01. FUNCTIONS

LONG ANSWER QUESTIONS (7 MARKS)

01. Let $f : A \to B$, $g : B \to C$ be bijections. Then show that $gof : A \to C$ is a bijection.

Mar 09, May 06, 08, 10, 12; AP Mar 16

02. Let $f : A \to B$, $g : B \to C$ be bijections. Then show that $(gof)^{-1} = f^{-1}og^{-1}$.

Mar 06, 10, 11, 14, May 09, 11; TS Mar 16

03. Let $f : A \to B$ be a bijection. Then show that $fof^{-1} = I_B$ and $f^{-1}of = I_A$.

Mar 07, 12, 15, 17, May 05, 07

04. If $f : A \to B$, $g : B \to A$ are two functions such that $gof = I_A$ and $fog = I_B$, then prove that 'f' is a bijection and $g = f^{-1}$. **Mar 01, May 03, Mar 08; TS May 15**

05. I) If $f : R \to R$, $g : R \to R$ are defined by $f(x) = 4x - 1$ and $g(x) = x^2 + 2$, then find

(i) $(gof)(x)$ (ii) $(gof)\left(\frac{a+1}{4}\right)$ (iii) $fof(x)$ (iv) $go(fof)(0)$

II) If $g : Q \to Q$ defined by $f(x) = 5x + 4$ for all $x \in Q$. Show that 'f' is a bijection and find f^{-1}.

Mar 10; TS Mar 17

06. Let $f : A \to B$, I_A and I_B be identity functions on A and B respectively. Then show that $foI_A = f = I_Bof$. **May 05, 08, Mar 13**

VERY SHORT ANSWER QUESTIONS (2 MARKS)

07. If $f = \{(1,2),(2,-3),(3,-1)\}$, then find (i) $2f$, (ii) $2 + f$, (iii) f^2, iv) $\sqrt{f}$. **Mar 08,12; AP Aug 22**

08. If $f = \{(4,5),(5,6),(6,-4)\}$ and $g = \{(4,-4),(6,5),(8,5)\}$, then find **TS Mar 17, May 22**

i) $f + g$ ii) $f - g$ iii) fg iv) $\sqrt{f}$

09. If $f : R - \{0\} \to R$ is defined by $f(x) = x^3 - \frac{1}{x^3}$, then show that $f(x) + f\left(\frac{1}{x}\right) = 0$. **AP May 22**

10. 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.

Mar & June 11, Mar 16; TS Mar 2017; AP Aug 22

11. 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'.

May 10; TS Mar 16, 17

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

i) $fof(x^2 + 1)$ ii) $fog(2)$ iii) $gof(2a - 3)$.

13. If $f(x)=2x-1,\ g(x)=\frac{x+1}{2}$, for all $x\in R$ are two functions, then find i) $gof(x)$ ii) $fog(x)$

AP & TS Mar 19

14. Find the inverse of the function $a,b\in R$; $f:R\to R$ defined by $f(x)=ax+b\ (a\neq 0)$. Mar 13

15. Find the inverse of the function $f:R\to(0,\infty)$ defined by $f(x)=5^x$. Mar 06, 11, 15

16. Find the inverse of the function $f:(0,\infty)\to R$ defined by $f(x)=\log_2 x$.

17. Find the domain of the real function $\frac{2x^2-5x+7}{(x-1)(x-2)(x-3)}$.

18. Find the domain of the real value function $f(x)=\frac{1}{6x-x^2-5}$.

19. Find the domain of the real value function $f(x)=\frac{\sqrt{3+x}+\sqrt{3-x}}{x}$. Mar 07

20. Find the domain of the real function $\sqrt{16-x^2}$.

21. Find the domain of the real value function $f(x)=\sqrt{x^2-25}$. Mar 12

22. Find the domain of the real value function $f(x)=\frac{1}{\sqrt{x^2-a^2}}(a>0)$. Mar 15

23. Find the domain and range of the real valued function $f(x)=\sqrt{9-x^2}$. TS Mar 15, 17

02. Mathematical Induction

LONG ANSWER QUESTIONS (7 MARKS)

01. Show that $2\cdot 3+3\cdot 4+4\cdot 5+....+\text{upto n terms}=\frac{n(n^2+6n+11)}{3}$, $\forall n\in N$. May 06, Mar 13

02. Show that $1\cdot 2\cdot 3+2\cdot 3\cdot 4+3\cdot 4\cdot 5+...+\text{upto n terms}=\frac{n(n+1)(n+2)(n+3)}{4}$, $\forall n\in N$.

TS Mar 15, 17

03. Show that $\forall n\in N$, $\frac{1}{1\cdot 4}+\frac{1}{4\cdot 7}+\frac{1}{7\cdot 10}+...+\text{upto n terms}=\frac{n}{3n+1}$. Mar 06, 11, May 11

04. Show that $1^2+(1^2+2^2)+(1^2+2^2+3^2)+...+\text{upto n terms}=\frac{n(n+1)^2(n+2)}{12}$, $\forall n\in N$.

Mar 09, May 09, Mar 12; AP Mar 16

05. Show that $\frac{1^3}{1}+\frac{1^3+2^3}{1+3}+\frac{1^3+2^3+3^3}{1+3+5}+...+\text{upto n terms}=\frac{n}{24}(2n^2+9n+13)$. Mar 05, 07, 14

06. Prove by Mathematical induction, for all $n \in N$, $a + ar + ar^2 + ... +$ upto n terms $= \frac{a(r^n - 1)}{r - 1}$, $r \neq 1$. Mar 11; TS Mar 20; AP Mar 19

07. Use mathematical induction to prove the statement,
$\left(1+\frac{3}{1}\right)\left(1+\frac{5}{4}\right)\left(1+\frac{7}{9}\right)....\left(1+\frac{2n+1}{n^2}\right) = (n+1)^2$. Mar 15; TS Mar 19

08. Show that $49^n + 16n - 1$ divisible by 64 for all positive integers 'n'.
May 05, AP Mar 17, 20; TS Mar 18

09. Show that $3 \cdot 5^{2n+1} + 2^{3n+1}$ is divisible by 17, $\forall n \in N$. May 08, 10, 12

03. Matrices

LONG ANSWER QUESTIONS (7 MARKS)

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

02. If $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^3 \end{vmatrix} = 0$ and $\begin{vmatrix} a & a^2 & 1 \\ b & b^2 & 1 \\ c & c^2 & 1 \end{vmatrix} \neq 0$, then show that $abc = -1$. Mar 04, 14

03. Show that $\begin{vmatrix} b+c & c+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$. Oct 96, Mar 15

04. Show that $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}^2 = \begin{vmatrix} 2bc-a^2 & c^2 & b^2 \\ c^2 & 2ac-b^2 & a^2 \\ b^2 & a^2 & 2ab-c^2 \end{vmatrix} = (a^3+b^3+c^3-3abc)^2$. Mar 12; TS Mar 18

05. Show that $\begin{vmatrix} 1 & a^2 & a^3 \\ 1 & b^2 & b^3 \\ 1 & c^2 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(ab+bc+ca)$. Mar 09; AP Mar 17

06. Show that $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$. Mar & May 11

07. If $A = \begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix}$ is a non-singular matrix, then show that A is invertible and $A^{-1} = \frac{\text{adj}\,A}{\det A}$.

Mar 07, June 10; AP Mar 17; TS Mar 18

08. Solve the following simultaneous linear equation $2x-y+3z=9$, $x+y+z=6$, $x-y+z=2$ by using Cramer's rule. **TS Mar 17; AP 16, 22**

09. Solve the following simultaneous linear equation $3x+4y+5z=18$, $2x-y+8z=13$, $5x-2y+7z=20$ by using Cramer's rule **AP Mar 15, 17, May 22, TS Mar 19**

10. Solve the following simultaneous linear equation $x+y+z=1$, $2x+2y+3z=6$, $x+4y+9z=3$ by using Cramer's rule **AP & TS Mar 20**

11. Solve the following simultaneous linear equation $x-y+3z=5$, $4x+2y-z=0$, $-x+3y+z=5$ by using Cramer's rule **TS Mar 15, AP Mar 19, May 22**

12. Solve the following simultaneous linear equation $2x-y+3z=9$, $x+y+z=6$, $x-y+z=2$ by using Matrix inversion method. **AP Mar 15; TS Mar 19**

13. Solve the following simultaneous linear equation $2x-y+3z=8$, $-x+2y+z=4$, $3x+y-4z=0$ by using Matrix inversion method. **AP Mar 15; TS May 22**

14. Solve the following simultaneous linear equation $3x+4y+5z=18$, $2x-y+8z=13$, $5x-2y+7z=20$ by using Matrix inversion method. **AP Mar 15, May 22, TS Mar 19**

15. Solve the following simultaneous linear equation $x-y+3z=5$, $4x+2y-z=0$, $-x+3y+z=5$ by using Matrix inversion method.

16. Solve the following simultaneous linear equation $2x-y+3z=9$, $x+y+z=6$, $x-y+z=2$ by using Gauss - Jordan method. **AP Mar 16, 18**

17. Solve the following simultaneous linear equation $3x+4y+5z=18$, $2x-y+8z=13$, $5x-2y+7z=20$ by using Gauss - Jordan method. **TS Mar 15**

18. Examine whether the following system of equation is consistent or inconsistent. If consistent find the complete solution $x+y+z=3$, $2x+2y-z=3$, $x+y-z=1$ **June 02**

19. Examine whether the following system of equation is consistent or inconsistent. If consistent find the complete solutions $x+y+z=6$, $x-y+z=2$, $2x-y+3z=9$. **Mar 05, 11**

20. By using Gauss-jordan method, show that the following system has no solution $2x+4y-z=0$, $x+2y+2z=5$, $3x+6y-7z=2$.

SHORT ANSWER QUESTIONS (4 MARKS)

21. If $\theta-\phi=\frac{\pi}{2}$, then show that $\begin{bmatrix}\cos^2\theta & \cos\theta\cdot\sin\theta\\ \cos\theta\cdot\sin\theta & \sin^2\theta\end{bmatrix}\begin{bmatrix}\cos^2\phi & \cos\phi\cdot\sin\phi\\ \cos\phi\cdot\sin\phi & \sin^2\phi\end{bmatrix}=0$.

Mar 04, May 09,12

22. If $I=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ and $E=\begin{bmatrix}0 & 1\\ 0 & 0\end{bmatrix}$, then show that $(aI+bE)^3=a^3I+3a^2bE$. **Mar 10,15; TS Mar 16**

23. If $A=\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & 2\\ 2 & 2 & 1\end{bmatrix}$, then show that $A^2-4A-5I=O$. **AP Mar 16; TS Mar 17, May 22**

24. If $A=\begin{bmatrix}1 & -2 & 1\\ 0 & 1 & -1\\ 3 & -1 & 1\end{bmatrix}$, then find A^3-3A^2-A-3I, where I is unit matrix of order 3. **TS Mar 19**

25. If $A=\begin{bmatrix}3 & 0 & 0\\ 0 & 3 & 0\\ 0 & 0 & 3\end{bmatrix}$, then find A^4. **TS Mar 17, 20**

26. 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 $(AB)^T=B^TA^T$. **Mar 13**

27. If $A=\begin{bmatrix}2 & -4\\ -5 & 3\end{bmatrix}$, then find $A+A'$ and AA'. **May 07; AP Mar 15,18,19**

28. If $A=\begin{bmatrix}2 & 0 & 1\\ -1 & 1 & 5\end{bmatrix}$, $B=\begin{bmatrix}-1 & 1 & 0\\ 0 & 1 & -2\end{bmatrix}$, then find $(AB')'$. **TS Mar 19**

29. Find the value of x, if $\begin{vmatrix}x-2 & 2x-3 & 3x-4\\ x-4 & 2x-9 & 3x-16\\ x-8 & 2x-27 & 3x-64\end{vmatrix}=0$. **Mar 06; TS Mar 15**

30. If $3A=\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & -2\\ -2 & 2 & -1\end{bmatrix}$, then show that $A^{-1}=A^T$. **Mar 09, 14; AP Aug 22**

31. If $A=\begin{bmatrix}2 & 1 & 2\\ 1 & 0 & 1\\ 2 & 2 & 1\end{bmatrix}$, then find the adjoint and inverse of A. **Mar 05, 08**

32. If $A=\begin{bmatrix}1 & 2 & 1\\ 3 & 2 & 3\\ 1 & 1 & 2\end{bmatrix}$, then find A^{-1}. **Mar 12; TS Mar 17; AP Aug 22**

33. If $A=\begin{bmatrix}1 & -2 & 3\\ 0 & -1 & 4\\ -2 & 2 & 1\end{bmatrix}$ then find $(A')^{-1}$.

34. If $A=\begin{bmatrix}-1 & -2 & -2\\ 2 & 1 & -2\\ 2 & -2 & 1\end{bmatrix}$, then show that the adjoint of A is equal to $3A^T$. Find A^{-1}. **Mar 19**

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

VERY SHORT ANSWER QUESTIONS (2 MARKS)

36. Construct a 3×2 matrix whose elements are defined by $a_{ij}=\frac{1}{2}|i-3j|$. **TS Mar 15, Mar 17**

37. If $\begin{bmatrix} x-3 & 2y-8 \\ z+2 & 6 \end{bmatrix}=\begin{bmatrix} 5 & 2 \\ -2 & a-4 \end{bmatrix}$, then find x, y, z and a. **AP Mar 19**

38. If $\begin{bmatrix} x-1 & 2 & y-5 \\ z & 0 & 2 \\ 1 & -1 & 1+a \end{bmatrix}=\begin{bmatrix} 1-x & 2 & -y \\ 2 & 0 & 2 \\ 1 & -1 & 1 \end{bmatrix}$, then find the values of x, y, z & a.

39. If $A=\begin{bmatrix} 2 & 3 & 1 \\ 7 & 8 & 5 \end{bmatrix}$ and $B=\begin{bmatrix} 1 & 0 & 1 \\ 2 & -4 & -1 \end{bmatrix}$, then find $A+B$.

40. If $A=\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B=\begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$ and $2X+A=B$, then find 'X'. **Mar 95, 11, 13, 15**

41. If $A=\begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$ and $B=\begin{bmatrix} 3 & 2 & 1 \\ 1 & 2 & 3 \end{bmatrix}$, then find $3B-2A$. **Mar 12; TS Mar 19; AP Aug 22**

42. If $A=\begin{bmatrix} 2 & 4 \\ -1 & k \end{bmatrix}$ and $A^2=O$, then find the value of K. **Mar 05, 14, 17, May 11, TS May 22**

43. If $A=\begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$, then find A^2. **Mar 08, AP May 22**

44. Define trace of a matrix and find the trace of A, if $A=\begin{bmatrix} 1 & 2 & -1/2 \\ 0 & -1 & 2 \\ -1/2 & 2 & 1 \end{bmatrix}$. **June 10**

45. If $A=\begin{bmatrix} -1 & 2 & 3 \\ 2 & 5 & 6 \\ 3 & x & 7 \end{bmatrix}$ is a symmetric matrix, then find the value of x.

Mar 05; AP Mar 16, TS May 22

46. If $A=\begin{bmatrix} 0 & 2 & 1 \\ -2 & 0 & -2 \\ -1 & x & 0 \end{bmatrix}$ is a skew-symmetric matrix, then find the value of 'x'. **May 11**

47. If $A=\begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 4 \\ 5 & -6 & x \end{bmatrix}$ and $\det A=45$, then find x. **Mar 03, 07, May 09**

48. If 'ω' is a complex (non-real) cube root of unity, then show that $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix}=0$. **Mar 11, 14**

49. Find the adjoint and inverse of the matrix $\begin{bmatrix}1 & 2\\3 & -5\end{bmatrix}$. **AP Mar 18, TS May 22**

50. Find the adjoint and the inverse of the matrix $\begin{bmatrix}\cos\alpha & -\sin\alpha\\ \sin\alpha & \cos\alpha\end{bmatrix}$. **Mar 09, 13**

51. Find the rank of matrix $\begin{bmatrix}1 & 1 & 1\\1 & 1 & 1\\1 & 1 & 1\end{bmatrix}$. **Mar 08, June 10; TS Mar 18]**

04. Addition of Vectors

SHORT ANSWER QUESTIONS (4 MARKS)

01. Let ABCDEF be a regular hexagon with centre 'O'. Show that $\overline{AB}+\overline{AC}+\overline{AD}+\overline{AE}+\overline{AF}=3\overline{AD}=6\overline{AO}$. **May 09, 11; AP Mar 15, 16; TS Mar 17**

02. If the points whose position vectors are $3\overline{i}-2\overline{j}-\overline{k}$, $2\overline{i}+3\overline{j}-4\overline{k}$, $-\overline{i}+\overline{j}+2\overline{k}$ and $4\overline{i}+5\overline{j}+\lambda\overline{k}$ are coplanar, then show that $\lambda=\frac{-146}{17}$. **TS Mar 15**

03. a, b, c are non-coplanar vectors. Prove that the following four points are coplanar $-\overline{a}+4\overline{b}-3\overline{c}$, $3\overline{a}+2\overline{b}-5\overline{c}$, $-3\overline{a}+8\overline{b}-5\overline{c}$, $-3\overline{a}+2\overline{b}+\overline{c}$. **May 10, Mar 17**

04. a, b, c are non-coplanar vectors. Prove that the following four points are coplanar $6a+2b-c$, $2a-b+3c$, $a+2b-4c$, $-12a-b-3c$ **TS Mar 15**

05. 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 $\frac{x}{a}+\frac{y}{b}=1$. **June 00, 05, May 05**

06. Show that the line joining the pair of points $6\overline{a}-4\overline{b}+4\overline{c}$, $-4\overline{c}$ and the line joining the pair of points $-\overline{a}-2\overline{b}-3\overline{c}$, $\overline{a}+2\overline{b}-5\overline{c}$ intersect at the point $-4\overline{c}$, when $\overline{a},\overline{b},\overline{c}$ are non-coplanar vectors. **AP Mar 19, 22; TS Mar 16, 22**

07. If $\overline{a},\overline{b},\overline{c}$ are noncoplanar, find the point of intersection of the line passing through the points $2\overline{a}+3\overline{b}-\overline{c}$, $3\overline{a}+4\overline{b}-2\overline{c}$ with the line joining the points $\overline{a}-2\overline{b}+3\overline{c}$, $\overline{a}-6\overline{b}+6\overline{c}$. **TS Mar 17, 19**

VERY SHORT ANSWER QUESTIONS (2 MARKS)

08. Find the unit vector in the direction of vector $\overline{a}=2\overline{i}+3\overline{j}+\overline{k}$. **Mar 14; TS Mar 17**

09. Let $\overline{a}=\overline{i}+2\overline{j}+3\overline{k}$ and $\overline{b}=3\overline{i}+\overline{j}$. Find the unit vector in the direction of $\overline{a}+\overline{b}$. **TS Mar 16, TS Oct 21**

10. Let $\overline{a}=2\overline{i}+4\overline{j}-5\overline{k}$, $\overline{b}=\overline{i}+\overline{j}+\overline{k}$, $\overline{c}=\overline{j}+2\overline{k}$. Find the unit vector in the opposite direction of $\overline{a}+\overline{b}+\overline{c}$. **Mar 09, 10, 12; AP Mar 15, 19, Aug 22; TS Mar 19, May 22**

11. If $\overline{OA} = \bar{i} + \bar{j} + \bar{k}$, $\overline{AB} = 3\bar{i} - 2\bar{j} + \bar{k}$, $\overline{BC} = \bar{i} + 2\bar{j} - 2\bar{k}$ and $\overline{CD} = 2\bar{i} + \bar{j} + 3\bar{k}$, then find the vector $\overline{OD}$. **Mar 13; TS Mar 15, May 22**

12. If the vectors $-3\bar{i} + 4\bar{j} + \lambda\bar{k}$ and $\mu\bar{i} + 8\bar{j} + 6\bar{k}$ are collinear vectors, then find λ and μ.

May 2010, Mar 14; AP Mar 18, TS May 22

13. 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 the values of m and n.

June11; AP Mar 16, 20, May 22; TS Mar 15, 17

14. If the position vectors of the points A, B and C are $-2\bar{i} + \bar{j} - \bar{k}$, $-4\bar{i} + 2\bar{j} + 2\bar{k}$ and $6\bar{i} - 3\bar{j} - 13\bar{k}$ respectively and $AB = \lambda AC$, then find the value of λ. **Mar 11; AP Mar 17, TS May 22**

15. If α, β and γ are the angles made by the vector $3\bar{i} - 6\bar{j} + 2\bar{k}$ with the positive directions of the coordinate axes, then find $\cos\alpha$, $\cos\beta$ and $\cos\gamma$. **AP Mar 17**

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

Mar 08, 09, 10, 11; TS Mar 16, 18, Oct 21

17. Find the vector equation of the line passing through the point $2\bar{i} + 3\bar{j} + \bar{k}$ and parallel to the vector $4\bar{i} - 2\bar{j} + 3\bar{k}$. **Mar & May 07, June 10; AP Mar 15, 17, May 22; TS Mar 16, 17, May 22**

18. Find the vector equation of the plane passing through the points $\bar{i} - 2\bar{j} + 5\bar{k}$, $-5\bar{j} - \bar{k}$ and $-3\bar{j} + 5\bar{k}$. **Mar 06, 11, 13; AP Mar 15, 17, 19**

19. Find the vector equation of the plane passing through the points $(0,0,0)$, $(0,5,0)$ and $(2,0,1)$.

AP Aug 22

05. Product of Vectors

LONG ANSWER QUESTIONS (7 MARKS)

01. A line makes angles θ_1, θ_2, θ_3 and θ_4 with the diagonals of a cube. Show that $\cos^2\theta_1 + \cos^2\theta_2 + \cos^2\theta_3 + \cos^2\theta_4 = \frac{4}{3}$.

02. 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 $|(\bar{a} \times \bar{b}) \times \bar{c}|$ and $|\bar{a} \times (\bar{b} \times \bar{c})|$.

03. If $\bar{a} = 2\bar{i} + \bar{j} - 3\bar{k}$, $\bar{b} = \bar{i} - 2\bar{j} + \bar{k}$, $\bar{c} = -\bar{i} + \bar{j} - 4\bar{k}$ and $\bar{d} = \bar{i} + \bar{j} + \bar{k}$, then compute $|(\bar{a} \times \bar{b}) \times (\bar{c} \times \bar{d})|$. **TS Mar 15**

04. 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 $\bar{r} = (-4\bar{i} - \bar{k}) + s(3\bar{i} - 2\bar{j} - 2\bar{k})$, where s, t are scalars. **Mar 08, 09**

05. If $A = (1,-2,-1)$, $B = (4,0,-3)$, $C = (1,2,-1)$ and $D(2,-4,-5)$, find the distance between AB and CD. **Mar 07, 12, 14**

06. If $\bar{a}, \bar{b}, \bar{c}$ be three vectors. Then show that $(\bar{a} \times \bar{b}) \times \bar{c} = (\bar{a} \cdot \bar{c})\bar{b} - (\bar{b} \cdot \bar{c})\bar{a}$. **Mar 04; AP Mar 15**

SHORT ANSWER QUESTIONS (4 MARKS)

07. The vectors $\overline{AB} = 3\bar{i} - 2\bar{j} + 2\bar{k}$, $\overline{AD} = \bar{i} - 2\bar{k}$ represent adjacent sides of a parallelogram ABCD. Find the angle between the diagonals. **TS Mar 18**

08. Prove that the smaller angle θ between any two diagonals of a cube is given by $\cos\theta = \frac{1}{3}$

Mar & May 10, June 11

09. Show that the points $2\bar{i} - \bar{j} + \bar{k}$, $\bar{i} - 3\bar{j} - 5\bar{k}$ and $3\bar{i} - 4\bar{j} - 4\bar{k}$ are the vertices of a right angled triangle. Also find the other angles.

10. Show that the points $(5,-1,1)$, $(7,-4,7)$, $(1,-6,10)$ and $(-1,-3,4)$ are the vertices of a rhombus. **Mar 13**

11. Find the unit vector perpendicular to the plane passing through the points $(1,2,3)$, $(2,-1,1)$ and $(1,2,-4)$. **May 10, TS May 22**

12. Find a unit vector perpendicular to the plane determined by the points $P(1,-1,2)$, $Q(2,0,-1)$ and $R(0,2,1)$.

13. Find the area of the triangle whose vertices are $A(1,2,3)$, $B(2,3,1)$ and $C(3,1,2)$. **Mar 08, 14**

14. Let $\bar{a}$ and $\bar{b}$ be vectors, satisfying $|\bar{a}| = |\bar{b}| = 5$ and $(\bar{a},\bar{b}) = 45°$. Find the area of the triangle having $\bar{a} - 2\bar{b}$ and $3\bar{a} + 2\bar{b}$ as two of its sides. **Mar 08, 18**

15. If $\bar{a} = 2\bar{i} + 3\bar{j} + 4\bar{k}$, $\bar{b} = \bar{i} + \bar{j} - \bar{k}$ and $\bar{c} = \bar{i} - \bar{j} + \bar{k}$, then compute $\bar{a} \times (\bar{b} \times \bar{c})$ and verify that it is perpendicular to $\bar{a}$. **TS Mar 19**

16. For any two vectors $\bar{a}$ and $\bar{b}$. Then show that $(1+|\bar{a}|^2)(1+|\bar{b}|^2) = |1 - \bar{a}\cdot\bar{b}|^2 + |\bar{a} + \bar{b} + \bar{a}\times\bar{b}|^2$.

TS Mar 18

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

Mar 09; AP Mar 15, 19; TS Mar 17

18. Find the vector having magnitude $\sqrt{6}$ units and perpendicular to both $2\bar{i} - \bar{k}$ and $3\bar{j} - \bar{i} - \bar{k}$.

19. If $\bar{a} = 2\bar{i} - 3\bar{j} + \bar{k}$ and $\bar{b} = \bar{i} + 4\bar{j} - 2\bar{k}$, then find $(\bar{a} + \bar{b}) \times (\bar{a} - \bar{b})$.

20. For any three vectors $\bar{a}$, $\bar{b}$, $\bar{c}$ prove that $[\bar{b}\times\bar{c} \;\; \bar{c}\times\bar{a} \;\; \bar{a}\times\bar{b}] = [\bar{a} \;\; \bar{b} \;\; \bar{c}]^2$.

21. Find the volume of the tetrahedron having the edges $\bar{i} + \bar{j} + \bar{k}$, $\bar{i} - \bar{j}$ and $\bar{i} + 2\bar{j} + \bar{k}$. **May 09**

22. Find the volume of the tetrahedron whose vertices are $(1,2,1)$, $(3,2,5)$, $(2,-1,0)$ and $(-1,0,1)$.

May 07; TS Mar 15

23. If $a = (1,-1,-6)$, $b = (1,-3,4)$ and $c = (2,-5,3)$, then compute $a \times (b \times c)$.

VERY SHORT ANSWER QUESTIONS (2 MARKS)

24. Find the angle between the vectors $\bar{i} + 2\bar{j} + 3\bar{k}$ and $3\bar{i} - \bar{j} + 2\bar{k}$.

Mar 10, 14; AP Mar 18; TS Mar 17, May 22

25. If $\bar{a}=\bar{i}+2\bar{j}-3\bar{k}$ and $\bar{b}=3\bar{i}-\bar{j}+2\bar{k}$, then show that $\bar{a}+\bar{b}$ and $\bar{a}-\bar{b}$ are perpendicular to each other. **May 11, Mar 15, TS May 22**

26. If the vectors $\lambda\bar{i}-3\bar{j}+5\bar{k}$ and $2\lambda\bar{i}-\lambda\bar{j}-\bar{k}$ are perpendicular to each other, find λ. **Mar 11, 14; TS Mar 16**

27. If the vectors $2\bar{i}+\lambda\bar{j}-\bar{k}$ and $4\bar{i}-2\bar{j}+2\bar{k}$ are perpendicular to each other then find λ. **TS Mar 15,16**

28. If $|\bar{a}+\bar{b}|=|\bar{a}-\bar{b}|$ then find the angle between $\bar{a}$ and $\bar{b}$.

29. $\bar{a}=\bar{i}-\bar{j}-\bar{k}$ and $\bar{b}=2\bar{i}-3\bar{j}+\bar{k}$, then find the projection vector of $\bar{b}$ on $\bar{a}$. **Mar 91; AP Mar 17**

30. Find the angle between the planes $\bar{r}\cdot(2\bar{i}-\bar{j}+2\bar{k})=3$ and $\bar{r}\cdot(3\bar{i}+6\bar{j}+\bar{k})=4$. **AP Mar 20; TS Mar 15, 18, 20**

31. If $\bar{a}=2\bar{i}-\bar{j}+\bar{k}$ and $\bar{b}=\bar{i}-3\bar{j}-5\bar{k}$, then find $|\bar{a}\times\bar{b}|$. **Mar 13**

32. If $|\bar{a}|=13$, $|\bar{b}|=5$ and $\bar{a}\cdot\bar{b}=60$, then find $|\bar{a}\times\bar{b}|$. **TS Mar 20**

33. Let $\bar{a}=2\bar{i}-\bar{j}+\bar{k}$ and $\bar{b}=3\bar{i}+4\bar{j}-\bar{k}$. If θ is the angle between a and b, then find $\sin\theta$.

34. Find the unit vector perpendicular to the plane determined by the vectors $\bar{a}=4\bar{i}+3\bar{j}-\bar{k}$, $\bar{b}=2\bar{i}-6\bar{j}-3\bar{k}$. **May 09, Jun 09, 10**

35. If $\bar{a}=2\bar{i}-3\bar{j}+5\bar{k}$, $\bar{b}=-\bar{i}+4\bar{j}+2\bar{k}$, then find $\bar{a}\times\bar{b}$ and unit vector perpendicular to both $\bar{a}$ and $\bar{b}$. **TS May 22**

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

37. Find the area of the parallelogram whose diagonals are $3\bar{i}+\bar{j}-2\bar{k}$ and $\bar{i}-3\bar{j}+4\bar{k}$.

38. Find the area of the triangle having $(3\bar{i}+4\bar{j})$, $(-5\bar{i}+7\bar{j})$ as adjacent sides.

06. Trigonometry upto Transformations

LONG ANSWER QUESTIONS (7 MARKS)

01. If $A+B+C=180°$, then prove that $\sin 2A+\sin 2B+\sin 2C=4\sin A\sin B\sin C$. **AP Mar 19**

02. If A, B, C are angles in a triangle, then prove that $\sin 2A-\sin 2B+\sin 2C=4\cos A\sin B\cos C$. **TS May 22**

03. If $A+B+C=180°$, then show that $\cos 2A+\cos 2B+\cos 2C=-4\cos A\cos B\cos C-1$.

04. If A, B, C are angles in a triangle, then prove that $\sin A+\sin B+\sin C=4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$.

05. If A, B, C are angles in a triangle, then prove that

$\cos A+\cos B-\cos C=-1+4\cos\frac{A}{2}\cdot\cos\frac{B}{2}\cdot\sin\frac{C}{2}$. May 06; TS Mar 19

06. If A, B, C are angles in a triangle, then prove that $\sin^2 A+\sin^2 B-\sin^2 C=2\sin A\sin B\cos C$. AP Mar 19, Aug 22

07. If $A+B+C=\pi$, then prove that $\sin^2\frac{A}{2}+\sin^2\frac{B}{2}+\sin^2\frac{C}{2}=1-2\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$.

08. If $A+B+C=180°$, then prove that $\cos^2\frac{A}{2}+\cos^2\frac{B}{2}+\cos^2\frac{C}{2}=2\left(1+\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}\right)$.

Mar 12, 15; TS Mar 15

09. If A, B, C are angles of a triangle, then prove that

$\sin^2\frac{A}{2}+\sin^2\frac{B}{2}-\sin^2\frac{C}{2}=1-2\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$. May 06, 11, AP May 22

10. If $A+B+C=0$, then show that $\sin 2A+\sin 2B+\sin 2C=-4\sin A\cdot\sin B\cdot\sin C$. AP Mar 19

11. If $A+B+C=\frac{\pi}{2}$, then prove that $\cos 2A+\cos 2B+\cos 2C=1+4\sin A\sin B\sin C$. AP Mar 20

12. $A+B+C=2S$, then prove that

$\cos(S-A)+\cos(S-B)+\cos(S-C)+\cos S=4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$. TS Mar 18

13. If $A+B+C=2S$, then prove that $\sin(S-A)+\sin(S-B)+\sin C=4\cos\left(\frac{S-A}{2}\right)\cos\left(\frac{S-B}{2}\right)\sin\left(\frac{C}{2}\right)$.

14. If $A+B+C=2S$, then prove that

$\cos(S-A)+\cos(S-B)+\cos C=-1+4\cos\left(\frac{S-A}{2}\right)\cos\left(\frac{S-B}{2}\right)\cos\frac{C}{2}$. TS Mar 17

SHORT ANSWER QUESTIONS (4 MARKS)

15. Show that $\cot\frac{\pi}{16}\cdot\cot\frac{2\pi}{16}\cdot\cot\frac{3\pi}{16}\cdot\cot\frac{4\pi}{16}\cdot\cot\frac{5\pi}{16}\cdot\cot\frac{6\pi}{16}\cot\frac{7\pi}{16}=1$.

16. Prove that $\cos^2\frac{\pi}{10}+\cos^2\frac{2\pi}{5}+\cos^2\frac{3\pi}{5}+\cos^2\frac{9\pi}{10}=2$. AP Aug 22

17. Prove that $\cos^2\frac{\pi}{8}+\cos^2\frac{3\pi}{8}+\cos^2\frac{5\pi}{8}+\cos^2\frac{7\pi}{8}=2$.

18. If $A+B=\frac{\pi}{4}$, prove that

i) $(1+\tan A)(1+\tan B)=2$ May 11

ii) $(\cot A-1)(\cot B-1)=2$ Mar 07, May 09

iii) If $A-B=\frac{3\pi}{4}$, then show that $(1-\tan A)(1+\tan B)=2$.

19. Prove that $\tan 70^\circ - \tan 20^\circ = 2\tan 50^\circ$.

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

AP Mar 15; AP & TS Mar 19

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

22. Prove that $\cos^4\frac{\pi}{8}+\cos^4\frac{3\pi}{8}+\cos^4\frac{5\pi}{8}+\cos^4\frac{7\pi}{8}=\frac{3}{2}$. **AP May 16**

23. Prove that (i) $\tan A + \cot A = 2\operatorname{cosec} 2A$; (ii) $\cot A - \tan A = 2\cot 2A$

Hence show that $\tan\theta + 2\tan 2\theta + 4\tan 4\theta + 8\cot 8\theta = \cot\theta$.

VERY SHORT ANSWER QUESTIONS (2 MARKS)

24. If $\sin\theta = -\frac{1}{3}$ and θ does not lie in the third quadrant. Find the value of $\cos\theta$ and $\cot\theta$

Mar 13, TS Mar 19

25. If $\sin\theta = \frac{4}{5}$ and θ is not in the first quadrant, then find the value of $\cos\theta$.

AP Mar 19; TS Mar 17

26. If $3\sin\theta + 4\cos\theta = 5$, then find the value of $4\sin\theta - 3\cos\theta$. **May 12, AP May 22**

27. If $a\cos\theta - b\sin\theta = c$, then show that $a\sin\theta + b\cos\theta = \pm\sqrt{a^2+b^2-c^2}$.

28. If $\tan 20^\circ = \lambda$, then prove that $\frac{\tan 160^\circ - \tan 110^\circ}{1+\tan 160^\circ \tan 110^\circ} = \frac{1-\lambda^2}{2\lambda}$.

29. Find $\sin 330^\circ \cdot \cos 120^\circ + \cos 210^\circ \cdot \sin 300^\circ$.

30. Find the value of $\cos 42^\circ + \cos 78^\circ + \cos 162^\circ$. **May 11**

31. Find the value of $\sin^2 82\frac{1}{2}^\circ - \sin^2 22\frac{1}{2}^\circ$ **TS Mar 17, 19**

32. Find the value of $\cos^2 52\frac{1}{2}^\circ - \sin^2 22\frac{1}{2}^\circ$. **AP March 19**

33. Prove that $\sqrt{3}\operatorname{cosec} 20^\circ - \sec 20^\circ = 4$. **AP Mar 17**

34. Prove that $\frac{\cos 9^\circ + \sin 9^\circ}{\cos 9^\circ - \sin 9^\circ} = \cot 36^\circ$. **Mar 11,15; TS Mar 18**

35. Show that $\sin 50^\circ - \sin 70^\circ + \sin 10^\circ = 0$. **TS Mar 18**

36. If θ is not an integral multiple of $\frac{\pi}{2}$, prove that $\tan\theta + 2\tan 2\theta + 4\tan 4\theta + 8\cot 8\theta = \cot\theta$.

37. What is the value of $\tan 20^\circ + \tan 40^\circ + \sqrt{3}\tan 20^\circ \tan 40^\circ$? **TS Mar 20**

38. Prove that $\cos 48° \cdot \cos 12° = \frac{3+\sqrt{5}}{8}$. TS Mar 17

39. Find the period of the functions $f(x) = \cos\left(\frac{4x+9}{5}\right)$ Mar 05, May 10, Mar 14

40. Find the period of the function $f(x) = \tan 5x$. TS May 22

41. Find the period of the functions $f(x) = \cos(3x+5)+7$

42. Find the period of the functions $f(x) = \tan(x+4x+9x+...+n^2x)$ (n is any positive integer). AP & TS Mar 15

43. Find a cosine function whose period is 7. Mar 13

44. Find a sine function whose period is $\frac{2}{3}$. AP May 22

45. Find the maximum and minimum values of the function $f(x) = 7\cos x - 24\sin x + 5$

46. Find the maximum and minimum values of the function $f(x) = 3\sin x - 4\cos x$. Mar 14

47. Find the maximum and minimum values of $3\cos x + 4\sin x$. TS Mar 16, 18

48. Find the maximum and minimum value of $f(x) = 5\sin x + 12\cos x - 13$.

07. Trigonometric Equations

SHORT ANSWER QUESTIONS (4 MARKS)

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

02. Solve $2\cos^2\theta - \sqrt{3}\sin\theta + 1 = 0$ and write the general solutions. May 09

03. Solve $1 + \sin^2\theta = 3\sin\theta \cdot \cos\theta$. Mar 10

04. Solve $\sin x + \sqrt{3}\cos x = \sqrt{2}$. Mar 10

05. Solve the equation $\sqrt{3}\sin\theta - \cos\theta = \sqrt{2}$. Mar 18

06. Solve $\sqrt{2}(\sin x + \cos x) = \sqrt{3}$ and write the general solution. May 12, Mar 15

07. Solve $\sin 2x - \cos 2x = \sin x - \cos x$.

08. Solve the equation $\cot^2 x - (\sqrt{3}+1)\cot x + \sqrt{3} = 0$, $\left(0 < x < \frac{\pi}{2}\right)$. Mar 12, 14

08. Inverse Trigonometric Functions

SHORT ANSWER QUESTIONS (4 MARKS)

01. Prove that $\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{5}+\tan^{-1}\frac{1}{8}=\frac{\pi}{4}$.

May 06, 10, 11, 15, Mar 11; AP Mar 15, 17; TS May 15, 18

02. Prove that $\tan^{-1}\frac{3}{4}+\tan^{-1}\frac{3}{5}-\tan^{-1}\frac{8}{19}=\frac{\pi}{4}$.

03. Prove that $\sin^{-1}\frac{4}{5}+2\tan^{-1}\frac{1}{3}=\frac{\pi}{2}$. Mar 10, TS Mar 15, AP May 16

04. Prove that $\sin^{-1}\left(\frac{4}{5}\right)+\sin^{-1}\left(\frac{7}{25}\right)=\sin^{-1}\left(\frac{117}{125}\right)$. Mar 13, TS Mar 16

05. Prove that $\sin^{-1}\left(\frac{3}{5}\right)+\cos^{-1}\left(\frac{12}{13}\right)=\cos^{-1}\left(\frac{33}{65}\right)$. AP Mar 16

06. Prove that $\cos^{-1}\left(\frac{4}{5}\right)+\sin^{-1}\left(\frac{3}{\sqrt{34}}\right)=\tan^{-1}\left(\frac{27}{11}\right)$. May 13

07. If $\tan^{-1}x+\tan^{-1}y+\tan^{-1}z=\frac{\pi}{2}$, then prove that $xy+yz+zx=1$.

08. Prove that $\cos\left[2\mathrm{Tan}^{-1}\frac{1}{7}\right]=\sin\left[4\mathrm{Tan}^{-1}\frac{1}{3}\right]$

09. Show that $\cot\left(\sin^{-1}\sqrt{\frac{13}{17}}\right)=\sin\left(\tan^{-1}\frac{2}{3}\right)$. TS Mar 17

09. Hyperbolic Functions

VERY SHORT ANSWER QUESTIONS (2 MARKS)

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

02. Show that $\tanh^{-1}\left(\frac{1}{2}\right)=\frac{1}{2}\log_e 3$. Mar 05, 07, May 05, 07, Mar 15, May 15; AP Mar 17, 19

03. If $\sinh x=5$ show that $x=\log_e(5+\sqrt{26})$.

04. If $\sinh x=3$, then show that $x=\log_e(3+\sqrt{10})$. TS Mar 16, AP May 22, Aug 22

05. For any $x\in R$, prove that $\cosh^4 x-\sinh^4 x=\cosh(2x)$. TS Mar 20

06. For any $x\in R$, show that $\cosh 2x=2\cosh^2 x-1$. AP Mar 18

07. If $\cosh x=\frac{5}{2}$, find the value of (i) $\cosh(2x)$ and (ii) $\sinh(2x)$.

May 06, Mar 10, May 06, 11, Mar 11, 16; TS May 15, TS Mar 17, 19

08. If $\sinh x = \frac{3}{4}$, find $\cosh 2x$ and $\sinh 2x$ May 09, Mar 12, 14; TS May 16, 22

09. Prove that $(\cosh x - \sinh x)^n = \cosh(nx) - \sinh(nx)$, for any $n \in R$ Mar 06, 07; TS Mar 15

10. Prove that $(\cosh x + \sinh x)^n = \cosh(nx) + \sinh(nx)$, for any $n \in R$ TS Mar 18

10. Properties of Triangles

LONG ANSWER QUESTIONS (7 MARKS)

01. Show that $a\cos^2\frac{A}{2} + b\cos^2\frac{B}{2} + c\cos^2\frac{C}{2} = s + \frac{\Delta}{R}$. Mar 09; TS May 15

02. If $a:b:c = 7:8:9$, find $\cos A : \cos B : \cos C$. AP May 15

03. If $\cot\frac{A}{2} : \cot\frac{B}{2} : \cot\frac{C}{2} = 3:5:7$, show that $a:b:c = 6:5:4$. AP Mar 17

04. Prove that $\frac{\cot\frac{A}{2} + \cot\frac{B}{2} + \cot\frac{C}{2}}{\cot A + \cot B + \cot C} = \frac{(a+b+c)^2}{a^2+b^2+c^2}$ TS May 22

05. If $a = (b-c)\sec\theta$, prove that $\tan\theta = \frac{2\sqrt{bc}}{b-c}\sin\frac{A}{2}$. Mar 10, 11; AP Mar 18; TS May 16

06. If $a = (b+c)\cos\theta$, prove that $\sin\theta = \frac{2\sqrt{bc}}{b+c}\cos\frac{A}{2}$. May 11; AP Mar 19

07. If $\sin\theta = \frac{a}{b+c}$, prove that $\cos\theta = \frac{2\sqrt{bc}}{b+c}\cos\frac{A}{2}$.

Mar 11, May 11, Mar 12; AP Mar & May 16, TS May 22

08. If P_1, P_2, P_3 are the altitudes drawn from vertices A, B, C to the opposite sides of a triangle respectively then show that i) $\frac{1}{P_1} + \frac{1}{P_2} + \frac{1}{P_3} = \frac{1}{r}$ ii) $P_1P_2P_3 = \frac{(abc)^2}{8R^3} = \frac{8\Delta^3}{abc}$. Mar 10; TS Mar 18

09. In a ΔABC if $a = 13$, $b = 14$, $c = 15$, then show that $R = \frac{65}{8}$, $r = 4$, $r_1 = \frac{21}{2}$, $r_2 = 12$, $r_3 = 14$.

May 10, Jun 11, Mar 14; AP Mar 15, 16, Jun 16, Mar 19; TS Mar 17

10. If $r_1 = 2$, $r_2 = 3$, $r_3 = 6$ and $r = 1$ prove that $a = 3$, $b = 4$ and $c = 5$.

Mar 09; TS Mar 15, May 22

11. In ΔABC, if $r_1 = 8$, $r_2 = 12$, $r_3 = 24$, find a, b, c. AP May 15, Mar 17; TS May 16

12. Show that $r + r_3 + r_1 - r_2 = 4R\cos B$. Mar 13; AP Mar 18, May 22

13. In ΔABC, prove that $r_1 + r_2 + r_3 - r = 4R$. Mar 06

14. If $r : R : r_1 = 2:5:12$, then prove that the triangle is right angled at A. May 07 09

15. $\frac{1}{r^2} + \frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2} = \frac{a^2+b^2+c^2}{\Delta^2}$. TS Mar 17, 19

SHORT ANSWER QUESTIONS (4 MARKS)

16. Show that $a^2\cot A + b^2\cot B + c^2\cot C = \frac{abc}{R}$. **Mar 14**

17. Show that $\frac{\cos A}{a} + \frac{\cos B}{b} + \frac{\cos C}{c} = \left(\frac{a^2+b^2+c^2}{2abc}\right)$. **May 10, AP Aug 22**

18. In ΔABC, if $\frac{1}{a+c} + \frac{1}{b+c} = \frac{3}{a+b+c}$, show that $C = 60°$. **TS Mar 17, 19**

19. Prove that $\cot\frac{A}{2} + \cot\frac{B}{2} + \cot\frac{C}{2} = \frac{s^2}{\Delta}$. **TS May 16**

20. If $\cot\frac{A}{2}, \cot\frac{B}{2}, \cot\frac{C}{2}$ are in A.P., then prove that a, b, c are in A.P.

21. If $\sin^2\frac{A}{2}, \sin^2\frac{B}{2}, \sin^2\frac{C}{2}$ are in H.P., then show that a, b, c are in H.P

22. Prove that $\cot A + \cot B + \cot C = \frac{a^2+b^2+c^3}{4\Delta}$. **Mar 10, May 12; AP May 16; TS Mar 15, 18**

23. Prove that $4(r_1r_2 + r_2r_3 + r_3r_1) = (a+b+c)^2$.

24. Show that $(r_1+r_2)\sec^2\frac{C}{2} = (r_2+r_3)\sec^2\frac{A}{2} = (r_3+r_1)\sec^2\frac{B}{2}$. **AP Mar 19**

THE END