MATHS

BOOKS - SAI MATHS (TELUGU ENGLISH)

EAMCET - 2018 (TS) SHIFT - 1

Exercise Mathematics

1. Let $f:[R \to [Rg:[R \to [R$ be differentiable functions such that $(fog)(x) = (x)$

$f(x) = 2x + \cos + \sin^2 x$, then the value of $\sum_{n=1}^{99} g(1 + (2n-1)\pi)$ is

A. 1250π

B. $(99)^2 \frac{\pi}{2}$

C. $(99)^2 \pi$

D. 2500π

Answer: B

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2. If $f:[1.\infty]\to[1.\infty]$ is defined by $f(x)=\frac{1+\sqrt{1+4\log_2 x}}{2}$ then $f^{-1}(3)=$

A. 0

B. 1

C. 64

D. $\frac{1+\sqrt{5}}{2}$

Answer: C

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3. If α and β are the greatest divisors of $n\left(n^2-1\right)$ and $2n\left(n^2+2\right)$ respectively for all $n\in N$ then $\alpha\beta=$

A. 18

B. 36

C. 27

D. 9

Answer: B

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4. Let $A = \begin{vmatrix} \frac{1}{6} & \frac{-1}{3} & \frac{-1}{6} \\ \frac{-1}{3} & \frac{2}{3} & \frac{1}{3} \\ \frac{-1}{6} & \frac{1}{3} & \frac{1}{6} \end{vmatrix}$. If $A^{2016I} + A^{2017m} = \frac{1}{\alpha} A.$ for every $l, m, n \in N$, then the value of α is

A. $\frac{1}{6}$

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

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

D. $\frac{2}{3}$

Answer: B

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5. Let $l, m, n \in R$ and $A = \begin{vmatrix} 1 & r & r^2 & l \\ r & r^2 & l & m \\ r^2 & l & r & n \end{vmatrix}$, Then the set of all real values of r for which the rank of A is 3 , is

A. $(0, \infty)$

B. R

C. $R - \{1\}8$

D. $R - \{0\}$

Answer: C

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6. The following system of equations

$x + y + z = 9$

$2x + 5y + 7 = 52$

$x + 7y + 11z = 77$

has

A. no solution

B. exactly 2 solutions

C. only one solution

D. infinitely many solutions

Answer: D

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7. Z is a complex numbers such that $|Z| \leq 2$ and $-\frac{\pi}{3} \leq \text{amp}Z \leq \frac{\pi}{3}$.

The area of the region formed by locus of Z is

A. $\frac{2\pi}{3}$

B. $\frac{\pi}{3}$

C. $\frac{4\pi}{3}$

D. $\frac{8\pi}{3}$

Answer: C

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8. The points in the argand plane given by $Z_1 = -3+5i, Z_2 = -1+6i, Z_3 = -2+8i, Z_4 = -4+7i$ form a

A. parallelogram

B. rectangle

C. rhombus

D. square

Answer: D

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9. When $n = 8$, $\left(\sqrt{3} + i\right)^n + \left(\sqrt{3} - i\right)^n =$

A. -256

B. -128

C. $256i$

D. $128i$

Answer: A

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10. If 2c is $\frac{7\pi}{5}$ is one of the value of $z^{\frac{1}{5}}$, then z=

A. $32 + 32i$

B. -32

C. -1

D. 32

Answer: B

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11. The set of real values of x for which the inequality $|x-1|+|x+1|<4$ always holds good is

A. $(-2, 2)$

B. $(-\infty, -2) \cup (2, \infty)$

C. $(-\infty, -1] \cup [1, \infty)$

D. $(-2, -1) \cup (1, 2)$

Answer: A

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12. If the roots of the equation $x^2 + x + a = 0$ exceed a, then

A. $a > 2$

B. $a < -2$

C. $2 < a < 3$

D. $-2 < a < -1$

Answer: B

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13. If the roots of the equation $\sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}} = \frac{5}{2}$ are p and $q(p > q)$ and the roots of the equation $(p-q)x^4 - pqx^2 + \frac{p}{q} = 0$ are $\alpha, \beta, \gamma, B\eta$ then $\left(\sum \alpha\right)^2 - \sum \alpha\beta + \alpha\beta\gamma B\eta =$

A. 0

B. $\frac{104}{25}$

C. $\frac{25}{4}$

D. $\frac{16}{5}$

Answer: B

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14. The equation $x^5 - 5x^3 + 5x^2 - 1 = 0$ has three equal roots. If α, β are the other two roots of this equation, then $\alpha + \beta + \alpha\beta =$

A. -4

B. 3

C. -2

D. -5

Answer: C

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15. If all possible numbers are formed by using the digit 1,2,3,5,7 without repetition and they are arranged in descending order, then the rank of the number 327 is

A. 31

B. 175

C. 149

D. 271

Answer: D

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16. If a is the number of all even division and b is number of all odd divisors of the number 10800, then $2a + 3b =$

A. 72

B. 132

C. 96

D. 136

Answer: B

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17. If the coefficient of x^5 in the expansion of $\left(ax^2+\frac{1}{bx}\right)^{13}$ is equal to the coefficient of x^{-5} in the expansion of $\left(ax-\frac{1}{bx^2}\right)^{13}$, then ab=

A. 1

B. $\frac{1}{6}$

C. $\frac{7}{6}$

D. $\frac{4}{2}$

Answer: A

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18. For $n \in N$, in the expansion of $\left(\sqrt[4]{x^{-3}} + a\sqrt[4]{x^{-5}}\right)^n$, the sum of all binomial coefficient lies between 200 and 400 and the term independent of x is 448. Then the value of a is

A. 1

B. 2

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

D. 0

Answer: B

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19. If $\frac{x^4 + x^3 + 2x^2 - 2x + 1}{x^3 + x^2} = p(x) + \frac{A}{x} + \frac{B}{x^2} + \frac{C}{x+1}$ then $A + B + C =$

A. $P(0)$

B. $P(2)$

C. $P(3)$

D. $P(4)$

Answer: C

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20. If $A(n) = \sin^n \alpha + \cos^n \alpha$, then $A(1)A(4) + A(2)A(5) =$

A. $A(1)A(2) + A(4)A(5)$

B. $A(1)A(6) + A(2)A(3)$

C. $A(1)A(3) + A(2)A(6)$

D. $A(1)A(2) + A(3)A(6)$

Answer: B

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21. When $\frac{\sin 9\theta}{\cos 27\theta} + \frac{\sin 3\theta}{\cos 9\theta} + \frac{\sin \theta}{\cos 3\theta} = k(\tan 27\theta - \tan \theta)$ is defined $k =$

A. $\frac{\pi}{2}$

B. $-\frac{1}{2}$

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

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

Answer: C

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22. If $x = \sum_{n-0}^{\infty} \cos^{2n}\theta, y = \sum_{n=0}^{\infty} \sin^{2n}\theta, z = \sum_{n=0}^{\infty} \cos^{2n}\theta \sin^{2n}\theta$ and $0 < \theta < \frac{\pi}{2}$, then

A. $xz + yz = xy + z$

B. $xyz = yz + x$

C. $xy + z = xy + zx$

D. $x + y + z = xyz + z$

Answer: A

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23. Number of solutions of the equation $\sin x = \sin 2x + \sin 3x = 2\cos^2 x - 2\cos x$ in $(0, \pi)$ is

A. 1

B. 3

C. 2

D. 4

Answer: C

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24. $2\tan^{-1}\frac{1}{5}+\sec^{-1}\frac{5\sqrt{2}}{7}+\tan^{-1}\frac{1}{8}=$

A. $\frac{\pi}{6}$

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

C. $\frac{\pi}{3}$

D. $\frac{\pi}{8}$

Answer: B

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25. If $\cosh x=\frac{\sqrt{14}}{3}, \sin hx+\cos\theta$ and $-\pi<\theta<-\frac{\pi}{2}$ then $\sin\theta=$

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

B. $\frac{2}{3}$

C. $-\frac{1}{3}$

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

Answer: D

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26. In ΔABC, if $a = 5$ and $\tan. \frac{A-B}{2} = \frac{1}{4}\tan. \frac{A+B}{2}$, then $\sqrt{a^2 - b^2} =$

A. 2

B. 3

C. 4

D. 5

Answer: C

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27. In a triangle ABC, if $A = 2B$ and the side opposite to the angles A, B, C are $\alpha + 1, \alpha - 1$, and α respectively then $\alpha =$

A. 3

B. 4

C. 5

D. 6

Answer: C

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28. ΔABC, right angled at A, the circumradius, inradius and radius of the excircle opposite to A are respectively in the ratio $2:5:\lambda$, then the roots of the equation, $x^2(\lambda-5)x+(\lambda-6)=0$ are

A. 3,4

B. 5,13

C. 1,3

D. 8,13

Answer: C

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29. Let $3\bar{i} + \bar{j} - \bar{k}$ be the position vector of a point B. Let a be a point on the line which is passing through B and parallel to the vector $2\bar{i} - \bar{j} + 2$. If $\left|\overline{BA}\right| = 18$ then the position vector of A is

A. $-9\bar{i} + 7\bar{j} - 13\bar{k}$

B. $-9\bar{i} + 3\bar{j} + 12\bar{k}$

C. $9\bar{i} - 3\bar{j} + 2\bar{k}$

D. $3\bar{i} - \bar{j} + 7\bar{k}$

Answer: A

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30. The vector that is parallel to the vector $2\bar{i} - 2\bar{j} - 4\bar{k}$ and coplanar with the vectors $\bar{i} + \bar{j}$ and $\bar{j} + \bar{k}$ is

A. $\bar{i} - \bar{k}$

B. $\bar{i} + \bar{j} - \bar{k}$

C. $\bar{i} - \bar{j} - 2\bar{k}$

D. $3\bar{i} + 3\bar{j} + 6\bar{k}$

Answer: C

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31. A line L is passing through the point A whose position vector is $\bar{i} + 2\bar{j} + 3\bar{k}$ and parallel to the vector $2\bar{i} + \bar{j} + 2\bar{k}$. A plane π is passing through the points $\bar{i} + \bar{j} + \bar{k}, \bar{i} - \bar{j} - \bar{k}$ and parallel to the vector $\bar{i} - 2\bar{j}$. Then the point where this plane π meets the line L is

A. $\frac{1}{3}(-7\bar{i} + \bar{j} - 19\bar{k})$

B. $7\bar{i} + \bar{j} - 19\bar{k}$

C. $3\bar{I} + 3\bar{j} - \bar{k}$

D. $2\bar{j} - \bar{j} + \bar{k}$

Answer: A

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32. If the position vectors of three points A, B, C respectively are $I + 2\bar{j} + \bar{k}, 2\bar{i} - \bar{j} + 2\bar{k}$ and $\bar{i} + 2\bar{k}$, Then the perpendicular distance of the point C from the line AB is

A. $\sqrt{\frac{3}{11}}$

B. $\sqrt{\frac{4}{11}}$

C. $\sqrt{\frac{6}{11}}$

D. $\sqrt{\frac{8}{11}}$

Answer: C

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33. The volume of a tetrahedron whose vertices are $4\bar{i}+5\bar{j}+\bar{k},\ -\bar{j}+\bar{k}, 3\bar{i}+9\bar{j}+4\bar{k}$ and $-2\bar{i}+4\bar{j}+4\bar{k}$ is (in cubic units)

A. $\frac{14}{3}$

B. 5

C. 6

D. 30

Answer: B

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34. If the vectors $\bar{b}, \bar{c}, \bar{d}$ and not coplanar, then , the vector $(\bar{a}\times\bar{b})\times(\bar{c}\times\bar{d})+(\bar{a}\times\bar{c})\times(\bar{d}\times\bar{b})+(\bar{a}\times\bar{d})\times(\bar{b}\times\bar{c})$ is

A. parallel to $\bar{a}$

B. parallel to $\bar{b}$

C. Parallel to $\bar{c}$

D. perpendicular to $\bar{a}$

Answer: A

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35. $x_1 \ldots x_2 \ldots \ldots x_n$ are no observations with mean $\bar{x}$ and standard deviation σ. Match the items of List - I with those of list - II

List - I	List - II
(a) $\sum_{i=1}^{n}(x_1) - \bar{x}$	(i) Median
(b) Variance(σ^2)	(ii) Coefficie
(c) Mean deviation	(iii) Zero
(d) Measure used to find the homogeneity of given two series	(iv) Mean of
	(v) Mean of

A. $\begin{matrix} a & b & c & d \\ i & v & ii & iii \end{matrix}$

B. $\begin{matrix} a & b & c & d \\ i & iv & iii & ii \end{matrix}$

C. $\begin{matrix} a & b & c & d \\ iii & v & vi & ii \end{matrix}$

D. $\begin{matrix} a & b & c & d \\ iii & v & ii & i \end{matrix}$

Answer: C

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36. The variance of 50 observations is 7. If each observation is multiplied by 6 and then 5 is subtracted from it, then the variance of the new data is

A. 37

B. 42

C. 247

D. 252

Answer: D

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37. Two dies are thrown and two coins are tossed simultaneously. The probability of getting prime numbers on both the dice along with a head and a tail on the two coins is

A. $\frac{1}{8}$

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

C. $\frac{3}{16}$

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

Answer: A

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38. 5 Persons entered a lift cabin on the ground floor of a 7 floor house. Suppose that each of them independently and with equal probability can leave the cabinet any floor beginning with the first. The probability of all the 5 persons leaving cabin at different floors, is

A. $\frac{360}{2401}$

B. $\frac{5}{54}$

C. $\frac{5}{18}$

D. $\frac{51}{71}$

Answer: B

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39. A company produces 10,000 items per day. On a particular day 2500 items were produced on machine. A, 3500 on machine B and 4000 on machine C. The probability that an item produced by the machines A, B, C to defective is respectively 2% , 3% and 5%. If one item is selected at random from the output and is found to be defective, then the probability that it was produced by machine C, is

A. $\frac{10}{71}$

B. $\frac{16}{71}$

C. $\frac{40}{71}$

D. $\frac{21}{71}$

Answer: A

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40. A random variable X takes the values $1, 2, 3$ and 4 such that $2P(X=1) = 3P(X=2)P(X-3) = 5P(X=4)$. If σ^2 is the variance and μ is the mean of X then $\sigma^2 + \mu^2$

A. $\frac{421}{61}$

B. $\frac{570}{61}$

C. $\frac{149}{61}$

D. $\frac{3480}{3721}$

Answer: C

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41. An executive in a company makes on an average 5 telephone calls per hour at a cost of Rs. 2 per cell. The probability that in any hour the cost of the calls exceeds a sum of Rs.4 is

A. $\frac{2e^3 - 35}{2e^5}$

B. $\frac{2e^5 - 37}{2e^5}$

C. $1 - \frac{37}{e^4}$

D. $1 - (18.5)e^5$

Answer: B

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42. A quadrilateral ABCD is divided by the diagonal AC into two triangles of equal areas. If A, B, C are respectively, $(3, 4), (-3, 6), (-5, 1),$ then the locus of D is

A. $(x - 8y - 57)(x - 8y + 11) = 0$

B. $(x - 8y - 57)(x - 8y - 11) = 0$

C. $(3x - 8y - 57)(3x - 8y + 11) = 0$

D. $(3x - 8y011)(3x - 8y + 57) = 0$

Answer: D

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43. By rotating the coordinates axes in the positive direction about the origin by an angle α, If the point $(1, 2)$ is transformed to $\left[\frac{3\sqrt{3}-1}{2\sqrt{2}}, \frac{\sqrt{3}+3}{2\sqrt{2}}\right]$ in new coordinates system then $\alpha =$

A. $\frac{\pi}{3}$

B. $\frac{\pi}{6}$

C. $\frac{\pi}{9}$

D. $\frac{\pi}{12}$

Answer: D

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44. Let $a \neq 0, b \neq 0,$ c be three real numbers and $L(p, q) = \frac{ap + bq + c}{\sqrt{a^2 + b^2}}, f \text{ or } allp, q \in R.$

If $L\left(\frac{2}{3}, \frac{1}{3}\right) + L\left(\frac{1}{3}, \frac{2}{3}\right) + L(2, 2) = 0$, then the line $ax + by + c = 0$ always passes through the fixed point

A. $(0, 1)$

B. $(1, 1)$

C. $(2, 2)$

D. $(-1, -1)$

Answer: B

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45. The incentre of the triangle formed by the straight line having 3 as X-intercept 4 as Y- intercept, together with the coordinate axes, is

A. $(2, 2)$

B. $\left(\frac{3}{2}, \frac{3}{2}\right)$

C. $(1, 2)$

D. $(1, 1)$

Answer: D

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46. The equation of the straight line in the normal form which is parallel to the lines $x + 2y + 3 = 0$ and $x + 2y + 8 = 0$ and dividing the distance between there two lines in the ratio 1 : 2 internally is

A. $x\cos\alpha + y\sin x\alpha = \frac{10}{\sqrt{45}}, \alpha = \tan^{-1}\sqrt{2}$

B. $x\cos\alpha + y\sin\alpha = \frac{14}{\sqrt{45}}, \alpha = \pi + \tan^{-1}2$

C. $x\cos\alpha + y\sin\alpha = \frac{14}{\sqrt{45}}, \alpha = \tan^{-1}2$

D. $x\cos\alpha + y\sin\alpha = \frac{10}{\sqrt{45}}, \alpha = \pi + \tan^{-1}\sqrt{2}$

Answer: B

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47. A pair of straight lines is passing through the point $(1, 1)$. One of the lines makes an angle θ with the positive direction of X- axis and the other makes the same angle with the positive direction of Y-axis. If the equation of the pair of straight lines is $x^2 - (a+2)xy + y^2 + a(x + y - 1) = 0. a \neq -2,$ then the value of θ is

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

B. $\frac{1}{2}\sin\left(\frac{2}{a+2}\right)$

C. $\frac{1}{2}\tan^{-1}\left(\frac{2}{a+2}\right)$

D. $\frac{1}{2}\tan\left(\frac{2}{a+2}\right)$

Answer: A

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48. If the pair of lines $6x^2 - xy - y^2 = 0$ and $3x^2 - axy - y^2 = 0a > 0$ have a common line, then $a =$

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

B. 1

C. 2

D. 4

Answer: A

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49. If the chord $L \equiv y - mx - 1 = 0$ of the circle $S \equiv x^2 + y^2 - 1 = 0$ touches the circle

$S_1 \equiv x^2 + y^2 - 4x + 1 = 0$, then the possible points for which L = 0 is a chord of contact of S = 0 are

A. $(2 \pm \sqrt{6}, 0)$

B. $(2 \pm \sqrt{6}, 1)$

C. $(2, 0)$

D. $(\sqrt{6}, 1)$

Answer: B

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50. If $y + c = 0$ is a tangent to the circle $x^2 + y^2 - 6x - 2y + 1 = 0$ at (a, 4), then

A. $ac = 360$

B. $ac = -12$

C. $a + c = 0$

D. $4a = c$

Answer: B

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51. If the circle given by $S \equiv x^2 + y^2 - 14x + 16y + 33 = 0 ans S' \equiv x^2 + y^2 - a^2 = 0 (a \in N)$ have 4 common tangents, then the possible number of circles $S' = 0$ is

A. 1

B. 2

C. 0

D. infinite

Answer: B

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52. The centre of the circle passing through the point (1,0) and cutting the circles

$x^2 + y^2 - 2x + 4y + 1 = 0$ and

$x^2 + y^2 + 6x - 2y + 1 = 0$ orthogonally is

A. $\left(-\frac{2}{3}, \frac{2}{3}\right)$

B. $\left(\frac{1}{2}, \frac{1}{2}\right)$

C. $(0, 1)$

D. $(0, 0)$

Answer: D

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53. The equation of the tangent at the point (0, 3) on the circle which cuts the circles $x^2 + y^2 - 2x + 6y = 0$,

$x^2 + y^2 - 4x - 2y + 6 = 0$ and

$x^2 + y^2 - 12x + 2y + 3 = 0$ orthogonally is

A. $y = 3$

B. $x = 0$

C. $3x + y - 3 = 0$

D. $x + 3y - 9 = 0$

Answer: A

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54. If two tangents to the parabola $y^2 = 8x$ meet the tangent at its vertex in M and N such that MN = 4, then the locus of the point of intersection of those two tangents is

A. $y^2 = 8(x + 3)$

B. $y^2 = 8(-2)$

C. $y^2 = 8(x + 2)$

D. $y^2 = 4(x + 2)$

Answer: C

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55. Three normals are drawn from the point (c, 0) to the curve $y^2 = x$. If one of the normals is X-axis, then the value of c for which the other two normals are perpendicualr to each other is

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

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

C. $\frac{3}{4}$

D. $\frac{5}{8}$

Answer: C

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56. If the normal drawn at one end of the latus rectum of the ellipse $b^2x^2 + a^2y^2 = a^2b^2$ with eccentricity 'e' passes through one end of the minor axis. Then,

A. $e^4 + e^2 = 2$

B. $e^4 - e^2 = 1$

C. $e^4 + e^2 = 1$

D. $e^2 + e = 1$

Answer: C

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57. A variable tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ makes intercepts on both the axes. The locus of the middle point of the portion of the tangent between the coordinate axes is

A. $\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$

B. $\frac{a^2}{x^2} + \frac{b^2}{y^2} = 1$

C. $b^2x^2 + a^2x^2 = 4$

D. $\frac{a^2}{x^2} + \frac{b^2}{y^2} = 4$

Answer: D

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58. If the eccentricity of a conic satisfies the equation $2x^3 + 10x - 13 = 0$, then the conic is

A. a circle

B. a parabola

C. an ellipse

D. a hyperbola

Answer: D

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59. Assertion (A) If $(-1, 3, 2)$ and $(5, 3, 2)$ are respectively the orthocentre and circumcentre of a triangle, then (3, 3, 2) is its centroid.

Reason (R) Centroid of the triangle divides the line segment joining the

orthocentre and the circumcentre in the ratio 1 : 2.

Which one of the following is true ?

A. (A) and (R) are true and (R) is the correct explanation to (A)

B. (A) and (R) are true but (R) is not the correct explanation to (A)

C. (A) is true, (R) is false

D. (A) is false, (R) is true

Answer: C

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60. The line whose direction cosines are given by the relations $al + bm + cn = 0$ and $mn + lm = 0$ are

A. perpendicular if $\frac{1}{a} + \frac{1}{b} + \frac{1}{c}0$

B. perpendicular if $\sqrt{a} + \sqrt{b} + \sqrt{c} = 0$

C. parallel if $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 0$

D. parallel if $a + b + c = 0$

Answer: A

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61. If the plane passing through the points (1, 2, 3), (2, 3, 1) and (3, 1, 2) is $ax + by + cz = 1$, then $a + 2b + 3c =$

A. 0

B. 1

C. 6

D. 18

Answer: B

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62. $\lim_{x \to -\infty} \frac{3|x| - x}{|x| - 2x} - \lim_{x \to 0} \frac{\log(1 + x^3)}{\sin^3 x} =$

A. 1

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

C. $\frac{4}{3}$

D. 0

Answer: B

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63. If $f(x) = \begin{cases} \frac{x-2}{|x-2|} + a & x < 2 \\ a + b & x = 2 \\ \frac{x-2}{|x-2|} + b & x > 2 \end{cases}$

is continuous at x = 2, then $a + b =$

A. 2

B. 1

C. 0

D. -1

Answer: C

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64. If $f(x) = \begin{cases} \frac{x^2 \log(\cos x)}{\log(1+x^2)} & x \neq 0 \\ 0 & x = 0 \end{cases}$, then f is

A. Discontinuous at zero

B. Continuous but no differentiable at zero

C. Differentiable at zero

D. Not continuous and not differentiable at zero

Answer: C

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65. Match the items given in List - A with those of the items of List - B

List - A

(a) if $y = |x| + |x-2|$ then at $x = 2, \frac{dy}{dx} =$

(b) if $(x) = |\cos 2x|$, then $f\left(\frac{\pi}{4} + \right) =$

(c) if $f(x) = \sin \pi |x|$ Where $|\ \ |$ denotes the greatest integer function, then

(d) $f(x) = \log|x-1|, x \neq 1$ then $f\left(\frac{1}{2}\right) =$

A. $\begin{matrix} a & b & c & d \\ v & ii & i & ii \end{matrix}$

B. $\begin{matrix} a & b & c & d \\ iv & ii & i & iii \end{matrix}$

C. $\begin{matrix} a & b & c & d \\ iv & i & ii & iii \end{matrix}$

D. $\begin{matrix} a & b & c & d \\ i & iii & iv & ii \end{matrix}$

Answer: C

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66. If $y = \frac{\left(\sin^{-1} x\right)^2}{2}$, then $\left(1-x^2\right)y_2 - xy_1 =$

A. y

B. 2y

C. 1

D. 2

Answer: C

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67. If the relative errors in the base radius and the height of a cone are same and equal to 0.02, then the percentage error in the volume of that cone is

A. 2

B. 4

C. 6

D. 8

Answer: C

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68. The normal at a point θ to the curve $x = a(1 + \cos\theta), y = a\sin\theta$ always passes through the fixed point

A. $(0, a)$

B. $(2a, 0)$

C. $(a, 0)$

D. (a, a)

Answer: C

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69. Let f(x) be continuous on [0, 6] and differentiable on (0, 6). Let f(0) = 12 and $f(6) = -4$.

If $g(x) = \frac{f(x)}{x+1}$, then for some Lagrange's constant $c \in (0, 6)$, $g'(c) =$

A. $\frac{44}{3}$

B. $-\frac{22}{21}$

C. $\frac{32}{21}$

D. $-\frac{44}{21}$

Answer: D

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70. If (α, β) and (γ, δ) where $\alpha < \gamma$, are the turning points of $f(x) = 2x^3 - 15x^2 + 36x - 8$, then $\alpha - \gamma - \beta + \delta =$

A. 0

B. -2

C. 2

D. 1

Answer: B

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71. The height of a cylinder of the greatest volume that can be inscribed in a sphere of radius 3 is

A. $3\sqrt{3}$

B. $2\sqrt{3}$

C. $\sqrt{3}$

D. $\sqrt{2}$

Answer: B

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72. $\int \frac{dx}{\left(e^x + e^{-x}\right)^2} =$

A. $1\frac{1}{2(e^{2x}+1)}+c$

B. $-1\frac{1}{2(e^{2x}+1)}+c$

C. $-1\frac{1}{3(e^{2x}+1)}+c$

D. $-1\frac{1}{(e^{2x}+1)}+c$

Answer: B

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73. $\int_0^{\pi/2}\frac{dx}{1+(\tan x)^{\sqrt{2018}}}=$

A. π

B. $\frac{3\pi}{4}$

C. $\frac{\pi}{2}$

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

Answer: D

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74. If

$$\int \frac{x}{(x^2+1)(x-1)}dx = A\log|x^2+1| + B\tan^{-1}x + C\log|x-1| + d,$$

then $A + B + C =$

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

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

C. $\frac{3}{4}$

D. $\frac{5}{4}$

Answer: C

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75. $\int_0^{\frac{\pi}{2}} \frac{\cos^3 x}{\sin x + \cos x}dx =$

A. $\frac{\pi - 1}{2}$

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

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

D. $\frac{\pi - 3}{4}$

Answer: B

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76. $\int_0^3 (2 + x^2) dx =$

A. $\lim_{n \to \infty} \frac{1}{n} \left[2n + \frac{1^2 + 2^2 + \ldots + (3n)^2}{n^2} \right]$

B. $\lim_{n \to \infty} \frac{1}{n} \left[3n + \frac{1^2 + 2^2 + \ldots + 6n^2}{n^2} \right]$

C. $\lim_{n \to \infty} \frac{1}{n} \left[6n + \frac{1^2 + 2^2 + \ldots + 9n^2}{n^2} \right]$

D. $\lim_{n \to \infty} \frac{1}{n} \left[3n \frac{1^2 + 2^2 + \ldots + 3n^2}{n^2} \right]$

Answer: C

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77. The area enclosed (in square units) by the curve $y = x^4 - x^2$, the X-axis and the vertical lines passing through the two minimum points of the curve is

A. $\frac{48\sqrt{2}}{5}$

B. $\frac{5}{18\sqrt{2}}$

C. $\frac{7}{60\sqrt{2}}$

D. $\frac{7}{30\sqrt{2}}$

Answer: D

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78. The differential equation corresponding to the family of circles having centres on X-axis and passing through the origin is

A. $y^2 + x^2 + \frac{dy}{dx} = 0$

B. $y^2 - x^2 + \frac{dy}{dx} = 0$

C. $y^2 + x^2 + 2xy - \frac{dy}{dx} = 0$

D. $y^2 - x^2 - 2xy\frac{dy}{dx} = 0$

Answer: D

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79. The general solution of the differential equation $\left(x^2 + xy\right)y' = y^2$ is

A. $e^{\frac{y}{x}} = ex$

B. $e^{-\left(\frac{y}{x}\right)} = cy$

C. $e^{-\left(\frac{y}{x}\right)} = cxy$

D. $e^{\frac{-2y}{x}} = cy$

Answer: B

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80. At any point on a curve, the slope of the tangent is equal to the sum of abscissa and the product of ordinate and abscissa of that point. If the curve passes through (0, 1), then the equation of the curve is

A. $y = 2e^{\frac{x^2}{2}} - 1$

B. $2x^{x^2}$

C. e^{-x^2}

D. $2e^{-x^2} - 1$

Answer: A

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Exercise Physics

1. Assertion (A) : When we bounce a ball on the ground, it comes to rest after a few bounces, losing all its energy. This is an example of violation of conservation of energy.

Reason (R) : Energy can change from one form to another but the total energy is always conserved.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true, but (R) is not the correct explanation of (A)

C. (A) is true, (R) is false

D. (A) is false, (R) is true

Answer: D

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2. A gas satisfies the relation $pV^{5/3} = k$, where p is pressure, V is volume and k is constant. The dimension of constant k are

A. ML^4T^{-2}

B. ML^2T^{-2}

C. $ML^6T(-2)$

D. MLT^{-2}

Answer: A

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3. A car moves in positive y-direction with velocity v proportional to distance travelled y as $v(y) \propto y^{\beta}$, where β is a positive constant. The car covers a distance L with average velocity $< v >$ proportional to L as $< v > \propto L^{1/3}$, The constant β is given as

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

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

C. $\frac{2}{3}$

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

Answer: B

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4. Consider a particle moving along the positive direction of X-axis. The velocity of the particle is given by $v = \alpha\sqrt{x}$ (α is a positive constant). At time t = 0, if the particle is located at x = 0, the time dependence of the velocity and the acceleration of the particle are respectively

A. $\frac{\alpha^2}{2}t$ and $\frac{\alpha^2}{2}$

B. $\alpha^2 t$ and α^2

C. $\frac{\alpha}{2}t$ and $\frac{\alpha}{2}$

D. $\frac{\alpha^2}{4}t$ and $\frac{\alpha^2}{4}$

Answer: A

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5. The magnitude of acceleration and velocity of a particle moving in a plane, whose position vector $\bar{r}3t^2\hat{i} + 2t\hat{j} + \hat{k}$ at $t = 2\,\text{sec.}$ are,

respectively

A. $\sqrt{148}, 6$

B. $\sqrt{144}, 6$

C. $\sqrt{13}, 3$

D. $\sqrt{14}, 3$

Answer: A

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6. Two objects are located at height 10 m above the ground. At some point of time, the objects are thrown with initial velocity $2\sqrt{2}$ m/s at an angle 45° and 135° with the positive X-axis, respectively. Assuming $g = 10\frac{m}{s^2}$, the velocity vectors will be perpendicular to each other at time is equal to

A. 0.2 s

B. 0.4 s

C. 0.6 s

D. 0.8 s

Answer: B

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7. A block of mass 5 kg is kept against an accelerating wedge with a wedge angle of 45° to the horizontal. The co-efficient of friction between the block and the wedge is $\mu = 0.4$. What is the minimum absolute value of the acceleration of the wedge to keep the block steady. Assume $g = 10m/s^2$

A. $\frac{60}{7}m/s^2$

B. $\frac{30}{7}m/s^2$

C. $\frac{30}{\sqrt{7}}m/s^2$

D. $\frac{60}{\sqrt{7}}m/s^2$

Answer: B

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8. An object moves along the circle with normal acceleration proportional to t^{α}, where t is the time and α is a positive constant. The power developed by all the forces acting on the object will have time dependence proportional to

A. $t^{\alpha-1}$

B. $t^{\alpha/2}$

C. $t^{\frac{1+\alpha}{2}}$

D. $t^{2\alpha}$

Answer: A

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9. A ball of mass 1 kg moving along x-direction collides elastically with a stationary ball of mass m. The first ball (mass = 1 kg) recoils at right angle to its original direction of motion. If the second ball starts moving at an angle 30° with the X-axis, then the value of m must be

A. 0.5 kg

B. 1.5 kg

C. 2.5 kg

D. 2 kg

Answer: D

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10. A machine gun can fire 200 bullets/min. If 35 g bullets are fired at a speed of 750 m/s, then the average force exerted by the gun on the bullets is

A. 87.5 N

B. 26.2 N

C. 78.9 N

D. 110.3 N

Answer: A

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11. A solid sphere of radius R makes a perfect rolling down on a plane which is inclined to the horizontal axis at an angle θ. If the radius of gyration is k, then its acceleration is

A. $\frac{g\sin\theta}{\left(1+\frac{k^2}{R^2}\right)}$

B. $\frac{g\sin\theta}{(R^2+K^2)}$

C. $\frac{g\sin\theta}{2(R^2+K^2)}$

D. $\frac{g\sin\theta}{2\left(1+\frac{K^2}{R^2}\right)}$

Answer: A

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12. The ratio of the height above the surface of earth to the depth below, the surface of earth, for gravitational accelerations to be the same (assuming small heights) is

A. 0.25

B. 0.5

C. 1

D. 1.25

Answer: B

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13. A steel rod has radius 50 mm and length 2 m. It is stretched along its length with a force of 400 KN. This causes an elongation of 0.5 mm. Find the (approximate) Young's modulus of steel from this information.

A. $2 \times 10^{10} Nm^2$

B. $10^{11} Nm^2$

C. $2 \times 10^{11} Nm^2$

D. $10^{12} Nm^2$

Answer: C

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14. Consider a vessel filled with a liquid upto height H. The bottom of the vessel lies in the XY-plane passing through the origin. The density of the liquid varies with Z-axis as $\rho(z) = \rho_0 \left[2 - \left(\frac{z}{H}\right)^2\right]$. If p_1 and p_2 are the pressures at the bottom surface and top surface of the liquid, the magnitude of $(p_1 - p_2)$ is

A. $\rho_0 g H$

B. $\frac{8}{5}\rho_0 g H$

C. $\frac{3}{2}\rho_0 g H$

D. $\frac{5}{3}\rho_0 g H$

Answer: D

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15. A one mole of ideal gas goes through a process in which pressure p varies with volume V as $p = 3 - g\left(\frac{V}{V_0}\right)^2$, where, V_0 is a constant. The maximum attainable temperature by the ideal gas during this process is (all quantities are is SI units and Ris gas constant)

A. $\frac{2V_0}{3R}$

B. $\frac{2V_0}{R}$

C. $\frac{3V_0}{2R}$

D. $\frac{3V_0}{R}$

Answer:

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16. The internal energy of the air, in a room of volume V, at temperature T and with outside pressure p increasing linearly with time, varies as

A. increases linearly

B. increases exponentially

C. decreases linearly

D. remains constant

Answer: A

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17. The efficiency of Carnot engine is y, when it η hot and cold reservoirs are maintained at temperature T_1 and T_2, respectively. To increase the

efficiency to 1.5η, the increase in temperature (ΔT) of the hot reservoir by keeping the cold one constant at T_2 is

A. $\frac{T_1T_2}{(1-\eta)(1-1.5\eta)}$

B. $\frac{0.5T_2\eta}{(1-0.5\eta)(1-\eta)}$

C. $\frac{T_1}{1-\eta}-\frac{T_2}{1-1.5\eta}$

D. $\frac{(1-\eta)(1-1.5\eta)}{T_1T_2}$

Answer: B

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18. An air bubble rises from the bottom of a water tank of height 5 m. If the initial volume of the bubble is $3mm^3$, What will be its volume as it reaches the surface. Assume that its temperature does not change. *[Math Processing Error]*

A. $1.5mm^3$

B. $4.5mm^3$

C. $9mm^3$

D. $6mm^3$

Answer: B

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19. Two harmonic travelling waves are described by the equations $y_1 = a\sin(kx - \omega t)$ and $y_2 = a\sin(-kx + \omega t + \phi)$. The amplitude of the superimposed wave is

A. $2a\dfrac{\cos(\phi)}{2}$

B. $2a\sin\phi$

C. $2a\cos\phi$

D. $2a\dfrac{\sin(\phi)}{2}$

Answer: D

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20. Where should an object be placed on the axis of a convex lens of focal length 8 cm, so as to achieve magnification of -4? (Distances are measured from optic centre of the lens)

A. $-6cm$

B. $-10cm$

C. $-12cm$

D. $-9cm$

Answer: B

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21. Interference fringes are obtained in a Young's double slit experiment using beam of light consisting two wavelengths 500 nm and 600 nm. Bright fringes due to both wavelengths coincide at 2.5 mm from the

central maximum. If the separation between the slits is 3 mm, then the distance between the screen and plane of the slits is

A. 1.2 m

B. 2.8 m

C. 2.5 m

D. 3.2 m

Answer: C

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22. A point charge of 50 μC is placed in the XY plane at a location with radius vector $\overline{r_0} = 8\hat{I} - 5\hat{}jm\left(\in_0 8.85 \times 10^{-12} c^2 / N - m^2 \right)$

A. 4.5 kV/m

B. 45 V/m

C. 0.45 V/m

D. 450k V/m

Answer: A

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23. The work done to assemble the three charges in configuration as shown in the figure below is

A. $\frac{-3q^2}{3\pi\varepsilon_0 a}$

B. $\frac{-2q^2}{4\pi_0 a}$

C. $\frac{-q^2}{4\pi\varepsilon_0 a}$

D. 0

Answer: A

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24. Consider the following two circuits

[A]: 20 bulbs are connected in series to a power supply line

[B]: 20 bulbs identical to [A] are connected in a parallel circuit to an identical power supply line

identify which of the following is not true.

A. If one bulb in [A] blows out all others will stop glowing

B. Bulbs in [A] glow brighter since the current flowing in [A] is higher

C. If one bulb in [B] blows, others bulbs will still glow

D. Bulbs in [B] have the highest voltage across each bulb

Answer: B

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25. A tapered bar of length L and end diameters D_1 and D_2 is made of material of electrical resistivity ρ. The electrical resistance of the bar is

A. $\frac{4\rho L}{\pi(D_1 + D_2)}$

B. $\frac{4\rho L}{4(D_1 - D_2)^2}$

C. $\frac{\rho\pi\sqrt{D_1 D_2}}{4L}$

D. $\frac{4\rho L}{\pi D_1 D_2}$

Answer: B

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26. Two circular loops L_1 and L_2 of wire carrying equal and opposite currents are placed to each other with a common axis. The radius of loop L_1 is R_1 and that of L_2 is R_2. The distance between the centres of the loops is $\sqrt{3}R$. The magnetic field at the centre of L_2 shall be zero if

A. $R_2 = 4R_1$

B. $R_2 = 2R_1$

C. $R_2 = \sqrt{2}R_1$

D. $R_2 = 8R_1$

Answer: A

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27. A non-conducting thin disc of radius R rotates about its axis with an angular velocity ω. The surface charge density on the disc varies with the distance r from the centre as $\sigma(r) = \sigma_0\left[1 + \left(\frac{r}{R}\right)^{\beta}\right]$, where σ_0 and β are constants. If the magnetic induction at the center is $B = \left(\frac{9}{10}\right)\mu_0\sigma_0\omega R$, the value of β is

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

B. 4

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

D. 2

Answer: C

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28. A wire loop enclosing a semi-circle of radius 'R' is located on the boundary of a uniform magnetic filed of induction $\vec{B}$. At time $t = 0$, the loop is set into rotation of with velocity 'w' about its axis '0'. Coinciding with aline of vector $\vec{B}$ on the boundary as shown in the figure. The emf induced in the loop is

A. $\frac{BR^2}{2}\omega$

B. $BR\omega$

C. $BR^2\omega$

D. $\frac{BR^2}{2\omega}$

Answer: A

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29. A 100 W electric bulb produces electromagnetic radiation with electric field amplitude of $\frac{2V}{m}$ at a distance of 10 m.

Assuming it as a point source, estimate the efficiency of the bulb.

A. 0.049

B. $2.5\,\%$

C. $6.6\,\%$

D. $19.7\,\%$

Answer:

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30. At an incident radiation frequency of v_1, which is greater than the threshold frequency, the stopping potential for a certain metal is V_1. At frequency $2v_1$, the stopping potential is $3V_1$. If the stopping potential at frequency $4v_1$ is nV_1 then n is

A. 2

B. 3

C. 6

D. 7

Answer: D

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31. The de Broglie wavelength of an electron of kinetic energy 9e V is (take $h = 4 \times 10^{-15} eV.\ \text{sec}$, $c = 3 \times 10^{10}$ cm/sec and the mass m_e of electron as $m_e c^2 = 0.5 MeV$

A. $4 \times 10^{-8} cm$

B. $3 \times 10^{-8} cm$

C. $4 \times 10^{-7} cm$

D. $3 \times 10^{-7} cm$

Answer: A

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32. An active nucleus decays to one - third $\left(\frac{1}{3}\right)$ in 20 Hrs. The fraction of original activity remaining after 80 Hrs is

A. $\frac{1}{16}$

B. $\frac{1}{81}$

C. $\frac{1}{36}$

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

Answer: B

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33. Consider an amplifier circuit, where in a transistor is used in common emitter mode. The change in collector current and base current respectively are 4 mA and 20 UA when a signal of 40 mV is added to the base-emitter voltage. If the load resistance is 10 k 2, then power gain in the circuit is

A. 1×10^4

B. 2×10^5

C. 8×10^5

D. 1×10^6

Answer: B

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34. The output 'F' of the logic circuit given below is

A. $X + \overline{Y} . Z$

B. $(Y + Z) . X$

C. $\left(\overline{Y} + Z\right) + X$

D. $X + \overline{Y} + Z$

Answer: A

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35. A carrier wave of peak voltage 20 V is used to transmit a message signal. For getting a modulation index of 60%, the peak voltage of the modulating signal is

A. 6V

B. 8V

C. 12 V

D. 33.3 V

Answer: C

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Exercise Chemistry

1. Match the reactants in List - I with the products in List - II

List - I	List - II
(a) $H_2O + H_2S$	(i) (H_3O^+, HS^-)
(b) $H_2O + N^{3-}$	(ii) $(NH3, OH^-)$
(c) $H_2O + SiCI_4$	(iii) (OH^-, H_3S^+)
(d) $H_2O + F_2$	(iv) (SiO_2, HCI)
	(v) $\left(SiO_4^{4-}, HCI\right)$
	(vi) (O_2, F^-)
	(vii) (HF, OH^-)
	(viii) (OH^-, HN_3)

The correct answer is

A. $\begin{matrix} a & b & c & d \\ i & viii & v & vi \end{matrix}$

B. $\begin{matrix} a & b & c & d \\ iii & ii & v & vii \end{matrix}$

C. $\begin{matrix} a & b & c & d \\ iii & viii & iv & vii \end{matrix}$

D. $\begin{matrix} a & b & c & d \\ i & ii & iv & vi \end{matrix}$

Answer: D

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2. When sodium (Na) metal is dissolved in liquid ammonia (NH_3), it imparts a blue colour to the solution. This blue colouration is due to

A. Liquid NH_3

B. $\left[Na(NH_3)_x\right]^+$

C. $NaNH_2$

D. $\left[\bar{e}(NH_3)_x\right]^-$

Answer: D

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3. The EMF of a galvanic cell consisting of two hydrogen electrodes is 0.17 V. If the solution of one of the electrodes has $\left[H^+\right] = 10^{-3}$ M, the pH at the other electode is

A. 5.88

B. 4.88

C. 2.08

D. 2.08

Answer: A

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4. The following graphs is obtained for physisorption of a gas as a function of pressure at different temperatures.

The correct order of temperature is

A. $T_3 < T_2 < T_1$

B. $T_2 l T_3 < T_1$

C. $T_2 < T_1 < T_3$

D. $T_1 < T_3 < T_2$

Answer: B

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5. The major product (P) formed in the following reaction is

A. 

B. 

C. 

D. 

Answer: C

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6. The product (P) of the below reaction is

A. 

B. 

C. 

D. 

Answer: C

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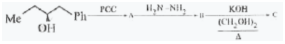
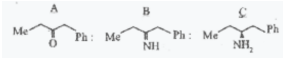
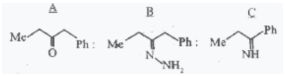
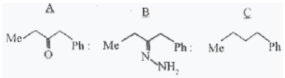
7. The product A, B, and C in the following reaction sequence are

A. 

B. 

C. 

D. 

Answer: D

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8. Identify A and B in the following reaction

A. 

B. 

C. 

D. 

Answer: B

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