MATHS

BOOKS - ML KHANNA

THE ELLIPSE

Problem Set 1 Multiple Choice Questions

1. Find the eccentricity of an ellipse if its latus rectum is one-third of its major axis.

A. $2/3$

B. $\sqrt{(2/3)}$

C. $5 \times 4 \times 3/7^3$

D. $(3/4)^4$

Answer: B

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2. The latus rectum of an ellipse is half of its minor axis. Its eccentricity is :

A. $\sqrt{3}/2$

B. $1/4$

C. $1/2$

D. none

Answer: A

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3. If the line joining foci subtends an angle of 90° at an extremity of minor axis, then the eccentricity e is

A. $1/\sqrt{6}$

B. $1/\sqrt{3}$

C. $1/\sqrt{2}$

D. none

Answer: C

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4. Find the equation of the ellipse whose major axis is 8 and eccentricity $\frac{1}{2}$.

A. $3x^2 + 4y^2 = 12$

B. $3x^2 + 4y^2 = 48$

C. $4x^2 + 3y^2 = 48$

D. $3x^2 + 9y^2 = 12$

Answer: B

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5. S and T are foci of an ellipse and B is an end of the minor axis , if STB is an equilateral triangle , the eccentricity of the ellipse , is

A. $1/4$

B. $1/3$

C. $1/2$

D. $2/3$

Answer: C

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6. An ellipse has OB as the semi-minor axis, $FandF'$ as its foci, and $\angle FBF'$ a right angle. Then, find the eccentricity of the ellipse.

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

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

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

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

Answer: C

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7. if the major axis of an ellipse is three times the length of its minor axis , its eccentricity , is

A. $1/3$

B. $1/\sqrt{3}$

C. $1/\sqrt{2}$

D. $2\sqrt{2}/3$

Answer: D

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8. Eccentricity of conic $16x^2 + 7y^2 = 112$ is

A. $4/3$

B. $7/16$

C. $3/\sqrt{7}$

D. $3/4$

Answer: D

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9. The eccentricity of the ellipse with centre at the origin which meets the straight line $\frac{x}{7}+\frac{y}{2}=1$ on the axis of x and the straight line $\frac{x}{3}-\frac{y}{5}=1$ on the axis of y and whose axes lie along the axes of coordinates, is

A. $\frac{3\sqrt{2}}{7}$

B. $\frac{2\sqrt{3}}{7}$

C. $\frac{\sqrt{3}}{7}$

D. $\frac{2\sqrt{6}}{7}$

Answer: D

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10. The eccentricity of an ellipse whose pair of conjugate diameters are $2y = x$ and $3y = -2x$ is

A. $2/3$

B. $1/3$

C. $1/\sqrt{3}$

D. $\sqrt{2/3}$

Answer: D

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11. The eccentricity of the ellipse $9x^2 + 5y^2 - 30y = 0$ is

A. $1/3$

B. $2/3$

C. $3/4$

D. none of these

Answer: B

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12. The eccentricity of the ellipse $25x^2 + 16y^2 - 150x - 175 = 0$ is

A. $2/5$

B. $3/5$

C. $4/5$

D. none of these

Answer: B

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13. The eccentricity of the curve $x^2 - 4x + 4y^2 = 12$ is

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

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

C. $\sqrt{3}$

D. none of these

Answer: A

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14. If e is the eccentricity of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ (a $<$ b) , then ,

A. $b^2 = a^2\left(1 - e^2\right)$

B. $a^2 = b^2\left(1 - e^2\right)$

C. $a^2 = b^2\left(e^2 - 1\right)$

D. $b^2 = a^2\left(e^2 - 1\right)$

Answer: B

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15. In an ellipse the distance between its foci is 6 and its minor axis is 8. Then its 'eccentricity is

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

B. $\frac{1}{\sqrt{5}}$

C. $\frac{1}{\sqrt{4}}$

D. $\frac{1}{\sqrt{6}}$

Answer: A

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16. If the distance between the foci of an ellipse is equal to its axis, then its eccentricity is

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

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

C. $\frac{1}{\sqrt{4}}$

D. $\frac{1}{\sqrt{6}}$

Answer: A

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17. An ellipse is described by using an endless string which is passed over two pins. If the axes are 6 cm and 4 cm, the necessary length of the string and the distance between the pins respectively in cm are

A. $6, 2\sqrt{5}$

B. $6, \sqrt{5}$

C. $4, 2\sqrt{5}$

D. $6 + 2\sqrt{5}, 2\sqrt{5}$

Answer: D

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18. If (5, 12) and (24, 7) are the foci of an ellipse passing through the origin, then find the eccentricity of the ellipse.

A. $\frac{\sqrt{386}}{38}$

B. $\frac{\sqrt{386}}{12}$

C. $\frac{\sqrt{386}}{13}$

D. $\frac{\sqrt{386}}{25}$

Answer: A::B

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19. The eccentricity of an ellipse with its centre at the origin is $\frac{1}{2}$. If one of the directrices is x = 4 , then the equation of ellipse is

A. $3x^2 + 4y^2 = 1$

B. $3x^2 + 4y^2 = 12$

C. $4x^2 + 3y^2 = 12$

D. $4x^2 + 3y^2 - 1$

Answer: B

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20. If $P = (x, y), F_1 = (3, 0), F_2 = (-3, 0),$ and $16x^2 + 25y^2 = 400$, then $PF_1 + PF_2$ equal 8 (b) 6 (c) 10 (d) 12

A. 6

B. 8

C. 10

D. 12

Answer: C

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21. If P is a point on the ellipse $\frac{x^2}{16} + \frac{y^2}{25} = 1$ whose foci are S and S', then $PS + PS' = 8$.

A. 6

B. 8

C. 10

D. 12

Answer: C

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22. Let P be a variable point on the elipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ with foci F_1 and F_2. If A is the area of the triangle PF_1F_2, then maximum value of A is

A. abe

B. abe(c)

C. 2abe

D. none

Answer: A

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23. if r_1 and r_2 are distances of points on the ellipse $5x^2 + 5y^2 + 6xy - 8 = 0$ which are at maximum and minimum distance from the origin then

A. 3

B. 4

C. 5

D. none

Answer: C

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24. The line passing through the extremity A of the major exis and extremity B of the minor axis of the ellipse $x^2 + 9y^2 = 9$ meets is auxiliary circle at the point M. Then the area of the triangle with vertices at $A, M,$ and O (the origin) is 31/10 (b) 29/10 (c) 21/10 (d) 27/10

A. $\frac{31}{10}$

B. $\frac{29}{10}$

C. $\frac{21}{10}$

D. $\frac{27}{10}$

Answer: D

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25. An ellipse has OB as the semi-minor axis, $FandF'$ as its foci, and $\angle FBF'$ a right angle. Then, find the eccentricity of the ellipse.

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

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

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

D. none

Answer: B

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26. The length of the latus rectum of the ellipse $5x^2 + 9y^2 = 45$ is

A. $5/3$

B. $10/3$

C. $2\sqrt{5}/3$

D. $\sqrt{5}/3$

Answer: B

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27. Find the foci of the ellipse $25(x+1)^2+9(y+2)^2=225.$

A. $(-1,2)$ and $(-1,-6)$

B. $(-2,1)$ and $(-2,6)$

C. $(-1,-2)$ and $(-2,-1)$

D. $(-1,-2)$ and $(-1,-6)$

Answer: A

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28. A man running round a racecourse notes that the sum of the distance of two flag-posts from him is always 10 m and the distance between the flag posts is 8m. The area of the path he encloses is:

A. 15π

B. 12π

C. 18π

D. 8π

Answer: A

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29. if S and S are two foci of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ (altb) and $P(x_1, y_1)$ a point on it then SP+ S'P is equal to

A. $2a$

B. $2b$

C. $a + ex_1$

D. $b + ey_1$

Answer: B

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30. A focus of an ellipse is at the origin. The directrix is the line $x = 4$ and the eccentricity is 1/2. Then the length of the semimajor axis is (1) $\frac{8}{3}$ (2) $\frac{2}{3}$ (3) $\frac{4}{3}$ (4) $\frac{5}{3}$

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

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

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

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

Answer: A

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31. The eccentric angles of the extremities of latus-rectum of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ are given by

A. $\tan^{-1}\left(\pm\frac{ae}{b}\right)$

B. $\tan^{-1}\left(\pm\frac{be}{a}\right)$

C. $\tan^{-1}\left(\pm\frac{b}{ae}\right)$

D. $\tan^{-1}\left(\pm\frac{a}{be}\right)$

Answer: C

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32. The eccentric angle of a point on the ellipse $\frac{x^2}{6} + \frac{y^2}{2} = 1$ whose distance from the centre of the ellipse is 2, is

A. 210°

B. 270°

C. 300°

D. 45°

Answer: D

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33. the equation of the circle passing through the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and having centre at (0,3) is

A. 4

B. 3

C. $\sqrt{12}$

D. $7/2$

Answer: A

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34. In an ellipse the distance between the foci is 8 and the distance between the directrices is 25. The length of major axis, is

A. $10\sqrt{2}$

B. $20\sqrt{2}$

C. $30\sqrt{2}$

D. none of these

Answer: A

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35. Let E be the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ and C be the circle $x^2 + y^2 = 9$. Let P and Q be the points (1, 2) and (2, 1) respectively. Then,

A. Q lies inside C but outside E

B. Q lies outside both C and E

C. P lies inside both C and E

D. P lies inside C but outside E

Answer: D

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36. The distance from the foci of $P(x_1, y_1)$ on the ellipse $\frac{x^2}{9} + \frac{y^2}{25} = 1$ are

A. $4 \pm \frac{5}{4} y_1$

B. $5 \pm \frac{4}{5} x_1$

C. $5 \pm \frac{4}{5} y_1$

D. none of these

Answer: C

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37. If L.R. = 30, distance between foci = length of minor axis, then eqn. of ellipse is

A. $\frac{x^2}{50} + \frac{y^2}{100} = 1$

B. $\frac{x^2}{100} + \frac{y^2}{50} = 1$

C. $\frac{x^2}{50} + \frac{y^2}{20} = 1$

D. none

Answer:

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38. if the coordinates of the centre , a foucs and adjacent vertex are $(2, -3), (3, -3)$ and $(4, -3)$ respectively , then the equation of the ellipse Is

A. $\frac{(x-2)^2}{4} + \frac{(y+3)^2}{3} = 1$

B. $\frac{(x-2)^2}{3} + \frac{(y+3)^2}{2} = 1$

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

D. none

Answer: A

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39. The equation of the ellipse having foci $(1, 0), (0, -1)$ and minor axis of length 1 is .....

A. $\frac{x^2}{1/4} + \frac{y^2}{5/4} = 1$

B. $\frac{x^2}{5/4} + \frac{y^2}{1/4} = 1$

C. $\frac{x^2}{3/4} + \frac{y^2}{1/4} = 1$

D. $\frac{x^2}{1/4} + \frac{y^2}{3/4} = 1$

Answer: A

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40. A bar of given length moves with its extremities on two fixed straight lines at right angles. Show that any point on the bar describes an ellipse.

A. a circle

B. a parabola

C. an ellipse

D. none

Answer: C

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41. Find the equation of the ellipse whose : One focus is $(6, 7)$, directrix is $x + y + 2$ and eccentricity is $\frac{1}{\sqrt{3}}$

A. $5x^2 + 2xy + 5y^2 - 76x - 88y + 506 = 0$

B. $5x^2 - 2xy + 5y^2 - 76x - 88y + 506 = 0$

C. $5x^2 - 2xy + 5y^2 + 76x + 88y - 506 = 0$

D. none of these

Answer: B

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42. Find the equation of the ellipse in the following case: eccentricity $e = \frac{2}{3}$ and length of latus rectum $= 5$.

A. $\frac{2x^2}{81} + \frac{2y^2}{45} = 1$

B. $\frac{4}{81}x^2 + \frac{4}{45}y^2 = 1$

C. $\frac{2x^2}{27} + \frac{2y^2}{18} = 1$

D. $\frac{4}{27}x^2 + \frac{4}{18}y^2 = 1$

Answer: B

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43. the equation of the ellipse passing through (2,1) having e=1/2 , is

A. $3x^2 + 4y^2 = 6$

B. $3x^2 + 5y^2 = 17$

C. $5x^2 + 3y^2 = 23$

D. none

Answer: A

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44. The curve represented by $x = 3(\cos t + \sin t), y = 4(\cos t - \sin t)$, is

A. ellipse

B. parabola

C. hyperbola

D. circle

Answer: A

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45. The curve with parametric equations $x = 1 + 4\cos\theta, y = 2 + 3\sin\theta$ is

A. an ellipse

B. a parabola

C. a hyperbola

D. a circle

Answer: A

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46. The equation $\sqrt{(x-3)^2+(y-1)^2}+\sqrt{(x+3)^2+(y-1)^2}=6$ represents

A. an ellipse

B. a circle

C. a pair of lines

D. a line

Answer: D

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47. If the focal distance of an end of the minor axis of an ellipse (referred to its axes as the axes of $xandy$, respectively) is k and the distance between its foci is $2h,$ them find its equation.

A. $\frac{x^2}{k^2}+\frac{y^2}{h^2}=1$

B. $\frac{x^2}{k^2}+\frac{y^2}{k^2-h^2}=1$

C. $\frac{x^2}{k^2}+\frac{y^2}{h^2-k^2}=1$

D. $\frac{x^2}{k^2}+\frac{y^2}{k^2+h^2}=1$

Answer: B

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48. The equation $\frac{x^2}{10-a}+\frac{y^2}{4-a}=1$ represents an ellipse , if

A. $a<4$

B. $a>4$

C. $4<a<10$

D. $a>10$

Answer: A

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49. The equatio $\frac{x^2}{2-r}+\frac{y^2}{r-5}+1=0$ represents an ellipse, if

A. $a>2$

B. $a>5$

C. $2<a<5$

D. none of these

Answer: C

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50. If the ellipse $\frac{x^2}{4} + y^2 = 1$ meets the ellipse $x^2 + \frac{y^2}{a^2} = 1$ at four distinct points and $a = b^2 - 5b + 7$, then b does not lie in $[4, 5]$ (b) $(-\infty, 2) \cup (3, \infty)$ $(-\infty, 0)$ (d) $[2, 3]$

A. $[2, 3]$

B. $[4, 5]$

C. $(-\infty, 0)$

D. $(0, \infty)$

Answer: A

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51. the centre of the ellipse $\frac{(x+y-2)^2}{9}+\frac{(x-y)^2}{16}=1$, is

A. $(0, 0)$

B. $(1, 1)$

C. $(1, 0)$

D. $(0, 1)$

Answer: B

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52. The parametric representation of a point on the ellipse whose foci are (-1, 0) and (7, 0) and eccentricity 1/2, is

A. $\left(3+8\cos\theta, 4\sqrt{3}\sin theat\right)$

B. $\left(8\cos\theta, 4\sqrt{3}\sin theat\right)$

C. $\left(3+4\sqrt{3}\cos\theta, 8\sin\theta\right)$

D. none of the above

Answer: A

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53. If e_1 is the eccentricity of the conic $9x^2 + 4y^2 = 36$ *and* e_2 is the eccentricity of the conic $9x^2 - 4y^2 = 36$ then $e12 - e22 = 2$ b. $e22 - e12 = 2$ c. $2 < 322 - 312 < 3$ d. $e22 - e12 > 3$

A. $e_1^2 + e_2^2 > 3$

B. $e_1^2 + e_2^2 = 2$

C. $e_1^2 + e_2^2 > 4$

D. $e_1^2 + e_2^2 < 4$

Answer: A::D

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54. If the equation $(5x-1)^2+(5y-2)^2=\left(\lambda^2-2\lambda+1\right)(3x+4y-1)^2$ represents an ellipse, then find values of λ.

A. $(0, 1)$

B. $(0, 2)$

C. $(1, 2)$

D. $(-1, 0)$

Answer: B

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55. Let $P(x_1, y_1)$ and $Q(x_2, y_2), y_1 < 0, y_2 < 0$, be the end points of the latus rectum of the ellipse $x^2 + 4y^2 = 4$. The equations of parabolas with latus rectum PQ are

A. $x^2 + 2\sqrt{3}y = 3 + \sqrt{3}$

B. $x^2 - 2\sqrt{3}y = 3 + \sqrt{3}$

C. $x^2 + 2\sqrt{3}y = 3 - \sqrt{3}$

D. $x^2 - 2\sqrt{3}y = 3 - \sqrt{3}$

Answer: B::C

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Problem Set 1 True And False

1. Let S and S" be the fociof the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ whose eccentricity is i.e. P is a variable point on the ellipse. Consider the locus the incenter of $\Delta PSS''$ The eccentricity of the locus oc the P is

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Problem Set 1 Fill In The Blanks

1. The egn. of ellipse whose foci are (3, 2) and (1, -2) and major axis is of length 10 is .....

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2. Find the equation of the ellipse whose foci are $(2, 3), (-2, 3)$ and whose semi-minor axes is $\sqrt{5}$.

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3. The following equation represents an ellipse $25(x^2 - 6x + 9) + 16y^2 = 400$. How should the axes be transformed so that the ellipse is represented by the equation $\frac{x^2}{25} + \frac{y^2}{16} = 1$.....

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4. An ellipse has eccentricity $\frac{1}{2}$ and one focus at the point $P\left(\frac{1}{2}, 1\right)$, its one directix is the common tangent, (nearer to the point P), to the circle $x^2 + y^2 = 1$ and the hyperbola $x^2 - y^2 = 1$. The equation of the ellipse, in the standard form, is .....

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Problem Set 2 Multiple Choice Questions

1. If the straight line $y = 4x + c$ is a tangent to the ellipse $x^2/8 + y^2/4 = 1$, then c will be equal to

A. ± 4

B. ± 6

C. $\pm \sqrt{132}$

D. ± 8

Answer: C

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2. If any tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2}$=1 intercepts lengths h and k on the axes, then.

A. $\frac{h^2}{a^2} + \frac{k^2}{b^2} = 1$

B. $\frac{h^2}{a^2} + \frac{k^2}{b^2} = 2$

C. $\frac{a^2}{h^2} + \frac{b^2}{k^2} = 1$

D. $\frac{a^2}{h^2} + \frac{b^2}{k^2} = 2$

Answer: C

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3. Tangents are drawn to the ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$ at end of latus rectum . Find the area of quadrilateral so formed.

A. 27

B. $27/2$

C. $27/4$

D. $27/55$

Answer: A

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4. From a point on the axis of x common tangents are drawn to the parabola y^(2)=4x and the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1(a>b>0)$. If these tangents from an equilateral trianlge with their chord of contact w.r.t parabola, then set of exhaustive values of a is

A. $(0, 3)$

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

C. $\left(1, \frac{3}{2}\right)$

D. $\left(0, \frac{3}{2}\right)$

Answer: B

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5. The line x cos $\alpha + y \sin \alpha + y \sin \alpha = p$ is tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. if

A. $a^2 \cos^2 \alpha + b^2 \sin^2 \alpha = p^2$

B. $a^2 \sin^2 \alpha + b^2 \cos^2 \alpha = p^2$

C. $a^2 \cos^2 \alpha - b^2 \sin^2 \alpha = p^2$

D. $a^2 \sin^2 \alpha - b^2 \cos^2 \alpha = p^2$

Answer: A

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6. If a tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ makes equal intercepts of length l on cordinates axes, then the values of l is

A. $a^2 + b^2$

B. $\sqrt{a^2+b^2}$

C. $\left(a^2+b^2\right)^2$

D. none

Answer: B

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7. An ellipse passes through the point $(4, -1)$ and touches the line $x+4y-10=0$. Find its equation if its axes coincide with the coordinate axes.

A. $\frac{x^2}{16}+\frac{y^2}{15}=1$

B. $\frac{x^2}{80} + \frac{y^2}{5/4} = 1$

C. $\frac{x^2}{20} + \frac{y^2}{5} = 1$

D. $\frac{x^2}{5} + \frac{y^2}{16} = 1$

Answer: B::C

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8. If a tangent having a slope of $-\frac{4}{3}$ to the ellipse $\frac{x^2}{18} + \frac{y^2}{32} = 1$ intersects the major and minor axes in points A and B respectively, then the area of ΔOAB is equal to (A) 12 sq. untis (B) 24 sq. units (C) 48 sq. units (D) 64 sq. units

A. 12

B. 24

C. 48

D. 64

Answer: B

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9. The sum of the squares of the perpendiculars on any tangents to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ from two points on the minor axis each at a distance ae from the center is $2a^2$ (b) $2b^2$ (c) a^2+b^2 a^2-b^2

A. a^2

B. b^2

C. $2a^2$

D. $2b^2$

Answer: C

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10. The product of the perpendiculars drawn from the two foci of an ellipse to the tangent at any point of the ellipse is

A. a^2

B. b^2

C. $4a^2$

D. $4b^2$

Answer: B

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11. The points $(1, -1)$ and $(2, -1)$ are the foci of an ellipse and the line $x + y = 5$ is a tangent to this ellipse. The point of contact of the tangent is

A. $\left(\frac{34}{9}, \frac{11}{9}\right)$

B. $\left(\frac{32}{9}, \frac{13}{9}\right)$

C. $\left(-\frac{34}{9}, \frac{79}{9}\right)$

D. $\left(-\frac{32}{9}, \frac{77}{9}\right)$

Answer: A

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12. If F_1 and F_2 be the feet of the perpendiculars from the foci S_1 and S_2 of an ellipse $\frac{x^2}{5} + \frac{y^2}{3} = 1$ on the tangent at any point P on the ellipse then $(S_1F_1)(S_2F_2)$ is equal

A. 2

B. 3

C. 4

D. 5

Answer: B

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13. if the tangent at the point $\left(4\cos\phi, \frac{16}{\sqrt{11}}\sin\phi\right)$ to the ellipse $16x^2 + 11y^2 = 256$ Is also a tangent to the circle $x^2 + y^2 - 2x = 15,$ then the value of ϕ is

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

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

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

D. $\pm\frac{\pi}{6}$

Answer: C

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14. The length of a common tangent to $x^2+y^2=16$ and $9x^2+25y^2=225$ is

A. $\frac{9}{4}$

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

C. $\frac{3}{4}\sqrt{7}$

D. $\frac{5}{4}\sqrt{7}$

Answer: C

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15. If $\frac{x}{a}+\frac{y}{b}=\sqrt{2}$ touches the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ at a point P, then eccentric angle of P is

A. 0

B. 45°

C. 60°

D. 90°

Answer: B

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16. If $\sqrt{3}bx + ay = 2ab$ touches the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at P then eccentric angle of P is :

A. $\pi/6$

B. $\pi/4$

C. $\pi/3$

D. $\pi/2$

Answer: A

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17. The eccentric angle of a point P lying in the first quadrant on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is θ . If OP makes an angle ϕ with x-axis, then $\theta-\phi$ will be maximum when θ =

A. $\tan^{-1}\sqrt{\frac{a}{b}}$

B. $\tan^{-1}\sqrt{\frac{b}{a}}$

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

D. none

Answer: A

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18. If θ is the angle between the pair of tangents drawn to the ellipse $3x^2 + 2y^2 = 5$ from the point (1, 2), then the value of $\tan^2\theta$ is equal to

A. $\tan^{-1}(12/5)$

B. $\tan^{-1}\left(6/\sqrt{5}\right)$

C. $\tan^{-1}\left(12/\sqrt{5}\right)$

D. $\tan^{-1}\left(8/\sqrt{5}\right)$

Answer: C

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19. Two perpendicular tangents drawn to the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$ intersect on the curve.

A. $x=a/e$

B. $x^2+y^2=41$

C. $x^2+y^2=9$

D. $x^2 - y^2 = 41$

Answer: B

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20. An ellipse slides between two perpendicular lines the locus of its centre , is

A. circle

B. parabola

C. ellipse

D. hyperbola

Answer: A

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21. The line $2x + y = 3$ cuts the ellipse $4x^2 + y^2 = 5$ at points P and Q. If θ is the acute angle between the normals at P and Q, then θ is equal to

A. $1/2$

B. $3/4$

C. $3/5$

D. 5

Answer: C

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22. If the normal at one end of the latus rectum of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ passes through one end of the monor axis, then prove that eccentricity is constant.

A. $e^4 - e^2 + 1 = 0$

B. $e^2 - e + 1 = 0$

C. $e^2 + e + 1 = 0$

D. $e^4 + e^2 - 1 = 0$

Answer: D

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23. Find the equation of the normal to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ at the positive end of the latus rectum.

A. $x+ey+e^3a=0$

B. $x-ey-e^3a=0$

C. $x-ey-e^2a=0$

D. none

Answer: B

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24. The area of rectangle formed by perpendiculars from the centre of ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ to the tangent and normal at the point whose eccentric angle is $\pi/4$ is

A. $\left(\frac{a^2+b^2}{a^2-b^2}\right)ab$

B. $\left(\frac{a^2-b^2}{a^2+b^2}\right)ab$

C. a^2+b^2

D. a^2-b^2

Answer: B

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25. If the normal at the point $P(\theta)$ to the ellipse $\frac{x^2}{14} / \frac{y^2}{5} = 1$ intersects it again at the point Q $(2, \theta)$ then $\cos\theta$ is equal to

A. $2/3$

B. $-2/3$

C. $3/2$

D. $-3/2$

Answer: B

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26. The locus of the mid-points of the portion of the tangents to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ intercepted between the axes is

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

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

C. $\frac{x^2}{a^2}-\frac{y^2}{b^2}=4$

D. none of these

Answer: B

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27. Tangents are drawn to $x^2 + 3y^2 = 2$. The locus" of mid-point of intercept made by tangents between the axes is

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

B. $\frac{1}{4x^2} + \frac{1}{2y^2} = 1$

C. $\frac{1}{2x^2} + \frac{1}{6y^2} = 1$

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

Answer: C

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28. Tangents are drawn to ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ at points $P(\theta_1)$ and $Q(\theta_2)$ then the point of intersection of these tangents is

A. $\left(\frac{\text{acos}\frac{\theta_1+\theta_2}{2}}{\cos\frac{\theta_1-\theta_2}{2}}, \frac{\text{b sin}\frac{\theta_1+\theta_2}{2}}{\cos\frac{\theta_1-\theta_2}{2}}\right)$

B. $\left(\frac{\text{acos}\frac{\theta_1-\theta_2}{2}}{\cos\frac{\theta_1+\theta_2}{2}}, \frac{\text{b sin}\frac{\theta_1-\theta_2}{2}}{\cos\frac{\theta_1+\theta_2}{2}}\right)$

C. $\left(\frac{\text{a sin}\frac{\theta_1+\theta_2}{2}}{\sin\frac{\theta_1-\theta_2}{2}}, \frac{\text{b cos}\frac{\theta_1+\theta_2}{2}}{\sin\frac{\theta_1-\theta_2}{2}}\right)$

D. none

Answer: A

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29. The locus of the point of intersection of tangents to an ellipse at two points sum of whose eccentric angles is constant is

A. straight line

B. circle

C. parabola

D. ellipse

Answer: A

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30. The eccentric angles of extremities of a chord of an ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ are θ_1 and θ_2 .If this chord passes through the foucs, then

A. $\tan\frac{\theta_1}{2}.\tan\frac{\theta_2}{2}+\frac{1-e}{1+e}=0$

B. $\cos\frac{\theta_1-\theta_2}{2}=e.\cos\frac{\theta_1+\theta_2}{2}$

C. $e=\frac{\sin\theta_1+\sin\theta_2}{\sin(\theta_1+\theta_2)}$

D. $\cot\frac{\theta_1}{2}.\cot\frac{\theta_2}{2}=\frac{e-1}{e-1}$

Answer: A::B::C::D

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31. The tangent at a point $P(a\cos\varphi, b\sin\varphi)$ of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ meets its auxiliary circle at two points, the chord joining which subtends a right angle at the center. Find the eccentricity of the ellipse.

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

B. $\left(1+\sin^2\theta\right)^{-1/2}$

C. $\left(1+\sin^2\theta\right)^{-3/2}$

D. $\left(1+\sin^2\theta\right)^{-2}$

Answer: B

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32. If the line $x+2y+4=0$ cutting the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ in points whose eccentric angies are 30° and 60° subtends right angle at the origin then its equation is

A. $\frac{x^2}{4}+\frac{y^2}{16}=1$

B. $\frac{x^2}{16}+\frac{y^2}{4}=1$

C. $\frac{x^2}{8}+\frac{y^2}{4}=1$

D. $\frac{x^2}{4} + \frac{y^2}{8} = 1$

Answer: B

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33. If PQR is an equilateral triangle inscribed in the auxiliary circle of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, (a > b),$ and $P'Q'R'$ is the correspoinding triangle inscribed within the ellipse, then the centroid of triangle $P'Q'R'$ lies at center of ellipse focus of ellipse between focus and center on major axis none of these

A. focus of ellips

B. any vertex of the ellipse

C. centre of the ellipse

D. none

Answer: C

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34. On the ellipse $4x^2 + 9y^2 = 1$, the points at which the tangent are parallel to the line $8x = 9y$ are

A. $\left(\frac{2}{5}, \frac{1}{5}\right)$

B. $\left(-\frac{2}{5}, \frac{1}{5}\right)$

C. $\left(-\frac{2}{5}, -1, 5\right)$

D. $\left(\frac{2}{5}, -\frac{1}{5}\right)$

Answer: B::D

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35. Tangents are drawn to the ellipse $3x^2 + 5y^2 = 32$ and $25x^2 + 9y^2 = 450$ passing through the point (3,5). The number of such tangents are

A. 2

B. 3

C. 4

D. 0

Answer: B

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36. Let two perpendicular chords of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1, a>b$ each passing through exactly one of the foci meet at a point P. If from P two tangents are drawn to the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$, then $\angle QPR=$

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

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

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

D. $2\tan^{-1}\frac{b}{a}$

Answer: C

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37. An ellipse passes through the point $(4, -1)$ and touches the line $x + 4y - 10 = 0$. Find its equation if its axes coincide with the coordinate axes.

A. $\frac{x^2}{100}+\frac{y^2}{5}=1$

B. $\frac{x^2}{80}+\frac{y^2}{5/4}=1$

C. $\frac{x^2}{20}+\frac{y^2}{5}=1$

D. none of these

Answer: B::C

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38. Locus of mid-point of the focal chord of ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ with eccentricity e is

A. $\frac{x^2}{a^2}-\frac{y^2}{b^2}=\frac{ex}{a}$

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

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

D. none

Answer: B

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39. The normal at a variable point P on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ of eccentricity e meets the axes of the ellipse at $QandR\cdot$ Then the locus of the midpoint of QR is a conic with eccentricity e' such that e' is independent of e (b) $e'=1$ $e'=e$ (d) $e'=\frac{1}{e}$

A. $e = 1$

B. $e = 1/e$

C. $e' = e$

D. none

Answer: C

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40. If $P(\theta_1)$ and $D(\theta_2)$ be the end, points of two semi-conjugate diameters of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ whose centre is C, then answer the

following questions :

$\theta_1 - \theta_2$ =

A. 45°

B. 90°

C. 135°

D. none

Answer: A

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41. If CP and CD are semi-conjugate diameters of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then $CP^2 + CD^2 =$

A. $\frac{a^2+b^2}{4}$

B. (a^2+b^2)

C. $\frac{b^4+a^4}{b^2+a^2}$

D. $\frac{a^4+b^4}{2(a^2+b^2)}$

Answer: B

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42. CP and CD are conjugate semi-diameters of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, The locus of the mid-point of PD, is

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

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

C. $\frac{x^2}{a^2}+\frac{y^2}{b^2}=\frac{1}{4}$

D. none

Answer: A

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43. The maximum distance of the centre of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ from the chord of contact of mutually perpendicular tangents of the ellipse is

A. $\frac{9}{5}$

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

C. $\frac{144}{5}$

D. none

Answer: A

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44. Tangents are drawn from the point P(3,4) to the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ touching the ellipse at point A and B. Q. The coordinates of A and B are

A. $(3, 0)$ and $(0, 2)$

B. $\left(-\frac{8}{5}, \frac{2\sqrt{161}}{15}\right)$ and $\left(-\frac{9}{5}, \frac{8}{5}\right)$

C. $\left(-\frac{8}{5}, \frac{2\sqrt{161}}{15}\right)$ and $(-0, 2)$

D. $(3, 0)$ and $\left(-\frac{9}{5}, \frac{8}{5}\right)$

Answer: D

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45. Tangents are drawn from the point P(3, 4) to the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ touching the ellipse at points A and B. The orthocenter of the triangle PAB is

A. $\left(5, \frac{8}{7}\right)$

B. $\left(\frac{7}{5}, \frac{25}{8}\right)$

C. $\left(\frac{11}{5}, \frac{8}{5}\right)$

D. $\left(\frac{8}{25}, \frac{7}{25}\right)$

Answer: C

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46. Tangents are drawn from the point P(3,4) to the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ touching the ellipse at points A and B.

The equation of the locus of the point whose

distance from the point P and the line AB are equal, is:

A. $9x^2 + y^2 - 6xy - 54x - 62y + 241 = 0$

B. $x^2 + 9y^2 + 6xy - 54x + 62y - 241 = 0$

C. $9x^2 + 9y^2 - 6xy - 54x - 62y - 241 = 0$

D. $x^2 + y^2 - 2xy + 27x + 31y - 120 = 0$

Answer: A

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Problem Set 2 True And False

1. The line 2x+3y=12 touches the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=2$ at the points (3,2).

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2. Prove that if any tangent to the ellipse is cut by the tangents at the endpoints of the major axis at $TandT'$, then the circle whose diameter is T' will pass through the foci of the ellipse.

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3. The locus of feet of perpendiculars from the focii upon any tangent is an auxilliary circle.

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4. If the portion of the line $x\cos\alpha + y\sin\alpha = p$ intercepted by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ subtends a right angle at the centre of the ellipse, then the line touches a cirlce of radius $ab/\sqrt{(a^2+b^2)}$ concentric with the ellipse.

True or False

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Problem Set 2 Fill In The Blanks

1. The condition that the line $Ix + my = n$ be a tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ are .....

.....

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2. Find the equations of the tangents to the ellipse $3x^2 + 4^2 = 12$ which are perpendicular to the line $y + 2x = 4.$

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3. Tangents at the extremities of the latus rectum of an ellipse intersect on the line whose equation is .....

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4. A tangent of the ellipse $x^2/a^2 + y^2/b^2 = 1$ cuts the axes in A and B respectively and touches the ellipse at any point P in the first quadrant, so that P divides AB into two equal parts. The equation of the tangent is..... .

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5. If the normal at any point P on the ellipse cuts the major and mirror axes in G and g respectively and C be the centre of the ellipse, then

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6. The locus of the feet of perpendiculars drawn from the centre of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ on any tangent to it is ..... .

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Problem Set 3 True And False

1. If the chord of contact of the tangents drawn from the point (α, β) to the ellipse $x^2/a^2 + y^2/b^2 = 1$ touches the circle $x^2 + y^2 = c^2$, then the point (α, β) lies on the ellipse $x^2/a^4 + y^2/b^4 = 1/c^2$. T or F?

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Problem Set 3 Fill In The Blanks

1. The condition that the chord of the ellipse $x^2/a^2 + y^2/b^2 = 1$, whose middle point is (x_1, y_1)

subtends a right angle at the centre of the ellipse is

..... .

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2. The locus of the middle points of the chords of the ellipse $x^2/a^2 + y^2/b^2 = 1$ touching the ellipse $x^2/\alpha^2 + y^2/\beta^2 = 1$ is..... .

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3. The locus of the point the chord of contact of tangents from which to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

subtends a right angle at the centre of the ellipse is

.....

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4. A chord PQ of the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ subtends a right angle at the centre of the ellipse. The locus of the point of intersection of the tangents to the ellipse at P and Q is .....

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5. The locus of the point the chord of contact of tangents from which to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ touches the circle $x^2+y^2=c^2$ is.....

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6. The condition that the chord of the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ whose middle point is (x_1, y_1) subtends a right angle at the centre of the ellipse is .....,

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7. The locus of the poles of normal chords of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, is

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8. The locus of the mid-points of the lines joining the extremities of two semi-conjugate diameters of an ellipse is .....

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9. The locus of the point of intersection of tangents at the end-points of conjugate diameters of the

ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, is

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10. Tangents are drawn from the points on the line $x-y-5=0$ to $x^2+4y^2=4$. Then all the chords of contact pass through a fixed point. Find the coordinates.

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11. The length of the common chord of the ellipse $\frac{(x-1)^2}{9}+\frac{(y-2)^2}{4}=1$ and the circle

$(x-1)^2+(y-2)^2=1$is .....

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Miscellaneous Exercise Matching Entries

1. Match the entries of List - A and List - B

List-A	List-B
(a) S and S' are foci and B is end of minor axis of an ellipse. If $\Delta SS'B$ is equilateral, then eccentricity of ellipse is ...	1. 10
(b) If $P(x, y)$ be a point on the ellipse $16x^2+25y^2=400$ and $F_1=(3,0), F_2=(-3,0)$ then $PF_1+PF_2=$...	2. $\frac{(x-2)^2}{4}+\frac{(y+3)^2}{3}=1$
(c) A circle with centre at $(0,3)$ passes through the foci of ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$. Its radius is of length	3. $\frac{1}{2}$
(d) In an ellipse $C=(2,-3), S=(3,-3)$ and A is $(4,-3)$, then the equation of ellipse is	4. 4

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2. Match the entries of List - A and List - B

List-A	List-B
(a) If p_1, p_2 be the lengths of perpendiculars drawn from the two foci of an ellipse to any tangent to it then $p_1 p_2$ =	1. $-\frac{2}{3}$
(b) The angle between a pair of tangents drawn to the ellipse $3x^2 + 2y^2 = 5$ from the point (1, 2) is	2. $x - ey - e^3 a = 0$
(c) The equation of normal to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at the positive end of latus rectum is	3. b^2
(d) If the normal at the point $P(\theta)$ to the ellipse $\frac{x^2}{14} + \frac{y^2}{5} = 1$ meets it again at the point 2θ, then $\cos\theta$ =	4. $\tan^{-1}\left(\frac{12}{\sqrt{5}}\right)$

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3. Locus of the point of intersection of two perpendicular tengents to

List-A	List-B
(a) Circle $x^2 + y^2 = a^2$	1. $x = -a$
(b) Ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	2. $x^2 + y^2 = a^2 + a^2$
(c) Hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$	3. $x^2 + y^2 = a^2 + b^2$
(d) Parabola $y^2 = 4ax$	4. $x^2 + y^2 = a^2 - b^2$

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Self Assessment Test

1. The ellipse $x^2 + 4y^2 = 4$ is inscribed in a rectangle aligned with the coordinate axes, which in turn is inscribed in another ellipse that passes through the point (4, 0). Then the equation of the ellipse is (1) $x^2 + 16y^2 = 16$ (2) $x^2 + 12y^2 = 16$ (3) $4x^2 + 48y^2 = 48$ (4) $4x^2 + 64y^2 = 48$

A. $x^2 + 12y^2 = 16$

B. $4x^2 + 48y^2 = 48$

C. $4x^2 + 64y^2 = 48$

D. $x^2 + 16y^2 = 16$

Answer: A

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2. The normal at a point P on the ellipse $x^2 + 4y^2 = 16$ meets the x-axis at Q. If M is the midpoint of the line segment PQ, then the locus of M intersects the latus rectums of the given ellipse at points. $\left(\pm \frac{\left(3\sqrt{5}\right)}{2} \pm \frac{2}{7} \right)$ (b) $\left(\pm \frac{\left(3\sqrt{5}\right)}{2} \pm \frac{\sqrt{19}}{7} \right)$ $\left(\pm 2\sqrt{3}, \pm \frac{1}{7} \right)$ (d) $\left(\pm 2\sqrt{3} \pm \frac{4\sqrt{3}}{7} \right)$

A. $\left(\pm \frac{3\sqrt{5}}{2}, \pm \frac{2}{7} \right)$

B. $\left(\pm \frac{3\sqrt{5}}{2}, \pm \frac{\sqrt{19}}{7} \right)$

C. $\left(\pm 2\sqrt{3}, \pm \frac{1}{7} \right)$

D. $\left(\pm 2\sqrt{3}, \pm \frac{4\sqrt{3}}{7} \right)$

Answer: C

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3. A focus of an ellipse is at the origin. The directrix is the line $x = 4$ and the eccentricity is 1/2. Then the length of the semimajor axis is (1) $\frac{8}{3}$ (2) $\frac{2}{3}$ (3) $\frac{4}{3}$ (4) $\frac{5}{3}$

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

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

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

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

Answer: B

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4. An ellipse has OB as the semi-minor axis, $FandF'$ as its foci, and $\angle FBF'$ a right angle. Then, find the eccentricity of the ellipse.

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

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

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

D. none of these

Answer: C

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5. If tangents are drawn to the ellipse $x^2 + 2y^2 = 2$, then the locus of the midpoint of the intercept made by the tangents between the coordinate axes is

$\frac{1}{2x^2} + \frac{1}{4y^2} = 1$ (b) $\frac{1}{4x^2} + \frac{1}{2y^2} = 1$ $\frac{x^2}{2} + y^2 = 1$

(d) $\frac{x^2}{4} + \frac{y^2}{2} = 1$

A. $x^2 + 2y^2 = 4x^2y^2$

B. $2x^2 + y^2 = 4x^2y^2$

C. $2x^2 + y^2 = 4$

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

Answer: A

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6. Tangents are drawn to the ellipse $\frac{x^2}{9} + \frac{y^2}{5}$ at the end of the latus rectum. The area of the quadrilateral so formed is

A. 27

B. $\frac{27}{2}$

C. $\frac{27}{4}$

D. $\frac{27}{55}$

Answer: A

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7. the equation of the circle passing through the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and having centre at (0,3) is

A. 4

B. 3

C. $\sqrt{12}$

D. 7.2

Answer: A

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8. The eccentricity of an ellipse with its centre at the origin is $\frac{1}{2}$. If one of the directrices is x = 4 , then the equation of ellipse is

A. $3x^2 + 4y^2 = 1$

B. $3x^2 + 4y^2 = 12$

C. $4x^2 + 3y^2 = 12$

D. $4x^2 + 3y^2 = 1$

Answer: B

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9. the equation of the circle passing through the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ and having centre at (0,3) is

A. $x^2+y^2-6y-7=0$

B. $x^2+y^2-6y+7=0$

C. $x^2+y^2-6y-5=0$

D. $x^2+y^2-6y+5=0$

Answer: A

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