1. The relation
$R = \{(4,4)(4,5),(5,7),(4,8),(5,5),(7,8),(7,7),(7,5),(8,8),(8,7),(8,5),(9,9)\}$ on the set
$A=\{4,5,7,8,9\}$ is

A) transitive

B) symmetric

C) reflexive

D) equivalence relation

E) a function

Correct Answer : Option C

2. Let $A =\{ 1,2,3,4\}$ and $B =\{ 7,8,3,4\}$ Then the number of elements common to both $A \times B$ and
$B \times A$ is

A) 8

B) 6

C) 12

D) 4

E) 2

Correct Answer : Option D

3. The range of the function $f(x) = log_e\left(4x^2 - 4x + 1\right)$, where $x \neq \frac{1}{2}$ is

A) $(-\infty, 0)$

B) $[0, \infty)$

C) $(0, \infty)$

D) $(-\infty, 0)$

E) $(-\infty, \infty)$

Correct Answer : Option E

4. The domain of the function $f(x) = \sqrt{x^2 + 2x - 15}$ is

A) $(-\infty, -5) \cup (3, \infty)$

B) $(-\infty, -5) \cup [3, \infty)$

C) $(-\infty, -5] \cup (3, \infty)$

D) $(-\infty, -5] \cup [3, \infty)$

E) $[-5, 3]$

Correct Answer : Option D

5. All the points in $A = \left\{ \dfrac{\lambda + i}{\lambda - i}; \lambda \in \mathbb{R} \right\}$ lie on

A) a circle with radius $\sqrt{2}$

B) a circle with radius 2

C) a circle with radius $\dfrac{1}{2}$

D) a circle with radius 1

E) a straight line with slope 1

Correct Answer : Option D

6. $\displaystyle\sum_{n=1}^{2025} i^n (1 + i), i^2 = -1$,is equal to

A) $i + 1$

B) $i - 1$

C) $-i - 1$

D) $-i + 1$

E) $-i$

Correct Answer : Option B

7. If $x, y \in \mathbb{R}$ and $x + iy = -(6 + i)^3, i^2 = -1$, then $x - y$ is equal to

A) 93

B) -93

C) 91

D) -91

E) -107

Correct Answer : Option D

8. Let $z = x + iy$, where $x, y \in \mathbb{R}$ and $i^2 = -1$. If $|z - i| = |z - 1|$, then $y =$

A) $-x$

B) $x + 1$

C) $-x - 1$

D) $x + 2$

E) x

Correct Answer : Option E

9. If a, b, c are real numbers such that $(a - 2)^2 + (b - 2)^2 + (c - 2)^2 = 0$

A) a, b, c are in G.P. and $a + b + c = 6$

B) a, b, c are in G.P. and $a + b + c = 4$

C) a, b, c are not in G.P.

D) a, b, c are in G.P. and $a + b + c = 8$

E) a, b, c are not in G.P. and $a + b + c = 16$

Correct Answer : Option A

10. Let $a, \dfrac{3}{4}, ar^2, ar^3, \ldots$ be in G.P. where $r > 0$ If the product of first four terms of the G.P. is $\dfrac{3^6}{4^5}$ then a is equal to

A) $\dfrac{3}{2}$

B) $\dfrac{2}{3}$

C) $\dfrac{1}{3}$

D) $\dfrac{1}{2}$

E) 1

Correct Answer : Option D

11. Let $a_1, a_2, \ldots, a_n$ be positive non-zero real numbers. If $a_1, a_2, \ldots, a_n = k$ then the minimum value of $a_1 + a_2 + \ldots + a_n$ is

A) $n(k)^{2/n}$

B) $n(k)^{1/n}$

C) $(k)^{1/n}$

D) $(k)^{2/n}$

E) $2n(k)^{2/n}$

Correct Answer:-Question Cancelled

12. Let λ be the A.M. between α and β and also G.M. between α and β. Then $\alpha^2 + \beta^2 =$

A) $3\alpha\beta$

B) $\dfrac{1}{2}\alpha\beta$

C) $\alpha\beta$

D) $4\alpha\beta$

E) $2\alpha\beta$

Correct Answer : Option E

13. The number of integers greater than 7000 using 2,4,6,7,8 without repetition, is

A) 168

B) 336

C) 196
D) 256
E) 512

Correct Answer : Option A

14. The coefficient of x^9 in the expansion of $\left(4-\dfrac{x^2}{4}\right)^{12}$ is

A) $-^{12}C_7(4)^7(3)^5$

B) $^{12}C_7(4)^7(3)^5$

C) $^{12}C_6(4)^6(3)^6$

D) $^{12}C_5(4)^5(3)^7$

E) 0

Correct Answer : Option E

15. Five digit number is formed using the digits 0,1,2,3,4 and 5 without repetitions. Number of five digit numbers which are divisible by 10 is

A) 360
B) 240
C) 120
D) 480
E) 520

Correct Answer : Option C

16. The constant term in the expansion of $\left(2x^2-\dfrac{1}{x^2}\right)^6$ is

A) -160
B) 160
C) -180
D) 180
E) 0

Correct Answer : Option A

17. If n is a positive integer and the coefficient of x in the expansion of $\left(x^2+\dfrac{1}{x^3}\right)^n$ is $^nC_7$, then n is equal to

A) 18
B) 16
C) 17
D) 21
E) 19

Correct Answer : Option A

18. Let $A = (a_{ij})_{3 \times 3}, B = (b_{ij})_{3 \times 2}$ and $C = (c_{ij})_{3 \times 1}$. Which one of the following products, is not defined ?

A) $C^T AB$

B) $A^T AB$

C) $(AB)^T C$

D) $(AB)C$

E) $B^T C$

Correct Answer : Option D

19. Let A be a square matrix of order 3 and $|A| = 9$ Then $|adj(adjA)| =$

A) 6561

B) 6564

C) 6569

D) 8187

E) 8164

Correct Answer : Option A

20. If $\begin{vmatrix} 1 & 0 & 0 \\ x & x+2 & 0 \\ x^2 & x & x+3 \end{vmatrix} = 0$, then value of x are

A) 2,3

B) -2,3

C) -2,-3

D) 1,2,3

E) -1,2,-3

Correct Answer : Option C

21. Let $A = \begin{pmatrix} 0 & 2 \\ 3 & 4 \end{pmatrix}$, $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. If $(I + A)\begin{pmatrix} 4 & -3 \\ 2 & -1 \end{pmatrix} = \begin{pmatrix} 8 & -5 \\ 22 & x \end{pmatrix}$, then the value of x is equal to

A) 14

B) -14

C) 12

D) -12

E) 15

Correct Answer : Option B

22. The solution set for $-12x > 38$, where x is a natural number, is

A) {1,2,3}

B) {1,2}

C) {1}

D) empty set

E) {-1,-2,-3}

Correct Answer : Option D

23. Let x be a real number such that $x + \frac{x}{4} + \frac{x}{3} < 13$ .Then the solution set is

A) $\left(-\infty, \frac{156}{19}\right)$

B) $\left(\frac{156}{19}, \infty\right)$

C) $\left(\frac{154}{19}, \infty\right)$

D) $\left(-\infty, \frac{154}{17}\right)$

E) $\left(\frac{-156}{19}, \frac{156}{19}\right)$

Correct Answer : Option A

24. $cos75°cos45°cos15° =$

A) $\frac{1}{3\sqrt{2}}$

B) $\frac{1}{\sqrt{2}}$

C) $\frac{1}{4\sqrt{2}}$

D) $\frac{1}{2\sqrt{3}}$

E) $\frac{2}{\sqrt{3}}$

Correct Answer : Option C

25. If $\alpha + \beta + v = 2\pi$, then $\tan\frac{\alpha}{2} + tan\frac{\beta}{2} + tan\frac{v}{2} =$

A) $\tan\frac{\alpha}{2} tan\frac{\beta}{2} tan\frac{v}{2}$

B) $-\tan\frac{\alpha}{2} tan\frac{\beta}{2} tan\frac{v}{2}$

C) $2\tan\frac{\alpha}{2} tan\frac{\beta}{2} tan\frac{v}{2}$

D) $3\tan\frac{\alpha}{2} tan\frac{\beta}{2} tan\frac{v}{2}$

E) $4 \tan \frac{\alpha}{2} tan \frac{\beta}{2} tan \frac{v}{2}$

Correct Answer : Option A

26. $\tan (315°) \cot (-405°) =$

A) -1

B) 1

C) $\frac{1}{\sqrt{2}}$

D) $\frac{\sqrt{3}}{2}$

E) $\frac{1}{2}$

Correct Answer : Option B

27. $\dfrac{sin \frac{\pi}{7} + sin \frac{2\pi}{7}}{1 + cos \frac{\pi}{7} + cos \frac{2\pi}{7}} =$

A) $cot \dfrac{\pi}{7}$

B) $cos \dfrac{\pi}{14}$

C) $1 + sin \dfrac{\pi}{14}$

D) $1 + cos \dfrac{\pi}{14}$

E) $tan \dfrac{\pi}{7}$

Correct Answer : Option E

28. $\sec\left(\cos^{-1}\left(\dfrac{2024}{2025} \right) \right)$ is equal to

A) $\dfrac{2024}{2025}$

B) $\dfrac{2025}{2024}$

C) $\dfrac{1}{2025}$

D) $\dfrac{-1}{2025}$

E) $\dfrac{-2025}{2024}$

Correct Answer : Option B

29. If $\sec^{-1}\left(\dfrac{x}{x+2}\right) = \dfrac{\pi}{2} - \csc^{-1}\left(\dfrac{1}{2}\right)$, then $x =$

A) -2

B) -4

C) 2

D) 4

E) -1

Correct Answer:-Question Cancelled

30. $\tan^{-1}\left(\dfrac{1001}{999}\right) - \tan^{-1}\left(\dfrac{2}{2000}\right) =$

A) $\dfrac{\pi}{3}$

B) π

C) 1

D) $\dfrac{\pi}{6}$

E) $\dfrac{\pi}{4}$

Correct Answer : Option E

31. Let $a \neq 1$ be non-zero real number. If the lines $2x + ay = 1$ and $x + 2y = 1$ are perpendicular, then the value of a is equal to

A) 1

B) -2

C) 2

D) -1

E) $-\dfrac{1}{2}$

Correct Answer : Option D

32. Let $P(1, 2), Q(a, b), R(5, 7)$ and $S(2, 3)$ be the vertices of a parallelogram PQRS . Then

A) $a = 4, b = 2$

B) $a = 6, b = 2$

C) $a = 6, b = 4$

D) $a = 3, b = 2$

E) $a = 4, b = 6$

Correct Answer : Option E

33. Which one of the following lines, passes through the point of intersection of $x + y = 5$ and $2x + y = 7$?

A) $4x + 3y = -1$

B) $3x + 2y = 7$

C) $4x - 3y = -1$
D) $4x + 3y - 2 = 0$
E) $4x + 3y + 3 = 0$

Correct Answer : Option C

34. The axis of a parabola is $x = 0$. If the vertex is at a distance 3 from the origin above the x-axis. The vertex of the parabola is at

A) (3,0)
B) (-3,0)
C) (3,-3)
D) (3,3)
E) (0,3)

Correct Answer : Option E

35. Length of the Latus rectum of the ellipse $\dfrac{x^2}{9} + \dfrac{y^2}{16} = 1$ is

A) $\dfrac{3}{2}$
B) 8
C) $\dfrac{9}{2}$
D) 2
E) $\dfrac{25}{2}$

Correct Answer : Option C

36. The centre of the ellipse $4x^2 + 24x + 9y^2 - 18y + 9 = 0$ is

A) $(1, 3)$
B) $(1, -3)$
C) $(3, -1)$
D) $(-3, 1)$
E) $(3, -3)$

Correct Answer : Option D

37. The line $x - y + 4 = 0$ touches the ellipse $x^2 + 3y^2 = 12$ at

A) (1,3)
B) (3,1)
C) (0,2)
D) (0,-2)
E) (-3,1)

Correct Answer : Option E

38. Let $\vec{OA} = 2\hat{i} + 3\hat{j} - 5\hat{k}$, $\vec{OB} = 3\hat{i} + \hat{j} - 2\hat{k}$; $\vec{OC} = 6\hat{i} - 5\hat{j} + 7\hat{k}$ be the position vectors of the points ,A B and C. Then

A) $\vec{AC} = 3\vec{AB}$

B) $\vec{AB} = 3\vec{BC}$

C) $\vec{AC} = 2\vec{AB}$

D) $\vec{AB} = 3\vec{BC}$

E) $\vec{AC} = 4\vec{AB}$

Correct Answer : Option E

39. Let $\vec{AB} = 2\hat{i} + 10\hat{j} + 11\hat{k}$ and $\vec{AC} = -\hat{i} + 2\hat{j} + 2\hat{k}$ .If θ is the angle between $\vec{AB}$ and $\vec{AC}$ then sinθ=

A) $\dfrac{\sqrt{13}}{9}$

B) $\dfrac{\sqrt{15}}{9}$

C) $\dfrac{\sqrt{14}}{9}$

D) $\dfrac{\sqrt{17}}{9}$

E) $\dfrac{4}{9}$

Correct Answer : Option D

40. Let $\vec{a} \times (2\hat{i} + 3\hat{j} + 4\hat{k}) = (2\hat{i} + 3\hat{j} + 4\hat{k}) \times \vec{b}$. If $|\vec{a} + \vec{b}| = \sqrt{29}$,then $\vec{a} + \vec{b} =$

A) $(2\hat{i} + 3\hat{j} - 4\hat{k})$

B) $-(2\hat{i} + 3\hat{j} - 4\hat{k})$

C) $\pm(2\hat{i} + 3\hat{j} + 4\hat{k})$

D) $\pm(2\hat{i} - 3\hat{j} + 4\hat{k})$

E) $\pm\sqrt{29}(2\hat{i} + 3\hat{j} + 4\hat{k})$

Correct Answer : Option C

41. Let $\vec{a} = \hat{i} + 2\hat{j} + 4\hat{k}$,$\vec{b} = 2\hat{i} + 4\hat{j} + 8\hat{k}$ and $\vec{c} = 2\hat{i} + 4\hat{j} + 3\hat{k}$ .Then $(\vec{a} \times \vec{b}) . \vec{c} =$

A) 4

B) 6

C) 8

D) 2

E) 0

Correct Answer : Option E

42. The point of intersection of the lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-11}{4}$ and $\frac{x-3}{1} = \frac{y-\frac{9}{2}}{2} = \frac{z}{1}$ is

A) $\left(-2, \frac{11}{2}, 5\right)$

B) $\left(-2, \frac{11}{2}, -5\right)$

C) $\left(-2, \frac{-11}{2}, -5\right)$

D) $\left(-2, \frac{11}{4}, -5\right)$

E) $\left(-2, \frac{-11}{5}, \frac{-5}{2}\right)$

Correct Answer:-Question Cancelled

43. The equation of the line passing through $(0, 0, 1)$ and $(1, 1, 0)$ is

A) $\vec{r} = \hat{k} + \lambda\left(\hat{i} + \hat{j} - \hat{k}\right), \lambda \in \mathbb{R}$

B) $\vec{r} = \hat{j} + \lambda\left(\hat{i} - \hat{j} + \hat{k}\right), \lambda \in \mathbb{R}$

C) $\vec{r} = \hat{i} + \lambda\left(\hat{i} + \hat{j} + \hat{k}\right), \lambda \in \mathbb{R}$

D) $\vec{r} = \hat{i} + \hat{j} + \lambda\left(\hat{i} - \hat{j} - \hat{k}\right), \lambda \in \mathbb{R}$

E) $\vec{r} = \hat{i} + \hat{j} + \hat{k} + \lambda\left(\hat{i} + \hat{j} - \hat{k}\right), \lambda \in \mathbb{R}$

Correct Answer : Option A

44. Which one of the following is a vector parallel to the straight line
$\vec{r} = \left(\hat{i} - 11\hat{j} + 101\hat{k}\right) + \lambda\left(3\hat{i} - 5\hat{j} + 2\hat{k}\right), \lambda \in \mathbb{R}$

A) $-3\hat{i} + 5\hat{j} - 2\hat{k}$

B) $3\hat{i} + 5\hat{j} + 2\hat{k}$

C) $\hat{i} - 11\hat{j} + 101\hat{k}$

D) $-\hat{i} + 11\hat{j} + 101\hat{k}$

E) $-4\hat{i} - 16\hat{j} + 103\hat{k}$

Correct Answer : Option A

45. A straight line through the point (1,-1,0) meets the line $\frac{x-1}{1} = \frac{y+1}{1} = \frac{z-1}{-1}$ at right angle. It's equation is

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

B) $\dfrac{x-1}{1} = \dfrac{y-1}{1} = \dfrac{z}{4}$

C) $\dfrac{x-1}{-1} = \dfrac{y-1}{1} = \dfrac{z}{6}$

D) $\dfrac{x-1}{-1} = \dfrac{y-1}{-1} = \dfrac{z}{3}$

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

Correct Answer : Option A

The mean deviation about the mean for the following data

46.

x	:	2	4	6	10
f	:	7	4	5	4

A) 2

B) 2.5

C) 4

D) 6

E) 5

Correct Answer : Option B

47. If $P(A) = 0.7, P(B) = 0.5$ and $P(A \cup B) = 0.9$. Then $P(A / B)$ is

A) 0.3

B) 0.4

C) 0.5

D) 0.6

E) 0.7

Correct Answer : Option D

48. The variance of 240, 260, 270, 280 is

A) $\dfrac{475}{4}$

B) $\dfrac{475}{2}$

C) $\dfrac{475}{8}$

D) $\dfrac{475}{16}$

E) $\dfrac{875}{4}$

Correct Answer : Option E

49. Four unbiased coins are tossed simultaneously. Probability of getting atmost two heads, is

A) $\dfrac{5}{8}$

B) $\dfrac{9}{16}$

C) $\dfrac{11}{16}$

D) $\dfrac{13}{16}$

E) $\dfrac{15}{16}$

Correct Answer : Option C

50. $\lim\limits_{x \to 0} \dfrac{sin(\pi\ sin^2 x)}{x^2} =$

A) $\dfrac{\pi}{2}$

B) π

C) 2π

D) π^2

E) $\dfrac{\pi^2}{2}$

Correct Answer : Option B

51. If $[x]$ is the greatest integer less than or equal to x, then $\lim\limits_{x \to 0^-} \dfrac{sin[x]}{[x]}$ is equal to

A) 1

B) sin 1

C) -1

D) 0

E) -sin 1

Correct Answer : Option B

52. $\lim\limits_{x \to 2} \dfrac{(x^3-8)sin(x-2)}{x^2-4x+4}$ is equal to

A) 4

B) 8

C) 12

D) -8

E) -12

Correct Answer : Option C

53. $\lim\limits_{x \to 0} \dfrac{x\cos^2 x}{\sin x}$ is equal to

A) 4

B) 2

C) -2

D) 0

E) 1

Correct Answer : Option E

54. Let $[a]$ be the greatest integer less than or equal to a, then $\lim\limits_{x \to 0^+} x\left\{ \left[\dfrac{1}{x} \right] + \left[\dfrac{2}{x} \right] \right\}$ is equal to

A) 2

B) 1

C) 3

D) 0

E) 4

Correct Answer : Option C

55. If $f(x) = sin(\,|\,x\,|\,) - \,|\,x\,|\,, x \in \mathbb{R}$, then f is

A) not differentiable at $x = \dfrac{\pi}{6}$

B) not differentiable at $x = \dfrac{\pi}{2}$

C) not differentiable at $x = \dfrac{\pi}{4}$

D) not differentiable at $x = \pi$

E) not differentiable at $x = 0$

Correct Answer:-Question Cancelled

56. The function $f(x) = \,|\,x^2 - 3x + 2\,|\,, x \in \mathbb{R}$ is not differentiable at

A) $x = 1$ and $x = 3$

B) $x = 1$ and $x = 2$

C) $x = 2$ and $x = 4$

D) $x = 4$ and $x = 5$

E) $x = -1$ and $x = -2$

Correct Answer : Option B

57. If $e^y + x^2 y + xy^2 = e^2$, then $\dfrac{dy}{dx}$ at (0,1) is equal to

A) $\dfrac{1}{e}$

B) e

C) $-e$

D) $\dfrac{2}{e}$

E) $\dfrac{-1}{e}$

Correct Answer : Option E

58. If $f(x) = x \mid x\mid$, then $f'(-10)=$

A) -20

B) -10

C) -40

D) 20

E) 40

Correct Answer : Option D

59. If $y = (\tan x)^x$, then $\dfrac{1}{y}\dfrac{dy}{dx} =$

A) $log(\tan x) + 2x\,cosec(2x)$

B) $log(tanx) + x\,\,cosec(2x)$

C) $x\,log(\tan x) + 2x cosec(2x)$

D) $x log(\tan x) + x^2 cosec(2x)$

E) $log(tanx) + \dfrac{x}{2} cosec(2x)$

Correct Answer : Option A

60. The minimum of $f(x) = \mid x+2\mid$, $x \in \mathbb{R}$ occurs at

A) $x = 0$

B) $x = 2$

C) $x = 1$

D) $x = -2$

E) $x = -1$

Correct Answer : Option D

61. If $g(x) = x^2 - x, x \in \mathbb{R}$, then $g(x)$ is increasing in

A) $(-\infty, \infty)$

B) $(-\infty, 0)$

C) $(0, -\infty)$

D) (-5,5)

E) $\left[\dfrac{1}{2}, \infty\right)$

Correct Answer : Option E

62. The distance travelled by a moving particle is given by $s = t^2 - 6t + 10$, where t is the time in seconds. The particle is at rest when $t =$

A) 1
B) 4
C) 6
D) 3
E) 8

Correct Answer : Option D

63. The maximum value of the function $f(x) = x\sqrt{4x - x^2}$ is

A) $\sqrt{3}$
B) $4\sqrt{3}$
C) $5\sqrt{3}$
D) $3\sqrt{3}$
E) $6\sqrt{3}$

Correct Answer : Option D

64. $\int \frac{sin2x}{sinx} dx =$

A) $sinx + C$
B) $2cosx + C$
C) $-cosx + C$
D) $-sinx + C$
E) $2sinx + C$

Correct Answer : Option E

65. $\int \frac{log(1+x)}{(1+x)} dx =$

A) $\frac{1}{2} log(1 + x) + C$

B) $\frac{1}{2}[log(1 + x)]^2 + C$

C) $[log(1 + x)]^2 + C$
D) $log(1 + x) + C$
E) $x\, log(1 + x) + C$

Correct Answer : Option B

66. $\int \frac{cos\,\theta}{2 - sin^2\,\theta} d\theta =$

A) $\frac{1}{2} log\left|\frac{\sqrt{2} - sin\,\theta}{\sqrt{2} + sin\,\theta}\right| + C$

B) $\frac{1}{2}\log\left|\frac{\sqrt{2}+\sin\theta}{\sqrt{2}-\sin\theta}\right|+C$

C) $\log\left|\frac{\sqrt{2}+\sin\theta}{\sqrt{2}-\sin\theta}\right|+C$

D) $\frac{1}{\sqrt{2}}\log\left|\frac{\sqrt{2}+\sin\theta}{\sqrt{2}-\sin\theta}\right|+C$

E) $\frac{1}{2\sqrt{2}}\log\left|\frac{\sqrt{2}+\sin\theta}{\sqrt{2}-\sin\theta}\right|+C$

Correct Answer : Option E

67. $\int\left(\sin^{-1}\sqrt{x}+\cos^{-1}\sqrt{x}\right)dx =$

A) $\frac{\pi}{2}+C$

B) $\frac{\pi x}{4}+C$

C) $\frac{\pi x}{3}+C$

D) $\frac{\pi x}{2}+C$

E) $\frac{-\pi x}{2}+C$

Correct Answer : Option D

68. $\int e^x\left[\frac{1}{1+x}-\frac{1}{(1+x)^2}\right]dx =$

A) $\frac{e^x}{1+x}+C$

B) $\frac{xe^x}{1+x}+C$

C) $e^x(1+x)^2+C$

D) $\frac{e^x}{(1+x)^2}+C$

E) $\frac{e^x}{1+x^2}+C$

Correct Answer : Option A

69. $\int_{3}^{5}\frac{1}{x(1+x)}dx =$

A) $\log\left(\frac{10}{9}\right)$

B) $\log(5)$

C) $\log(2)$

D) $\log\left(\dfrac{11}{9}\right)$

E) $\log\left(\dfrac{13}{9}\right)$

Correct Answer : Option A

70. If $[x]$ is the greatest integer less than or equal to x, then $\displaystyle\int_{-3}^{3}[x]\,dx =$

A) -3

B) -6

C) -4

D) -2

E) 0

Correct Answer : Option A

71. $\displaystyle\int_{-\pi/2}^{\pi/2}\left(x^5+x^3+x\right)\cos x\,dx =$

A) $\dfrac{\pi}{4}$

B) π

C) $\dfrac{2\pi}{3}$

D) $\dfrac{\pi}{2}$

E) 0

Correct Answer : Option E

72. $\displaystyle\int_{-\log 3}^{+\log 3} e^{|x|}\,dx =$

A) 3

B) 6

C) 4

D) 8

E) 0

Correct Answer : Option C

73. The integrating factor of the differential equation $\dfrac{dy}{dx}-2y=2x-3$ is

A) e^{2x}

B) $\dfrac{-1}{2}e^{-2x}$

C) $\frac{1}{2}e^{-2x}$

D) $\frac{1}{2}e^{-2x}$

E) e^{-2x}

Correct Answer : Option E

74. The elimination of arbitrary constants c_1, c_2, c_3, c_4 from $y = (c_1 + c_2)sin(2x + c_3) + c_4 e^{5x}$ gives a differential equation of order

A) 2

B) 4

C) 3

D) 1

E) 5

Correct Answer : Option C

75. Consider the linear programming problem.
Minimize $z = x + y$
Subject to the constraint
$2x + 3y \geq 6, x \geq 0, y \geq 0$
Then the solution of L.P.P. is

A) 0

B) 2

C) 3

D) 5

E) 6

Correct Answer : Option B

76. The dimensions of $\frac{mB}{kT}$ where m is the magnetic moment, B, the magnetic flux density, k, Boltzmann constant and T, the absolute temperature are:

A) $ML^{-1}T^{-1}$

B) ML^2T^{-1}

C) MLT^{-1}

D) $ML^{-2}T$

E) $M^0L^0T^0$

Correct Answer : Option E

77. The SI unit of surface tension is

A) Nm^{-1}
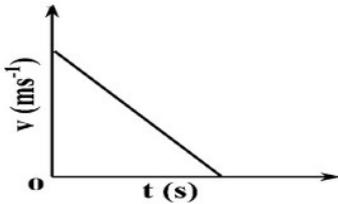
B) Nm^{-2}

C) Nm^2

D) Nm

E) N

Correct Answer : Option A

78. A car starting from rest moves such that its acceleration varies with time as a = 6t (ms^{-2}) . Its velocity (in ms^{-1}) and displacement (in m) after 4 seconds, respectively, are

A) 48, 64

B) 16, 24

C) 16, 38

D) 24, 32

E) 32, 24

Correct Answer : Option A

For the graph shown below between time t and velocity v of the motion of a body, the correct statement is:

79.

A) The body comes to rest at infinite time

B) At t = 0, acceleration is positive

C) At t = 0, acceleration is negative

D) At t = 0, the body has maximum velocity

E) The displacement of the particle is zero.

Correct Answer : Option D

80. The coefficient of friction is defined as the ratio of

A) frictional force to applied force

B) frictional force to normal force

C) normal force to frictional force

D) weight of the object to frictional force

E) applied force to frictional force

Correct Answer : Option B

81. A tennis ball of mass 150 g is moving at 20 ms^{-1} . A racket strikes it, reversing its direction with a final speed of 30 ms^{-1} . If the contact time is 0.02 s, then the magnitude of the force (in N) exerted by the racket is

A) 1.5 N

B) 3.75 N

C) 15 N

D) 150 N

E) 375 N

Correct Answer : Option E

82. A traffic light of mass 10 $\sqrt{3}$ kg is suspended by two cables making 30° with the vertical. The tension in each cable is:

A) 10 N

B) 9.8 N

C) 98 N

D) 19.6 N

E) 20 N

Correct Answer : Option C

83. A car moves at a speed of 20 ms^{-1} under a force of 500 N. The power output of the car is

A) 9.8 kW

B) 980 kW

C) 98 kW

D) 10 kW

E) 100 kW

Correct Answer : Option D

84. A spring is stretched twice its initial extension. Compared to its initial value, the potential energy

A) becomes four times

B) is doubled

C) is halved

D) remains the same

E) becomes zero

Correct Answer : Option A

85. If a spinning object contracts, its angular velocity

A) remains the same

B) becomes zero

C) becomes negative

D) increases

E) decreases

Correct Answer : Option D

86. A boy whirls a ball on a string along a horizontal circle of radius 98 cm. The angular velocity (in rad s^{-1}) with which the ball has to be whirled so that its acceleration towards the centre of the circle has the same magnitude as acceleration due to gravity is

A) $\sqrt{10}$

B) $\dfrac{1}{\sqrt{10}}$

C) 10

D) 0.1

E) 100

Correct Answer : Option A

87. The centre of mass of a thin uniform rod of length L lies at a distance (from one end)

A) $\dfrac{2L}{3}$

B) $\dfrac{3L}{4}$

C) $\dfrac{L}{2}$

D) $\dfrac{L}{3}$

E) $\dfrac{L}{4}$

Correct Answer : Option C

88. The ratio of the escape velocity to the orbital velocity of the earth is

A) 2

B) $\sqrt{2}$

C) $\dfrac{1}{\sqrt{2}}$

D) $\dfrac{1}{2}$

E) $\sqrt{3}$

Correct Answer : Option B

89. The gravitational potential energy of a body of mass m on the surface of earth of mass M and radius R is (G - Gravitational constant)

A) $\dfrac{-GMm}{R}$

B) $\dfrac{GMm}{R}$

C) mgR

D) -mgR

E) Zero

Correct Answer:-Question Cancelled

90. In a liquid medium, if the depth increases, the pressure at that place

A) decreases

B) increases

C) remains constant

D) depends on the shape of the container

E) is zero

Correct Answer : Option B

91. The angle of contact is the angle between

A) the normals to the liquid surface and the container wall

B) the liquid surface and the container wall

C) the tangent to the liquid surface and solid surface within the liquid at the point of contact

D) the liquid surface and solid surface outside the liquid

E) the line joining the centres of curvature of the liquid meniscus

Correct Answer : Option C

92. Water flows at 3 ms^{-1} in a horizontal pipe under a pressure of 2 × 10^5 Nm^{-2} The pipe narrows to half its original diameter at one end. The speed of water (in ms^{-1}) in this narrow section is

A) 3

B) 4

C) 6

D) 12

E) 24

Correct Answer : Option D

93. A Carnot engine is working between 127 °C and 27 °C. Keeping the sink temperature unaltered, the temperature at which the source has to be kept so as to double its efficiency is

A) 400°C

B) 273 °C

C) 327°C

D) 525 °C

E) 600°C

Correct Answer : Option C

94. The ratio of specific heat capacities of a diatomic gas at constant pressure and constant volume is

A) 1.4

B) 1.6

C) 1.7

D) 1.8

E) 1.5

95. The translational kinetic energy of an ideal gas containing N molecules at temperature T is (k - Boltzmann constant)

A) $\dfrac{5}{2} NkT$

B) $\dfrac{1}{2} NkT$

C) $\dfrac{3}{2} NkT$

D) $\dfrac{7}{2} NkT$

E) $\dfrac{9}{2} NkT$

96. For an ideal gas of molar mass M, the slope of the plot between the rms velocity (v_{rms} along the y-axis) and the square root of absolute temperature ($\sqrt{T}$ along the x-axis) is

A) $\sqrt{\dfrac{M}{3R}}$

B) $\sqrt{\dfrac{3R}{M}}$

C) $\sqrt{\dfrac{R}{3M}}$

D) $\dfrac{R}{3M}$

E) $\dfrac{3R}{M}$

97. In a simple harmonic motion,
A) the velocity is constant
B) the motion is periodic
C) the acceleration is directly proportional to velocity
D) the acceleration is along the direction of displacement
E) the motion must be along a straight line

98. The principle of superposition in wave motion states that
A) the net displacement is the vector sum of individual displacements
B) waves interfere with each other and lose energy
C) waves cannot occupy the same space at the same time
D) it is applicable to sound waves only

E)   it is applicable to standing waves only

Correct Answer : Option A

99. The number of nodes and antinodes in a guitar string vibrating in the third harmonic is:
A)   5 nodes, 4 antinodes
B)   4 nodes, 3 antinodes
C)   3 nodes, 2 antinodes
D)   2 nodes, 3 antinodes
E)   1 node, 2 antinodes

Correct Answer : Option B

100. The electric field inside a uniformly charged spherical shell of radius R is:
A)   directly proportional to the charge within the shell
B)   inversely proportional to R^2
C)   same as that outside the shell
D)   zero
E)   maximum at the centre

Correct Answer : Option D

101. The torque on an electric dipole consisting of charges q and -q of dipole moment **P** in a uniform electric field **E** is
A)   q**E**
B)   -q**E**
C)   Zero
D)   **P.E**
E)   **P × E**

Correct Answer : Option E

102. The direction of the electric field due to a positive charge is:
A)   circular around the charge
B)   radially inwards towards the charge
C)   radially outwards away from the charge
D)   along a fixed straight line away from the charge
E)   along a fixed straight line towards the charge

Correct Answer : Option C

103. A Wheatstone bridge is used to measure
A)   unknown resistances
B)   direct current
C)   alternating current
D)   electric power

E) voltage

Correct Answer : Option A

104. The current carrying rail of a subway track is made of steel and has a cross-sectional area of about 20 cm^2. The resistance of 2 km of the track is (in ohm) as a multiple of the specific resistance of steel, ρ is:

A) 10^2 ρ

B) 10^3 ρ

C) 10^4 ρ

D) 10^5 ρ

E) 10^6 ρ

Correct Answer : Option E

105. If n identical cells each of emf E and internal resistance r are connected in parallel, the total EMF and total internal resistance of the combination, respectively, are

A) nE, nr

B) E, nr

C) $E, \dfrac{r}{n}$

D) $nE, 2nr$

E) $nE, \dfrac{r}{n}$

Correct Answer : Option C

106. The line integral of the magnetic field around a closed loop is directly proportional to the:

A) current enclosed

B) charge enclosed

C) voltage across the loop

D) length of the loop

E) electric field around the loop

Correct Answer : Option A

107. The magnetic dipole moment of a current loop carrying current I and of area A with n turns is

A) $\dfrac{IA}{n}$

B) $\dfrac{IA}{n^2}$

C) $\dfrac{IA}{2}$

D) nIA

E) IA

Correct Answer : Option D

108. A galvanometer is converted into a voltmeter by connecting

A) a high resistance in series

B) a low resistance in series

C) a high resistance in parallel

D) a low resistance in parallel

E) an inductance in series

Correct Answer : Option A

109. The resistance of a semiconductor

A) increases with increase in temperature

B) decreases with increase in temperature

C) is independent of temperature

D) becomes infinite at high temperature

E) becomes zero at high temperature

Correct Answer : Option B

110. A metal rod of length 0.5 m moves with its length perpendicular to a uniform magnetic field of 0.2 T with a velocity of 3 ms^{-1} . The induced emf in the rod is

A) 0.1 V

B) 0.2 V

C) 0.3 V

D) 0.4 V

E) 0.6 V

Correct Answer : Option C

111. The speed of electromagnetic waves in a medium depends on the

A) intensity of the wave

B) initial phase of the wave

C) permittivity and permeability of the medium

D) energy it carries

E) reflectivity of the medium

Correct Answer : Option C

112. When a beam of white light enters into an optical prism, the most deviated colour is

A) green

B) violet

C) yellow

D) red

E) blue

Correct Answer : Option B

113. The phenomenon of diffraction is most significant when the slit width is
- **A)** much larger than the wavelength
- **B)** much smaller than the wavelength
- **C)** comparable to the wavelength
- **D)** equal to the screen distance
- **E)** independent of the wavelength

Correct Answer : Option C

114. In Huygens construction, the secondary wavelets move
- **A)** in all directions
- **B)** only radially outward
- **C)** only radially inward
- **D)** only in the backward direction of the incident light
- **E)** in a direction perpendicular to the direction of the incident light

Correct Answer : Option A

115. The plot of maximum kinetic energy of photo-electrons to the energy of the incident photon above its threshold frequency on a photo-sensitive material of work function φ is
- **A)** an oblique straight line with a positive slope.
- **B)** an oblique straight line with a negative slope.
- **C)** an oblique straight line passing through the origin.
- **D)** an exponential curve.
- **E)** a polynomial curve of order 2.
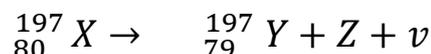
Correct Answer : Option A

116. The ratio of the respective de Broglie wavelengths of two particles with kinetic energy of 0.02 eV and 2 eV, respectively, is
- **A)** 1 : 1
- **B)** 10 : 1
- **C)** 1 : 10
- **D)** $1 : \sqrt{10}$
- **E)** $\sqrt{10} : 1$

Correct Answer : Option B

117. In the following nuclear reaction, Z is a/an

$$^{197}_{80} X \rightarrow \quad ^{197}_{79} Y + Z + v$$

- **A)** α particle
- **B)** $β^+$ particle

C) β^- particle

D) proton

E) neutron

Correct Answer : Option B

118. If a radioactive element disintegrates for a period of time equal to its mean life, then the fraction of the original amount remaining undisintegrated is

A) $e-$

B) $1-e$

C) $1-\dfrac{1}{e}$

D) $\dfrac{1}{e}$

E) $2e$

Correct Answer : Option D

119. In a Germanium crystal containing N atoms, the total number of outer electrons in the crystal is

A) N

B) 2 N

C) 3 N

D) 6 N

E) 4 N

Correct Answer : Option E

120. The donor level in an *n*-type semiconductor lies

A) just below the conduction band

B) exactly at the middle of the band gap

C) just below the valence band

D) just above the conduction band

E) on the valence band

Correct Answer : Option A

121. Ten grams of calcium carbonate which is only 90% pure is treated with excess hydrochloric acid. What is the mass of CO_2 gas liberated? (Atomic mass: Ca=40, C=12 & O=16)

A) 4.4g

B) 3.96g

C) 2.2g

D) 0.44g

E) 0.22g

Correct Answer : Option B

122. For any sub-shell defined by $'l'$ value how many values of magnetic quantum number (m_l) are possible?

A) *(2l)*

B) *(2l -1)*

C) *(2l +1)*

D) *(l +1)*

E) *(l-1)*

Correct Answer : Option C

123. What is the total number of orbitals associated with the principal quantum number n=3?

A) 3

B) 6

C) 9

D) 10

E) 14

Correct Answer : Option C

124. The alkali metal with the highest first enthalpy of ionization is

A) Cs

B) Rb

C) K

D) Na

E) Li

Correct Answer : Option E

125. Which one of the following molecules contains two 'sigma' bonds and two 'pi' bonds?

A) O_2

B) N_2

C) C_2H_2

D) CO_2

E) CO

Correct Answer : Option D

126. 12g of pure graphite is burnt completely in a bomb calorimeter in excess of oxygen at 298 K at 1 atm. pressure. During combustion, the temperature rises from 298 K to 308 K. The heat capacity of the bomb calorimeter is 20.7 kJ K^{-1} . What is the enthalpy change for combustion of 1 mole of graphite
(in kJ mol^{-1}) at 298 K and 1 atm. pressure? (R=8.3 JK^{-1} mol^{-1})

A) -2070
B) -207
C) +2070
D) +207
E) +2.07

Correct Answer : Option B

127. If water vapour is assumed to be a perfect gas, molar enthalpy change for vapourisation of 1 mol of water at 1bar and 100°C is 41kJ mol^{-1}. Calculate the internal energy change (in kJ mol^{-1}) when 1 mole of water is vaporized at 100°C at 1 bar assuming water vapour as an ideal gas. (R=8.3 JK^{-1}mol^{-1})

A) 43.1
B) 37.9
C) -43.1
D) -37.9
E) 41.0

Correct Answer : Option B

128. If "S" is the solubility of X_3Y_2 in pure water, assuming that neither kind of ion reacts with water, then, the solubility product, K_{sp} is

A) $27 S^4$
B) $108 S^5$
C) $108 S^2$
D) $27 S^6$
E) $27 S^2$

Correct Answer : Option B

129. In which of the following equilibrium $K_P = K_C$?

A) $CaCO_{3(s)} \leftrightharpoons CaO_{(s)} + CO_{2(g)}$
B) $2SO_{2(g)} + O_{2(g)} \leftrightharpoons 2SO_{3(g)}$
C) $PCl_{5(g)} \leftrightharpoons PCl_{3(g)} + Cl_{2(g)}$
D) $H_{2(g)} + I_{2(g)} \leftrightharpoons 2HI_{(g)}$
E) $N2O_{4(g)} \leftrightharpoons 2NO_{2(g)}$

Correct Answer : Option D

130. In the following cell reaction,

$Zn(s) + Cu^{2+}$ (0.1 M) $\leftrightharpoons Zn^{2+}$ (0.001 M) + $Cu(s)$, at 298 K,

Calculate the E_{cell} at 298 K if E^0_{cell} at this temperature is 1.1V. (2.303 RT/F = 0.059 V at 298 K)

A) 1.218 V

B) 1.118 V

C) 1.159 V

D) 1.041 V

E) 0.982 V

Correct Answer : Option C

131. For which of the following electrode reactions the standard electrode potential is the highest at 298 K? The ions are present in aqueous solution.

A) $Co^{3+} + e^- \rightarrow Co^{2+}$

B) $Cl_{2(g)} + 2e^- \rightarrow 2Cl^-$

C) $MnO_{2(s)} + 4H^+ + 2e^- \rightarrow Mn^{2+} + 2H_2O$

D) $F_{2(g)} + 2e^- \rightarrow 2F^-$

E) $AgCl_{(s)} + e^- \rightarrow Ag_{(s)} + Cl^-$

Correct Answer : Option D

132. The vapour pressure of pure benzene (molar mass=78 g mol^{-1}) at a certain temperature is 0.85 bar. When 0.5 g of a non-volatile, non-electrolyte is added to 39 g of benzene, the vapour pressure was found to be 0.845 bar at the same temperature. What is the molar mass of the substance?

A) 85 g mol^{-1}

B) 127.5 g mol^{-1}

C) 170 g mol^{-1}

D) 210 g mol^{-1}
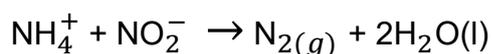
E) 145 g mol^{-1}

Correct Answer : Option C

133. A first order reaction is 75% completed in 6000 s at 300 K. What is its half life period at the same temperature? (log 2 = 0.3010)

A) 15 min

B) 25 min

C) 75 min

D) 50 min

E) 60 min

Correct Answer : Option D

134. Ammonium ion (NH$_4^+$) reacts with nitrite ion (NO$_2^-$) according to the following equation:

$NH_4^+ + NO_2^- \rightarrow N_{2(g)} + 2H_2O(l)$

The following initial rates of reaction have been measured for the given reactant

concentrations.

Experiment	$[NH_4^+]_0$,M	$[NO_2^-]_0$,M	Initial rate, M/hour
I	0.010	0.020	0.020
II	0.015	0.020	0.030
III	0.010	0.010	0.005

Which of the following is the rate law (rate equation) for this reaction?

A) Rate = $k[NH_4^+]^{1/2} [NO_2^-]$

B) Rate = $k[NH_4^+] [NO_2^-]$

C) Rate = $k[NH_4^+]^0 [NO_2^-]$

D) Rate = $k[NH_4^+] [NO_2^-]^{1/2}$

E) Rate = $k[NH_4^+] [NO_2^-]^2$

Correct Answer : Option E

135. Acidified potassium dichromate cannot oxidize

A) Iodides to iodine

B) Iron (II) salt to iron (III) salt

C) Tin (II) salt to tin (IV) salt

D) $H_2 S$ to sulphur

E) Fluoride to fluorine

Correct Answer : Option E

136. Which of the following is a basic oxide?

A) CrO

B) CrO_3

C) Mn_2O_7

D) Cr_2O_3

E) V_2O_5

Correct Answer : Option A

137. The transistion metal ion with the highest magnetic moment is

A) Fe^{2+}

B) Mn^{2+}

C) Ni^{2+}

D) Co^{2+}

E) Cr^{2+}

Correct Answer : Option B

138. The transition metal with the highest melting point is

A) Mo

B) Mn

C) W

D) Cr

E) Au

Correct Answer : Option C

139. Which of the following complex has the least conductivity?

A) $[Co(NH_3)_5 Cl]Cl_2$

B) Cis-$[Co(NH_3)_4 Cl_2]Cl$

C) $[Co(NH_3)_6]Cl_3$

D) $[Co(NH_3)_3 Cl_3]$

E) trans-$[Co(NH_3)_4 Cl_2]Cl$

Correct Answer : Option D

140. Which one of the following is an ambidentate ligand?

A) Oxalate

B) Carbon monoxide

C) Ethylene diamine

D) Ammonia

E) Nitrite

Correct Answer : Option E

141. The empirical formula of an organic compound is CH_2. The molar mass of the compound is 56g mol^{-1}. The organic compound is

A) n-Butane

B) Propene

C) Propane

D) 2-Methylpropane

E) Cyclobutane

Correct Answer : Option E

142. Which of the following finely divided metals can be used as catalyst in the hydrogenation of alkenes and alkynes?

(i) Pt   (ii) Fe   (iii)   Ni   (iv) Pd

A) (i), (ii) & (iii)

B) (ii), (iii) & (iv)

C) (i), (iii) & (iv)

D) (ii) & (iii)

E) (i), (ii), (iii) & (iv)

Correct Answer : Option C

143. The solvent used in Wurtz reaction is

A) Water

B) Methanol

C) Ethanol

D) Dry ether

E) Aqueous ethanol

Correct Answer : Option D

144. When chlorobenzene is treated with Cl_2 in the presence of anhydrous $FeCl_3$ catalyst gives a mixture of 1,2-dichlorobenzene and 1,4-dichlorobenzene. This reaction is an example of

A) Nucleophilic substitution reaction

B) Electrophilic substitution reaction

C) Free radical substitution reaction

D) Nucleophilic addition reaction

E) Electrophilic addition reaction

Correct Answer : Option B

145. Which of the following compound contains two primary alcoholic and one secondary alcoholic groups?

A) Ethylene glycol

B) Isopropyl alcohol

C) 3° Butyl alcohol

D) Glycerol

E) 2° Butyl alcohol

Correct Answer : Option D

146. Propene on hydroboration-oxidation gives

A) 1-propanol

B) 2-propanol

C) propanal

D) propanone

E) etanoic acid

Correct Answer : Option A

147. When propanone is treated with Zn/Hg and Con.HCl propane is formed. This reaction is known as

A) Wolf-Kishner reaction

B) Clemmensen reaction

C) Hoffman reaction

D) Kolbe's reaction

E) Cannizzaro reaction

Correct Answer : Option B

148. Benzoyl chloride can be converted to benzaldehyde by

A) Rosenmund reduction

B) Etard reaction

C) Stephen reaction

D) Gatterman reaction

E) Gatterman-Koch reaction

Correct Answer : Option A

149. The amine with the highest pK_b value is

A) Methanamine

B) N-methylmethanamine

C) Benzeneamine

D) N-Methylaniline

E) Ethanamine

Correct Answer : Option C

150. The base that is not present in DNA is

A) uracil

B) adenine

C) guanine

D) thymine

E) cytosine

Correct Answer : Option A