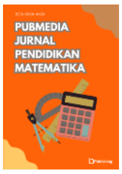

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Significance of Conic Section in Daily Life and Real Life Questions Related to it in Different Sectors

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Abstract: Students tend to think of mathematics as, "that difficult, boring subject" that only exists within the walls of a classroom. Many students do not realize that mathematics is all around us occurring in our daily lives. Mathematics can be found easily in everyday activities such as cooking, driving, and even walking. Here, we are going to overview the conic section: ellipse, circle, parabola, hyperbola from different angle of life. In this report we will be analyzing a very crucial applications of conic section in the medical field, engineering field, some real life based questions will be sloved, some galleries specially a whispering gallery and some elliptical art works. We will be looking that how a conic section had given a great way to our life

Keywords: Conic sections, circle, ellipse, parabola, hyperbola, and etc.

Introduction

Objectives:

Ellipses, parabolas, hyperbola and circles lie beneath the umbrella of conic sections which have various applications in real life as fit as technology. Some key goals include the following:

Helps in Cultivating Interaction Networks:

Parabolic reflectors:, they enhance communication and data collecting, by combining signals on the point of a receiver. They find claims in radio telescopes, satellite dishes and parabolic microphones.

Improving Mechanical Designs:

DonQui Style — Architectural Elliptical Objects; Structural and Visual.ResponseEntity Design Patterns: Roles, Implementation & Invocationpatterns ↓0Structure vs Surface → App featured image for 'Ellipses in architecture.' -Corten steel makes up the entirety of this elliptically-shaped house. Elliptical forms allow for weight to be spread evenly and with consistency.

Improving GPS and triangulation capabilities:
Hyperbolic navigation: a method of determining locations using the difference in distances to two or more slightly spread out stations from each other. Hyperboloid systems include LORAN_HELLO_EDGE
Encouraging a Scientific Inquiry:
The Orbits of the Planets: Identification as Ellipses Astronomical Remarks and Models for the Motions Of The Sun, Moon, And Stars.
Limitations of conic sections:

The Conic sections — parabolas, ellipses and hyperbolas are the primary shapes in mathematics which have wide applications. Still, they are not as cool:

Geometric Constraints
Parabolas: Describe the path of objects in uniform gravitational fields or a special type of reflection. They are not modeling the heterogeneous paths that other forces orw interactions would exhibit.
Ellipses:Orbits and other nice things with two foci; But they are inadequate in the cases of objects that are governed by non-central force interactions or under multiple different forces.
Hyperbolas: Better suited for objects on tracks of a constant difference between 2 foci, but not for systems where this relationship does not hold or multiple bodies are interacting.

Methodology

Historical Background:

It is assumed that the first definition of a conic section was given by Menaechmus (died 320 BC) as part of his key of the Delian issue (Duplicating the cube). His work did not survive, not even the names he used for these curves, and is only known through secondary accounts. The description used at that time differs from the one commonly used today (Salsabila, 2019). Cones were created by rotating a right triangle about one of its legs so the hypotenuse generates the surface of the cone (such a line is called a generatrix). Three types of cones were determined by their vertex angles (measured by twice the angle formed by the hypotenuse and the leg being rotated about in the right triangle) (Pellegrinetti, 2021). The conic section was then found by crossing one of these cones with a plane drawn perpendicular to a generatrix. The type of the conic is firm by the type of cone, that is, by the angle created at the vertex of the cone: If the angle is acute then the conic is an ellipse; if the angle is right then the conic is a parabola; and if the angle is obtuse then the conic is a hyperbola (but only one branch of the curve).

Contribution of Apollonius of Perga

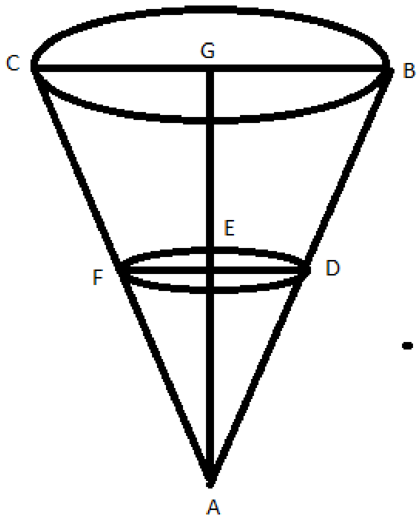
The greatest advancement in the study of conics by the ancient Greeks is qualified to Apollonius of Perga (died c. 190 BC), whose eight-volume Conic Sections or Conics collected and noticeably extended existing knowledge (Easter, 2020). Apollonius's investigation of the features of these curves made it achievable to establish that any plane cutting a fixed double cone (two napped), regardless of its angle, will yield a conic according to the older definition, resulting to the definition usually used today. Circles, not constructible by the earlier method, are also available in this fashion (Lüttge, 2022). This may account for why Apollonius regarded circles a fourth form of conic section, a distinction that is never longer made. Apollonius used the names 'ellipse', 'parabola' and 'hyperbola' for these curves, stealing the phrase from earlier Pythagorean work area (see [1-11]).

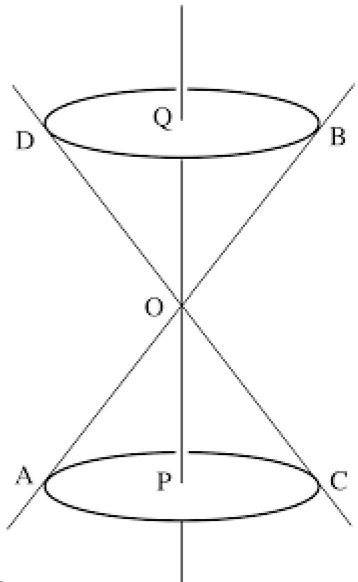
Result and Discussion

Introduction to conic section:

Conic Section:

Let A be the fixed point and AG, the fixed line. Then the surface generated by rotating the line AB around AC such that AGB is always constant, is known as the right cone. The point A is known as the vertex, AC, the axis and AC, the generator. ABG is known as the semi-vertical angle.

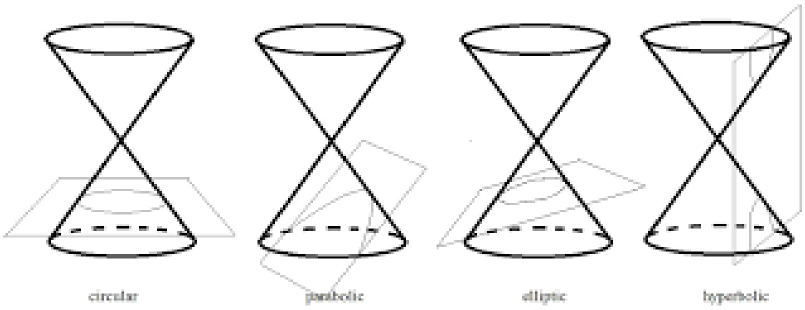




If the cone OAC is symmetrical to the cone OBD about OQ opposite to OP, then ACODB is said to be the double right cone.

The closed or the open curve obtained by the intersection of the cone and the plane is the conic section. If a plane cuts the cone, a curve will be obtained. The nature of the curve depends upon the position of the cutting plane. The following are the curves (conic section) obtained when a cone is intersected by a plane in different positions.

i. If a plane intersects a cone perpendicular to the axis, then the section is a circle.
ii. If a plane intersects a cone at a given angle with the axis greater than the semi-vertical angle, then the section is an ellipse.
   Circle
iii. If an intersecting plane, not passing through the vertex, is parallel to the generator of the cone, then the section is a parabola.
iv. If a plane intersects the double right cone such that the angle between the axis and the plane be less than the semi-vertical angle, then the section is a hyperbola.



Usually, a conic section is defined in the following ways: The locus of a point which moves in a plane in such a way that the ratio of its distance from a fixed point to its distance from a fixed straight line is constant is called a conic section.

The fixed point is called the focus, the fixed straight line its directrix, and the constant ratio the eccentricity (denoted be e). The straight line passing through the focus and perpendicular to the directrix is called the avis. The intersection of the curve and the axis is called the vertex.

A conic section in which the value of the eccentricity is unity ie. $e = 1$ is known as the parabola. A conic section in which the eccentricity is less than 1 ie. $e < 1$ is known as the ellipse. Also, conic section greater than 1 ie $e > 1$ in which the eccentricity is is known as the hyperbola.

In particular, if the value of e is zero ie. $e = 0$ the locus represents a circle.

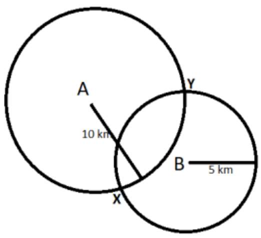
Real Life Numerical Problems Sloved with Conic Section in Different Sectors

- **Problems in engineering field**

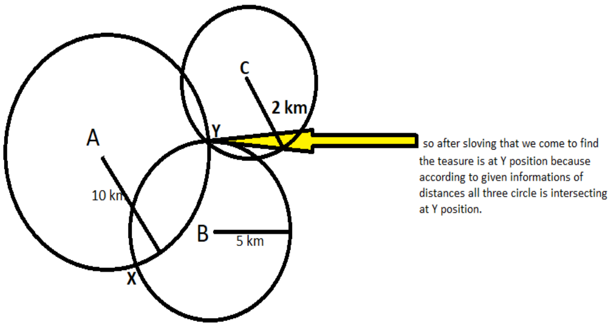
Problem: if you are said to find the Treasure and you are kept at one point on A and you are said that you are 10 km away from the Treasure after that your place is changed and you are made Standing and B position and again you are said that you are 5 km away from the treasure, again your position is shifted to other C point now you are 2 km away from the Treasure then find the exact position of treasure**.**

Solution:

First a/q to given information's we will take point A and B and will draw a circle of 10 km radius and 5 km radius respectively;

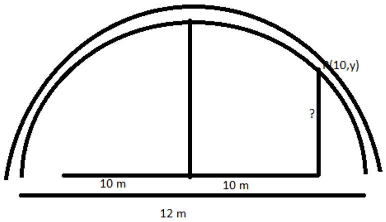


Now we can guess that the teasure must be at point X or Y because both circle is intersecting at X and Y;now we are going to draw a third circle of radius 2 km at point



Hence with help of circle we found the exact location of treasure as all three circle is intersecting at position

Problem: A Street which two lens is 10 feet wide goes through a semicircular tunnels with radius 12 ft how high is the edge of each lane.



Solution:

Hence it is semicircle, suppose Centre be (0, 0) and to find the height at P

let the radius(r) of semicircle is 12 ft

now,

or, $(x-h)^2+(y-k)^2 = r^2$

or, $(10-0)^2+(y-0)^2 = 12^2$

or, $(10)^2+(y)^2 = 144$

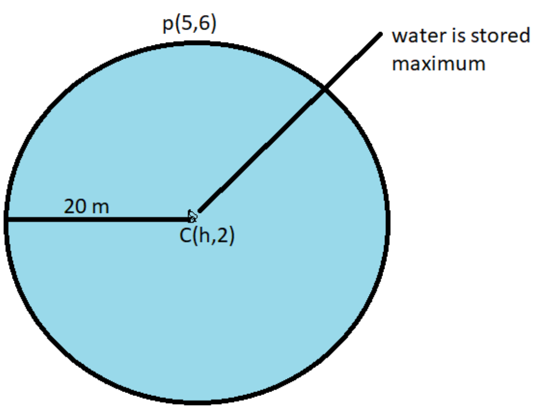
since, y=6.33 ft

i.e height of tunnel at the edge of lane is 6,33 ft

Problem: Suppose you have a dog, and you want to let the dog play in the back grass but stay away from the boundary(s). You can put a rod in the middle of the yard and tie your

dog's string to it. But you need to find the right *length* (think radius of a circle) to allow the dog run of the yard but keep him/her away from the boundaries.
Soln:
Let center (0,0) and (3,4) be any point on circle
We know,
Eq of circle is $(x-h)^2 + (y-k)^2 = r^2$
(h,k)=(0,0)
(x,y)=(3,4)
Now,
$(3-0)^2 + (4-0)^2 = r^2$
Or, $r = \sqrt{25}$
r =5 units
so that person should take ta length of 5 meter string(rope)

Problem: One engineer thinks to build a circular pond in that pond he wants a area where he could collect a lot of water in comparison to other area then finf the co-ordinate of that area where water can be collected in large amount,if radius of pond is 20 m,and (5,6) is any point on circumference of the circle which is mearsure with help of machine.if one of the point of center is k=2
Soln:



Let
We know the needed area must be center ,
Eq of circle is $(x-h)^2 + (y-k)^2 = r^2$
Substituting the values ;
(x,y)=(5,6)
r = 20
now,
$(5-h)^2 + (6-2)^2 = 10^2$
Or,$(5-h)^2+16=100$
Or,$(5-h)= \sqrt{84}$
Or,h=14.16 m

So coordinate of that area is (14.16,2)

Conic in scientific studies

Problem: A spaceship's path as it approaches the sun can be modelled by one branch of hyperbola $\frac{y^2}{1000} - \frac{x^2}{40400}$ where the sun is at the focus of the path of the hyperbola. Each part of the coordinate system is 1 million kilometres. Find the coordinates of the sun and how close does the spaceship come to the sun?

Solution:

We set the center of the hyperbola at the origin with coordinates (0,0). The hyperbola's transverse axis is parallel to the y-axis thus $a^2 = 1000$ and $b^2 = 40, 400$ It follows that a =31.62 and b = 200.99

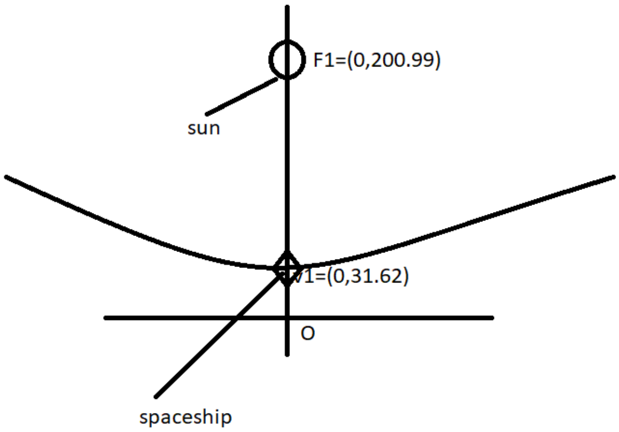
Since the sun is at the focus, the distance of the sun from the center is c units. Solving for c, we have

$c^2 = a^2 + b^2 = 1000+40400=41400$

Taking the square root of both sides of the equation, we have,

c = 203.46

Hence, the coordinates of the sun is at F1(h, k + c) = F1(0, 0 + 203.46) = F1(0, 203.46) point that the closest distance of the spaceship to the sun is when the spaceship is at the vertex, which is at coordinates V1(h, k + a) = V1(0, 0 + 31.62) = V1(0, 31.62)



So the closest the spaceship gets to the sun is about 200.99-31.62=160.37. Since 1 unit in the coordinate system is equivalent to 1 million kilometres, we can conclude that the nearest distance of the spaceship to the sun is

160.37 * 1000000 = 160370000km

Problem; Two microphones, 2000 meters apart, recorded an explosion. The west microphone (M2) received the sound 5 seconds after the east microphone (M_1). Supposing sound travels 332 meters per second, find an equation of the hyperbola where the explosion might occurred if the foci are located at M_1 and M2.

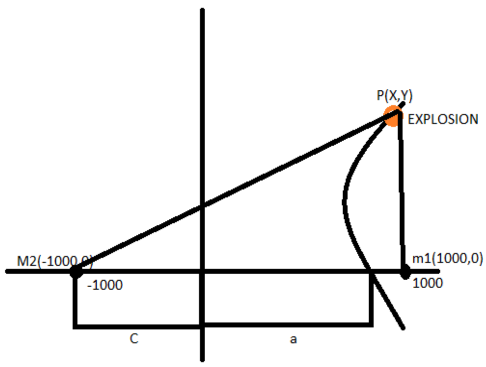
Solution:

distance = (rate)(time)

so, distance = 332 meters second*5 sec

distance =1660 meters
we know
2a = 1660

SINCE, a=830 i.e a^2 =688900
$b^2 = c^2 - a^2$
or, $b^2=1000^2-830^2$
since b^2= 311100



We know ,let equation of hyperbola be:

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

$$\frac{x^2}{688900} - \frac{y^2}{311100} = 1$$

The explosion occurred somewhere on the right branch (the branch closer to M_1) of the hyperbola given by the equation

- **Conic section in aqua life:**

Problem: Crabs are known to be detritivores meaning they eat decaying plants and animal parts. Mr. Oksana crab is located at the origin. He sees some food floating nearby at the coordinates of (8,8). If his initial equation was, what will his new equation be if he wanted to go eat his fill? Determine the new Focus, Vertex, and Directrix.

Solution:
Hence the shape of crab is parabolic and it is origin
Its initial equation be y^2=4ax
Since he has his food at (8, 8) so it lies in curve of parabola so, we can write
8^2=4a*8

Or, 4a=1
Since, a=1/4
Now we know a so the new equation of crab be :
Y^2=4*1/4*x
i.e y^2 = x is required equation of crab
focus(1/4,0)
vertex(0,0)
directrix = 4*1/4=1

- **conic section in games and play**

Problem: A boy with a basketball at origin wants to throw that ball in basket net which is at 6 meter away and 5 meter height from him .now in which path should he throw that ball to keep it in net nad what will be the equation of that curved path ?
Solution :
Hence boy is down the the net that means he has to throw ball upward which means he will throw wuth some velocity and due to gravitation of eartyh ball will be pooled downward that means ball will attend parabolic path means path of ball will be parabolic
Now he is at origin so, vertex is (0,0)
Equation of path be y^2=4ax ……………….(1)
Hence he has to to throw ball in net which is at 6 meter and 5 meter height considering x and y axes point of net be (6,5) i.e (x,y)=(6,5)
Putting x and y values in equation (1)
5^2=4*a*6
Since a= 1.04
So final equation of that path be y^2 = 4*1.04*x

- **USE OF CONIC SECTION IN MEDICAL FIELD:**

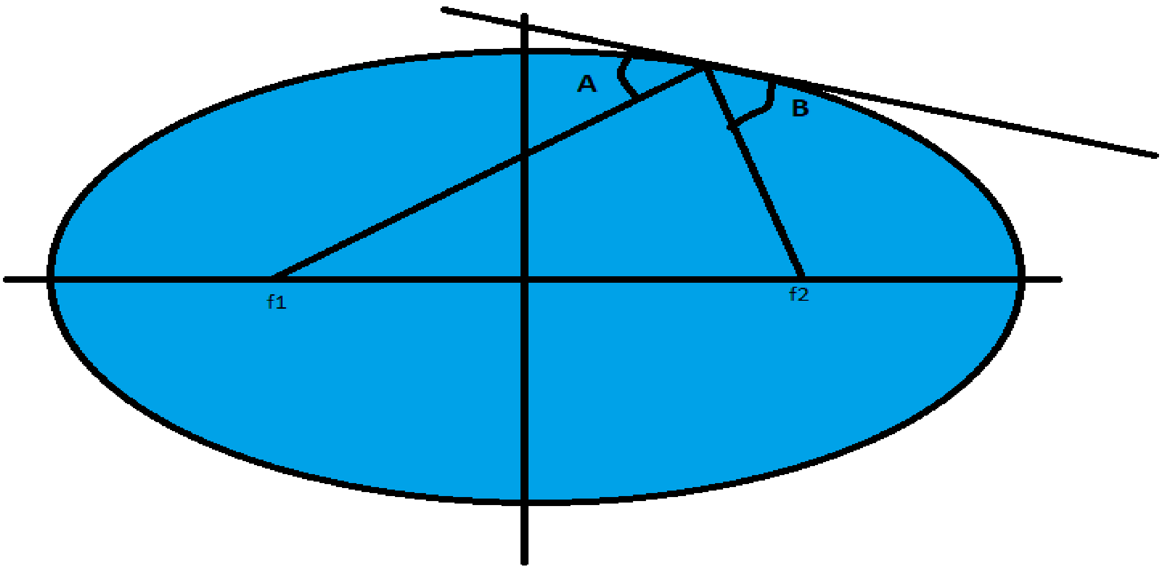
USE OF ELLIPSE IN LITHOTRIPSY SOUNDWAVE

Jean Civiale (1792-1867) was a French surgeon and urologist,Civiale has been also recently recognized as a pioneer of evidence-based medicine. In 1835. the Académie des Sciences in Paris commissioned a report on the statistical research that had been conducted by him on a wider scale throughout Europe, with the aim of proving that bladder lithotripsy was superior to lithotomy.

Jean Civiale (1792-1867)

An exceptionally unique and useful conic section is the ellipse. The reflecting quality of the ellipse is one of its key characteristics. A light beam emitted from one focus will reflect off the ellipse and pass through the second focus if you imagine that an ellipse is composed of a reflecting substance. This also holds true for other types of energy, such as shockwaves, in addition to light rays. The ellipse will reflect shockwaves produced at one focus, allowing them to flow through the second focus. This special property of the ellipse has led to a practical medical use. The ellipse has been utilized by medical professionals to develop a kidney stone and gallstone treatment tool that works well. Shockwaves are used by a lithotripter to effectively fracture an uncomfortable kidney.

The process in which stone (or gallstone) into small fragments that the body can readily pass through. We call this procedure lithotripsy.



As illustrated in the diagram above, when as energy ray reflects off a surface, the angle of incidence is equal to the angle of reflection.

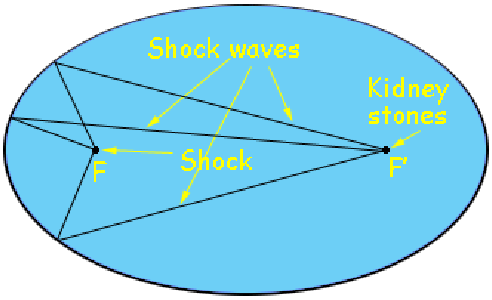
Angle A = Angle B

The use of extracorporeal shockwave therapy

Doctors can treat gallstones and kidney stones without open surgery by using extracorporeal shockwave lithotripsy (ESWL). Surgery-related hazards are greatly decreased when this alternative is used. Compared to a surgical technique, there is a lower risk of infection and shorter recuperation time needed. The tool used in lithotripsy is called a lithotripter. This medical discovery is based on the mathematical features of an ellipse.

The Foci

A half-ellipsoid-shaped component of the lithotripter machine sits against the patient's side. An ellipse represented in three dimensions is called an ellipsoid. The patient's stone must be at one focus point of the ellipsoid and the shockwave generator at the other focus for the lithotripter to function by leveraging the ellipse's reflecting feature. After being placed on the table, the patient is positioned close to the lithotripter. A fluoroscopic x-ray system is used by medical professionals to keep an eye on the stone. This makes it possible to precisely place the stone as the focal point. The stone must be exactly the correct distance from the focus point. It is essential that the stone be exactly the correct distance from the lithotripter's focus because it is serving as one of the focus points. For the shockwaves to be directed onto the stone, this is necessary.



- ➢ How actually does lithotripsy happen and what are its processes?
- ❖ A shockwave generator
- ❖ A focusing system
- ❖ A Coupling Mechanism
- ❖ An Imaging/localization unit

Shockwave generator:

Generator of Piezoelectric Shockwaves

It is suggested to create a piezoelectric shock wave generator with electronic focalization. The system consists of a 25 piezoelectric independent transducers organized in a bidimensional array within a 10 cm diameter spherical shell. There are twenty-five pulsers in the system's electronic circuitry. By adjusting in stages of 10 ns, the interdelay of every channel can be changed between 10 ns and 100 mu s. At the shell's surface, the pressure was 22*10/sup 5/ Pa. Within an ellipsoidal zone measuring 3 cm in diameter and 4 cm in length, the focal point can be electronically shifted (Li, 2023). These measurements are sufficiently large to track the renal calculus's displacement during breathing.

Electromagnetic soundwave generator

The piezoelectric lithotripter was shown to cause distinctly less pain than the electrohydraulic and electromagnetic generators. In view of the results obtained by evaluating the pain sensations experienced during shockwave application (Kanas, 2019). the fragmentation results appeared surprising: for gallstones up to 15 mm in diameter, the piezoelectric system achieved significantly better fragmentation in uitro than the electrohydraulic generator when submaximal intensities were applied.

- **A focusing system:**
  All the machines require a focusing system to align, direct and concentrate the energy produced at point
  Urinary stone imaging or localization system Visualization and localization of urinary stones are used to position the stone at F2 point. Fluoroscopy and ultrasound can be used to localize the stone
  Electrode.
- **A coupling mechanism:**
  Lithotripsy coupling mechanism
  The aim is to achieve stone comminution using as few shock waves and at as low a power level as possible. Important challenges remain, including the need to improve acoustic coupling, enhance stone targeting, better determine when stone breakage is complete. and minimize the occurrence of residual stone fragments.
- **An Imaging/localization unit:**
  Imaging systems are used to localize the stone and to direct the shockwaves onto the calculus, as well as to track the progress of treatment and to make alterations as the stone fragments. The 2 methods commonly used to localize stones include fluoroscopy and ultrasonography.
  Fluoroscopy, which is familiar to most urologists, involves ionizing radiation to visualize calculi. As such, fluoroscopy is excellent for detecting and tracking calcified and otherwise radio-opaque stones, both in the kidney and the ureter. Conversely, it is usually poor for localizing radiolucent stones (eg, uric acid stones). To compensate for this shortcoming, intravenous contrast can be introduced or (more commonly) cannulation of the ureter with a catheter and retrograde instillation of contrast (ie retrograde pyelography) can be performed.

Ultrasonographic localization allows for visualization of both radiopaque and radiolucent renal stones and the real-time monitoring of lithotripsy. Most second-generation lithotriptors can use this imaging modality, which is much less expensive to use than radiographic systems (Jaud, 2024). Although ultrasonography has the advantage of preventing exposure to ionizing radiation, it is technically limited by its ability to visualize ureteral calculi, typically due to interposed air-filled intestinal loops. In particular, smaller stones may be difficult to localize accurately.

Conclusion

Here we have seen that how conic section has contributed its crucial role in different field . we have also seen that math is not just a subject but also it is one of the way to real life we people are just trapped in this loop that math is just calculations subject but through this report we came to know that math is not just limited within books it has huge imapact on real life too (Won, 2021). A fundamental concept in geometry, conic sections show how algebra and geometry relate deeply. We obtain a detailed grasp of the various shapes that result from the intersection of a plane with a double-napped cone by studying ellipses, parabolas, and hyperbolas. Different properties and equations are displayed by each conic section, providing important information for theoretical and practical applications(In-Im, 2024).

The two foci that define an ellipse are essential to knowing orbital optics and mechanics. With their focus-directrix definitions and reflecting qualities, parabolas are essential to a variety of industries, including satellite technology and projectile motion. Asymptotic behavior, which characterizes hyperbolas, has important applications in signal processing and navigation.

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The reference is written in Palatino Linotype 12-point font and follows the APA (American Psychological Association) Style guidelines. The reference consists of scholarly literature references (80% primary sources and 20% secondary sources). Primary sources include journals, research reports, and conference papers. Secondary sources include books, theses, dissertations, and internet sources. It is recommended to use the Mendeley reference manager application for citation purposes.

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