MATHS

BOOKS - TELUGU ACADEMY MATHS (TELUGU ENGLISH)

QUESTION PAPER

Section A

1. If $f: R \to R, g: R \to R$ are defined by $f(x) = 3x - 1$ and $g(x) = x^2 + 1$, then find (i) $(fog)(2)$

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2. If $f = \{(1, 2), (2, -3), (3, -1)\}$ then find (i) $2f$

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3. If $A = \left\{0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}\right\}$ and $f: A \to B$ is a surjection defined by $f(x) = \cos x$ then find B.

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4. If $A = \{-2, -1, 0, 1, 2\}$ and $f: A \to B$ is a surjection defined by $f(x) = x^2 + x + 1$ then find B.

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5. If Q is the set of all rational numbers, and $f: Q \to Q$ is defined by $f(x) = 5x + 4, \forall x \in Q$, show that f is a bijection.

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6. Find the inverse function of $f(x) = 5^x$.

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7. Find the domain of the real function $f(x) = \sqrt{x^2 - 25}$

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8. Find the domain of the real function $f(x) = \frac{1}{\sqrt{1 - x^2}}$

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9. Find the domain of the real function $\log(x^2 - 4x + 3)$

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10. Find the domain of the real function $f(x) = \frac{1}{(x^2 - 1)(x + 3)}$

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11. Find the range of the real function $\frac{x^2-4}{x-2}$

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12. If $\begin{bmatrix} x-1 & 2 & 5-y \\ 0 & z-1 & 7 \\ 1 & 0 & a-5 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 4 & 7 \\ 1 & 0 & 0 \end{bmatrix}$ then find the values of x,y,z and a.

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13. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix} 2X + A = B$ then find X.

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14. Find the trace of $\begin{bmatrix} 1 & 3 & -5 \\ 2 & -1 & 5 \\ 2 & 0 & 1 \end{bmatrix}$.

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15. If $A = \begin{bmatrix} 2 & -4 \\ 5 & 3 \end{bmatrix}$ then find $A + A'$ and AA'.

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16. IF $A = \begin{bmatrix} 2 & -1 & 2 \\ 1 & 3 & -4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -3 & 0 \\ 5 & 4 \end{bmatrix}$ then verify that (AB)'=B'A'.

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17. If $\begin{bmatrix} 0 & 2 & 1 \\ -2 & 0 & -2 \\ -1 & x & 0 \end{bmatrix}$ is a skew symmetric matrix then find the value of x.

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18. Find the cofactors of 2 and -5 in the matrix $\begin{bmatrix} -1 & 0 & 5 \\ 1 & 2 & -2 \\ -4 & -5 & 3 \end{bmatrix}$

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19. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 4 \\ 5 & -6 & x \end{bmatrix}$ det A = 45 then find x.

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20. IF $A = \begin{bmatrix} 2 & 4 \\ -1 & k \end{bmatrix}$ and $A^2 = 0$ then find the value of k

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21. Find the rank of $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$

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22. Define symmetric and skew symmetric matrix and give an example to each.

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23. If $\bar{a}=2\bar{i}+4\bar{j}-5\bar{k}, \bar{b}=\bar{i}+\bar{j}+\bar{k}$ and $\bar{c}=\bar{j}+2\bar{k}$. Find the unit vector in the opposite direction of $\bar{a}+\bar{b}+\bar{c}$.

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24. Find a vector in the direction of vector $\bar{a}=\bar{i}-2\bar{j}$ has magnitude 7 units.

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25. If α, β and γ be the angle made by the vector $3\bar{i}-6\bar{j}+2\bar{k}$ with the positive direction of the coordinate axes, then find $\cos\alpha, \cos\beta, \cos\gamma$.

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26. Show that the points $A(2\bar{i} - \bar{j} + \bar{k}), B(\bar{i} - 3\bar{j} - 5\bar{k}), C(3\bar{i} - 4\bar{j} - 4\bar{k})$ are the vertices of a right angled triangle.

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27. If $\bar{a} = 2\bar{i} + 5\bar{j} + \bar{k}$ and $\bar{b} = 4\bar{i} + m\bar{j} + n\bar{k}$ are collinear vectors then find m,n.

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28. If the position vectors of the points A,B,C are $-2\bar{i} + \bar{j} - \bar{k}, \ -4\bar{i} + 2\bar{j} + 2\bar{k}, 6\bar{i} - 3\bar{j} - 13\bar{k}$ respectively and $\overline{AB} = \lambda\overline{AC}$ then find the value of λ.

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29. Show that the points whose P,V are $-2\bar{a}+3\bar{b}+5\bar{c}$, $\bar{a}+2\bar{b}+3\bar{c}$, $7\bar{a}-\bar{c}$ are collinear, where $\bar{a}$, $\bar{b}$, $\bar{c}$ are non-coplanar vectors.

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30. Find the vectore equation of the line passing through the point $2\bar{i}+\bar{j}+3\bar{k}$ parallel to vector $4\bar{i}-2\bar{j}+3\bar{k}$.

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31. Find the vector equation of the line passing through the points $2\bar{i}+\bar{j}+3\bar{k}$ and $-4\bar{i}+3\bar{j}-\bar{k}$.

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32. Find the vector equation of the plane passing through the points $\bar{i} - 2\bar{j} + 5\bar{k}, \ -5\bar{j} - \bar{k}, \ -3\bar{i} + 5\bar{j}.$

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33. If $\bar{a} = \bar{i} + 2\bar{j} - 3\bar{k}, \bar{b} = 3\bar{i} - \bar{j} + 2\bar{k}$ then S.T $\bar{a} + \bar{b}, \bar{a} - \bar{b}$ are perpendicular.

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34. If vectors $\lambda\bar{i} - 3\bar{j} + 5\bar{k}, 2\lambda\bar{i} - \lambda\bar{j} - \bar{k}$ are perpendicular to each other find λ.

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35. Find a unit vector perpendicular to the plane containing the vector $\bar{a} = 4\bar{i} + 3\bar{j} - \bar{k}, \bar{b} = 2\bar{i} - 6\bar{j} - 3\bar{k}$

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36. If $\bar{a} = \bar{i} + \bar{j} + \bar{k}, \bar{b} = 2\bar{i} + 3\bar{j} + \bar{k}$ then find the projection vector of $\bar{b}$ on $\bar{a}$ and its magnitude.

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37. Find the vector area and area of the parallelogram having $\bar{a} = \bar{i} + 2\bar{j} - \bar{k}, \bar{b} = 2\bar{i} - \bar{j} + 2\bar{k}$ as adjacent sides.

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38. Find anle between planes $\bar{r}.\left(2\bar{i} - \bar{j} + 2\bar{k}\right) = 3, \bar{r}.\left(3\bar{i} + 6\bar{j} + \bar{k}\right) = 4$

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39. If $\cos\theta+\sin\theta=\sqrt{2}\cos\theta$ then S.T $\cos\theta-\sin\theta=\sqrt{2}\sin\theta$

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40. Show that $\cos 340^\circ \cos 40^\circ + \sin 200^\circ \sin 140^\circ = \frac{1}{2}$.

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41. Prove that $\frac{\cos 9^\circ + \sin 9^\circ}{\cos 9^\circ - \sin 9^\circ} = \cot 36^\circ$.

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42. Prove that $\sin^2 42^\circ - \cos^2 78^\circ$.

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43. Prove that $\tan 50^\circ - \tan 40^\circ - 2\tan 10^\circ$.

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44. Prove that $(1+\cot\theta-\text{cosec}\theta)(1+\tan\theta+\sec\theta)=2.$

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45. If $\sin\alpha=\frac{3}{5}$, where $\frac{\pi}{2}<\alpha<\pi$, evaluate $\cos 3\alpha$ and $\tan 2\alpha$.

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46. Find the period of $f(x)=\cos\left(\frac{4x+9}{5}\right)$

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47. Find the period of $\tan\left(x+4x+9x+\ldots\ldots+n^2x\right)$ (n any positive integer)

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48. Find a cosine function whose period is 7.

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49. Find the range of $13\cos x + 3\sqrt{3}\sin x - 4$

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50. Find the extreme values of $3\sin^2 x + 5\cos^2 x$.

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51. Find max. and min. of $3\sin x + 4\cos x$.

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52. Prove that $\cosh^2 x - \sinh^2 x = 1$

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53. Prove that $(\cosh x - \sinh x)^n = \cosh(nx) - \sinh(nx)$

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54. IF sinhx=$3/4$ then find cosh2x and sinh2x.

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55. If $\sinh x = 3 \text{ then show that } x = \log\left(3 + \sqrt{10}\right)$

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56. S.T $\frac{\tanh^{-1} 1}{2} = \frac{1}{2}\log_e 3.$

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Section B

1. Show that the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix}$ is non-singular and find A^{-1}.

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2. IF $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ then show that $A^{-1} = A^3$.

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3. S.T $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$.

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4. Without expanding the determinant , prove that $\begin{vmatrix} a & a^2 & bc \\ b & b^2 & ca \\ c & c^2 & ab \end{vmatrix} = \begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix}$

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5. Show that $|(b+c, c+a, a+b), (a+b, b+c, c+a)(a, b, c)| = a^3 + b^3 + c^3 - 3abc$

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6. If $diagA = [a_1, a_2, a_3]$, then for any integer $n \geq 1$ show that $A^n = diag[a_1^n, a_2^n, a_3^n]$

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7. If ABCDEF is a regular hexagon with centre O , then P.T $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} = 3\overline{AD} = 6\overline{AO}$

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8. If the points whose position vectors are $3\overline{i} - 2\overline{j} - \overline{k}, 2\overline{i} + 3\overline{j} - 4\overline{k}, -\overline{i} + \overline{j} + 2\overline{k}, 4\overline{i} + 5\overline{j} + \lambda\overline{k}$ are coplanar, then show that $\lambda = -\frac{146}{17}$.

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9. Find the vector equation of the plane passing through the points. $4\overline{i} - 3\overline{j} - \overline{k}, 3\overline{i} + 7\overline{j} - 10\overline{k}$ and $2\overline{i} + 5\overline{j} - 7\overline{k}$ and show that the point $\overline{i} + 2\overline{j} - 3\overline{k}$ lies in the plane.

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10. In the two dimensional plane, prove by using vector methods, the equation of the line whose intercepts on the axes are 'a' and 'b' is $\frac{x}{a}+\frac{y}{b}=1.$

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11. If $\bar{a}, \bar{b}, \bar{c}$ are non-coplaner, then show that the vectors $\bar{a}-\bar{b}, \bar{b}+\bar{c}, \bar{c}+\bar{a}$ are coplanar

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12. Find the area of the triangle formed with the points $A(1, 2, 3), B(2, 3, 1), C(3, 1, 2)$.

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13. If $\bar{a}=2\bar{i}+\bar{j}-\bar{k}, \bar{b}=-\bar{i}+2\bar{j}-4\bar{k}, \bar{c}=\bar{i}+\bar{j}+\bar{k}$ then find $(\bar{a}\times\bar{b}).(\bar{b}\times\bar{c})$.

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14. Prove that angle in a semi circle is a rightangle by using Vector method.

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15. If $\dfrac{\sin(\alpha+\beta)}{\sin(\alpha-\beta)}=\dfrac{a+b}{a-b}$, then prove that a $\tan\beta=b\tan\alpha$.

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16. Show that $\sin A=\dfrac{\sin 3A}{1+2\cos 2A}$. Hence find the value of $\sin 15^\circ$.

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17. Show that $\frac{1}{\sin 10^\circ} - \frac{\sqrt{3}}{\cos 10^\circ} = 4.$

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18. Show that $\sin^4.\ \frac{\pi}{8} + \sin^4.\ \frac{3\pi}{8} \sin^4.\ \frac{5\pi}{8} + \sin^4.\ \frac{7\pi}{8} = \frac{3}{2}$

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19. Prove that

$$\left(1 + \cos\frac{\pi}{10}\right)\left(1 + \cos\frac{3\pi}{10}\right)\left(1 + \cos\frac{7\pi}{10}\right)\left(1 + \cos\frac{9\pi}{10}\right) = \frac{1}{16}$$

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20. If $\cos\alpha = \frac{3}{5}$ and $\cos\beta = \frac{5}{13}$ and α, β are acute angles, then prove that

(a)$\sin^2\left(\frac{\alpha - \beta}{2}\right) = \frac{1}{65}$ and

(b) $\cos^2\left(\frac{\alpha + \beta}{2}\right) = \frac{16}{65}$

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22. If α, β are the solutions of the equation $a\cos\theta + b\sin\theta = c$, where $a, b, c \in R$ and if $a^2 + b^2 > 0, \cos\alpha \neq \cos$

then show that (i) $\sin\alpha + \sin\beta = \frac{2bc}{a^2 + b^2}$ (ii) $\sin\alpha . \sin\beta = \frac{c^2 - a^2}{a^2 + b^2}$

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23. If α, β are the solutions of the equation $a\cos\theta + b\sin\theta = c$, where $a, b, c \in R$ and if $a^2 + b^2 > 0, \cos\alpha \neq \cos$

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24. If A is not an integral multiple of (π), prove that $\cos A \cos 2A \cos 4A \cos 8A = \frac{\sin 16A}{16 \sin A}$ Hence deduce that $\cos . \frac{2\pi}{15} . \cos . \frac{4\pi}{15} . \cos . \frac{8\pi}{18} . \cos . \frac{16\pi}{15} = \frac{1}{16}$

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25. Solve $\sin x + \sqrt{3} \cos x = \sqrt{2}$.

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26. Solve that $\sqrt{2}(\sin x + \cos x) = \sqrt{3}$

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27. Solve $2\cos^2\theta - \sqrt{3}\sin\theta + 1 = 0.$

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28. Solve $2\cos^2\theta + 11\sin\theta = 7.$

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29. Solve $\sin\theta + \sin 5\theta = \sin 3\theta, 0 < \theta < \pi.$

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30. Solve $1 + \sin^2\theta = 3\sin\theta\cos\theta$

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31. Solve $\tan\theta + 3\cot\theta = 5\sec\theta.$

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32. If $a\cos 2\theta + b\sin 2\theta = c$ has θ_1, θ_2 as its solutions then show that $\tan\theta_1 + \tan\theta_2 = \frac{2b}{c+a}\tan\theta_1 . \tan\theta_2 = \frac{c-a}{c+a}$ and hence show that $\tan(\theta_1 + \theta_2) = b/a.$

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33. Given $p \neq \pm q$. Show that the solutions of $\cos P\theta + \cos q\theta = 0$ form two series each of which is in A.P . Find also the common difference of each A.P .

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34. Prove that $\sin^{-1}\frac{3}{5} + \sin^{-1}\frac{8}{17} = \cos^{-1}\frac{36}{85}$

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35. P.T. $\cos^{-1}\left(\frac{4}{5}\right)+\sin^{-1}\left(\frac{3}{\sqrt{34}}\right)=\tan^{-1}\left(\frac{27}{11}\right)$.

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36. Find the value of $\tan\left(\frac{\sin^{-1}3}{5}+\frac{\cos^{-1}5}{\sqrt{34}}\right)$.

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37. Show that $\cos\left(2\tan^{-1}.\ \frac{1}{7}\right)=\sin\left(2\tan^{-1}.\ \frac{3}{4}\right)$

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38. Prove that $\tan^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\left(\frac{1}{5}\right)+\tan^{-1}\left(\frac{1}{8}\right)=\frac{\pi}{4}$

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39. Prove that $\sin^{-1}\left(\frac{4}{5}\right) + 2\tan^{-1}\left(\frac{1}{3}\right) = \frac{\pi}{2}$.

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40. If $\cos^{-1}p + \cos^{-1}q + \cos^{-1}r = \pi$ then, $P.T. \, p^2 + q^2 + r^2 = 2pqr = 1$

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41. Prove that $\sin\left[\frac{\cot^{-1}(2x)}{1-x^2} + \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)\right] = 1.$

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42. Prove that $\cot A + \cot B + \cot C = \frac{a^2+b^2+c^2}{4\,\triangle}$.

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43. Show that $a^2 \cot A + b^2 \cot B + c^2 \cot C = \frac{abc}{R}$

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44. If $C = 60^\circ, \quad \text{then show that} \frac{a}{b+c} + \frac{b}{c+a} = 1$

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45. If $\frac{\cot A}{2} : \cot \frac{B}{2} : \cot \frac{C}{2} = 3 : 5 : 7$ then show that $a : b : c = 6 : 5 : 4.$

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46. In a $\triangle ABC$, if $a : b : c = 7 : 8 : 9$, then find $\cos A : \cos B : \cos C$.

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47. Value of $\frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} + \frac{1}{r^2}$ is :

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48. Show that $r_1 + r_2 + r_3 - r = 4R$

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49. Show that $r + r_3 + r_1 - r_2 = 4R \cos B$.

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Section C

1. If $f: A \to B, g: B \to C$ are two bijective functions then prove that $gof: A \to C$ is also a bijective function.

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2. If $f: A \to B, g: B \to C$ are two bijective functions then P.T $(\text{gof})^{-1} = f^{-1}\text{og}^{-1}$

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3. If $f: A \to B$ is a function and I_A, I_B are identify functions on A,B respectively then prove that $foI_A = f = I_B$ of

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4. If $f: A \to B$ is a bijective function then prove that

(i) $fof^{-1} = I_B$

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5. If $f: A \to B$ is a bijective function then prove that

(ii) $f^{-1}of = I_A$.

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6. Statement -I: $f: A \rightarrow B$ is one -one and $g: B \rightarrow C$ is a one-one function, then $gof: A \rightarrow C$ is one-one

Statement-II: If $f: A \rightarrow B, g: B \rightarrow A$ are two functions such that gof $= I_A$ and $fog = I_B$, then $f = g^{-1}$.

Statement-III: $f(x) = \sec^2 x - \tan^2 x, g(x) = \operatorname{cosec}^2 x - \cot^2 x$, then f=g.

Which of the above statements is/are true:

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7. Using Mathematical Induction, prove that statement for all $n \in N$

$$1.2.3 + 2, 3, 4 + \dots\dots\dots + (\text{upto n terms}) = \frac{n(n+1)(n+2)(n+3)}{4}$$

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8. Using the principle of finite Mathematical Induction prove that

$$1^2 + \left(1^2 + 2^2\right) + \left(1^2 + 2^2 + 3^2\right) + \text{n terms} = \frac{n(n+1)^2(n+2)}{12}, \forall n \in N$$

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9. Using the principle of finite Mathematical Induction prove the following:

(iii) $\frac{1}{1.4} + \frac{1}{4.7} + \frac{1}{7.10} + \ldots\ldots\ldots + \text{n terms} = \frac{n}{3n+1}$.

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10. Using the principle of finite Mathematical Induction prove the following:

(iv) $a + ar + ar^2 + \ldots\ldots\ldots + \text{n terms} = \frac{a(r^n - 1)}{r - 1}, r \neq 1.$

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11. Using the principle of finite Mathematical Induction prove the following:

(v) $3.5^{2n+1} + 2^{3n+1}$ is divisible by 17, $\forall n \in N$.

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12. Using the principle of finite Mathematical Induction prove the following:

(vi) $2 + 3.2 + 4.2^2 + \ldots\ldots\ldots \text{upto n terms} = n.2^n$.

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13. If A is a non-singular matrix then prove that $A^{-1} = \frac{adjA}{|A|}$.

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14. Show that $\begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix}$ =(a-b)(b-c)(c-a)(ab+bc+ca)

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15. Show that $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$

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16. Show that

$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}^2 = \begin{vmatrix} 2bc-a^2 & c^2 & b^2 \\ c^2 & 2ac-b^2 & a^2 \\ b^2 & a^2 & 2ab-c^2 \end{vmatrix} = \left(a^3+b^3+c^3-3abc\right)^2$$

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17. Find the value of x, if $\begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ x-4 & 2x-9 & 3x-16 \\ x-8 & 2x-27 & 3x-64 \end{vmatrix} = 0.$

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18. If $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ then show that for all the positive integers n,

$A^n = \begin{bmatrix} \cos n\theta & \sin n\theta \\ -\sin n\theta & \cos n\theta \end{bmatrix}$.

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19. By Cramer's rule, solve

$x - y + 3z = 5,\ 4x + 2y - z = 0,\ x + 3y + z = 5.$

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20. By Matrix inverse method, solve

$3x + 4y + 5z = 18,\ 2x - y + 8z = 13,\ 5x - 2y + 7z = 20.$

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21. By Matrix inverse method, solve

$3x + 4y + 5z = 18,\ 2x - y + 8z = 13,\ 5x - 2y + 7z = 20.$

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22. Solve the system of equations $x + y + z = 3, 2x + 2y - z = 3, x + y - z = 1$ by Gauss Jordan method.

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23. Examine the consistency of the following systems of equations $x + y + z = 1, 2x + y + z = 2, x + 2y + 2z = 1$ and if consistent find the complete solutions.

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24. P.T the smaller angle θ between any two diagonals of a cube is given by $\cos\theta = 1/3$

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25. If

$\bar{a}=\bar{i}-2\bar{j}+3\bar{k}, \bar{b}=2\bar{i}+\bar{j}+\bar{k}, \bar{c}=\bar{i}+\bar{j}+2\bar{k}$ then find $\left(\bar{a}\times\bar{b}\right)\times\bar{c}|$

A. TS 18

B.

C.

D.

Answer:

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26. If $\bar{a}=2\bar{i}+3\bar{j}+4\bar{k}, \bar{b}=\bar{i}+\bar{j}-\bar{k}, \bar{c}=\bar{i}-\bar{j}+\bar{k},$ compute $\bar{a}x\left(\bar{b}x\bar{c}\right)$ and verify that it is perpendicular to $\bar{a}$.

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27. Find the shortest distance between the skew lines .

$\bar{r} = (6\bar{i} + 2\bar{j} + 2\bar{k}) + t(\bar{i} - 2\bar{j} + 2\bar{k})$ and $\bar{r} = (-4\bar{i} - \bar{k}) + s(3\bar{i} - 2\bar{j}$ -

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28. If

$A = (1, -2, -1), B = (4, 0, -3), C = (1, 2, -1), D = (2, -4, -5)$

then find distance between $\overline{AB}, \overline{CD}$

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29. If $A + B + C = 180^\circ$, then show that

$\sin 2A + \sin 2B + \sin 2C = 4 \sin A \sin B \sin C.$

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30. IF A,B,C are angles in the triangle, then prove that

$$\cos A+\cos B-\cos C=\ -1+4\cos\frac{A}{2}.\cos\frac{B}{2}.\sin\frac{C}{2}$$

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31. If A, B, C are angles in a triangle, then the $\sin^2 A+\sin^2 B-\sin^2 C=2\sin A\sin B\cos C$

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32. If $A+B+C=\pi,$ then prove that $\cos^2\left(\frac{A}{2}\right)+\cos^2\left(\frac{B}{2}\right)+\cos^2\left(\frac{C}{2}\right)=2\left(1+\sin.\frac{A}{2}\sin.\frac{B}{2}\sin.\frac{C}{2}\right)$

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33. If $A, B, C$are angles of a triangle, then $P.T\sin^2.\frac{A}{2}+\sin^2.\frac{B}{2}-\sin^2.\frac{C}{2}=1-2\cos.\frac{A}{2}\cos.\frac{B}{2}\sin.\frac{C}{2}$

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34. In triangle ABC, prove that $\cos.\frac{A}{2}+\cos.\frac{B}{2}+\cos.\frac{C}{2}=4\cos.\frac{\pi-A}{4}\cos.\frac{\pi-B}{4}\cos.\frac{\pi-C}{4}$

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35. If $A+B+C=\frac{3\pi}{2}$, prove that $\cos 2A+\cos 2B+\cos 2C=1-4\sin A\sin B\sin C$.

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36. If A+B+C = 2S , then

P.T

$\cos(S-A)+\cos(S-B)+\cos(S-C)+\cos S=4\cos.\frac{A}{2}\cos.\frac{B}{2}\cos.\frac{C}{2}$

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37. In a $\triangle ABC$ if $a = 13, b = 14, c = 15$ then S.T $R = \frac{65}{8}, r = 4, r_1 = \frac{21}{2}, r_2 = 12, r_3 = 14.$

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38. If $r_1 = 2, r_2 = 3, r_3 = 6$ and $r = 1,$ prove that $a = 3, b = 4 \text{ and } c = 5.$

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39. In ΔABC prove that $\frac{r_1}{bc} + \frac{r_2}{ca} + \frac{r_3}{ab} = \frac{1}{r} - \frac{1}{2R}$

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40. If $\sin\theta = \frac{a}{b+c}$ then show that $\cos\theta = \frac{2\sqrt{bc}}{b+c}\cos\left(\frac{A}{2}\right)$

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41. $a\cos^2 A/2 + b\cos^2 B/2 + c\cos^2 C/2 = s + \frac{\Delta}{R}$ అని చూపండి.

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42. In a $\triangle ABC$ if $a^2 + b^2 + c^2 = 8R^2$ then show that $\triangle ABC$ is a right angled triangle.

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Section A

1. Find the value of y, if the line joining (3,y) and (2,7) is parallel to the line joining the points (-1,4) and (0,6).

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2. Find the value of k, if the straight lines y-3kx+4=0 and (2k-1)x-(8k-1)y-6=0 are perpendicular.

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3. Find the equation of the straight line perpendicular to the line 5x-3y+1=0 and passing through the point (4,-3).

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4. Transform the equation $\sqrt{3x} + y = 4$ into

(i) Slope intercept form

(ii) Intercept form

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5. Transform the equation of $x + y + 1 = 0$ into

Normal form

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6. Find the equation of the straight line passing through (-4,5) and cutting off equal and non-zero intercepts on the co-ordinate axes.

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7. Find the equation of the straight line passing through the point $(-2, 4)$ and making intercepts ,whose sum is zero .

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8. Find the distance between the parallel lines $5x-3y-4=0, 10x-6y-9=0.$

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9. Find the value of a it the area of the triangle formed by the liners x=0,y=0,3x+4y=a is 6 sq units.

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10. Find the ratio in which the straight line $2x + 3y - 5 = 0$ divides the line joining the points (0,0) and (-2,1).

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11. Find the value of p, if straight line $x + p = 0, y + 2 = 03x + 2y + 5 = 0$ are concurrent.

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12. The distance between the points (5,-1,7) and (c,5, 1) is 9 then c =

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13. Show that the points (1,2,3), (2,3,1) and (3,1,2) form an equilateral triangle.

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14. Find the coordinates of the vertex 'C' of ΔABC if its centroid is the origin and the vertices A,B are (1,1,1) are (-2,4,1) respectively.

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15. If (3,2,-1),(4,1,1) and (6,2,5) are three vertices and (4,2,2) is the centroid of a tetrahedro, find the fourth vertex to that tetrahedron.

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16. Find the ratio in which YZ-plane divides the line joining A(2,4,5),B(3,5,-4). Find the point of intersection.

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17. Find the equation of tbe plane passing through the point $(1, 2, -3)$ & parallel to the plane $2x - 3y + 6z = 0$.

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Section A

1. Find the angle between the planes 2x - y + z = 6 and x + y + 2 z = 7 .

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2. Find the intercepts of the plane $4x + 3y - 2z + 2 = 0$ on the coordinate axes.

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3. Reduce the equation $4x - 4y + 2z + 5 = 0$ of the plane to the intercept form.

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4. Reduce the equation $x + 2y - 3z - 6 = 0$ of the plane to the normal form.

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5. $\underset{y \to 0}{\text{Lt}} \frac{a^x - 1}{b^x - 1} =$

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6. Evalute $Lt_{x \to \infty} \frac{11x^3 - 3x + 4}{13x^3 - 5x^2 - 7}$.

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7. Evaluate $Lt_{x \to 0} \frac{\sqrt[3]{1+x} - \sqrt[3]{1-x}}{x}$

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8. $\operatorname*{Lt}_{x \to \infty} \frac{8|x| + 3x}{3|x| - 2x}$.

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9. If $f(x) = a^x . e^{x^2}$ then find $f'(x)$

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10. Find the dirivative of $\log(\sin(\log x))$.

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11. Find the derivative of $y = e^{\sin^{-1}} x$.

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12. Find the derivative of $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$

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13. Find the derivative of $\cos^{-1}(4x^3 - 3x)$ w.r.to x.

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14. Find the derivative of $\log(\sec x + \tan x)$.

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15. If $y = x^2 + 3x + 6$ then find $\triangle y$ and dy when $x = 10, \triangle x = 0.01$.

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16. Find Δy and dy for the function $y = x^2 + x$, when $x = 10, \Delta x = 0.1$

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17. Find the approximate value of $\sqrt[3]{999}$

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18. Find the approximate value of $\sin 62^\circ$

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19. If the increase in the side of a square is 4% then find the approximate percentage of increase in the area of the square.

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20. If the radius of a sphere is increased from 7 cm to 7.02 cm. then find the approximate increase in the volume of the sphere.

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21. State Rolle's Theorem.

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22. Verify Rolle's theorem for the function $y = f(x) = x^2 + 4$on [-3,3]

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23. Verify Rolle's theroem for the function $x^2 - 1$ on [-1,1]`.

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24. Verify the conditions of Lagrange's mean value theorem for the function $x^2 - 1$ on [2,3]

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25. Verify Lagrange's mean value theorem for the function $f(x) = x^2$ on [2,4]

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Section B

1. Find the equation of locus of P, if the line segment joining (2,3) & (-1,5) subtends a right angle at P.

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2. A(5,3) and B(3,-2) are 2 fixed points. Find the equation of locus of P, so that the area of $\triangle PAB$ is 9sq. Units.

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3. Find the equation of the locus of P, if A=(2,3), B=(2,-3) and PA +PB =8.

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4. $A(1, 2), B(2, -3), C(-2, 3)$ are 3 points. A point P moves such that $PA^2 + PB^2 = 2PC^2$. Show that the equation to the locus of P is 7 x - 7y + 4 = 0 .

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5. Find the locus of P(x,y) which moves such that its distances from A(5,-4),B(7,6) are in the ratio 2:3.

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6. When the origin is shifted to the point (2 , 3) the transformed equation of a curve is $x^2 + 3xy - 2y^2 + 17x - 7y - 11 = 0$. Find the original equation of curve.

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7. The transformed equation of $x^2 - 2\sqrt{3}xy - y^2 = 2a^2$ when the axes are rotated through an angle 60° is

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8. When the axes are rotated through an angle α, find the transformed equation of $x\cos\alpha + y\sin\alpha = p$.

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9. When the axes are rotated through an angle 45°, the transformed equation of a curve is $17x^2 - 16xy + 17y^2 = 225$. Find the original equation of the curve.

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10. Prove that the angle of rotation of the axes to eliminate xy term from the equation $ax^2 + 2hxy + by^2 = 0$ is $\tan^{-1}\left(\frac{2h}{a-b}\right)$ where $a \neq b$ and $\frac{\pi}{4}$ if $a = b$.

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11. Transform the equation $\frac{x}{a} + \frac{y}{b} = 1$ into normal form where $a > 0, b > 0$. If the perpendicular distance of the straight line from the Origin is p then deduce that $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$

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12. Find the points on the line $3x - 4y - 1 = 0$ which are at a distance of 5 units from the point (3,2).

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13. The value of k such that the lines $2x - 3y + k = 0, 3x - 4y - 13 = 0$ and $8x - 11y - 33 = 0$ are concurrent, is

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14. If the straight lines $ax + by + c = 0, bx + cy = a = 0$ and $cx = ay + b = 0$ are concurrent, then prove that $a^3 + b^3 + c^3 = 3abc$

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15. Find the equation of the line passing through the point of intersection of $2x + 3y = 1, 3x + 4y = 6$ and perpendicular to the lines

$5x - 2y = 7$

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16. Find the value of k if the angle between the straight lines $4x - y + 7 = 0, kx - 5y - 9 - 0$ is 45°

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17. A straight line with slope 1 passes through Q(-3,5) and meets the straight line x+y-6=0 at P. Find the distance PQ.

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18. Show that $f(x) = \begin{cases} \frac{\cos ax - \cos bx}{x^2} & \text{if } x \neq 0 \\ \frac{1}{2}\left(b^2 - a^2\right) & \text{if } x = 0 \end{cases}$ is continuous at 0

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19. If f is given by $f(x) = \begin{cases} k^2x - k & \text{if } x \geq 1 \\ 2 & \text{if } x < 1 \end{cases}$ is a continuous function on R, then find k .

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20. Is f given by $f(x) = \begin{cases} \frac{x^2 - 9}{x^2 - 2x - 3} & \text{if } 0 < x < 5 \text{ and } x \neq 3 \\ 1.5 & \text{if } x = 3 \end{cases}$, continuous at the point 3.

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21. Find the derivative of sin2x from the first principles .

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22. Find the derivative of $\cos ax$ from the first Principle.

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23. Find the derivative of $\tan 2x$ from the first principle.

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24. Find the derivative of $\cos^2 x$ from the first principle.

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25. Find the derivative of $x \sin x$ from the first principle.

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26. Find the derivative of the function from first principle

x^2

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27. A particle is moving in a straight line so that after 't' seconds its distance is 'S' (in cms) from a fixed point of the line is given be S=f(t)= $8t + t^3$.

Find (i) the velocity at time t=2 (ii) the initial velocity (iii) acceleration at t=2 sec

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28. The distance-time formula for the motion of a particle along a straight line is $s = t^3 - 9t^2 + 24t - 18$. Find when and where the velocity is zero.

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29. A stone is dropped into a quiet lake and ripples move in circles at the speed of 5 cm/sec. At the instant when the radius of circular ripple is 8cm, how fast is the enclosed area increases?

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30. The volume of a cube is increasing at a rate of 8 cubie centimeters per second. How fast is the surface area increasing when the length of the edge is 12 cm?

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31. Find the equations of the tangent and the normal to the curve $y^4 = ax^3$ at (a,a)

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32. Find the equations of the tangent and the normal to the curve $y = x^3 + 4x^2$ at (-1,3)

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33. Show that the curves $x^2 + y^2 = 2, 3x^2 + y^2 = 4x$ have a common tangent at the point (1,1)

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34. S.T the tangent at any point θ on the curve $x = c\sec\theta, y = c\tan\theta$ is $y\sin\theta = x - \cos\theta.$

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35. Find the value of k, so that the length of the subnormal at any point on the curve $xy^k = a^{k+1}$ is a constant.

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36. Find the length of subtangent subnormal at a pont t on the curve $x = a(\cos t + \sin t)y = a(\sin t - t\cos t)$

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Section C

1. Find the circumcentre of the triangle whose vertices are (1,3) (-3,5) and (5,-1).

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2. Find the orthocentre of the triangle formed by the vertices (-2,-1),(6,-1), (2,5)

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3. Find the orthocentre of the triangle whose sides are $7x+y-10=0, x-2y+5=0, x+y+2=0$

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4. Find the circumcentre of the triangle whose sides are given by $x + y = 0, 2x + y + 5 = 0$ and $x - y = 0$

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5. If $Q(h, k)$ is the foot of the perpendicular of $P(x_1, y_1)$ on the line $ax + by + c = 0$ then prove that $(h - x_1), a = (k - y_1), b = -(ax_1 + by_1 + c): (a^2 + b^2)$.

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6. If $Q(h, k)$ is the foot of the perpendicular of $P(x_1, y_1)$ on the line $ax + by + c = 0$ then prove that $(h - x_1), a = (k - y_1), b = -(ax_1 + by_1 + c): (a^2 + b^2)$.

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7. Find the centroid and the area of the triangle formed by the lines

$12x^2 - 20xy + 7y^2 = 0, 2x - 3y + 4 = 0$

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8. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents two parallel lines then prove that $h^2 = ab$.

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9. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents two parallel lines then prove that $af^2 = bg^2$.

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10. If $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents two parallel lines then prove that the distance between the parallel lines is

$$2\sqrt{\frac{g^2-ac}{a(a+b)}} \text{ or } 2\sqrt{\frac{f^2-bc}{b(a+b)}}.$$

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11. Find the angle between the lines joining the origin to the points of intersection of the curve $x^2+2xy+y^2+2x+2y-5=0$ and the line 3x-y+1=0.

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12. Find the value if k , if the lines joining the origin with the points of intersection of the curve $2x^2-2xy+3y^2+2x-y-1=0$ and the x + 2y = k are mutually perpendicular .

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13. Show that the lines joining the origin with the points of intersection of the curve $7x^2-4xy+8y^2+2x-4y-8=0$ with the line

$3x - y = 2$ are mutually perpendicular.

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14. Find the condition for the chord lx + my=1 of the circle $x^2 + y^2 = a^2$ to subtend a right angle at the origin.

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15. Find the angle between the lines whose d.c's are related by $l + m + n = 0 \& l^2 + m^2 - n^2 = 0$

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16. Find the direction cosines of the two lines which are connected by the relations $l - 5m + 3n = 0, 7l^2 + 5m^2 - 3n^2 = 0$

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17. Find the angle between the lines, whose direction cosines are given by the equation $3l + m + 5n = 0$ and $6mn - 2nl + 5lm = 0$.

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18. If a line makes angles $\alpha, \beta, \lambda, \delta$ with the four diagonals of a cube, then show that $\cos^2\alpha + \cos^2\beta + \cos^2\lambda + \cos^2\delta = \frac{4}{3}$.

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19. If $y = \tan(-1)\left(\frac{\sqrt{(1+x^2)} + \sqrt{1-x^2}}{\sqrt{1+x^2} - \sqrt{1-x^2}}\right)$ then find $\frac{dy}{dx}$.

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20. Find the derivative of $(\sin x)^{\log x} + x^{\sin x}$.

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21. Find the derivative of $x^{\tan x} + (\sin x)^{\cos x}$ w.r.to x.

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22. if $\sin y = x \sin(a+y)$ then show that $\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$.

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23. If $x^y = y^x$ then show that $\frac{dy}{dx} = \frac{y(x \log y - y)}{x(y \log x - x)}$.

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24. If $x^y + y^x = a^b$ then prove that $\frac{dy}{dx} = -\left[\frac{yx^{y-1} + y^x \log y}{x^y \log x + xy^{x-1}}\right]$.

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25. If $\sqrt{1-x^2}+\sqrt{1-y^2}=a(x-y)$ then prove that $\frac{dy}{dx}=\frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}$.

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26. If $y=x\sqrt{a^2+x^2}+a^2\log\left(x+\sqrt{a^2+x^2}\right)$, then show that $\frac{dy}{dx}=2\sqrt{a^2+x^2}$.

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27. IF the tangent at a point on the curve $x^{2/3}+y^{2/3}=a^{2/3}$ intersects the coordinate axes in A and B then show that the length AB is a constant.

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28. Find the angle between the curves xy=2 and $x^2+4y=0$

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29. The sum of the intercepts on the coordinate axes of any tangent to $\sqrt{x} + \sqrt{y} = \sqrt{a}$ is

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30. Show that the tangent at $P(x_1, y_1)$ on the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ is $xx_1^{\frac{-1}{2}} + yy_1^{\frac{-1}{2}} = a^{\frac{1}{2}}$

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31. Find the maximum area of the rectangle that can be formed with fixed perimeter 20.

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32. From a rectangular sheet of dimensions $30cm \times 80cm$, four squares of sides x cm are removed at the corners, and the sides are then turned up so as to form an open rectangular box. What is the value of x, so that the volume of the box is the greatest?

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33. A wire of length l is cut into two parts which are bent respectively in the form of a square and a circle. What are the lengths of pieces of wire so that the sum of areas is least ?

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34. A window is in the shape of a rectangle surmounted by a semi-circle. If the perimeter of the window be 20 feet then find the maximum area.

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35. Show that when the curved surface of a is right circular cylinder inscribed in a sphere of radius R is maximum , then the height of the cylinder is $\sqrt{2R}$.

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36. Find the positive integers x and y such that $x + y = 60$ and xy^3 is maximum.

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