

ANSWERS

1.3 EXERCISE

1. $(b,b), (c,c), (a,c)$
2. $[-5,5]$
3. $4x^2 + 4x - 1$
4. $f^{-1}(x) = \frac{x+3}{2}$
5. $f^{-1}\{(b,a), (d,b), (a,c), (c,d)\}$
6. $f(f(x)) = x^4 - 6x^3 + 10x^2 - 3x$
7. $\alpha = 2, \beta = -1$
8. (i) represents function which is surjective but not injective
(ii) does not represent function.
9. $f \circ g = \{(2,5), (5,2), (1,5)\}$
12. (i) f is not function (ii) g is function (iii) h is function (iv) k is not function
14. $\left[\frac{1}{3}, 1\right]$
17. Domain of $R = \{1, 2, 3, 4, \dots, 20\}$ and
Range of $R = \{1, 3, 5, 7, 9, \dots, 39\}$. R is neither reflexive, nor symmetric and nor transitive.
21. (i) f is one-one but not onto, (ii) g is neither one-one nor onto (iii) h is bijective,
(iv) k is neither one-one nor onto.
22. (i) transitive (ii) symmetric (iii) reflexive, symmetric and transitive (iv) transitive.
23. $[(2,5)] = \{(1,4), (2,5), (3,6), (4,7), (5,8), (6,9)\}$

25. (i) $(fog)(x) = 4x^2 - 6x + 1$
 (ii) $(gof)(x) = 2x^2 + 6x - 1$
 (iii) $(fof)(x) = x^4 + 6x^3 + 14x^2 + 15x + 5$
 (iv) $(gog)(x) = 4x - 9$
26. (ii) & (iv)
27. (i) 28. C 29. B 30. D
 31. B 32. B 33. A 34. C
 35. C 36. B 37. D 38. A
 39. B 40. B 41. A 42. A
 43. C 44. B 45. D 46. A
47. B 48. $R = \{(3,8), (6,6), (9,4), (12,2)\}$
49. $R = \{(1,1), (1,2), (2,1), (2,2), (2,3), (3,2), (3,3), (3,4), (4,3), (4,4), (5,5)\}$
50. $gof = \{(1,3), (3,1), (4,3)\}$ and $fog = \{(2,5), (5,2), (1,5)\}$
51. $(fofof)(x) = \frac{x}{\sqrt{3x^2 + 1}}$ 52. $f^{-1}(x) = 7 + (4 - x)^{\frac{1}{3}}$
53. False 54. False 55. False 56. False
 57. True 58. False 59. False 60. True
 61. False 62. False

2.3 EXERCISE

1. 0 2. -1 4. $\frac{-}{12}$ 5. $-\frac{2}{3}$
 7. 0, -1 8. $\frac{14}{15}$ 11. $\frac{-3}{4}, \frac{3}{4}$

13. $\tan^{-1} \frac{4}{3} - x$ 17. $\frac{\pi}{4}$ 19. $\frac{a_n - a_1}{1 + a_1 a_n}$
20. C 21. D 22. B 23. D
24. A 25. A 26. B 27. C
28. A 29. B 30. A 31. D
32. D 33. B 34. A 35. C
36. A 37. A
38. $\frac{2}{3}$ 39. $\frac{2}{5}$ 40. $\sqrt{3}$ 41. ϕ
42. $-\frac{1}{3}$ 43. $\frac{2}{3}$ 44. 0 45. 1
46. -2, 2 47. $xy > -1$ 48. $-\cot^{-1} x$
49. False 50. False 51. True 52. True
53. True 54. False 55. True

3.3 EXERCISE

1. $28 \times 1, 1 \times 28, 4 \times 7, 7 \times 4, 14 \times 2, 2 \times 14$. If matrix has 13 elements then its order will be either 13×1 or 1×13 .

2. (i) 3×3 , (ii) 9, (iii) $a_{23} = x^2 - y, a_{31} = 0, a_{12} = 1$

3. (i) $\begin{bmatrix} \frac{1}{2} & \frac{9}{2} \\ 0 & 2 \end{bmatrix}$ (ii) $\begin{bmatrix} 1 & 4 \\ -1 & 2 \end{bmatrix}$

4. $\begin{bmatrix} e^x \sin x & e^x \sin 2x \\ e^{2x} \sin x & e^{2x} \sin 2x \\ e^{3x} \sin x & e^{3x} \sin 2x \end{bmatrix}$

5. $a = 2, b = 2$

6. Not possible

7. (i) $X + Y = \begin{bmatrix} 5 & 2 & -2 \\ 12 & 0 & 1 \end{bmatrix}$

(ii) $2X - 3Y = \begin{bmatrix} 0 & -1 & 1 \\ -11 & -10 & -18 \end{bmatrix}$

$$(iii) Z = \begin{bmatrix} -5 & -2 & 2 \\ -12 & 0 & -1 \end{bmatrix}$$

8. $x = 4$
11. $A^{-1} = \frac{-1}{7} \begin{bmatrix} -2 & -3 \\ 1 & 5 \end{bmatrix}$
13. $A = [-1 \ 2 \ 1]$
15. $AB = \begin{bmatrix} 12 & 9 \\ 12 & 15 \end{bmatrix}$ $BA = \begin{bmatrix} 9 & 6 & 12 \\ 7 & 8 & 16 \\ 4 & 5 & 10 \end{bmatrix}$
19. $X = \begin{bmatrix} -2 & 0 \\ -1 & -3 \end{bmatrix}, Y = \begin{bmatrix} 2 & 1 \\ 2 & 2 \end{bmatrix}$
24. $A = [-4]$
37. (i) $\frac{1}{22} \begin{bmatrix} 7 & -3 \\ 5 & 1 \end{bmatrix}$ (ii) not possible
38. $x = 2, y = 4$ or $x = 4, y = 2, z = -6, w = 4$
39. $\begin{bmatrix} -24 & -10 \\ -28 & -38 \end{bmatrix}$
41. $a = 2, b = 4, c = 1, d = 3$
43. $\begin{bmatrix} 18 & 8 \\ 16 & 18 \end{bmatrix}$
45. $a = -2, b = 0, c = -3$
10. $-2, -14$
12. $A = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$
18. $x = 1, y = 2$
20. $\begin{bmatrix} k \\ 2k \end{bmatrix}, \begin{bmatrix} k & k \\ 2k & 2k \end{bmatrix}$ etc.
where k is a real number
30. True when $AB = BA$
40. $A^3 = \begin{bmatrix} 187 & -195 \\ -156 & 148 \end{bmatrix}$
42. $\begin{bmatrix} 1 & -2 & -5 \\ 3 & 4 & 0 \end{bmatrix}$
44. True for all real values of α

50. $x = \pm \frac{1}{\sqrt{2}}, y = \pm \frac{1}{\sqrt{6}}, z = \pm \frac{1}{\sqrt{3}}$

51. (i) $\begin{bmatrix} -7 & -9 & 10 \\ -12 & -15 & 17 \\ 1 & 1 & -1 \end{bmatrix}$ (ii) inverse does not exist (iii) $\begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$

52. $\begin{bmatrix} 2 & 2 & \frac{5}{2} \\ 2 & -1 & \frac{3}{2} \\ \frac{5}{2} & \frac{3}{2} & 2 \end{bmatrix} + \begin{bmatrix} 0 & 1 & \frac{-3}{2} \\ -1 & 0 & \frac{1}{2} \\ \frac{3}{2} & \frac{-1}{2} & 0 \end{bmatrix}$

53. A 54. D 55. B 56. D
 57. D 58. D 59. A 60. B
 61. C 62. D 63. A 64. A
 65. D 66. D 67. A 68. Null matrix
 69. Skew symmetric matrix 70. -1 71. 0
 72. Rectangular matrix 73. Distributive
 74. Symmetric matrix 75. Symmetric matrix
 76. (i) $B' A'$ (ii) kA (iii) $k(A - B)$ 77. Skew Symmetric matrix
 78. (i) Skew symmetric matrix
 (ii) neither symmetric nor skew symmetric matrix
 79. Symmetric matrix 80. $AB = BA$ 81. does not exist
 82. False 83. False 84. False 85. True
 86. True 87. False 88. False 89. True
 90. False 91. False 92. False 93. False
 94. True 95. False 96. True 97. False
 98. True 99. False 100. True 101. True

4.3 EXERCISE

1. $x^3 - x^2 + 2$ 2. $a^2(a + x + y + z)$ 3. $2x^3y^3z^3$
 4. $3(x + y + z)(xy + yz + zx)$ 5. $16(3x + 4)$ 6. $(a + b + c)^3$
12. $=n$ or $n + (-1)^n \left(\frac{\pi}{6}\right)$ 13. $x = 0, -12$ 18. $x = 0, y = -5, z = -3$
19. $x = 1, y = 1, z = 1$ 20. $x = 2, y = -1, z = 4$
24. C 25. C 26. B 27. D
 28. C 29. A 30. A 31. A
 32. C 33. D 34. D 35. D
36. B 37. C 38. $27|A|$ 39. $\frac{1}{|A|}$
40. Zero 41. $\frac{1}{2}$ 42. $(A^{-1})^2$ 43. 9
44. Value of the determinant 45. $x = 2, y = 7$
 46. $(y - z)(z - x)(y - x + xyz)$ 47. Zero 48. True
 49. False 50. False 51. True 52. True
 53. True 54. False 55. True 56. True
 57. True 58. True

5.3 EXERCISE

1. Continuous at $x=1$ 2. Discontinuous 3. Discontinuous 4. Continuous
 5. Discontinuous 6. Continuous 7. Continuous 8. Discontinuous
9. Continuous 10. Continuous 11. $k = \frac{7}{2}$ 12. $k = \frac{1}{2}$
13. $k = -1$ 14. $k = \pm 1$ 16. $a = 1, b = -1$
17. Discontinuous at $x = -2$ and $x = -\frac{5}{2}$ 18. Discontinuous at $x = 1, \frac{1}{2}$ and 2
 20. Not differentiable at $x = 2$ 21. Differentiable at $x = 0$
 22. Not differentiable at $x = 2$ 25. $-(\log 2) \cdot \sin 2x \cdot 2^{\cos^2 x}$

26. $\frac{8^x}{x^8} \left[\log 8 - \frac{8}{x} \right]$ 27. $\frac{1}{\sqrt{x^2+a}}$ 28. $\frac{5}{x \log(x^5) \log(\log x^5)}$
29. $\frac{\cos \sqrt{x}}{2\sqrt{x}} - \frac{\sin 2\sqrt{x}}{2\sqrt{x}}$ 30. $n(2ax+b) \sin^{n-1}(ax^2+bx+c) \cos(ax^2+bx+c)$
31. $\frac{-1}{2\sqrt{x+1}} \sin(\tan \sqrt{x+1}) \sec^2(\sqrt{x+1})$
32. $2x \cos(x)^2 + 2x \sin(2x^2) + \sin 2x$ 33. $\frac{-1}{2\sqrt{x}(x+1)}$
34. $(\sin x)^{\cos x} \left[\frac{\cos^2 x}{\sin x} - \sin x \cdot \log \sin x \right]$ 35. $\sin^{mx} x \cos^n x (-n \tan x + m \cot x)$
36. $(x+1)(x+2)^2(x+3)^3 [9x^2+34x+29]$
37. -1 38. $\frac{1}{2}$ 39. $\frac{1}{2}$ 40. -1
41. $\frac{-3}{\sqrt{1-x^2}}$ 42. $\frac{3a}{a^2+x^2}$ 43. $\frac{-x}{\sqrt{1-x^4}}$ 44. $\frac{t^2+1}{t^2-1}$
45. $e^{-2} \left(\frac{-3+2+1}{3+2+1} \right)$ 46. $\cot \theta$ 47. 1
48. t 51. $\frac{1}{\sqrt{3}}$ 52. $\frac{\tan x - x}{\sin^2 x}$ 53. $\frac{1}{2}$
54. $\frac{2xy^2 - y^3 \cos(xy) - y}{xy^2 \cos(xy) - x + y^2}$ 55. $\frac{y - \sec(x+y) \tan(x+y)}{\sec(x+y) \tan(x+y) - x}$
56. $\frac{-x}{y}$ 57. $\frac{y-4x^3-4xy^2}{4yx^2+4y^3-x}$ 64. $-2 \sin y \cos^3 y$
70. Not applicable since f is not differentiable at $x = 1$

71. $(\pi, -2)$ 72. $(2, -4)$ 77. $\left(\frac{7}{2}, \frac{1}{4}\right)$ 78. $\left(\frac{3}{2}, 0\right)$
79. $p=3, q=5$ 82. $x^{\tan x} \left(\sec^2 x \log x + \frac{\tan x}{x} \right) + \frac{x}{\sqrt{2}\sqrt{x^2+1}}$ 83. D
84. C 85. B 86. A 87. A
88. A 89. C 90. B 91. B
92. A 93. A 94. B 95. A
96. B 97. $|x|+|x-1|$ 98. $\frac{2}{3x}$ 99. $\frac{-1}{\sqrt{2}}$
100. $\left(\frac{\sqrt{3}+1}{2}\right)$ 101. -1 102. False 103. True
104. True 105. True 106. False

6.3 EXERCISE

3. 8 m/s 4. $(\sqrt{2-\sqrt{2}})^v$ unit/sec. 5. $=\frac{1}{3}$ 6. 31.92
7. $0.018\pi\text{cm}^3$ 8. $2\frac{2}{3}$ m/s towards light, -1 m/s
9. 2000 litres/s, 3000 litre/s 11. $2x^3 - 3x + 1$
12. $k^2 = 8$ 14. $(4, 4)$ 15. $\tan^{-1}\left(\frac{4\sqrt{2}}{7}\right)$ 17. $x + 3y = \pm 8$
18. $(3, 2), (-1, 2)$ 23. $(1, -16)$, max. slope = 12
26. $x = 1$ is the point of local maxima; local maximum = 0
 $x = 3$ is the point of local minima; local minimum = -28
 $x = 0$ is the point of inflection.
27. Rs 100 30. 6cm, 12 cm, $864\pi\text{cm}^3$

31. 1:1 33. Rs 1920 34. $\frac{2}{3}x^3\left(1+\frac{2}{27}\right)$
35. C 36. B 37. A 38. C
39. D 40. A 41. A 42. D
43. B 44. B 45. C 46. B
47. D 48. A 49. B 50. C
51. A 52. C 53. B 54. C
55. B 56. A 57. B 58. B
59. C 60. (3, 34) 61. $x + y = 0$ 62. $(-\infty, -1)$
63. $(1, \infty)$ 64. $2\sqrt{ab}$

7.3 EXERCISE

3. $\frac{x^2}{2} - x + 3\log|x+1| + c$ 4. $\frac{x^3}{3} + c$ 5. $\log|x + \sin x| + c$
6. $\tan \frac{x}{2} + C$ 7. $\frac{\tan^5 x}{5} + \frac{\tan^3 x}{3} + c$ 8. $x + c$
9. $-2\cos \frac{x}{2} + 2\sin \frac{x}{2} + c$ 10. $2\left[\frac{x\sqrt{x}}{3} - \frac{x}{2} + \sqrt{x} - \log|\sqrt{x}+1|\right] + c$
11. $-a\left[\cos^{-1}\left(\frac{x}{a}\right) + \sqrt{1-\frac{x^2}{a^2}}\right] + c$ 12. $\frac{4}{3}\left[x^{3/4} - \log\left|1+x^{3/4}\right|\right] + c$
13. $\frac{-1}{3}\left(1+\frac{1}{x^2}\right)^{\frac{3}{2}} + c$ 14. $\frac{1}{3}\sin^{-1}\frac{3x}{4} + c$
15. $\frac{1}{\sqrt{2}}\sin^{-1}\left(\frac{4t-3}{3}\right) + c$
16. $3\sqrt{x^2+9} - \log|x+\sqrt{x^2+9}| + c$

17. $\frac{x-1}{2} \sqrt{5-2x+x^2} + 2 \log |x-1+\sqrt{5-2x+x^2}| + c$
18. $\frac{1}{4} \{ \log |x^2-1| - \log |x^2+1| \} + c$
19. $\frac{1}{4} \left\{ \log \left| \frac{1+x}{1-x} \right| \right\} - \frac{1}{2} \tan^{-1} x + c$
20. $\frac{x-a}{2} \sqrt{2ax-x^2} + \frac{a^2}{2} \sin^{-1} \left(\frac{x-a}{a} \right) + c$
21. $\frac{x \sin^{-1} x}{\sqrt{1-x^2}} + \log \left| \sqrt{1-x^2} \right|$
22. $-\left(\frac{1}{2} \sin 2x + \sin x \right) + c$
23. $\tan x - \cot x - 3x + c$
24. $\frac{2}{3} \sin^{-1} \sqrt{\frac{x^3}{a^3}} + c$
25. $2 \sin x + x + c$
26. $\frac{1}{2} \sec^{-1}(x^2) + c$
27. $\frac{26}{3}$
28. $e^2 - 1$
29. $\tan^{-1} e - \frac{\pi}{4}$
30. $\frac{\log m}{m^2 - 1}$
31. π
32. $\sqrt{2} - 1$
33. $\frac{\pi}{3}$
34. $\frac{\sqrt{2}}{2} \tan^{-1} \frac{\sqrt{2}}{3}$
35. $\frac{1}{7} \log \left| \frac{x-2}{x+2} \right| + \frac{\sqrt{3}}{7} \tan^{-1} \frac{x}{\sqrt{3}} + c$
36. $\frac{1}{a^2 - b^2} \left\{ a \tan^{-1} \frac{x}{a} - b \tan^{-1} \frac{x}{b} \right\} + c$
37. π
38. $\log \left| \frac{\sqrt{x-3}}{(x-1)^{\frac{1}{6}} (x+2)^{\frac{1}{3}}} \right| + c$
39. $x e^{\tan^{-1} x} + c$
40. $a \left[\frac{x}{a} \tan^{-1} \sqrt{\frac{x}{a}} - \sqrt{\frac{x}{a}} + \tan^{-1} \sqrt{\frac{x}{a}} \right] + c$
41. $\frac{3}{2}$

42. $\frac{e^{-3x}}{24} [\sin 3x - \cos 3x] + \frac{3e^{-3x}}{40} [\sin x - 3 \cos x] + c$

43. $\frac{1}{\sqrt{2}} \tan^{-1} \left(\frac{\tan x - 1}{\sqrt{2} \tan x} \right) + \frac{1}{2\sqrt{2}} \log \left| \frac{\tan x - \sqrt{2} \tan x + 1}{\tan x + \sqrt{2} \tan x + 1} \right| + c$

44. $\frac{1}{4} \left(\frac{a^2 + b^2}{a^3 b^3} \right)$

45. $\frac{3}{8} \log 3$

46. $\frac{1}{2} \log \frac{1}{2}$

47. $\frac{1}{4} \log \frac{1}{2}$

48. A

49. C

50. A

51. C

52. D

53. C

54. D

55. D

56. D

57. A

58. D

59. e^{-1}

60. $\frac{e^x}{x+4} + c$

61. $\frac{1}{2}$

62. $\frac{-1}{2\sqrt{3}} \tan^{-1} \left(\frac{2 \cos x}{\sqrt{3}} \right) + c$

63. 0

8.3 EXERCISE

1. $\frac{1}{2}$ sq. units

2. $\frac{4}{3} p^2$ sq. units

3. 10 sq. units

4. $\frac{16}{3}$ sq. units

5. $\frac{27}{2}$ sq. units

6. $\frac{9}{2}$ sq. units

7. $\frac{32}{3}$ sq. units

8. 2π sq. units

9. $\frac{4}{3}$ sq. units

10. 96 sq. units

11. $\frac{16}{3}$ sq. units

12. $\frac{a^2}{4}$ sq. units

13. $\frac{1}{6}$ sq. units

14. $\frac{9}{2}$ sq. units

15. 9 sq. units

16. $2 \left[-\frac{8}{3} \right]$ sq. units

17. 4 sq. units

18. $\frac{15}{2}$ sq. units

19. $\frac{4}{3} (\sqrt{3} + 2) a^2$ sq. units

20. 6 sq. units

21. $\frac{15}{2}$ sq. units

22. 8 sq. units

23. 15 sq. units

24. C

25. D

26. A

27. B

28. A 29. A 30. D 31. A
 32. B 33. A 34. C

9.3 EXERCISE

1. $2^{-x} - 2^{-y} = k$ 2. $\frac{d^2y}{dx^2} = 0$ 3. $\frac{e^6 + 9}{2}$
4. $y(x^2 - 1) = \frac{1}{2} \log \left(\left| \frac{x-1}{x+1} \right| \right) + k$ 5. $y = c.e^{x-x^2}$
6. $(a+m)y = e^{mx} + ce^{-ax}$ 7. $(x-c)e^{x+y} + 1 = 0$
8. $y = kxe^{\frac{-x^2}{2}}$ 9. $y = \tan \left(x + \frac{x^2}{2} \right)$ 10. $x = y(y^2 + c)$ 11. $\frac{1}{3}$
13. $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - 2 = 0$ 14. $(x^2 - y^2)\frac{dy}{dx} - 2xy = 0$
15. $y = \frac{4x^3}{3(1+x^2)}$ 16. $\tan^{-1} \left(\frac{y}{x} \right) = \log|x| + c$
17. $2xe^{\tan^{-1}y} = e^{2\tan^{-1}y} + c$ 18. $\tan^{-1} \left(\frac{x}{y} \right) + \log y = c$
19. $x + y = ke^{x-y}$ 20. $x^2(y+3)^3 = e^{y+2}$ 21. $y \sin x = \frac{-\cos 2x}{2} + \frac{3}{2}$
22. $xy y' + x(y')^2 - y'y = 0$ 23. $\frac{1}{2}(\tan^{-1}x)^2 + \log(1+y^2) = c$
24. $(x-1) + (y-2)\frac{dy}{dx} = 0$ 25. $y = -\cos x + \frac{2\sin x}{x} + \frac{2\cos x}{x^2} + \frac{x \log x}{3} - \frac{x}{9} + cx^{-2}$

26. $x(\sin y + \cos y) = \sin y + ce^{-y}$

27. $\log \left| 1 + \tan \left(\frac{x+y}{2} \right) \right| = x+c$

28. $y = - \left[\frac{3 \sin 2x + 2 \cos 2x}{13} \right] + ce^{3x}$

29. $2(x^2 - y^2) = 3x$

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

31. $ke^{2x}(1-x+y) = 1+x-y$

32. $xy = 1$

33. $\log \left(\frac{x}{y} \right) = cx$

34. D

35. C

36. A

37. C

38. B

39. C

40. C

41. D

42. A

43. C

44. D

45. B

46. B

47. C

48. C

49. D

50. A

51. A

52. B

53. B

54. B

55. B

56. C

57. B

58. A

59. A

60. C

61. C

62. D

63. C

64. C

65. A

66. D

67. D

68. C

69. C

70. A

71. A

72. A

73. C

74. B

75. A

76. (i) not defined

(ii) not defined

(iii) 3

(iv) $\frac{dy}{dx} + py = Q$

(v) $xe^{\int p_1 dy} = \int (Q_1 \times e^{\int p_1 dy}) dy + c$

(vi) $y = \frac{x^2}{4} + cx^{-2}$

(vii) $3y(1+x^2) = 4x^3 + c$

(viii) $xy = Ae^{-y}$

(ix) $y = ce^{-x} + \frac{\sin x}{2} - \frac{\cos x}{2}$

(x) $x = c \sec y$

(xi) $\frac{e^x}{x}$

77. (i) True

(ii) True

(iii) True

(iv) True

(v) False

(vi) False

(vii) True

(viii) True

(ix) True

(x) True

(xi) True

10.3 EXERCISE

1. $\frac{1}{3}(2\hat{i} + \hat{j} + 2\hat{k})$ 2. (i) $\frac{1}{3}(2\hat{i} + \hat{j} - 2\hat{k})$ (ii) $\frac{1}{\sqrt{37}}(\hat{j} + 6\hat{k})$
3. $\frac{1}{7}(-2\hat{i} + 3\hat{j} - 6\hat{k})$ 4. $\vec{c} = \frac{3\vec{b} - \vec{a}}{2}$ 5. $k = -2$ 6. $\pm 2(\hat{i} + \hat{j} + \hat{k})$
7. $\frac{2}{7}, \frac{3}{7}, \frac{-6}{7}; 4\hat{i}, 6\hat{j}, -12\hat{k}$ 8. $-2\hat{i} + 4\hat{j} + 4\hat{k}$ 9. $\cos^{-1}\left(\frac{1}{\sqrt{156}}\right)$
10. Area of the parallelograms formed by taking any two sides represented by \vec{a}, \vec{b} and \vec{c} as adjacent are equal
11. $\frac{2}{\sqrt{7}}$ 12. $\sqrt{21}$ 13. $\frac{\sqrt{274}}{2}$
16. $\hat{n} = \frac{\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}}{|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}|}$ 17. $\frac{\sqrt{62}}{2}$
18. $\frac{1}{3}(5\vec{i} + 2\vec{j} + 2\vec{k})$
19. C 20. D 21. C 22. B
23. D 24. A 25. D 26. D
27. D 28. A 29. C 30. A
31. C 32. C 33. B
34. If \vec{a} and \vec{b} are equal vectors
35. 0 36. $\frac{\pi}{4}$ 37. $k \in]-1, 1[[k \neq -\frac{1}{2}$ 38. $|\vec{a}|^2 |\vec{b}|^2$
39. 3 40. \vec{a} 41. True 42. True
43. True 44. False 45. False

11.3 EXERCISE

1. $5\hat{i} + 5\sqrt{2}\hat{j} + 5\hat{k}$ 2. $(x-1)\hat{i} + (y+2)\hat{j} + (z-3)\hat{k} = \lambda(3\hat{j} - 2\hat{j} + 6\hat{k})$
3. $(-1, -1, -1)$

4. $\cos^{-1}\left(\frac{19}{21}\right)$ 7. $x + y + 2z = 19$ 8. $x + y + z = 9$
9. $3x - 2y + 6z - 27 = 0$ 10. $21x + 9y - 3z - 51 = 0$
11. $\frac{x}{1} = \frac{y}{2} = \frac{z}{-1}$ and $\frac{x}{-1} = \frac{y}{1} = \frac{z}{-2}$ 12. 60°
14. $ax + by + cz = a^2 + b^2 + c^2$ 14. (1, 1)
15. 15° or 75° 16. (2, 6, -2) $3\sqrt{5}$
17. 7 18. $\sqrt{6}$
19. $(x-3)\hat{j} + y\hat{j} + (z-1)\hat{k} = \lambda(-2\hat{i} + \hat{j} + 3\hat{k})$
20. $18x + 17y + 4z = 49$ 21. 14 22. $51x + 15y - 50z + 173 = 0$
24. $4x + 2y - 4z - 6 = 0$ and $-2x + 4y + 4z - 6 = 0$
26. $3\hat{i} + 8\hat{j} + 3\hat{k}, -3\hat{i} - 7\hat{j} + 6\hat{k}$ 29. D 30. D
31. A 32. D 33. D 34. A
35. D 36. C 37. $\frac{x}{2} + \frac{y}{3} + \frac{z}{4} = 1$
38. $\frac{2}{3}, \frac{2}{3}, \frac{-1}{3}$ 39. $(x-5)\hat{i} + (y+4)\hat{j} + (z-6)\hat{k} = \lambda(3\hat{i} + 7\hat{j} + 2\hat{k})$
40. $(x-3)\hat{i} + (y-4)\hat{j} + (z+7)\hat{k} = \lambda(-2\hat{i} - 5\hat{j} + 13\hat{k})$ 41. $x + y - z = 2$
42. True 43. True 44. False 45. False
46. True 47. True 48. False 49. True

12.3 EXERCISE

1. 42 2. 4 3. 47 4. -30
5. 196 6. 43 7. 21 8. 47
9. Minimum value = 3 10. Maximum = 9, minimum = $3\frac{1}{7}$

- 11.** Maximise $Z = 50x + 60y$, subject to:
 $2x + y \leq 20, x + 2y \leq 12, x + 3y \leq 15, x \geq 0, y \geq 0$
- 12.** Minimise $Z = 400x + 200y$, subject to:
 $5x + 2y \geq 30$
 $2x + y \leq 15$
 $x \leq y, x \geq 0, y \geq 0$
- 13.** Maximise $Z = 100x + 170y$ subject to :
 $3x + 2y \leq 3600, x + 4y \leq 1800, x \geq 0, y \geq 0$
- 14.** Maximise $Z = 200x + 120y$ subject to :
 $x + y \leq 300, 3x + y \leq 600, y \leq x + 100, x \geq 0, y \geq 0$
- 15.** Maximise $Z = x + y$, subject to
 $2x + 3y \leq 120, 8x + 5y \leq 400, x \geq 0, y \geq 0$
- 16.** Type A : 6, Type B : 3; Maximum profit = Rs. 480
- 17.** 2571.43 **18.** 138600
- 19.** 150 sweaters of each type and maximum profit = Rs 48,000
- 20.** $54\frac{2}{7}$ km. **21.** $3\frac{10}{11}$
- 22.** Model X : 25, Model Y : 30 and maximum profit = Rs 40,000
- 23.** Tablet X : 1, Tablet Y : 6 **24.** Factory I : 80 days, Factory II : 60 days
- 25.** Maximum : 12, Minimum does not exist
- 26.** B **27.** B **28.** A **29.** D
- 30.** C **31.** D **32.** D **33.** A
- 34.** B **35.** Linear constraints **36.** Linear **37.** Unbounded
- 38.** Maximum **39.** Bounded **40.** Intersection **41.** Convex
- 42.** True **43.** False **44.** False **45.** True

13.3 EXERCISE

1. Independent 2. not independent 3. 1.1 4. $\frac{25}{56}$
5. $P(E) = \frac{1}{12}$, $P(F) = \frac{5}{18}$, $P(G) = \frac{7}{36}$, no pair is independent
7. (i) $\frac{3}{4}$, (ii) $\frac{1}{2}$, (iii) $\frac{1}{4}$, (iv) $\frac{5}{8}$ 8. $\frac{3}{4}$, $\frac{3}{10}$
9. (i) E_1 and E_2 occur
 (ii) E_1 does not occur, but E_2 occurs
 (iii) Either E_1 or E_2 , or both E_1 and E_2 occurs
 (iv) Either E_1 or E_2 occurs, but not both
10. (i) $\frac{1}{3}$, (ii) $\frac{23}{18}$ 12. $\frac{\sqrt{3}}{2}$ 13. Rs 0.50 14. $\frac{1}{10}$
15. Expectation = Rs 0.65 16. $\frac{85}{153}$ 17. $\frac{7}{15}$
18. $\frac{5}{9}$ 19. $\frac{1}{270725}$ 20. $\frac{5}{16}$ 21. $\frac{7}{128}$
22. $\frac{4547}{8192}$ 23. $1 - \left(\frac{9}{10}\right)^8$ 24. (i) .1118 (ii) .4475
25. (i) $\frac{8}{15}$, (ii) $\frac{14}{15}$, $\frac{1}{15}$, (iii) 1 26. 0.7 (approx.) 27. 0.18
28. $\frac{1}{2}$ 29.

X	0	1	2
P(X)	.54	.42	.04
31. (i) $\left(\frac{49}{50}\right)^{10}$ (ii) $\frac{45(49)^8}{(50)^{10}}$ (iii) $\frac{59(49)^9}{(50)^{10}}$

32. $\frac{1}{3}$

33. $\frac{9}{44}$

34. $\frac{p-1}{n-1}$

35.

X	1	2	3	4	5	6
P(X)	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{1}{36}$

36. $p = \frac{1}{2}$

37. $\frac{665}{324}$

38. $\frac{775}{7776}$

39. not independent

41. (i) $\frac{7}{18}$, (ii) $\frac{11}{18}$

42. (i) $\frac{2}{11}$, (ii) $\frac{9}{11}$

43. (i) 0.49, (ii) 0.65, (iii) .314

44. $\frac{7}{11}$

45. $\frac{11}{21}$

46. $\frac{1}{3}$

47. $\frac{110}{221}$

48. $\frac{5}{11}$

49. (i) $\frac{1}{50}$, (ii) 5.2, (iii) 1.7 (approx.)

50. (i) 3, (ii) 19.05

51. (i) 4.32, (ii) 61.9, (iii) $\frac{15}{22}$

52. 10

53. Mean = $\frac{2}{13}$, S.D. = 0.377

54. $\frac{1}{2}$

55. Mean = 6, Variance = 3

56. C

57. A

58. D

59. C

60. C

61. D

62. B

63. D

64. C

65. D

66. D

67. D

68. C

69. D

70. D

71. D

72. C

73. C

74. C

75. B

76. B

77. D

78. C

79. A

80. D

81. B

82. C

83. C

84. A

85. B

86. A

87. C

88. D

89. D

90. A

91. B

92. D 93. D 94. False 95. True
96. False 97. False 98. True 99. True
100. True 101. True 102. False 103. True
104. $\frac{1}{3}$ 105. $\frac{10}{9}$ 106. $\frac{1}{10}$
107. $\sum p_i x_i^2 - (\sum p_i x_i)^2$ 108. independent

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