MATHS

BOOKS - FULL MARKS MATHS (TAMIL ENGLISH)

TWO DIMENSIONAL ANALYTICAL GEOMETRY

Example Questions Solved

1. Find the locus of a polnt which moves such that its distance from the x-axis is equal to the distance from

the y-axis.

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2. Find the path traced out by the point $\left(ct, \frac{c}{t}\right)$ here $t \neq 0$ is the parameter and c is a constant .

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3. Find the locus of a point p moves such that its distance from two fixed point A(1,0) and B (5,0) , are always equal .

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4. If θ is a variable , find the equation to the locus of a moving point whose coordinates are $(a\sec\theta, b\tan\theta)$

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5. A straight red of the length 6 units , slides with its ends A and B always on the x and y axes respectively. If O is the origin , then find the locus of the centroid of ΔOAB.

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6. If θ is a parameter . Find the equation of the locus of a moving point , whose coordinates are $(a(\theta - \sin\theta), a(1 - \cos\theta)$

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7. Find the slope of the straight line passing through the points (5,7) and (7,5). Also find the angle of inclination of the line with the x-axis .

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8. Find the equation of a straight line cutting an intercept of 5 from the negative direction of the y-axis and is inclined at an angle 150° to the x-axis .

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9. The pamban sea Bridge is a railway bridge of length about 2065 m constructed on the palkstrait, which connects the Island town of Ramerswaram to Mandapam, the main land of India. The Bridge is restricted to a uniform speed of only 12.5 m/s If a train of length 560 m starts at the entry point of the bridge from Mandapam, then

(i) Find as equation of the motion of the train .

(ii) When does the engine touch Island

(iii) When does the last coach cross the point of the bridge

(iv) What is the time taken by a train to cross the bridge.

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10. The seventh term of an arithmetic progression in 30 and tenth term 21.

(i) Find the first three terms of anb A.P.

(ii) Which term of the A.P .is zero (if exists).

(iii) Find the relationship between slop of the straight line and common different of A.P .

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11. Find the equation of the straight line passing thought (-1,1) and cutting off equal intercepts, but opposite in signs with the two coordinate axes.

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12. straight line L with negative slope passes through the point (9,4) cuts the positive coordinate axes at

the point P and W As L. Varies, find the minimum value of $|OP|+|OQ|$, where O is origin .

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13. The Length of the perpendicular drawn from the origin to a line is 12 and makes an angle 150° with positive direction of the x-axis . Find the equation of the line.

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14. Area of the triangle formed by a line with the coordinate axes , in 36 square units . Find the

equation of the line if the perpendicular drawn from the origin to the line makes an angle of 45° with positive the x-axis.

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15. Find the equation of the lines make an angle 60° with positive x-axis and at a distance $5\sqrt{2}$ units measured from the point (4,7) along the line x–y+3=0.

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16. Find the equations of a parallel line and a perpendicular line passing through the point (1,2) to

the line 3x + 4y = 7

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17. Find the distance ,

(i) Between two points (5,4) and (2,0)

(ii) From a point (1,2) to the line $5x + 12y - 3 = 0$

(iii) Between two parallel lines $3x + 4y = 12$ and $6x + 8y + 1 = 0$

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18. Find the nearest point on the line $2x + y = 5$ from the origin.

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19. Find the equations of the bisector of the acute angle between the lines $3x + 4y + 2 = 0$ and $5x + 12y - 5 = 0$.

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20. Find the points on the line $x + y = 5$, that lie at a distance 2 units from the line $4x + 3y - 12 = 0$.

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21. A straight line passes through a fixed point (6,8) : Find the locus of the foot of the perpendicular drawn to it from the origin O.

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22. Find the equations of the straight lines in the family of the lines $y = mx + 2$, for which m and the x - coordinate of the point of intersection of the lines with $2x + 3y = 10$ are integers.

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23. Find the equation of the line through the intersection of the lines $3x + 2y + 5 = 0$ and $3x - 4y + 6 = 0$ and the point (1,1)

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24. Suppose the Government has decided to erect a new Electrical Power Transmission Substation to provide better power supply to two villages namely A and B . The substation has to be on the line l. The distances of villages A and B from the foot of the perpendiculars P and Q on the line l are B from the foot of the perpendiculars P and Q on the line l are 3

km and 5 km respectively and the distance between P and Q is 6 km.

(i) What is the smallest length of cable required to connect the two villages.

(ii) Find the equations of the cable lines that connect the power station to two villages.(Using the knowledge in conjunction with the principle of reflection allows for approach to solve this problem) .

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25. A car rental firm has charges Rs 25 with 1.8 kilometers , and Rs 12 for every additional kilometer.

Find the equation relating the cost y to the number of kilometers x . Also find cost to travel 15 kilometers .

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26. If a line joining two points (3,0) and (5,2) is rotated about the point (3,0) in counter clockwise direction through an angle 15°, Then find the equation of the line in the new position.

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27. Separate the equation $5x^2 + 6xy + y^2 = 0$

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28. Find the separate equation of straight lines by the following equation $2x^2 + 2xy - y^2 = 0$.

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29. Find the equation of the pair of lines through the origin and perpendicular to the pair of line $ax^2 + 2hxy + by^2 = 0$.

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30. Show that the straight line $x^2 - 4xy + y^2 = 0$ and x + y = 3 form an equilateral triangle.

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31. If the of lines represented by $x^2 - 2cxy - y^2 = 0$ and $x^2 - 2dxy - y^2 = 0$ be such that each pair bisects the angle between the other pair, prove that cd = -1.

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32. If one of the straight of $ax^2 + 2hxy + by^2 = 0$ is perpendicular to $px + qy = 0$ then show that $ap^2 + 2hpq + bq^2 = 0$

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33. Show that straight lines joining the origin to the points of intersection of $3x - 2y + 2 = 0$ and $3x^2 + 5x - 2y^2 + 4x + 5y = 0$ are at right angles .

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Exercise 6 1

1. Find the locus of P, if for all values of α, the co-ordinates of a moving point P is

$(9\cos\alpha, 9\sin\alpha)$

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2. Find the locus of a point P that moves at a constant distant of

two units from the X-axis

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3. If θ is a parameter, find the equation of the locus of moving point, whose coordinates are $x = a\cos^3 y = a\sin^3\theta.$

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4. Find the value of k and b, if the points P(-3, 1) and Q(2, b) lie on the locus of $x^2 - 5x + ky = 0.$

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5. A straight rod of length 8 units slides with its ends A and B always on the x and y axes respectively. Find

the locus of the mid point of the line segment AB.

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6. Find the equation of the locus of a point such that the sum of the squares of the distance from the points (3, 5), (1, -1) is equal to 20.

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7. Find the equation of the locus of the point P such that the line segment AB, joining the points A(1, -6) and B(4, -2), subtends a right angle at P.

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8. If O is origin and R is a variable point on $y^2 = 4x$, then find the equation of the locus of the mid-point of the line segment OR.

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9. The coordinates of a moving point P are $\left(\frac{a}{2}(\cos ec\theta + \sin\theta), \frac{b}{2}(\cos ec\theta - \sin\theta)\right)$, where θ is a variable parameter. Show that the equation of the locus P is $b^2x^2 - a^2y^2 = a^2b^2$.

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10. If P(2,-7) is a given point and Q is a point on $\left(2x^2 + 9y^2 = 18\right)$, then find the equations of the locus of the mid-point of PQ.

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11. If R is any point on the x-axis and Q is any point on they y-axis and P is a variable point on RQ with RP=b, PQ=a, then find the equation of locus of P.

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12. If the points P(6,2) and Q(-2,1) and R are the vertices of a ΔPQR and R is the point on the locus of $y = x^2 - 3x + 4$, then find the equation of the locus of centroid of ΔPQR.

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13. If Q is a point on the locus of $x^2 + y^2 + 4x - 3y + 7 = 0$, then find the equation of locus of P which divides segment OQ externally in the ratio 3:4, where O is origin.

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14. Find the points on the locus of points that are 3 units from x-axis and 5 units from the point (5,1).

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15. The sum of the distance of a moving point from the points (4,0) and (-4,0) is always 10 units. Find the equation to the locus of the moving point.

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Exercise 6 2

1. Find the equation of the lines passing through the point (1,1)

and (-2,3)

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2. If p(r,c) is mid-point of a line segment between the axes, then show that $\frac{x}{r}+\frac{y}{c}=2$.

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3. Find the equation of the line passing through the point (1,5) and also divides co-ordinate axes in the

ratio 3:10.

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4. If p is length of perpendicular from the origin to the line whose intercepts on the axes are a and b, then show that $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$.

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5. The normal boiling point of water is $100^\circ C$ or $212^\circ F$ and the freezing point of water is $0^\circ C$ or $32^\circ F$.

Find the linear relationship between C and F.

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6. An object was launched from a place P in constant speed to hit a target. At the 15^{th} second it was 1400m away from the target and the 18^{th} second 800m away. Find

the distance between the place and the target

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7. Population of a city in the years 2005 and 2010 are 1,35,000 and 1,45,000 respectively. Find the

approximate population in the year 2015. (assuming that the growth of population is constant)

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8. Find the equation of the line, if the perpendicular drawn from the origin makes as angle 30° with x-axis and its length is 12

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9. Find the equation of the straight lines passing thought (8,3) and having intercepts whose sum is 1

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10. Show that the points (1, 3), (2, 1) and $\left(\frac{1}{2}, 4\right)$ are collinear, by using concept of slope

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11. A straight line is passing through the point A(1,2) with slope $\frac{5}{12}$. Find points on the line which are 13 units away from A.

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12. A 150m long train is moving with constant velocity of 12.5 m/s. Find

the equation of the motion of the train,

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13. A spring was hung from hook in the ceiling. . A number of different weight were attached to the spring to make it stretch, and the total of the spring was measured each time shown in the following table.

$\text{Weight}(\text{kg})$	2	4	5	8
$\text{Length}\,(\text{cm})$	3	4	4.5	6

(i) Draw a graph showing the results .

(ii) Find the equation relating the length of the

spring to the weight on it .

(iii) What is the actual length of the spring .

(iv) If the spring has to stretch to 9 cm long , how much weight should be added ?

(v) How long will the spring be when 6 kilograms of weight on it ?

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14. A family is using petroleum gas (LPG) of weight 14.2 kg for consumption . (Full weight 29.5 kg) Includes the empty cylinder tare weight of 15.3 kg). If it is are with constant rate then It lasts for 24 days. Then the new cylinder is replaced (i) Find the

equation relating the quantity of gas in the cylinder to the days . (ii) Draw the graph for first 96 days.

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15. In a shopping mall there is a hall of cuboids shape with dimension $800 \times 800 \times 720$ units , which needs to be added the facility of an escalator in the path as shown by the dotted line in the figure. Find (i) The minimum total length of the escalator . (ii) The heights at which the escalator changes its direction. (ii) The slopes of the escalator at the turing points.

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Exercise 6 3

1. Show that the lines are $3x + 2y + 9 = 0$ and $12x + 8y - 15 = 0$ are parallel lines.

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2. Find the equation of the straight line parallel to $5x - 4y + 3 = 0$ and having x - intercept 3.

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3. Find the distance between the line $4x+3y+4=0$ and a point (i) (-2, 4) (ii) (7, -3)

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4. Write the equation of the lines through the point (1,-1)

(i) Parallel to $x + 3y - 4 = 0$

(ii) Perpendicular to $3x + 4y = 6$

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5. If (-4,7) is one vertex of a rhombus and if the equation of one diagonal is 5x-y+7=0, then find the equation of another diagonal.

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6. Find the equation of the lines passing through the point of intersection lines 4x-y+3=0 and 5x+2y+7=0 Parallel to x-y+5=0

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7. Find the equations of two straight lines which are parallel to the line $12x+5y+2=0$ and at a unit distance from the point $(1, -1)$.

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8. Find the equations of straight lines which are perpendicular to the line $3x+4y-6=0$ and are at a distance of 4 units from $(2,1)$.

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9. Find the equation of a straight line parallel to $2x+3y=10$ and which is such that the sum of its intercepts on the axes is 15.

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10. Find the length of the perpendicular and the co-ordinates of the foot of the perpendicular from $(-10,-2)$ to the line $x+y-2=0$.

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11. Find the distance between the parallel lines

$12x+5y=7$ and $12x+5y+7=0$

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12. Find the family of straight lines (i) Perpendicular (ii) Parallel to $3x+4y-12=0$.

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13. If the line joining two points A(2,0) and B(3,1) is rotated about A in anticlockwise direction through an

angle of 15°, then find the equation of the line in new position.

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14. A ray of light coming from the point (1,2) is reflected at a point A on the x-axis and it passes through the point (5,3). Find the co-ordinates of the point A.

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15. A line is drawn perpendicular to 5x=y+7. Find the equation of the line if the area of the triangle formed

by this line with co-ordinate axes is 10 sq. units.

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16. Find the of the image of the point (-2,3) about the line x+2y-9=0.

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17. A photocopy store charge Rs 1.50 per copy for the first 10 copies and Rs 1.00 per copy after the 10th copy . Let x be the total cost of photocopying . (i) Draw graph of the cost as x goes from 0 to 50 copies . (ii) Find the cost of making 40 copies.

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18. Find at least two equations of the straight lines in the family of the lines $y = 5x + b$, for which b and the x - coordinate of the point of intersection of the lines with $3x - 4y = 6$ are integers .

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19. Find all the equations of the straight lines in the family of the lines $y=mx-3$, for which m and the x - coordinate of the point of intersection of the lines with $x-y=6$ are integers.

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Exercise 6 4

1. Find the combined equation of the straight lines whose separate equations are x-2y-3=0 and x+y+5=0.

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2. Show that $4x^2 + 4xy + y^2 - 6x - 3y - 4 = 0$ represents a pair of parallel lines.

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3. Show that $2x^2 + 3xy - 2y^2 + 3x + y + 1 = 0$ represents a pair of perpendicular lines.

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4. Show that the equations $2x^2 - xy - 3y^2 - 6x + 19y - 20 = 0$ represents a pair of intersecting lines. Show further that the angle between them is $\tan^{-1}(5)$.

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5. Find the equation of the pair of straight lines passing through the point (1,3) and perpendicular to the lines 2x-3y+1=0 and 5x+y-3=0.

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6. Find the separate equation of the following pair of straight lines

$3x^2 + 2xy - y^2 = 0$

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7. The slope of one of the straight lines $ax^2 + 2hxy + by^2 = 0$ is twice that of the other, show that $8h^2 = 9ab$.

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8. The slope of one of the straight lines $ax^2 + 2hxy + by^2 = 0$ is three times the other, show that $3h^2 = 4ab$.

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9. A ΔOPQ is formed by the pair of straight lines $x^2 - 4xy + y^2 = 0$ and the line PQ. The equation of PQ is x+y-2=0. Find the equation of the median of the triangle ΔOPQ drawn from the origin O.

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10. Find p and q, if the following equation represents a pair of perpendicular lines $6x^2 + 5xy - py^2 + 7x + qy - 5 = 0.$

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11. Find the value of k if the following equation represents a pair of straight lines. Further, find whether these lines are parallel or intersecting $12x^2 + 7xy - 12y^2 - x + 7y + k = 0.$

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12. For what value of k does the equation $12x^2 + 2kxy + 2y^2 + 11x - 5y + 2 = 0$ represent two straight lines.

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13. Show that the equation $9x^2 - 24xy + 16y^2 - 12x + 16y - 12 = 0$ represents a pair of parallel lines. Find the distance between them.

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14. Show that the equation $4x^2 + 4xy + y^2 - 6x - 3y - 4 = 0$ represents a pair of parallel lines. Find the distance between them.

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15. Prove that the straight lines joining the origin to the points of intersection of $3x^2 + 5xy - 3y^2 + 2x + 3y = 0$ and $3x - 2y - 1 = 0$ are at right angles.

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Exercise 6 5

1. The equation of the locus of the point whose distance from y-axis is half the distance from origin is

A. $x^2 + 3y^2 = 0$

B. $x^2 - 3y^2 = 0$

C. $3x^2 + y^2 = 0$

D. $3x^2 - y^2 = 0$

Answer: D

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2. Which of the following equation is the locus of $(at^2, 2at)$

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

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

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

D. $y^2 = 4ax$

Answer: D

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3. Which of the following point lie on the locus of $3x^2 + 3y^2 - 8x - 12y + 17 = 0$

A. (0,0)

B. (-2,3)

C. (1,2)

D. (0,-1)

Answer: C

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4. If the point (8,-5) lies on the locus $\frac{x^2}{16} - \frac{y^2}{25} = k$, then the value of k is

A. 0

B. 1

C. 2

D. 3

Answer: D

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5. Straight line joining the points (2,3) and (-1,4) passes through the point (α, β) if

A. $\alpha + 2\beta = 7$

B. $3\alpha + \beta = 9$

C. $\alpha + 3\beta = 11$

D. $3\alpha + \beta = 11$

Answer: A

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6. The slope of the line which makes an angle 45 with the line 3x-y=-5 are

A. 1,-1

B. $\frac{1}{2}, -2$

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

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

Answer: B

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7. Equation of the straight line forms an isosceles triangle with coordinate axes in the I-quadrant with perimeter $4 + 2\sqrt{2}$ is

A. x + y + 2 = 0

B. $x + 2 - 2 = 0$

C. $x + y - \sqrt{2} = 0$

D. $x + y + \sqrt{2} = 0$

Answer: B

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8. The coordinates of the four vertices of a quadrilateral are (-2,4),(-1,2),(1,2) and (2,4) taken in order. The equation of the line passing through the vertex (-1,2) and dividing the quadrilateral in the equal areas is .....

A. $x + 1 = 0$

B. $x + y = 1$

C. $x + y + 3 = 0$

D. $x - y + 3 = 0$

Answer: B

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9. The intercepts of the perpendicular bisector of the line segment joining (1,2) and (3,4) with coordinate axes are

A. 5,-5

B. 5,5

C. 5,3

D. 5,-4

Answer: A

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10. The equation of the line with slope 2 and the length of the perpendicular from the origin equal to $\sqrt{5}$ is

A. $x + 2y = \sqrt{5}$

B. $2x + y = \sqrt{5}$

C. $2x + y = 5$

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

Answer: C

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11. A line perpendicular to the line $5x - y = 0$ forms a triangle with the coordinate axes. If the area of the triangle is 5 aq. units , then its equation is .....

A. $x + 5y \pm 5\sqrt{2} = 0$

B. $x - 5y \pm 5\sqrt{2} = 0$

C. $5x + y \pm 5\sqrt{2} = 0$

D. $5x - 5y \pm 5\sqrt{2} = 0$

Answer: A

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12. Equation of the straight line perpendicular to the line x-y+5=0, through the point of intersection the y-axis and the given line

A. $x - y - 5 = 0$

B. $x + y - 5 = 0$

C. $x + y + 5 = 0$

D. $x + y + 10 = 0$

Answer: B

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13. If the equation of the base opposite to the vertex (2,3) of a equilateral triangle is x+y=2, then the length of a side is

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

B. 6

C. $\sqrt{6}$

D. $3\sqrt{2}$

Answer: C

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14. The line $(p+2q)x+(p-3q)y=p-q$ for different values of p and q passes through the point

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

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

C. $\left(\frac{3}{5}, \frac{3}{5}\right)$

D. $\left(\frac{2}{5}, \frac{3}{5}\right)$

Answer: D

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15. The point on the line 2x-3y=5 is equidistance from (1,2) and (3,4) is

A. (7,3)

B. (4,1)

C. (1,-1)

D. (-2,3)

Answer: B

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16. The image of the point (2,3) in the line y = -x is

A. (-3,-2)

B. (-3,2)

C. (-2,-3)

D. (3,2)

Answer: A

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17. The length of $\perp$ from the origin to the line $\frac{x}{3} - \frac{y}{4} = 1$ is

A. $\frac{11}{5}$

B. $\frac{5}{12}$

C. $\frac{12}{5}$

D. $-\frac{5}{12}$

Answer: C

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18. The y-intercept of the straight line passing through (1,3) and perpendicular to 2x-3y+1=0 is

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

B. $\frac{9}{2}$

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

D. $\frac{2}{9}$

Answer: B

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19. If the two straight lines $x + (2k - 7)y + 3 = 0$ and $3kx + 9y - 5 = 0$ are perpendicular then the value of k is

A. k = 3

B. $k = \frac{1}{3}$

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

D. $k = \frac{3}{3}$

Answer: A

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20. If a vertex of a square is at the origin and its one side lies along the line 4x+3y-20=0, then the area of the square is

A. 20 sq. units

B. 16 sq. units

C. 25 sq. units

D. 4 sq. units

Answer: B

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21. If the lines represented by the equation $6x^2 + 41xy - 7y^2 = 0$ make angle α and β with x-axis, then $\tan\alpha \tan\beta =$

A. $-\frac{6}{7}$

B. $-\frac{6}{7}$

C. $-\frac{7}{6}$

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

Answer: A

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22. The area of the triangle formed by the lines $x^2 - 4y^2 = 0$ and $x = a$ is

A. $2a^2$

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

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

D. $\frac{2}{\sqrt{3}}a^2$

Answer: C

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23. If one of the line given by $6x^2 - xy + 4cy^2 = 0$ is $3x + 4y = 0$, then c equals to

A. -3

B. -1

C. 3

D. 1

Answer: A

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24. θ is acute angle between the lines $x^2 - xy - 6y^2 = 0$, then $\dfrac{2\cos\theta + 3\sin\theta}{4\sin\theta + 5\cos\theta}$ is

A. 1

B. $-\dfrac{1}{9}$

C. $\dfrac{5}{9}$

D. $\dfrac{1}{9}$

Answer: C

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25. The equation of one of the line represented by the equation $x^2 + 2xy\cot\theta - y^2 = 0$ is

A. $x - y\cot\theta = 0$

B. $x + y\tan\theta = 0$

C. $x\cos\theta + y(\cos\theta + 1) = 0$

D. $x\sin\theta + y(\cos\theta + 1) = 0$

Answer: D

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Additional Questions Solved

1. A point moves so that square of its distance from the point (3,-2) is numerically equal to its distance from the line 5x - 12 y = 3. The equation of its locus is .....

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2. Find the Locus of the mid points of the line $x\cos\theta + y\sin\theta = p$ intercepted between the axis .

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3. Show that the locus of the mid - point of the segment intercepted between the axes of the variable line $x\cos\alpha + y\sin\alpha = p$ is $\frac{1}{x^2} + \frac{1}{y^2} = \frac{4}{p^2}$ where p is a constant .

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4. The line $\frac{x}{a} + \frac{y}{b} = 1$ moves in such a way that $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$. Wehre c is a constant. Find the locus of the perpendicular from the origin on the given line .

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5. Find the equation of a straight on which length of perpendicular from the origin is four units and the line makes an angles 120° with the positive direction of x - axis.

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6. Find the equation of the line which passes through the point (-4,3) and the portion of the line intercepted between the axes is divided internally in the ratio 5 : 3 by this point.

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7. If the intercept of a line between the corrdinatinate axes is divided by the point (-5,4) in the ration 1 : 2 , then find the equation of the line .

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8. Find the equation of the straight line which passes through the point (1,-2) and cuts off equal intercepts from axes.

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9. Find the distance of the line 4x - y = 0 from the point P (4,1) measured along the line making an angle 135° with the positive x - axis.

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10. Find the equation of the line passing through the point (5,2) and perpendicular to the line joining the point (2,3) and (3,-1)

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11. Find the equation of the line passing through the point of intersection 2x + y = 5 and x + 3y + 8 = 0 and parallel to the line $3x + 4y = 7$.

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12. A line points (a,2a) and (-2,3) is perpendicular to the line 4x + 3y + 5 = 0 , find the value of a .

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13. Find the equation of the straight line which passes through the intersection of the straight line

$2x + y = 8$ and $3x - 2y + 7 = 0$ and is parallel to the straight line 4x + y -11 = 0 .

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14. Find the equation of the straight line through the intersection of 5x-6y=1 and 3x+2y+5=0 and perpendicular to the straight line 3x-5y+11=0

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15. Find the angle between the pair of straight lines given by

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16. Show that $9x^2 + 24xy + 16y^2 + 21x + 28y + 6 = 0$ represents a pair of parallel straight lines and find the distance between them .

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17. If the equation $12x^2 - 10xy + 2y^2 + 14x - 5y + c = 0$ represents a pair of straight lines, find the value of c . Find the separate equations of the straight lines and also the angle between them .

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18. For what value of k does $12x^2 + 7xy + ky^2 + 13x - y + 3 = 0$ represents a pair of straight lines ? Also write the separate equations.

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19. Show that $3x^2 + 10xy + 8y^2 + 14x + 22y + 15 = 0$ represents a pair of straight lines and the angle between them is $\tan^{-1}\left(\frac{2}{11}\right)$.

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