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

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

32. $\dfrac{\pi}{2}(\pi-2)$

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

40. $\dfrac{1}{3}\left(e^2-\dfrac{1}{e}\right)$

41. A   **42.** B
43. D   **44.** B

EXERCISE 8.1

1. $\dfrac{14}{3}$ **2.** $16-4\sqrt{2}$ **3.** $\dfrac{32-8\sqrt{2}}{3}$

4. 12π **5.** 6π **6.** $\dfrac{\pi}{3}$

7. $\dfrac{a^2}{2}\left(\dfrac{\pi}{2}-1\right)$ **8.** $(4)^{\frac{2}{3}}$ **9.** $\dfrac{1}{3}$

10. $\dfrac{9}{8}$ **11.** $8\sqrt{3}$ **12.** A   **13.** B

<div style="text-align:center">

EXERCISE 8.2

</div>

1. $\dfrac{\sqrt{2}}{6} + \dfrac{9}{4} \sin^{-1} \dfrac{2\sqrt{2}}{3}$ **2.** $\left(\dfrac{2\pi}{3} - \dfrac{\sqrt{3}}{2} \right)$

3. $\dfrac{21}{2}$ **4.** 4   **5.** 8

6. B   **7.** B

<div style="text-align:center">

Miscellaneous Exercise on Chapter 8

</div>

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

2. $\dfrac{1}{6}$ **3.** $\dfrac{7}{3}$ **4.** 9   **5.** 4

6. $\dfrac{8}{3} \dfrac{a^2}{m^3}$ **7.** 27   **8.** $\dfrac{3}{2}(\pi - 2)$

9. $\dfrac{ab}{4}(\pi - 2)$ **10.** $\dfrac{9}{2}$ **11.** 2   **12.** $\dfrac{1}{3}$

13. 7   **14.** $\dfrac{7}{2}$ **15.** $\dfrac{9\pi}{8} - \dfrac{9}{4} \sin^{-1}\left(\dfrac{1}{3}\right) + \dfrac{1}{3\sqrt{2}}$

16. D   **17.** C   **18.** C   **19.** B

<div style="text-align:center">

EXERCISE 9.1

</div>

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

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EXERCISE 9.2

</div>

11. D   **12.** D

EXERCISE 9.3

1. $y'' = 0$

2. $xy\,y'' + x\,(y')^2 - y\,y' = 0$

3. $y'' - y' - 6y = 0$

4. $y'' - 4y' + 4y = 0$

5. $y'' - 2y' + 2y = 0$

6. $2xyy' + x^2 = y^2$

7. $xy' - 2y = 0$

8. $xyy'' + x(y')^2 - yy' = 0$

9. $xyy'' + x(y')^2 - yy' = 0$

10. $(x^2 - 9)(y')^2 + x^2 = 0$

11. B

12. C

EXERCISE 9.4

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

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 9.5

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. $cy=\log\dfrac{y}{x}-1$ 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 9.6

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. $y=(\tan x-1)+C\,e^{-\tan x}$ 6. $y=\dfrac{x^2}{16}(4\log x-1)+Cx^{-2}$

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

9. $y=\dfrac{1}{x}-\cot x+\dfrac{C}{x\sin x}$ 10. $(x+y+1)=C\,e^y$
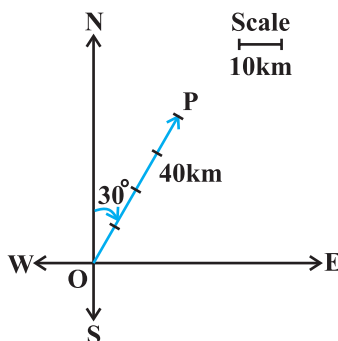
11. $x=\dfrac{y^2}{3}+\dfrac{C}{y}$ 12. $x=3y^2+Cy$

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

3. $y' = \dfrac{2y^2 - x^2}{4xy}$ **5.** $(x + yy')^2 = (x - y)^2 (1 + (y')^2)$

6. $\sin^{-1}y + \sin^{-1}x = C$ **8.** $\cos y = \dfrac{\sec x}{\sqrt{2}}$

9. $\tan^{-1} y + \tan^{-1}(e^x) = \dfrac{\pi}{2}$ **10.** $e^{\frac{x}{y}} = y + C$

11. $\log |x - y| = x + y + 1$ **12.** $y e^{2\sqrt{x}} = (2\sqrt{x} + C)$

13. $y \sin x = 2x^2 - \dfrac{\pi^2}{2}$ (sin $x \neq 0$) **14.** $y = \log \left| \dfrac{2x+1}{x+1} \right|, x \neq -1$

15. 31250 **16.** C

17. C **18.** 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.** (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)

<div align="center">

EXERCISE 10.4

</div>

1. $19\sqrt{2}$ **2.** $\pm\dfrac{2}{3}\hat{i} \mp \dfrac{2}{3}\hat{j} \mp \dfrac{1}{3}\hat{k}$ **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)

<div align="center">

Miscellaneous Exercise on Chapter 10

</div>

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. Vector equation of the line: $\vec{r} = \lambda\,(\,5\,\hat{i} - 2\,\hat{j} + 3\hat{k}\,)$;

Cartesian equation of the line: $\dfrac{x}{5} = \dfrac{y}{-2} = \dfrac{z}{3}$

9. Vector equation of the line: $\vec{r} = 3\hat{i} - 2\hat{j} - 5\hat{k} + \lambda\,(11\hat{k})$

Cartesian equation of the line: $\dfrac{x-3}{0} = \dfrac{y+2}{0} = \dfrac{z+5}{11}$

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

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

12. $p = \dfrac{70}{11}$ **14.** $\dfrac{3\sqrt{2}}{2}$ **15.** $2\sqrt{29}$

16. $\dfrac{3}{\sqrt{19}}$ **17.** $\dfrac{8}{\sqrt{29}}$

EXERCISE 11.3

1. (a) 0, 0, 1; 2

   (b) $\dfrac{1}{\sqrt{3}}, \dfrac{1}{\sqrt{3}}, \dfrac{1}{\sqrt{3}} ; \dfrac{1}{\sqrt{3}}$

   (c) $\dfrac{2}{\sqrt{14}}, \dfrac{3}{\sqrt{14}}, \dfrac{-1}{\sqrt{14}} ; \dfrac{5}{\sqrt{14}}$

   (d) $0, 1, 0; \dfrac{8}{5}$

2. $\vec{r} \cdot \left(\dfrac{3\,\hat{i} + 5\,\hat{j} - 6\,\hat{k}}{\sqrt{70}} \right) = 7$

3. (a) $x + y - z = 2$ (b) $2x + 3y - 4\,z = 1$
   (c) $(s - 2t)\,x + (3 - t)\,y + (2s + t)\,z = 15$

4. (a) $\left(\dfrac{24}{29}, \dfrac{36}{29}, \dfrac{48}{29} \right)$

   (b) $\left(0, \dfrac{18}{5}, \dfrac{24}{5} \right)$

   (c) $\left(\dfrac{1}{3}, \dfrac{1}{3}, \dfrac{1}{3} \right)$

   (d) $\left(0, \dfrac{-8}{5}, 0 \right)$

5. (a) $[\vec{r} - (\hat{i} - 2\,\hat{k}\,)] \cdot (\hat{i} + \hat{j} - \hat{k}) = 0;\ \ x + y - z = 3$

   (b) $[\vec{r} - (\hat{i} + 4\,\hat{j} + 6\,\hat{k}\,)\,] \cdot (\hat{i} - 2\,\hat{j} + \hat{k}) = 0;\ \ x - 2y + z + 1 = 0$

6. (a) The points are collinear. There will be infinite number of planes
      passing through the given points.
   (b) $2x + 3y - 3z = 5$

7. $\dfrac{5}{2}$, 5, –5   8. $y = 3$ 9. $7x - 5y + 4z - 8 = 0$

10. $\vec{r} \cdot \left(38\hat{i} + 68\hat{j} + 3\hat{k} \right) = 153$ 11. $x - z + 2 = 0$

12. $\cos^{-1} \left(\dfrac{15}{\sqrt{731}} \right)$

13. (a) $\cos^{-1} \left(\dfrac{2}{5} \right)$ (b) The planes are perpendicular

    (c) The planes are parallel   (d) The planes are parallel
    (e) 45°

14. (a) $\dfrac{3}{13}$ (b) $\dfrac{13}{3}$
    (c) 3   (d) 2

Miscellaneous Exercise on Chapter 11

3. 90°

4. $\dfrac{x}{1} = \dfrac{y}{0} = \dfrac{z}{0}$

5. $\cos^{-1}\left(\dfrac{5}{\sqrt{187}}\right)$

6. $k = \dfrac{-10}{7}$

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

8. $x + y + z = a + b + c$

9. 9

10. $\left(0,\ \dfrac{17}{2},\ \dfrac{-13}{2}\right)$

11. $\left(\dfrac{17}{3},\ 0,\ \dfrac{23}{3}\right)$

12. $(1, -2, 7)$

13. $7x - 8y + 3z + 25 = 0$

14. $p = 1$ or $\dfrac{7}{3}$

15. $y - 3z + 6 = 0$

16. $x + 2y - 3z - 14 = 0$

17. $33x + 45y + 50z - 41 = 0$

18. 13

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

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

22. D

23. B

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 12.2

1. Minimum cost = Rs 160 at all points lying on segment joining $\left(\dfrac{8}{3}, 0\right)$ and $\left(2, \dfrac{1}{2}\right)$.

2. Maximum number of cakes = 30 of kind one and 10 cakes of another kind.

3. (i) 4 tennis rackets and 12 cricket bats

   (ii) Maximum profit = Rs 200

4. 3 packages of nuts and 3 packages of bolts; Maximum profit = Rs 73.50.

5. 30 packages of screws A and 20 packages of screws B; Maximum profit = Rs 410

6. 4 Pedestal lamps and 4 wooden shades; Maximum profit = Rs 32

7. 8 Souvenir of types A and 20 of Souvenir of type B; Maximum profit = Rs 1600.

8. 200 units of desktop model and 50 units of portable model; Maximum profit = Rs 1150000.

9. Minimise Z = 4x + 6y

   subject to 3x + 6y ≥ 80, 4x + 3y ≥ 100, x ≥ 0 and y ≥ 0, where x and y denote the number of units of food F_1 and food F_2 respectively; Minimum cost = Rs 104

10. 100 kg of fertiliser F_1 and 80 kg of fertiliser F_2; Minimum cost = Rs 1000

11. (D)

Miscellaneous Exercise on Chapter 12

1. 40 packets of food P and 15 packets of food Q; Maximum amount of vitamin A = 285 units.

2. 3 bags of brand P and 6 bags of brand Q; Minimum cost of the mixture = Rs 1950

3. Least cost of the mixture is Rs 112 (2 kg of Food X and 4 kg of food Y).

5. 40 tickets of executive class and 160 tickets of economy class; Maximum profit = Rs 136000.

6. From A : 10,50, 40 units; From B: 50,0,0 units to D, E and F respectively and minimum cost = Rs 510

7. From A: 500, 3000 and 3500 litres; From B: 4000, 0, 0 litres to D, E and F respectively; Minimum cost = Rs 4400

8. 40 bags of brand P and 100 bags of brand Q; Minimum amount of nitrogen = 470 kg.

9. 140 bags of brand P and 50 bags of brand Q; Maximum amount of nitrogen = 595 kg.

10. 800 dolls of type A and 400 dolls of type B; Maximum profit = Rs 16000

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. $\dfrac{198}{1197}$ **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

EXERCISE 13.4

1. (ii), (iii) and (iv)   **2.** X = 0, 1, 2; yes   **3.** X = 6, 4, 2, 0

4. (i)

X	0	1	2
P(X)	$\dfrac{1}{4}$	$\dfrac{1}{2}$	$\dfrac{1}{4}$

(ii)

X	0	1	2	3
P(X)	$\dfrac{1}{8}$	$\dfrac{3}{8}$	$\dfrac{3}{8}$	$\dfrac{1}{8}$

(iii)

X	0	1	2	3	4
P(X)	$\dfrac{1}{16}$	$\dfrac{1}{4}$	$\dfrac{3}{8}$	$\dfrac{1}{4}$	$\dfrac{1}{16}$

5. (i)

X	0	1	2
P(X)	$\dfrac{4}{9}$	$\dfrac{4}{9}$	$\dfrac{1}{9}$

(ii)

X	0	1
P(X)	$\dfrac{25}{36}$	$\dfrac{11}{36}$

6.

X	0	1	2	3	4
P(X)	$\dfrac{256}{625}$	$\dfrac{256}{625}$	$\dfrac{96}{625}$	$\dfrac{16}{625}$	$\dfrac{1}{625}$

7.

X	0	1	2
P(X)	$\dfrac{9}{16}$	$\dfrac{6}{16}$	$\dfrac{1}{16}$

8. (i) $k = \dfrac{1}{10}$ (ii) $P(X < 3) = \dfrac{3}{10}$ (iii) $P(X > 6) = \dfrac{17}{100}$

(iv) $P(0 < X < 3) = \dfrac{3}{10}$

9. (a) $k = \dfrac{1}{6}$ (b) $P(X < 2) = \dfrac{1}{2}, P(X \le 2) = 1, P(X \ge 2) = \dfrac{1}{2}$

10. 1.5   11. $\dfrac{1}{3}$ 12. $\dfrac{14}{3}$

13. Var(X) = 5.833, S.D = 2.415

14.

X	14	15	16	17	18	19	20	21
P(X)	$\dfrac{2}{15}$	$\dfrac{1}{15}$	$\dfrac{2}{15}$	$\dfrac{3}{15}$	$\dfrac{1}{15}$	$\dfrac{2}{15}$	$\dfrac{3}{15}$	$\dfrac{1}{15}$

Mean = 17.53, Var(X) = 4.78 and S.D(X) = 2.19

15. E(X) = 0.7 and Var (X) = 0.21   16. B   17. D

EXERCISE 13.5

1. (i) $\dfrac{3}{32}$ (ii) $\dfrac{7}{64}$ (iii) $\dfrac{63}{64}$

2. $\dfrac{25}{216}$ **3.** $\left(\dfrac{29}{20}\right)\left(\dfrac{19}{20}\right)^{9}$

4. (i) $\dfrac{1}{1024}$ (ii) $\dfrac{45}{512}$ (iii) $\dfrac{243}{1024}$

5. (i) $(0.95)^{5}$ (ii) $(0.95)^{4} \times 1.2$ (iii) $1 - (0.95)^{4} \times 1.2$

    (iv) $1 - (0.95)^{5}$

6. $\left(\dfrac{9}{10}\right)^{4}$ **7.** $\left(\dfrac{1}{2}\right)^{20}\left[20C_{12} + {}^{20}C_{13} + \ldots + {}^{20}C_{20}\right]$

9. $\dfrac{11}{243}$

10. (a) $1 - \left(\dfrac{99}{100}\right)^{50}$ (b) $\dfrac{1}{2}\left(\dfrac{99}{100}\right)^{49}$ (c) $1 - \dfrac{149}{100}\left(\dfrac{99}{100}\right)^{49}$

11. $\dfrac{7}{12}\left(\dfrac{5}{6}\right)^{5}$ **12.** $\dfrac{35}{18}\left(\dfrac{5}{6}\right)^{4}$ **13.** $\dfrac{22 \times 9^{3}}{10^{11}}$

14. C   **15.** A

Miscellaneous Exercise on Chapter 13

1. (i) 1   (ii) 0

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

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

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

5. (i) $\left(\dfrac{2}{5}\right)^{6}$ (ii) $7\left(\dfrac{2}{5}\right)^{4}$ (iii) $1 - \left(\dfrac{2}{5}\right)^{6}$ (iv) $\dfrac{864}{3125}$

6. $\dfrac{5^{10}}{2 \times 6^9}$

7. $\dfrac{625}{23328}$

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

9. $\dfrac{31}{9}\left(\dfrac{2}{3}\right)^4$

10. $n \geq 4$

11. $\dfrac{11}{216}$

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

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

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

15. (i) 0.5   (ii) 0.05

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

17. A

18. C

19. B