1.Consider the following two binary relations on the set A={a, b, c} :

R_1={(c, a), (b, b), (a, c), (c, c), (b, c), (a, a)} and R_2={(a, b), (b, a), (c, c), (c, a), (a, a), (b, b), (a, c)}.

Then :

A. both R_1 and R_2 are not symmetric.

B. R_1 is not symmetric but it is transitive.

C. R_2 is symmetric but it is not transitive.

D. both R_1 and R_2 are transitive.

2.If $\lambda \in R$ is such that the sum of the cubes of the roots of the equation, $x^2 + (2 - \lambda)x + (10 - \lambda) = 0$ is minimum, then the magnitude of the difference of the roots of this equation is :

A. $4\sqrt{2}$

B. $2\sqrt{5}$

C. $2\sqrt{7}$

D. 20

3.The set of all $\alpha \in R$, for which $w = \frac{1+(1-8\alpha)z}{1-z}$ is a purely imaginary number, for all $z \in C$satisfying $|z| = 1$ and Re $z \neq 1$, is :

A. an empty set

B. {0}

C. $\left\{0, \frac{1}{4}, -\frac{1}{4}\right\}$

D. equal to R

4.Let A be a matrix such that A. $\begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$ is a scalar matrix and $|3A| = 108$. Then A^2 equals :

A. $\begin{bmatrix} 4 & -32 \\ 0 & 36 \end{bmatrix}$

B. $\begin{bmatrix} 36 & 0 \\ -32 & 4 \end{bmatrix}$

C. $\begin{bmatrix} 4 & 0 \\ -32 & 36 \end{bmatrix}$

D. $\begin{bmatrix} 36 & -32 \\ 0 & 4 \end{bmatrix}$

5.Let S be the set of all real values of k for which the system of linear equations

$x + y + z = 2$

$2x + y - z = 3$

$3x + 2y + kz = 4$

has a unique solution. Then S is :

A. an empty set

B. equal to {0}

C. equal to R

D. equal to R−{0}

6.n-digit numbers are formed using only three digits 2, 5 and 7. The smallest value of n for which 900 such distinct numbers can be formed, is :

A. 6

B. 7

C. 8

D. 9

7.If n is the degree of the polynomial, $\left[\frac{2}{\sqrt{5x^3+1}-\sqrt{5x^3-1}}\right]^8+\left[\frac{2}{\sqrt{5x^3+1}+\sqrt{5x^3-1}}\right]^8$ and m is the coefficient of x^n in it, the ordered pair (n, m) is equal to :

A. $(24, (10)^8)$

B. $(8, 5\,(10)^4)$

C. $(12, (20)^4)$

D. $(12, 8(10)^4)$

8.If $x_1, x_2, \ldots, x_n$ and $\frac{1}{h_1}, \frac{1}{h_2}, \ldots, \frac{1}{h_n}$ are two A.P.s such that $x_3 = h_2 = 8$ and $x_8 = h_7 = 20$, then $x_5 \cdot h_{10}$ equals :

A. 2560

B. 2650

C. 3200

D. 1600

9.If b is the first term of an infinite G.P. whose sum is 5, then b lies in the interval :

A. (−∞, −10]

B. (−10, 0)

C. (0, 10)

D. [10, ∞)

10.If $f(x) = \begin{vmatrix} \cos x & x & 1 \\ 2\sin x & x^2 & 2x \\ \tan x & x & 1 \end{vmatrix}$, then $\lim_{x\to 0}\frac{f'(x)}{x}$

A. does not exist.

B. exists and is equal to 2.

C. exists and is equal to 0.

D. exists and is equal to −2.

11.If $x^2 + y^2 + \sin y = 4$, then the value of $\frac{d^2y}{dx^2}$ at the point (-2, 0) is :

A. -34

B. -32

C. 4

D. -2

12.Let $S = \{(\lambda, \mu) \in R \times R : f(t) = (|\lambda| e^{|\lambda|} - \mu). \sin(2|t|), t \in R,$ is a differentiable function$\}$. Then S is a subset of :

A. R × [0, ∞)

B. [0, ∞) × R

C. R × [-∞, 0)

D. [-∞, 0) × R

13.If a right circular cone, having maximum volume, is inscribed in a sphere of radius 3 cm, then the curved surface area (in cm^2) of this cone is :

A. $6\sqrt{2}\pi$

B. $6\sqrt{3}\pi$

C. $8\sqrt{2}\pi$

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

14.If $f\left(\frac{x-4}{x+2}\right) = 2x + 1, \left(x \in R - \{1, -2\}\right)$, then $\int f(x)\,dx$ is equal to :

(where C is a constant of integration)p

A. $12 \log_e |1 - x| + 3x + C$

B. $-12 \log_e |1 - x| - 3x + C$

C. $12 \log_e |1 - x| - 3x + C$

D. $-12 \log_e |1 - x| + 3x + C$

15.The area (in sq. units) of the region $\left\{x \in : x \geq 0, y \geq 0, y \geq x - 2 \text{ and } y \leq \sqrt{x}\right\}$, is :

A. $\frac{13}{3}$

B. $\frac{8}{3}$

C. $\frac{10}{3}$

D. $\frac{5}{3}$

16.The value of the integral $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} sin^4 x\left(1+\log\left(\frac{2+\sin x}{2-\sin x}\right)\right)dx$ is :

A. 0

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

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

D. $\frac{3}{16}\pi$

17.Let $y = y(x)$ be the solution of the differential equation $\frac{dy}{dx}+2y=f(x)$, where $f(x)=\begin{cases}1, & x\in[0,1]\\ 0, & \text{otherwise}\end{cases}$ If $y(0)=0$, then $y\left(\frac{3}{2}\right)$ is :

A. $\frac{e^2+1}{2e^4}$

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

C. $\frac{e^2-1}{e^3}$

D. $\frac{e^2-1}{2e^3}$

18.In a triangle ABC, coordinates of A are (1, 2) and the equations of the medians through B and C are respectively, $x+y=5$ and $x=4$. Then area of ΔABC (in sq. units) is :

A. 12

B. 4

C. 5

D. 9

19.A circle passes through the points (2, 3) and (4, 5). If its centre lies on the line, $y-4x+3=0$, then its radius is equal to :

A. 2

B. $\sqrt{5}$

C. $\sqrt{2}$

D. 1

20.Two parabolas with a common vertex and with axes along x-axis and y-axis, respectively, intersect each other in the first quadrant. If the length of the latus rectum of each parabola is 3, then the equation of the common tangent to the two parabolas is :

A. $4(x+y)+3=0$

B. $3(x+y)+4=0$

C. $8(2x+y)+3=0$

D. $x+2y+3=0$

21.If the tangents drawn to the hyperbola $4y^2 = x^2+1$ intersect the co-ordinate axes at the distinct points A and B, then the locus of the midpoint of AB is :

A. $x^2-4y^2+16x^2y^2=0$

B. $x^2-4y^2-16x^2y^2=0$

C. $4x^2-4y^2+16x^2y^2=0$

D. $4x^2-4y^2-16x^2y^2=0$

22.If β is one of the angles between the normals to the ellipse, $x^2+3y^2=9$ at the points $\left(3\cos\theta, \sqrt{3}\sin\theta\right)$ and $\left(-3\sin\theta, \sqrt{3}\cos\theta\right)$; $\theta \in \left(0, \frac{\pi}{2}\right)$; then $\frac{2\cot\beta}{\sin 2\theta}$ is equal to :

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

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

C. $\sqrt{2}$

D. $\frac{\sqrt{3}}{4}$

23.A variable plane passes through a fixed point (3, 2, 1) and meets x, y and z axes at A, B and C respectively. A plane is drawn parallel to yz-plane through A, a second plane is drawn parallel zx-plane through B and a third plane is drawn parallel to xy-plane through C. Then the locus of the point of intersection of these three planes, is :

A. $\frac{x}{3}+\frac{y}{2}+\frac{z}{1}=1$

B. $x+y+z=6$

C. $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=\frac{11}{6}$

D. $\frac{3}{x}+\frac{2}{y}+\frac{1}{z}=1$

24.An angle between the plane, $x+y+z=5$ and the line of intersection of the planes, $3x+4y+z-1=0$ and $5x+8y+2z+14=0$, is :

A. $\sin^{-1}\left(\sqrt{3/17}\right)$

B. $\cos^{-1}\left(\sqrt{3/17}\right)$

C. $\cos^{-1}\left(3/\sqrt{17}\right)$

D. $\sin^{-1}\left(3/\sqrt{17}\right)$

25.If $\bar{a}, \bar{b},$ and $\bar{c}$ are unit vectors such that $\bar{a}+2\bar{b}+2\bar{c}=\bar{0},$ then $\left|\bar{a}\times\bar{c}\right|$ is equal to :

A. $\dfrac{\sqrt{15}}{4}$

B. $\dfrac{1}{4}$

C. $\dfrac{15}{16}$

D. $\dfrac{\sqrt{15}}{16}$

26.The mean of a set of 30 observations is 75. If each observation is multiplied by a non-zero number λ and then each of them is decreased by 25, their mean remains the same. Then λ is equal to :

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

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

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

D. $\dfrac{10}{3}$

27.A box 'A' contains 2 white, 3 red and 2 black balls. Another box 'B' contains 4 white, 2 red and 3 black balls. If two balls are drawn at random, without replacement, from a randomly selected box and one ball turns out to be white while the other ball turns out to be red, then the probability that both balls are drawn from box 'B' is :

A. $\dfrac{9}{16}$

B. $\dfrac{7}{16}$

C. $\dfrac{9}{32}$

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

28.If tanA and tanB are the roots of the quadratic equation, $3x^2-10x-25=0,$ then the value of $3\ \sin^2(A+B)-10\sin(A+B).\ \ \cos(A+B)-25\ \cos^2(A+B)$ is :

A. −10

B. 10

C. −25

D. 25

29.An aeroplane flying at a constant speed, parallel to the horizontal ground, $\sqrt{3}$ km above it, is observed at an elevation of 60 from a point on the ground. If, after five seconds, its elevation from the same point, is 30^{o}, then the speed (in km/hr) of the aeroplane, is :

A. 1500

B. 1440

C. 750

D. 720

30.If $(p \wedge \sim q) \wedge (p \wedge r) \to \sim p \vee q$ is false, then the truth values of p, q and r are, respectively :

A. F, T, F

B. T, F, T

C. T, T, T

D. F, F, F