01. Locus

SHORT ANSWER QUESTIONS (4 MARKS)

01. Find the equation of locus of a point P, if the distance of P from $A(3,0)$ is twice the distance of P from $B(-3,0)$. **AP May 16**

02. Find the equation of locus of P, if $A=(2,3)$, $B=(2,-3)$ and $PA+PB=8$. **Mar 08, AP Mar 15, 18, TS May 16**

03. Find the equation of locus of a point, the sum of whose distances from $(0,2)$ and $(0,-2)$ is 6 units. **Mar 10, TS Mar 16**

04. $A(1,2)$, $B(2,-3)$ and $C(-2,3)$ are three points. A point P moves such that $PA^2+PB^2=2PC^2$ show that the equation to the locus of 'P' is $7x-7y+4=0$. **AP May 15, AP Mar 17, TS Mar 19**

05. Find the equation of locus of a point, the difference of whose distances from $(-5,0)$ and $(5,0)$ is 8. **May 11, AP & TS 18, AP 20**

06. Find the equation of locus of P. If $A=(4,0)$, $B=(-4,0)$ and $|PA-PB|=4$. **Mar 95, 07, May 13**

07. If the distance from P to the points $(2,3)$, $(2,-3)$ are in the ratio $2:3$, then find the equation of locus of P. **May 14, TS May 15, AP Mar 16, May 22, Aug 22**

08. Find the equation of locus of P, if the ratio of the distance from P to $(5,-4)$ and $(7,6)$ is $2:3$. **Apr 98, July 01, May 08, Mar 14**

09. Find the equation of locus of P, if the line segment joining $(2,3)$ and $(-1,5)$ subtend a right angle at P. **AP May 12, Mar 13, May 19**

10. The ends of the hypotenuse of a right angled triangle are $(0,6)$ and $(6,0)$. Find the equation of the locus of its third vertex. **Mar 08, June 10**

11. Find the locus of the third vertex of a right angles triangle, the ends of whose hypotenuses are $(4,0)$ and $(0,4)$. **Mar 13, TS Mar 18, May 22**

12. $A(5,3)$ and $B(3,-2)$ are two fixed points. Find the equation of locus of P, so that the area of triangle PAB is 9 sq. units. **TS Mar 15, 17, 19, May 22; AP Mar 17, 19, May 22, Aug 22**

02. Transformation of Axes

SHORT ANSWER QUESTIONS (4 MARKS)

01. 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 the curve. **AP May 15, 17, 19 (TS) Mar 13, 16**

02. When the origin is shifted to the point $(-1,2)$, the transformed equation of a curve is $2x^2+y^2-4x+4y=0$. Find the original equation of the curve.

03. When the origin is shifted to the point $(3,-4)$ and transformed equation is $x^2+y^2=4$. Find the original equation of the curve. **AP Mar 19**

04. When the axes are rotated through an angle $\frac{\pi}{4}$, find the transformed equation of $3x^2+10xy+3y^2=9$. **May 14, TS May 16, 19 AP & TS Mar 17**

05. When the axes are rotated through an angle $\frac{\pi}{6}$, find the transformed equation of $x^2+2\sqrt{3}xy-y^2=2a^2$. **May 13, 15, TS Mar 18, May 22**

06. When the axes are rotated through an angle α, find the transformed equation of $x\cos\alpha+y\sin\alpha=p$. **AP Mar 20, TS Mar 14**

07. 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.
Mar 08, May 10, 16, TS Mar & May 15, Mar 20

08. Show that the axes are to be rotated through an angle of $\frac{1}{2}\tan^{-1}\left(\frac{2h}{a-b}\right)$ so as to remove the xy term from the equation $ax^2+2hxy+by^2=0$, if $a\neq b$ and through the angle $\frac{\pi}{4}$, if $a=b$.
Mar 06, 13, TS May 17

03. Straight Lines

LONG ANSWER QUESTIONS (7 MARKS)

01. If p and q are the lengths of the perpendiculars from the origin to the straight lines $x\sec\alpha+y\,\mathrm{cosec}\,\alpha=a$ and $x\cos\alpha-y\sin\alpha=a\cos2\alpha$, then prove that $4p^2+q^2=a^2$.
Mar 08, Mar 13, TS Mar 20 , AP May 22

02. If $Q(h,k)$ is the foot of the perpendicular from $P(x_1,y_1)$ on the line $ax+by+c=0$, then prove that $(h-x_1):a=(k-y_1):b=-(ax_1+by_1+c):a^2+b^2$ (or) $\frac{h-x_1}{a}=\frac{k-y_1}{b}=\frac{-(ax_1+by_1+c)}{a^2+b^2}$. Also find the foot of the perpendicular from $(-1,3)$ on the line $5x-y-18=0$. **May 07, 14, AP Mar 20**

03. If $Q(h,k)$ is the image of the point $P(x_1,\ y_1)$ w.r.to the straight line $ax+by+c=0$, then prove that $(h-x_1):a=(k-y_1):b=-2(ax_1+by_1+c):a^2+b^2$ (or) $\frac{h-x_1}{a}=\frac{k-y_1}{b}=\frac{-2(ax_1+by_1+c)}{a^2+b^2}$. Also find the image of $(1,-2)$ w.r.to the straight line $2x-3y+5=0$. **May 04, Mar 13, AP Mar 19**

04. Find the orthocentre of the triangle with the vertices $(-2,-1)$, $(6,-1)$ and $(2,5)$.
May 12, AP Mar 15, May 15, 18, Aug 22; TS May 19, TS May 22

05. Find the Orthocentre of the triangle with the vertices $(-5,-7)$, $(13,2)$ and $(-5,6)$.
Mar 12, AP Mar 16, TS May 17

06. Find the orthocentre of the triangle with the vertices $(5,-2)$, $(-1,2)$ and $(1,4)$.
TS Mar 17, 19

07. If the equation of the sides of a triangle are $7x+y-10=0$, $x-2y+5=0$ and $x+y+2=0$. Find the orthocentre of the triangle. **May 09, TS Mar 15**

08. Find the circumcentre of the triangle with the vertices $(-2,3)$, $(2,-1)$ and $(4,0)$. **13, AP Mar 17, AP May 16, TS May 15**

09. Find the circumcentre of the triangle whose vertices are $(1,3)$, $(0,-2)$ and $(-3,1)$. **AP Mar 18, TS May 16, 18,**

10. Find the circumcentre of the triangle whose vertices are $(1,3)$, $(-3,5)$ and $(5,-1)$. **AP May17, TS Mar 18**

11. Find the circumcentre of the triangle whose sides are $3x-y-5=0$; $x+2y-4=0$ and $5x+3y+1=0$. **June 05, Mar 06, May 11**

12. Find the circumcentre of the triangle whose sides are $x+y+2=0$; $5x-y-2=0$ and $x-2y+5=0$. **May 08, Mar 14**

SHORT ANSWER QUESTIONS (4 MARKS)

13. Transform the equation $\sqrt{3}x+y=4$ into (a) slope-intercept form (b) intercept form and (c) normal form. **Mar 04, 08, TS Mar 16**

14. Transform the equation $3x+4y+12=0$ into i) slope-intercept form ii) intercept form iii) normal form **TS May 2017, AP May 22**

15. Transform the equation $4x-3y+12=0$ into (i) Slope-Intercept form, (ii) Intercept form, (iii) Normal form. **May 14; AP Mar 16, 20**

16. Find the points on the line $3x-4y-1=0$ which are at a distance of 5 units from the point $(3,2)$. **Mar 15**

17. A straight line through $Q(\sqrt{3},2)$ makes an angle $\frac{\pi}{6}$ with positive direction of the x–axis. If the straight line intersects the line $\sqrt{3}x-4y+8=0$ at P, find the distance PQ. **Mar 04, TS Mar 19**

18. 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. **TS Mar 2015, AP May 22**

19. Find the equations of the straight lines passing through $(1,3)$ and (i) parallel to (ii) perpendicular to the line passing through points $(3,-5)$ and $(-6,1)$. **AP May 15, TS May 22**

20. Find the equation of the line passing through the point of intersection of $2x+3y=1$, $3x+4y=6$ and perpendicular to the line $5x-2y=7$.

21. Find the value of 'k', if the angle between the straight lines $4x-y+7=0$ and $kx-5y-9=0$ is 45°. **Mar 12, AP May 16, TS May 17**

22. Transform the equation $\frac{x}{a}+\frac{y}{b}=1$ into the normal form, when $a>0$ and $b>0$. If the perpendicular distance of straight line from the origin is P, deduce that $\frac{1}{p^2}=\frac{1}{a^2}+\frac{1}{b^2}$. **June 04, Mar 07, May 08**

23. Find the value of k, if the lines $2x-3y+k=0$, $3x-4y-13=0$ and $8x-11y-33=0$ are concurrent. **Mar 05**

24. If the straight lines $ax+by+c=0$, $bx+cy+a=0$ and $cx+ay+b=0$ are concurrent, then prove that $a^3+b^3+c^3=3abc$. **AP Mar 19**

25. Find the equation of the straight line parallel to the line $3x+4y=7$ and passing through the point of intersection of the lines $x-2y-3=0$ and $x+3y-6=0$. **TS Mar 16**

26. Find the equation of the straight line perpendicular to the line $2x+3y=0$ and passing through the point of intersection of the lines $x+3y-1=0$ and $x-2y+4=0$.

VERY SHORT ANSWER QUESTIONS (2 MARKS)

27. Find the value of x, if the slope of the line passing through $(2,5)$ and $(x,3)$ is 2. **May 12, (TS May 16), AP & TS Mar 18**

28. Find the angle which the straight line $y=\sqrt{3}x-4$ makes with the y-axis. **AP & TS Mar 19**

29. Find the equation of the straight line passing through $(-4,5)$ and cutting off equal non zero intercepts on the co-ordinate axes. **(AP May 16, 18, Mar 20), (TS Mar 15, May 18)**

30. Find the equation of the straight line passing through $(-2,4)$ and making non-zero intercepts whose sum is zero. **AP Mar 15, May 19, Aug 22; TS May 15**

31. Find the equation of the straight line passing through $(2,3)$ and making non-zero intercepts whose sum is zero. **May 09, Mar 12**

32. Find the area of the triangle formed by the straight line $3x-4y+12=0$ with the coordinate axes. **AP Mar 15**

33. If the area of the triangle formed by the straight lines $x=0$, $y=0$ and $3x+4y=a$ (>0) is 6, then find the value of 'a'. **May 11, 18**

34. Transform the equation $x+y+1=0$ into normal form. **May 10, Mar 12, AP Mar 17, TS Mar 18**

35. 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 $(0,6)$. **Mar 08, Mar 14 SAQ, TS Mar 17**

36. Find the value of 'p', if the straight lines $3x+7y-1=0$ and $7x-py+3=0$ are mutually perpendicular. **TS Mar 16, 19, AP & TS May 19**

37. Find the equation of straight line passing through the point $(5,4)$ and parallel to the line $2x+3y+7=0$. **Mar 13**

38. Find the equation of the straight line perpendicular to the line $5x-3y+1=0$ and passing through the point $(4,-3)$. **TS Mar 15, AP May 16**

39. Find the value of 'k', if the straight lines $6x-10y+3=0$ and $kx-5y+8=0$ are parallel.

40. Find the distance between the parallel straight lines $3x+4y-3=0$ and $6x+8y-1=0$. **AP Mar 19**

41. Find the distance between the parallel lines $5x-3y-4=0$; $10x-6y-9=0$. **Mar 09**

42. Find the value of P, if the straight lines $x+p=0$, $y+2=0$, $3x+2y+5=0$ are concurrent. **Mar 13, TS May 15, TS Mar 17, 20, AP May 22**

43. Show that the lines $2x+y-3=0$, $3x+2y-2=0$ and $2x-3y-23=0$ are concurrent and find the point of concurrence. **AP Mar 18**

44. Find the value of p, if the lines $3x+4y=5$, $2x+3y=4$, $px+4y=6$ are concurrent.
AP Mar & May 17, TS May 22

45. Find the ratio in which the straight line $L \cong 2x+3y=5$ divides the join of the points $(0,0)$ and $(-2,1)$. Mar 14

46. Find the ratio in which the straight line $2x+3y-20=0$ divides the join of the points $(2,3)$ and $(2,10)$.

04. Pair of Straight Lines

LONG ANSWER QUESTIONS (7 MARKS)

01. Let the equation $ax^2+2hxy+by^2=0$ represent a pair of straight lines. Then the angle 'θ' between the lines given by $\cos\theta=\frac{a+b}{\sqrt{(a-b)^2+4h^2}}$. Mar 11, AP Mar 20; TS Mar 18

02. If the equation $ax^2+2hxy+by^2=0$ represents a pair of distinct (i.e., intersecting) lines, then the combined equation of the pair of bisectors of the angles between these lines is $h(x^2-y^2)=(a-b)xy$. Mar 13, May 13; AP Mar 18

03. Show that the product of the perpendicular distances from a point (α,β) to the pair of straight lines $ax^2+2hxy+by^2=0$ is $\frac{|a\alpha^2+2h\alpha\beta+b\beta^2|}{\sqrt{(a-b)^2+4h^2}}$.
May 13, 14; AP May 15, 17; TS May 18, TS May 22

04. Show that the area of the triangle formed by the lines $ax^2+2hxy+by^2=0$ and $\ell x+my+n=0$ is $\frac{n^2\sqrt{h^2-ab}}{|am^2-2h\ell m+b\ell^2|}$ sq. units. AP Mar 17; TS May 15, May 16, Mar 17, Mar 19

05. Find the centroid and the area of the triangle formed by the lines $3x^2-4xy+y^2=0$; $2x-y=6$. AP May 19

06. If the second degree equation $S\equiv ax^2+2hxy+by^2+2gx+2fy+c=0$ in the two variables 'x' and 'y' represents a pair of straight lines, then Mar 14; AP & TS Mar16

i) $abc+2fgh-af^2-bg^2-ch^2=0$ ii) $h^2\geq ab, g^2\geq ac$ and $f^2\geq bc$

07. Show that the equation $2x^2-13xy-7y^2+x+23y-6=0$ represents a pair of straight lines also find the angle between them and the co-ordinates of the point of intersection of the lines. Mar 04, May 12; AP May 18

08. Prove that the equation $3x^2+7xy+2y^2+5x+5y+2=0$ represents a pair of straight lines and find the coordinates of the point of intersection. AP May 16

09. If the equation $S=ax^2+2hxy+by^2+2gx+2fy+c=0$ represents a pair of parallel straight lines, then show that (i) $h^2=ab$, (ii) $af^2=bg^2$ and (iii) the distance between the parallel lines is $2\sqrt{\frac{g^2-ac}{a(a+b)}}=2\sqrt{\frac{f^2-bc}{b(a+b)}}$. AP Mar 15, 19; TS Mar 20

10. Show that the product of the perpendicular distances from the origin to the pair of straight lines represented by $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ is $\frac{|c|}{\sqrt{(a-b)^2 + 4h^2}}$.

AP & TS May 19; AP Aug 22

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 $3x - y + 1 = 0$.

Mar 13, May 13, 14; AP Mar 16, May 16, Aug 22; TS May 18

12. Find the angles between the straight lines joining the origin to the points of intersection of the curve $7x^2 - 4xy + 8y^2 + 2x - 4y - 8 = 0$ with the straight line $3x - y = 2$.

(or)

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.

May 98, Mar 00, May 01; AP Mar 18; TS Mar 16

13. Find the condition for the chord $\ell x + my = 1$ of the circle $x^2 + y^2 = a^2$ (whose center is the origin) to subtend a right angle at the origin. **Mar 13, 14, TS May 22**

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

Mar 13; AP Mar 17, 19, May 22; TS Mar 15, May 17, Mar 19

15. Show that the lines joining the origin to the points of intersection of the curve $x^2 - xy + y^2 + 3x + 3y - 2 = 0$ and the straight line $x - y - \sqrt{2} = 0$ are mutually perpendicular.

AP Mar 15, May 18, Mar 20; TS May 15, Mar 18, Mar 20

05. 3D Coordinate System

VERY SHORT ANSWER QUESTIONS (2 MARKS)

01. Find 'x' if the distance between $(5,-1,7)$ and $(x,5,1)$ is 9 units.

Mar 11, AP Mar 19, Aug 22, TS May 22

02. Show that the points $(1,2,3)$, $(2,3,1)$ and $(3,1,2)$ from an equilateral triangle.

AP May 16, 18; Mar 18; (B.P)

03. Find the fourth vertex of the parallelogram whose consecutive vertices are $(2,4,-1)$, $(3,6,-1)$ and $(4,5,1)$. **Mar 11, TS Mar 17**

04. Find the ratio in which XZ-plane divides the line segment joining $A(-2,3,4)$ and $B(1,2,3)$.

May 14, 15, 17; TS Mar 18, 19, May 22

05. Find the ratio in which YZ-plane divides the line joining $A(2,4,5)$ and $B(3,5,-4)$. Also find the point of intersection. **May 10**

06. Show that the points $A(1,2,3)$, $B(7,0,1)$, $C(-2,3,4)$ are collinear. **Mar 13, TS Mar 16, 20**

07. Show that the points $A(5,4,2)$, $B(8,-2,-7)$, $C(6,2,-1)$ are collinear and find the ratio $AC : CB$.

AP Mar 07, May 17

08. Show that the points $A(3,2,-4)$, $B(5,4,-6)$ and $C(9,8,-10)$ are collinear and find the ratio in which 'B' divides $\overline{AC}$. AP May 19

09. Find the coordinates of the vertex 'c' of ΔABC if its centroid is the origin and the vertices A, B are $(1,1,1)$ and $(-2,4,1)$ respectively. May 13; AP Mar 16, 20; TS Mar 15, May 18, 22

10. If $(3,2,-1)$, $(4,1,1)$ and $(6,2,5)$ are three vertices and $(4,2,2)$ is the centroid of tetrahedron, find the fourth vertex. Mar 13, 14; AP Mar 15, May 15, 17, 22

06. DC's and DR's

LONG ANSWER QUESTIONS (7 MARKS)

01. Find the direction cosines of two lines which are connected by the relations $\ell+m+n=0$ and $mn-2n\ell-2\ell m=0$. TS May 15, Mar 17; AP Mar 17, May 22

02. Find the direction cosines of two lines which are connected by the relations $\ell-5m+3n=0$ and $7\ell^2+5m^2-3n^2=0$. AP May 16, Mar 18, Aug 22; TS Mar 16, May 19

03. If a ray makes the angles α, β, γ and δ with four diagonals of a cube, then find $\cos^2\alpha+\cos^2\beta+\cos^2\gamma+\cos^2\delta$. TS Mar 16; May 18, (B.P)

04. Find the angle between the lines whose direction cosines satisfy the equations $\ell+m+n=0$, $\ell^2+m^2-n^2=0$. May 13, 14; AP Mar 17, 19; TS Mar 19

05. Find the angle between the lines whose direction cosines are given by the equation $3\ell+m+5n=0$ and $6mn-2n\ell+5\ell m=0$. Mar 13; AP May 15, 17, 19; TS Mar 15, 20

06. Find the angle between the two lines which are connected by the relations $\ell+m+n=0$ and $2mn+3n\ell-5\ell m=0$. Mar 12; AP Mar 16, May 18

07. Find the angle between two diagonals of a cube. May 13; AP Mar 15, 20; TS Mar 18, May 22

07. The Plane

VERY SHORT ANSWER QUESTIONS (2 MARKS)

01. Find the equation of the plane passing through the $(1,1,1)$ and parallel to the plane $x+2y+3z-7=0$ May 09, 10, 11, 17,18

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

03. Find the equation of the plane whose intercepts on x, y, z axes are 1, 2, 4 respectively. Mar 10, May 14, AP May 22

04. Find the equation of the plane which makes intercepts 2, 3, 4 on the x, y, z-axes respectively.

05. Find the intercepts of the plane $4x+3y-2z+2=0$ on the coordinate axes. AP & TS Mar 18; TS May 18

06. Find the intercepts of the plane $x-3y+2z=9$ on the coordinate axes.

07. Write the equation of the plane $4x-4y+2z+5=0$ in the intercept form. AP 16, 19

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

May 13, Mar 14; AP & TS 16; AP Aug 22; TS Mar 19

09. Find the direction cosines of the normal to the plane $x+2y+2z-4=0$.

May 12, Mar 13, May 15, 16; TS Mar 20, May 22

10. Find the equation of the plane passing through $(2,3,4)$ and perpendicular to x-axis.

11. Find the angle between the planes $x+2y+2z-5=0$ and $3x+3y+2z-8=0$.

AP May 15; TS Mar 15, 17, 19

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

Mar 11 (B.P); AP Mar 15, 17

08. Limits & Continuity

SHORT ANSWER QUESTIONS (4 MARKS)

01. Show that $f(x)=\begin{cases}\dfrac{\cos ax-\cos bx}{x^2}, & \text{if } x\neq 0\\ \dfrac{1}{2}(b^2-a^2), & \text{if } x=0\end{cases}$, where 'a' and 'b' are real constants is continuous at $x=0$.

May 13, May 14, B.P.; AP Aug 22; TS Mar 17, May 17, Mar 20

02. Is 'f' defined by $f(x)=\begin{cases}\dfrac{\sin 2x}{x}, & \text{if } x\neq 0\\ 1, & \text{if } x=0\end{cases}$, continuous at $x=0$.

May 12; TS Mar 16; AP May 17

03. Check the continuity of 'f' given by $f(x)=\begin{cases}\dfrac{(x^2-9)}{(x^2-2x-3)}, & \text{if } 0<x<5 \,\&\, x\neq 3\\ 1.5, & \text{if } x=3\end{cases}$ at the point $x=3$.

13, 14 ; AP Mar 15, 20; TS Mar 19

04. Check the continuity of the following function at $x=2$.

$$f(x)=\begin{cases}\dfrac{1}{2}(x^2-4), & \text{if } 0<x<2\\ 0, & \text{if } x=2\\ 2-8x^{-3}, & \text{if } x>2\end{cases}.$$

AP Mar 17, May 19, TS May 15, Mar 19

• 05. If 'f' 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 the values of k.

AP May 16, 18, AP May 22; TS Mar 15, May 18

• 06. Find real constants a, b so that the function 'f' given by $f(x)=\begin{cases}\sin x, & \text{if } x\leq 0\\ x^2+a, & \text{if } 0<x<1\\ bx+3, & \text{if } 1\leq x\leq 3\\ -3, & \text{if } x>3\end{cases}$ is continuous on R.

May 13; AP & TS Mar 18

VERY SHORT ANSWER QUESTIONS (2 MARKS)

07. Compute $\lim_{x\to 3}\left[\frac{x^2-8x+15}{x^2-9}\right]$. AP Mar 16

08. Compute $\lim_{x\to 3}\left(\frac{x^2+3x+2}{x^2-6x+9}\right)$. AP Mar 19

09. Compute $\lim_{x\to 2}\frac{x^2+2x-1}{x^2-4x+4}$.

10. Find $\lim_{x\to a}\frac{x^2-a^2}{x-a}$. AP Aug 22

11. Compute $\lim_{x\to 2}\left(\frac{x-2}{x^3-8}\right)$.

12. Find $\lim_{x\to 3}\frac{x^3-6x^2+9x}{x^2-9}$.

13. Find $\lim_{x\to 3}\frac{x^2-8x+15}{x^2-9}$. AP & TS Mar 16; TS May 18

14. Find $\lim_{x\to 3}\frac{x^3-3x^2}{x^2-5x+6}$.

15. Find $\lim_{x\to 2}\left[\frac{1}{x-2}-\frac{4}{x^2-4}\right]$ AP 16

16. Find $\lim_{x\to 0}\left(\frac{\sqrt{1+x}-1}{x}\right)$. May 10, Mar 14; AP May 17, TS May 22

17. Evaluate $\lim_{x\to 3}\frac{x^3-27}{x-3}$

18. Evaluate $\lim_{x\to 0}\frac{(1+x)^{3/2}-1}{x}$ AP 15

19. Find $\lim_{x\to\infty}\frac{11x^3-3x+4}{13x^3-5x^2-7}$. Mar 14, AP Mar 18, 20, May 18

20. Find $\lim_{x\to\infty}\frac{8|x|+3x}{3|x|-2x}$. Mar 12; TS Mar 17, Mar 20, AP May 22

21. Compute $\lim_{x\to\infty}\left(\frac{x^2+5x+2}{2x^2-5x+1}\right)$. May 14, AP Mar 17; TS May 19, TS May 22

22. Find $\lim_{x\to 0}\left(\frac{\cos ax-\cos bx}{x^2}\right)$. May 11, AP May 17

23. Compute $\lim_{x\to 0}\left(\frac{1-\cos 2mx}{\sin^2 nx}\right)$. Mar 10; TS May 15

24. Evaluate $\lim_{x\to 1}\frac{\sin(x-1)}{x^2-1}$. May 02, May 06

25. Evaluate $\lim_{x\to 0}\frac{1-\cos x}{x}$.

26. Compute $\lim_{x\to a}\left(\frac{x\sin a - a\sin x}{x-a}\right)$. Mar 11, AP Mar 16, 19; TS May 16

27. Compute $\lim_{x\to a}\frac{\tan(x-a)}{x^2-a^2}$. May 04, TS Mar 15

28. Compute $\lim_{x\to 0}\left(\frac{\sin ax}{x\cos x}\right)$. 02, 03, AP Mar 20

29. Compute $\lim_{x\to 0}\left(\frac{\sin ax}{\sin bx}\right)$, $b\neq 0$, $a\neq 0$. AP May 18; TS Mar 18

30. Compute $\lim_{x\to 0}\frac{e^{3x}-1}{x}$. TS May 15; AP Mar 18

31. Find $\lim_{x\to 0}\left(\frac{3^x-1}{\sqrt{1+x}-1}\right)$. Mar 05, AP Mar 18

32. Compute $\lim_{x\to 0}\left(\frac{e^x-1}{\sqrt{1+x}-1}\right)$. Mar 13 (Old), Mar 15; AP May 16, AP May 22, TS May 18

33. Compute $\lim_{x\to 0}\left(\frac{a^x-1}{b^x-1}\right)$, $(a>0, b>0, b\neq 1)$. 13, AP Mar 15, TS Mar 19

34. Compute $\lim_{x\to 0}\frac{e^{3+x}-e^3}{x}$. AP Mar 19

35. Compute $\lim_{x\to 0}\left(\frac{e^x-\sin x-1}{x}\right)$. Mar 13, AP Mar 16; TS May 16

36. Compute $\lim_{x\to 0}\left(\frac{x(e^x-1)}{1-\cos x}\right)$. May 14

37. Compute $\lim_{x\to 0}\left(\frac{e^{7x}-1}{x}\right)$. May 13; AP Mar 17

38. Compute $\lim_{x\to 0}\frac{\log_e(1+5x)}{x}$. TS Mar 19

39. Evaluate $\lim_{x\to 1}\left(\frac{\log_e x}{x-1}\right)$. TS May 17

40. Show that $\lim_{x\to 2^-}\frac{|x-2|}{x-2}=-1$. June 04; AP & TS May 19, TS May 22

41. Show that $\lim_{x\to 0^+}\left(\frac{2|x|}{x}+x+1\right)=3$. May 08, AP Mar 15; B.P

09. Differentiation

LONG ANSWER QUESTIONS (7 MARKS)

01. If $\sqrt{1-x^2}+\sqrt{1-y^2}=a(x-y)$, then show that $\frac{dy}{dx}=\sqrt{\frac{1-y^2}{1-x^2}}$. **Mar 13, 14; AP May 16; TS Mar 05**

02. If $y=\tan^{-1}\left[\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right]$ for $0<|x|<1$, find $\frac{dy}{dx}$.

Mar 12; AP May 15, Mar 16, Mar 20; TS May 15, Mar 18, May 18

03. If $y=x^{\tan x}+(\sin x)^{\cos x}$, then find $\frac{dy}{dx}$. **May 13, Mar 13, 14; AP Mar 18**

04. If $x^{\log y}=\log x$, then find $\frac{dy}{dx}$. **TS Mar 19**

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

Mar 13; AP May 17; TS Mar 15, 17, May 19

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

Mar 11; AP Aug 22; TS Mar 16, May 16

07. If $x^y=y^x$, then show that $\frac{dy}{dx}=\frac{y(x\log y-y)}{x(y\log x-x)}$. **AP May 22**

08. If $y=x\sqrt{a^2+x^2}+a^2\log(x+\sqrt{a^2+x^2})$, then prove that $\frac{dy}{dx}=2\sqrt{a^2+x^2}$. **AP Mar 15, 19**

09. If $f(x)=\sin^{-1}\sqrt{\frac{x-\beta}{\alpha-\beta}}$ and $g(x)=\tan^{-1}\sqrt{\frac{x-\beta}{\alpha-\beta}}$, then show that $f'(x)=g'(x)$, $(\beta<x<\alpha)$.

Mar 06; TS May 17

SHORT ANSWER QUESTIONS (4 MARKS)

10. Find the derivative of $\sqrt{x+1}$ from the first principle w.r.t. x. **May 12, AP Aug 22**

11. Find the derivative of x^3 from the first principle w.r.t. 'x'. **TS Mar 15**

12. Find the derivative of $\cos^2 x$ from the first principles w.r.t. 'x'. **TS Mar 19**

13. Find the derivative of the $\tan 2x$ from the first principles w.r.t. 'x'.

Mar 13, May 13, Mar 14; AP May 15, 17

14. Find the derivative of $\cot 2x$ from first principle.

15. Find the derivative of $\sec 3x$ from the first principles w.r.t. 'x'. **Mar 12; AP Mar 16**

16. Find the derivative of $\cos(ax)$ from the first principles w.r.t. x.

Mar 13, May 14; AP & TS May 18, TS May 22

17. Find the derivative of $\sin 2x$ from the first principles w.r.t. 'x'.

AP Mar 18, 20; TS May 15, May 16, Mar 20

18. Find the derivative of $x\sin x$ from the first principles w.r.t. 'x'. AP Mar 15, 18; TS Mar 17

19. If $\sin y = x\sin(a+y)$, then show that $\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$ (a is not a multiple of π). Mar 11

20. Find the derivative of $f(x) = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$ w.r.t. $g(x) = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$. Mar 04

VERY SHORT ANSWER QUESTIONS (2 MARKS)

21. If $f(x) = 2x^2 + 3x - 5$, then prove that $f'(0) + 3\cdot f'(-1) = 0$. AP Mar 16, Aug 22

22. If $f(x) = 1 + x + x^2 + ... + x^{100}$, then find $f'(1)$. May 14; TS Mar 19

23. Find the derivative of the function $f(x) = (x^2-3)(4x^3+1)$. AP May 15

24. Find the derivative of $f(x) = e^x(x^2+1)$ w.r.t. x. May 02

25. Find the derivative of $5\sin x + e^x \log x$. AP Mar 17

26. Find the derivative of $5^x + \log x + x^3 e^x$.

27. Find the derivative of $e^x + \sin x \cos x$.

28. Find the derivative of $\sin mx \cdot \cos nx$.

29. If $f(x) = 7^{x^3+3x}$ $(x > 0)$, then find $f'(x)$. AP May 16; TS Mar 17

30. If $y = (x^3 + 6x^2 + 12x - 13)^{100}$, then find $\frac{dy}{dx}$.

31. If $f(x) = \log_7(\log x)$, then find $f'(x)$.

32. If $y = e^{2x}\cdot\log(3x+4)$, then find $\frac{dy}{dx}$ Mar 13, May 13

33. Find the derivative of $e^{2x}\log x$ w.r.t. x.

34. $y = \log(\sin(\log x))$, find $\frac{dy}{dx}$. Mar 08, TS May 22

35. If $y = \cos[\log(\cot x)]$, then find $\frac{dy}{dx}$. Mar 09, Mar 13

36. If $f(x) = \log(\sec x + \tan x)$, find $f'(x)$. Mar 14; AP May 17

37. If $y = \sin(\log x)$, find $\frac{dy}{dx}$. AP Mar 18, May 22

38. If $y = \sqrt{2x-3} + \sqrt{7-3x}$, then find $\frac{dy}{dx}$. TS Mar 15

39. If $f(x) = xe^x \sin x$, then find $f'(x)$. TS May 18

40. Find the derivative of $x^n n^x \log(nx)$.

41. If $f(x) = \frac{a-x}{a+x}$, then find $f'(x)$. TS Mar 18

42. If $y = \frac{2x+3}{4x+5}$, then find $\frac{dy}{dx}$. AP May 15

43. If $y = (\cot^{-1} x^3)^2$, find $\frac{dy}{dx}$. **May 13; TS Mar 18**

44. Find the derivative of $y = e^{\sin^{-1} x}$. **AP May 18**

45. If $y = e^{a\sin^{-1} x}$, then prove that $\frac{dy}{dx} = \frac{ay}{\sqrt{1-x^2}}$. **TS May 18**

46. If $y = \sin^{-1}(\cos x)$, then find $\frac{dy}{dx}$. **TS May 16**

47. If $y = \sin^{-1}\sqrt{x}$, find $\frac{dy}{dx}$

48. Find the derivative of the function $\tan^{-1}(\log x)$. **AP Mar 19; TS May 15**

49. If $f(x) = \sinh^{-1}\left(\frac{3x}{4}\right)$, then find $f'(x)$. **May 13**

50. If $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$, then find $\frac{dy}{dx}$. **Mar 12; TS Mar 15, May 15**

51. If $y = \mathrm{Tan}^{-1}\left(\frac{2x}{1-x^2}\right)$ $(|x| < 1)$, then find $\frac{dy}{dx}$.

52. If $y = \sin^{-1}(3x - 4x^3)$, then find $\frac{dy}{dx}$. **May 11; TS Mar 16**

53. Find the derivative of $\cos^{-1}(4x^3 - 3x)$ w.r.t. x. **June 02, Mar 14**

54. If $x^3 + y^3 - 3axy = 0$, then find $\frac{dy}{dx}$. **Mar 00**

55. If $2x^2 - 3xy + y^2x + 2y - 8 = 0$, then find $\frac{dy}{dx}$. **TS Mar 16**

56. If $y = x^x$, then find $\frac{dy}{dx}$. **Mar 11**

57. If $x^y = e^{x-y}$, then show that $\frac{dy}{dx} = \frac{\log x}{(1+\log x)^2}$. **Mar 07, 08; TS Mar 17**

58. If $x = a\cos^3 t$, $y = a\sin^3 t$, then find $\frac{dy}{dx}$. **May 12; AP Mar 16**

59. Find $\frac{dy}{dx}$ for the functions, $x = a(\cos t + t\sin t)$, $y = a(\sin t - t\cos t)$. **TS Mar 16**

60. If $x = 3\cos t - 2\cos^3 t$, $y = 3\sin t - 2\sin^3 t$, then find $\frac{dy}{dx}$. **Mar 10**

61. If $y = e^t + \cos t$, $x = \log t + \sin t$, then find $\frac{dy}{dx}$. **AP May 17**

62. Differentiate $f(x)$ with respect to $g(x)$ if $f(x) = e^x$, $g(x) = \sqrt{x}$. **Mar 03**

63. If $y = ae^{nx} + be^{-nx}$, then prove that $y'' = n^2 y$. **May 14; AP Mar 15; TS Mar 20**

64. If $y = x^4 + \tan x$, then find y''. **AP Mar 18**

10.1 Errors and Approximations

VERY SHORT ANSWER QUESTIONS (2 MARKS)

01. Find the approximate value of $\sqrt{82}$. May 09, Mar 13

02. Find the approximate value of $\sqrt[3]{999}$. AP Mar 19

03. Find the approximate value of $\sqrt[3]{65}$. AP May 18; B.P.

04. Find the approximate value of $\sqrt[4]{17}$. TS May 17

05. Find Δy and dy if $y = x^2 + 3x + 6$, when $x = 10$, $\Delta x = 0.01$.
AP May 15, Mar 20; TS Mar 14, 15, May 22

06. Find Δy and dy if $y = x^2 + x$, at $x = 10$, $\Delta x = 0.1$.
AP Mar 15, 17, May 17; TS May 15, Mar 16, 17 May 19

07. Find Δy and dy if $y = \frac{1}{x+2}$ when $x = 8$, $\Delta x = 0.02$.

08. Find Δy and dy for $y = e^x + x$, when $x = 5$, $\Delta x = 0.02$. May 13

09. The side of a square is increased from 3cm to 3.01cm. Find the approximate increase in the area of the square.

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

11. If the increase in the side of a square is 4%. Then find the approximate percentage of increase in the area of square. AP Mar 14, 16, 18; TS Mar 16, May 18

12. If the increase in the side of a square is 2%, then find the approximate percentage of increase in the area of square. Mar 12; TS Mar 18

10.2 Tangents and Normals

LONG ANSWER QUESTIONS (7 MARKS)

01. If the tangent at any 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.
Mar 13, 14; AP May 16, 17; TS Mar 15, May 17, Mar 19

02. Show that the equation of tangent at the point (x_1, y_1) on the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ is $xx_1^{-1/2} + yy_1^{-1/2} = a^{1/2}$. June 04; AP May 15, 22, Aug 22

03. Show that the curves $y^2 = 4(x+1)$ and $y^2 = 36(9-x)$ intersect orthogonally.
Mar 13 (Old); AP May 15

05. Find the angle between the curves $2y^2 - 9x = 0$, $3x^2 + 4y = 0$ (in the 4^{th} quadrant).
May 09; TS Mar 20; AP Aug 22

06. i) Define angle between two curves. May 13; AP Mar 17

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

07. Find the angle between the curves $y^2 = 8x$, $4x^2 + y^2 = 32$. May 12; AP Mar 18, May 19

08. Show that the condition for the orthogonality of the curves $ax^2 + by^2 = 1$ and $a_1x^2 + b_1y^2 = 1$ is $\frac{1}{a} - \frac{1}{b} = \frac{1}{a_1} - \frac{1}{b_1}$. **May 14; AP Mar 19; TS Mar 16**

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

10. At any point 't' on the curve $x = a(t + \sin t)$, $y = a(1 - \cos t)$, find the lengths of tangent, normal, subtangent and subnormal. **AP Mar 18; TS May 17; B.P.**

SHORT ANSWER QUESTIONS (4 MARKS)

12. Find the equations of tangent and normal to the curve $xy = 10$ at $(2,5)$. **Mar 11; AP Mar 17; TS May 18, TS May 22**

13. Find the equations of tangent and normal to the curve $y = x^3 + 4x^2$ at $(-1,3)$. **Mar 14; AP Mar 20; TS May 15**

14. Find the equations of tangent and normal to the curve $y^4 = ax^3$ at (a,a). **May 13**

15. Find the equations of the tangent and normal to the curve $x = \cos t$, $y = \sin t$ at $t = \pi / 4$. **TS May 19**

16. Show that the tangent at any point 'θ' on the curve $x = c\sec\theta$, $y = c\tan\theta$ is $y\sin\theta = x - c\cos\theta$. **TS Mar 19; B.P.**

17. Find the equations of the tangents to the curve $y = 3x^2 - x^3$, where it meet the x-axis. **AP May 19**

18. Find the equations of tangent and normal to the curve $y = 2e^{-x/3}$ at the point where the curve meets the y-axis. **TS Mar 16**

19. Show that at any point (x, y) on the curve $y = be^{x/a}$, the length of the sub tangent is a constant and the length of the sub normal is y^2 / a. **May 12; AP May 17; TS Mar 18**

20. Find the value of 'k' so that the length of the sub-normal at any point on the curve $y = a^{1-k}x^k$ is a constant. **AP May 16**

21. Find the lengths of subtangent and subnormal at a point on the curve $y = b\sin(x / a)$.

22. Find the equations of the tangents to the curve $y = 3x^2 - x^3$, where it meet the x-axis. **AP May 19**

10.3 Rate Measure

SHORT ANSWER QUESTIONS (4 MARKS)

01. A particle is moving in a straight line so that after 't' seconds its distance is 's' (in cms) from a fixed point on the line is given by $s = f(t) = 8t + t^3$. Find the i) velocity at time $t = 2$ sec, ii) initial velocity, iii) acceleration at $t = 2$ sec. **May, 12; AP Mar 15, 17; B.P.**

02. The distance-time formula for the motion of a particle along a straight line is given $s = t^3 - 9t^2 + 24t - 18$. Find when and where the velocity is zero. **Mar 12; AP Mar 19**

03. A particle is moving along a line according to $s = f(t) = 4t^3 - 3t^2 + 5t - 1$ where 's' is measured in meters and 't' is measured in seconds. Find the velocity and acceleration at time 't'. At what time the acceleration is zero. **AP Mar 18; TS Mar 15, 18**

04. The volume of a cube is increasing at the rate of $8\ cm^3\ s^{-1}$. How fast is the surface area increasing when the length of an edge is 12 cm. **AP Mar 14, 15; TS May 18**

05. The volume of a cube is increasing at a rate of 9 cubic centimetres per second. How fast is the surface area increasing when the length of the edge is 10 centimetres ?
Mar 13; AP Mar 16, May 18; TS May 15, 16, 17, 20

06. A stone is dropped into a quiet lake and ripples move in circles at the speed of $5\ cm\ s^{-1}$. At the instant when the radius of circular ripple is 8cm, how fast is the enclosed area increases ?
AP May 17, 19; TS Mar 19

07. A balloon, which always remains spherical on inflation, is being inflated by pumping in 900 cubic centimeters of gas per second. Find the rate at which the radius of balloon increases when the radius is 15 cm.

08. The radius of an air bubble is increasing at the rate of $(1/2)\ cm\ s^{-1}$. At what rate is the volume of the bubble increasing when the radius is $1\ cm$?

10.4 Mean Value Theorems

VERY SHORT ANSWER QUESTIONS (2 MARKS)

01. State Rolle's theorem.

02. State Lagrange's theorem.

03. Find the value of 'c' in Rolle's theorem for the function $y = f(x) = x^2 + 4$ on $(-3, 3)$.
AP Mar 17; TS Mar 15, 19; B.P.

04. Find the value of 'c' from Rolle's theorem for the function $f(x) = x^2 - 1$ on $[-1,1]$.
May 13, Mar 14; TS May 19

05. Verify Rolle's theorem for the function $f(x) = x^2 - 5x + 6$ on $[-3,8]$. **AP May 16; TS Mar 17**

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

10.5 Maxima and Minima

LONG ANSWER QUESTIONS (7 MARKS)

01. If the curved surface of right circular cylinder inscribed in a sphere of radius 'r' is maximum, then show that the height of the cylinder is $\sqrt{2}r$.
Mar 04, June 04, Mar 08, May 10, May 11, 13; AP May 15; TS Mar 16

02. From a rectangular sheet of dimensions $30\ cm \times 80\ cm$, four equal squares of side 'x'cm are removed at the corners, and the sides are then turned up so as to form an open rectangular box. Find the value of 'x', so that volume of the box is the greatest.
Mar 09, 14; AP Mar 16, 18, May 19; TS Mar 15, 20

03. A window is in the shape of a rectangle surmounted by a semicircle. If the perimeter of the window is 20ft. Find the maximum area. **May 09, 12; AP Mar 17; TS Mar 15, 17, May 19**

04. 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 the pieces of the wire respectively so that the sum of the areas is the least ? **Mar 11; AP Mar 17; TS May 18; B.P.**

05. Find two positive numbers whose sum is 16 and the sum of their squares is minimum.

AP Mar 18

06. Find two positive numbers whose sum is 15, so that the sum of their squares is minimum.

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

AP Aug 22

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

May 14, Mar 15

*****THE END*****