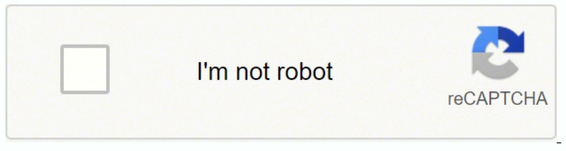

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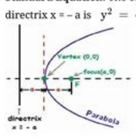
fixed straight line.

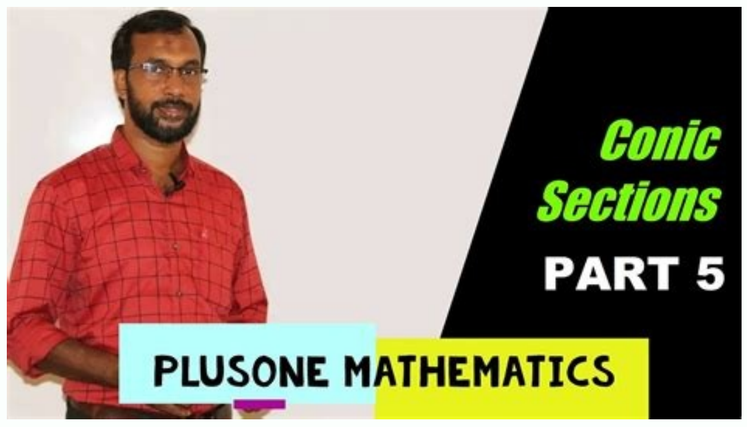
- **Standard Equation**: The equation of the parabola with focus at (a, 0) a > 0 and directrix x = – a is $y^2 = 4ax$.



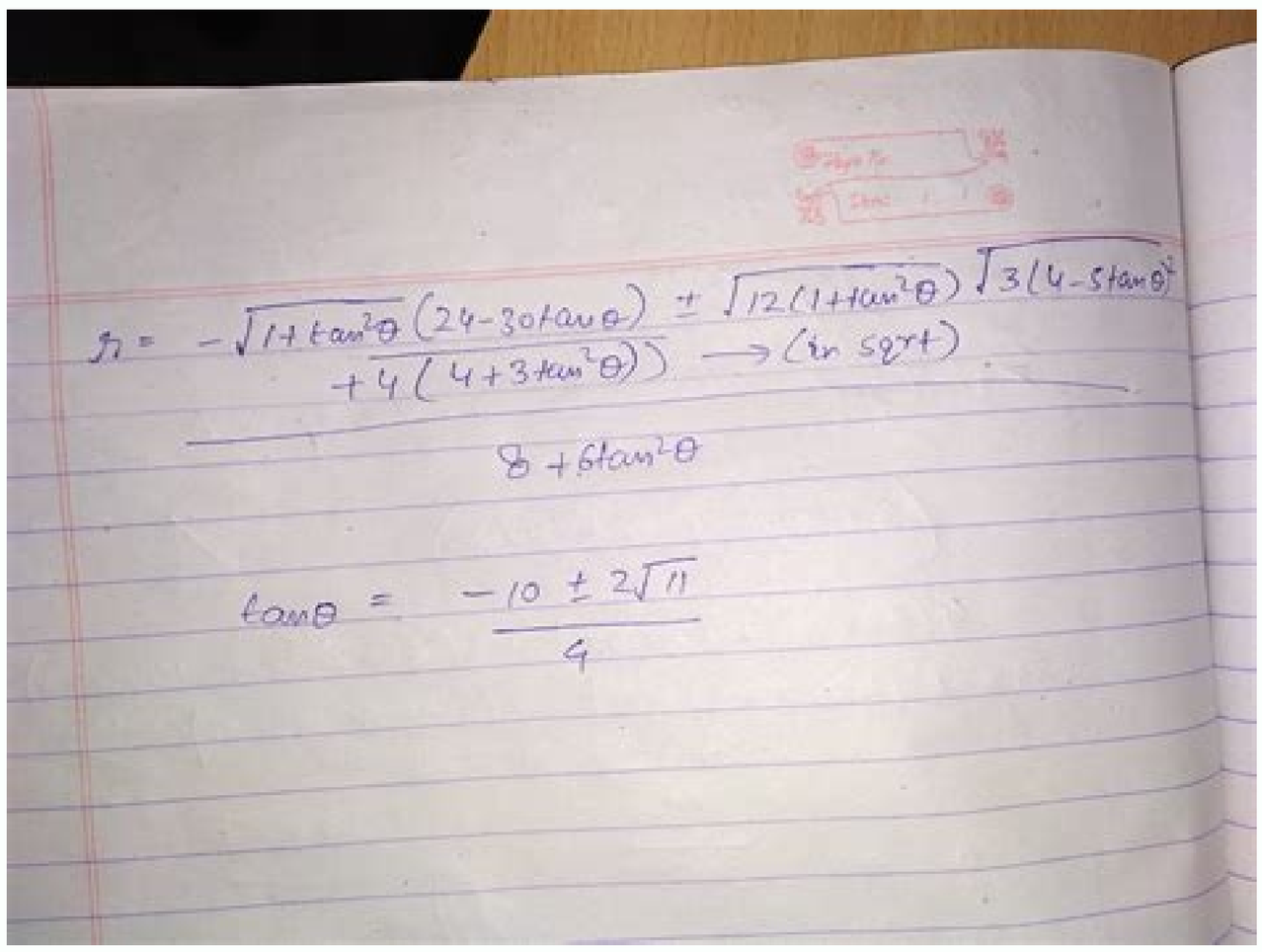
- **Focus**: The given points are known as Focus.
- **Directrix**: The fixed straight line is known as Directrix.
- **Axis**: Any line passing through the focus and perpendicular to the directrix is known as the axis of parabola.
- **Vertex**: The point of intersection of the axis and the parabola is known as Vertex.
- **Latus Rectum**: Latus rectum of a parabola is a line segment perpendicular to the axis of the parabola, through the focus and whose end points lie on the parabola.
- **Length of the latus rectum** of the parabola $y^2 = 4ax$ is 4a.
- **Double Ordinate**: A chord passing through P (any point on the parabola) and perpendicular to the axis of parabola is called the Double Ordinate through point P.
- Focal Chord: Any chord passing through the focus is known as Focal Chord.
- Four standard forms of Parabola: (i) $y^2 = 4ax$, (ii) $y^2 = -4ax$, (iii) $x^2 = 4ay$, (iv) $x^2 = -4ay$.

ELLIPSE

- **An Ellipse** is the set of all points in a plane, the sum of whose distances from two fixed points in the plane is a constant. If the plane cuts entirely across one nappe of the cone and $\theta < \alpha < 90^\circ$, then the curve of intersection of cone and plane is an Ellipse.
- **Focus**: The fixed point is called the focus and is denoted by F.
- **Major Axis**: When ellipse is drawn along $x-$axis, then the major axis is $x-$ and when ellipse is drawn along $y-$axis, then the major axis is $y-$.
- Distance between focus and centre is denoted by c.
- The equation of an ellipse with focion the x-axis is $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$



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



(A) $\frac{4}{3}v$, towards East (B) v, towards West (C) $\frac{4}{3}v$, towards West (D) v, towards East

26. Equation of trajectory of the boat is

(A) $y = \frac{x^2}{2d}$ (B) $x = \frac{y^2}{2d}$ (C) $y = \frac{x^2}{2d} - \frac{x^3}{3d^2}$ (D) $x = \frac{y^2}{2d} - \frac{y^3}{3d^2}$

Solution :

24. Ans. (B)

Time taken $= \frac{d}{v_y} = \frac{d}{v}$

25. Ans. (B)

At y=d, u =0 so absolute velocity of boat = v towards West.

26. Ans. (D)

For boat (w.r.t. ground) $v_y = v$, $v_x = u = \frac{y(d-y)}{d^2}v \Rightarrow \frac{dy}{dt} = v$ and $\frac{dx}{dt} = \frac{y(d-y)}{d^2}v$

$$\Rightarrow \frac{dx}{dy} = \frac{y(d-y)}{d^2} \Rightarrow \int_0^x dx = \int_0^y \frac{(yd-y^2)}{d^2}dy \Rightarrow x = \frac{y^2}{2d} - \frac{y^3}{3d^2}$$

Example #27

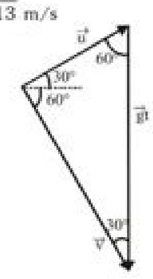
As shown in the figure there is a particle of mass $\sqrt{3}$ kg, is projected with speed 10 m/s at an angle 30 with horizontal (take g = 10 m/s^2) then match the following

Column I	Column II
(A) Average velocity (in m/s) during half of the time of flight, is	(P) $\frac{1}{2}$
(B) The time (in sec) after which the angle between velocity vector and initial velocity vector becomes $\pi/2$, is	(Q) $\frac{5}{2}\sqrt{13}$
(C) Horizontal range (in m), is	(R) $5\sqrt{3}$
(D) Change in linear momentum (in N-s) when particle is at highest point, is	(S) At an angle of $\tan^{-1}\left(\frac{1}{2\sqrt{3}}\right)$ from horizontal
	(T) 2

Solution : Ans. (A) → (Q,S); (B) → (T); (C) → (R); (D) → (R)

For (A) : $v_{av} = \sqrt{(v_{avx})^2 + (v_{avy})^2} = \sqrt{(10\cos 30°)^2 + \left(\frac{10\sin 30° + 0}{2}\right)^2} = \sqrt{75 + \frac{25}{4}} = \frac{5}{2}\sqrt{13}$ m/s

Angle with horizontal $\theta = \tan^{-1}\left(\frac{v_{avy}}{v_{avx}}\right) = \tan^{-1}\left(\frac{5/2}{5\sqrt{3}}\right) = \tan^{-1}\left(\frac{1}{2\sqrt{3}}\right)$



For (B) : By using $\vec{v} = \vec{u} + \vec{a}t$ We have $\frac{u}{gt} = \sin 30° \Rightarrow t = \frac{10}{(10)(1/2)} = 2$

For (C) : Horizontal range(R) $= \frac{u^2 \sin 2\theta}{g} = \frac{100 \times \sqrt{3}/2}{10} = 5\sqrt{3}$ m

For (D) : Change in linear momentum $= mu_y = \sqrt{3} \quad 10\sin 30 \quad = 5\sqrt{3}$ N-s

Formulas for conic sections pdf.

The value of eccentricity(e) for parabola is e = 1. The circle has a focus known as the center of the circle. The parabola has 1 directrix, the ellipse and the hyperbola have 2 directrices each. Eccentricity The eccentricity of a conic section is the constant ratio of the distance of the point on the conic section from the focus and directrix. Example 1: What will be the equation for the hyperbola which has center at (2, 3), vertex at (0, 3), and the focus at (5, 3). When the intersecting plane is at an angle to the surface of the cone, we get a conic section named parabola. The circle is a special type of ellipse where the cutting plane s parallel to the base of the cone. Using b2 = a2 – c2 We get: b2= 16 – 9 = 7 Putting in the equation of ellipse conic section: x2/a2 + y2/b2 = 1 x2/16 + y2/7 = 1 Answer: The equation of the ellipse is x2/16 + y2/7 = 1. Hyperbola - Conic Section A hyperbola is formed when the interesting plane is parallel to the axis of the cone, and intersect with both the nappes of the double cone. The value for eccentricity(e) for hyperbola is e > 1. The directrix is parallel to the conjugate axis and the latus rectum of the conic. Mirrors used to direct light beams at the focus of the parabola are parabolic. The following are the details of the parameters of the conic section. Now we can see from the given points: a = 2, c = 3 Hence b2 = c2- a2 = 9 – 4 = 5. Ellipse - Conic Section Ellipse is a conic section that is formed when a plane intersects with the cone at an angle. The value of eccentricity(e) for a circle is e = 0. And for a hyperbola having the conic equation of x2/a2 - y2/b2 = 1, the equation of the pair of asymptotes of the hyperbola are \(\dfrac{x}{a} ± \dfrac{y}{b} = 0\). It is a non-negative real number. Eccentricity is denoted by "e". Planets travel around the Sun in elliptical routes at one focus. Latus Rectum: It is a focal chord that is perpendicular to the axis of the conic. It is a symmetrical open plane curve formed by the intersection of a cone with a plane parallel to its side. The two unconnected sections of the hyperbola are called branches. For a circle, c = 0 so a2 = b2. The standard form of the equation of a parabola having the axis along the x-axis, and vertex at the origin is y2 = 4ax. These conic are obtained from a simple cone and is obtained by cutting the cone across different sections. When the intersecting plane cuts at an angle to the surface of the cone, we get a conic section named parabola. Let us briefly learn about each of these parameters related to the conic section. Book a Free Trial Class Check Answer > go to slidego to slide FAQs on Conic Section A conic section is a geometric representation of a parabola, ellipse, hyperbola in a two-dimensional coordinate system. The focal chord cuts the conic section at two distinct points. Let us learn in detail about each of them. The various conic figures are the circle, ellipse, parabola, and hyperbola. Find the equation of the ellipse. For ellipse, 0 ≤ e < 1 For parabola, e = 1 For hyperbola, e > 1 Terms Related To Conic Section Other than these three parameters, conic sections have a few more parameters like principal axis, latus rectum, major and minor axis, focal parameter, etc. Solution: As we see, for hyperbola, all three points i.e., center, vertex, and focus lie on the same line y = 3. Director Circle: The locus of the point of intersection of the perpendicular tangents drawn to the ellipse is called the director circle. If two conic sections have the same eccentricity, they will be similar. (x−h)2 + (y−k)2 = r2 What is Hyperbola in Conic Section? Ellipse has 2 foci, a major axis, and a minor axis. Circle: x2+y2= a2 Parabola: y2= 4ax when a>0 Ellipse: x2/a2 + y2/b2 = 1 Hyperbola: x2/a2 – y2/b2 = 1 Related Topics Check out the articles below to know more about topics related to the intersection of two lines. It is a non-negative real number, which lies between 0 and 1. Circle has no directrix. The circle is a special type of ellipse where the cutting plane is parallel to the base of the cone. Every point on the conic is defined by the ratio of its distance from the directrix and the foci. As eccentricity increases, the conic section deviates more and more from the shape of the circle. The conic equation of an ellipse is x2/a2 + y2/b2 = 1, and the equation of the auxiliary circle is x2 + y2 = a2. For an ellipse, the sum of the distance of the point on the ellipse from the two foci is constant. (x−h)2/a2 - (y−k)2/b2 = 1 Conic Section Formulas - Standard Forms Conic section formulas represent the standard forms of a circle, parabola, ellipse, hyperbola. The graph of a quadratic function is a parabola, a line-symmetric curve whose shape is like the graph of y = x2. (x−h)2/a2 + (y−k)2/b2 = 1 Note: If the major axis is parallel to the y-axis, switch the places of a and b in the above-given formula. Parabolic mirrors in solar ovens focus light beams for heating. We can get various shapes depending upon the angle of the cut between the plane and the cone and its nappe. A cone generally has two identical conical shapes known as nappes. The general form of the equation of an ellipse with center at (h, k) and length of the major and minor axes as '2a' and '2b' respectively. Conic sections are the curves obtained when a plane cuts the cone. The conjugate axis is also its minor axis. The locus of the points on the circle have a fixed distance from the focus or center of the circle and this fixed distance is called the radius of the circle. Conic Section Parameters The focus, directrix, and eccentricity are the three important features or parameters which defined the conic. Solution: From the given points, we can see that c = 3 and a = 4. (x−h)2/a2 + (y−k)2/b2 = 1 What is Eccentricity of a Conic Section? And the shape and orientation of these shapes are completely based on these three important features. Chord of Contact: The chord drawn to join the point of contact of the tangents, drawn from an external point to the conic is called the chord of contact. Math will no longer be a tough subject, especially when you understand the concepts through visualizations. The general form of the equation of a circle with center at (h, k), and radius r, is as follows. go to slidego to slide Breakdown tough concepts through simple visuals. Normal: The line drawn perpendicular to the tangent and passing through the point of contact and the focus of the conic is called the normal. Focus The focus or foci(plural) of a conic section is/are the point(s) about which the conic section is created. For circle, e = 0. By cutting a cone by a plane at different angles, we get the following shapes: Circle Parabola Ellipse Hyperbola Ellipse is a conic section that is formed when a plane intersects with the cone at an angle. Directrix Directrix is a line used to define the conic sections. For ellipses and hyperbolas, the standard form has the x-axis as the principal axis and the origin (0,0) as the center. The eccentricity(e) for hyperbola has a value greater than 1. Circle - Conic Section The circle is a special type of ellipse where the cutting plane is parallel to the base of the cone. Eccentricity is used to uniquely define the shape of a conic section. The value of e for different conic sections is as follows. They are mirror images of each other, and their diagonally opposite arms approach the limit to a line. The hyperbola has two foci and the absolute difference of the distance of the point on the hyperbola from the two foci is constant. What is Circle in Conic Section? The vertices are (±a, 0) and the foci (±c, 0)., and is defined by the equations c2= a2 − b2 for an ellipse and c2 = a2 + b2 for a hyperbola. For the parabola, the standard form has the focus on the x-axis at the point (a, 0) and the directrix is the line with equation x = −a. The locus of the points on the circle have a fixed distance from the focus or center of the circle and is called the radius of the circle. Ellipse is a conic section that is formed when a plane intersects with the cone at an angle. Telescopes use parabolic mirrors. Example 2: If for an ellipse, the focus lies at (3, 0), a vertex lies at (4, 0), and its center lies at (0, 0). The directrix is a line drawn perpendicular to the axis of the referred conic. Focal Distance: The distance of a point \((x_1, y_1)\) on the conic, from any of the foci, is the focal distance. They are specially defined for each type of conic section. Ellipse has 2 directrices. If you're behind a web filter, please make sure that the domains *.kastatic.org and *.kasandbox.org are unblocked. Value of eccentricity(e) for ellipse is e < 1. And the length of the latus rectum for an ellipse, and hyperbola is 2b2/a. For ellipse, 0 ≤ e < 1 For parabola, e = 1 For hyperbola, e > 1 What are the Applications of the Conic Section? It is a U-shaped conic section. If you're seeing this message, it means we're having trouble loading external resources on our website. For parabola, it is a limiting case of an ellipse and has one focus at a distance from the vertex, and another focus at infinity. Principal Axis: The axis passing through the center and foci of a conic is its principal axis and is also referred to as the major axis of the conic. The length of the latus rectum for a parabola is LL' = 4a. A hyperbola is formed when the interesting plane is parallel to the axis of the cone, and intersect with both the nappes of the double cone. Auxilary Circle: A circle drawn on the major axis of the ellipse as its diameter is called the auxiliary circle. We can have one normal for each of the tangents to the conic. Tangent: The tangent is a line touching the conic externally at one point on the conic. Car headlights and spotlights are designed based on parabola’s principles. Also from an external point, about two tangents can be drawn to the conic. A parabola has one focus, while ellipses and hyperbolas have two foci. Pole and Polar: For a point which is referred as a pole and lying outside the conic section, the locus of the points of intersection of the tangents, draw at the ends of the chords, drawn from this point is called the polar. For an ellipse, hyperbola we have two foci, and hence we have two focal distances. What is Parabola in Conic Section? A hyperbola is an example of a conic section that can be drawn on a plane that intersects a double cone created from two nappes.The general form of the equation of the hyperbola with (h, k) as the center is as follows. For an ellipse (x2/a2 + y2/b2 = 1), the equation of the director circle is x2 + y2 = a2 + b2 Asymptotes: The pair of straight lines drawn parallel to the hyperbola and assumed to touch the hyperbola at infinity. A circle has no directrix. The hyperbola represents the locus of a point such that the difference of its distances from the two foci is a constant value. The conic section formula for an ellipse is as follows. The path traveled by objects thrown into the air is parabolic. The path of a projectile under the influence of gravity ideally follows a curve of this shape. Focal Chord: The focal chord of a conic is the chord passing through the focus of the conic section. Vertex: The point on the axis where the conic cuts the axis is referred to as the vertex of the conic. The general form of the equation of a circle with center at (h, k), and radius r: (x−h)2 + (y−k)2 = r2 Parabola - Conic Section When the intersecting plane is at an angle to the surface of the cone we get a conic section named parabola. Putting in the equation of hyperbola conic section: (x−h)2/a2 - (y−k)2/b2 = 1 We get, (x−2)2/22 - (y−3)2/5 = 1 Answer: Equation of the hyperbola will be (x−2)2/4 - (y−3)2/5 = 1. The major axis of the ellipse is parallel to the x-axis. The graph of a parabola either opens upward like y = x2 or opens downward like the graph of y = - x2. Hyperbolas are used in long-range navigation systems called LORAN. Conjugate Axis: The axis drawn perpendicular to the principal axis and passing through the center of the conic is the conjugate axis. The point where the tangent touches the conic is called the point of contact. The eccentricity of a conic section is the constant ratio of the distance of the point on the conic section from the focus and directrix. Sound waves are focused on parabolic microphones. Here are a few real-life applications of conic sections which we might have seen or known are as follows. The excentricity values for the different conics is as follows. (x−h)2/a2 - (y−k)2/b2 = 1 What is Ellipse in Conic Section? The equations of the asymptotes of the hyperbola are y = bx/a, and y = -bx/a respectively. Circle, which is a special case of an ellipse, has both the foci at the same place and the distance of all points from the focus is constant. It is asymmetrical open plane curve formed by the intersection of a cone with a plane parallel to its side. (e > 1) The general form of the equation of the hyperbola with (h, k) as the center, the x-axis as the major axis, and the y-axis as the minor axis, is as follows. Center: The point of intersection of the principal axis and the conjugate axis of the conic is called the center of the conic.

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