

Ellipse > Locating the foci, finding the normal and the tangent

Learning outcomes:

- I can locate the foci and construct tangents and normals to an ellipse.

By the end of the lesson I will be able to:

- Locate the foci of an ellipse
- Construct normals to an ellipse
- Construct tangents to an ellipse
- Reflect the tangent to a new in-line point on the ellipse

Before studying this lesson I need to make sure that I know how to:

- Construct an ellipse using any method
- Bisect an angle
- Draw a perpendicular bisector

Self Assessment

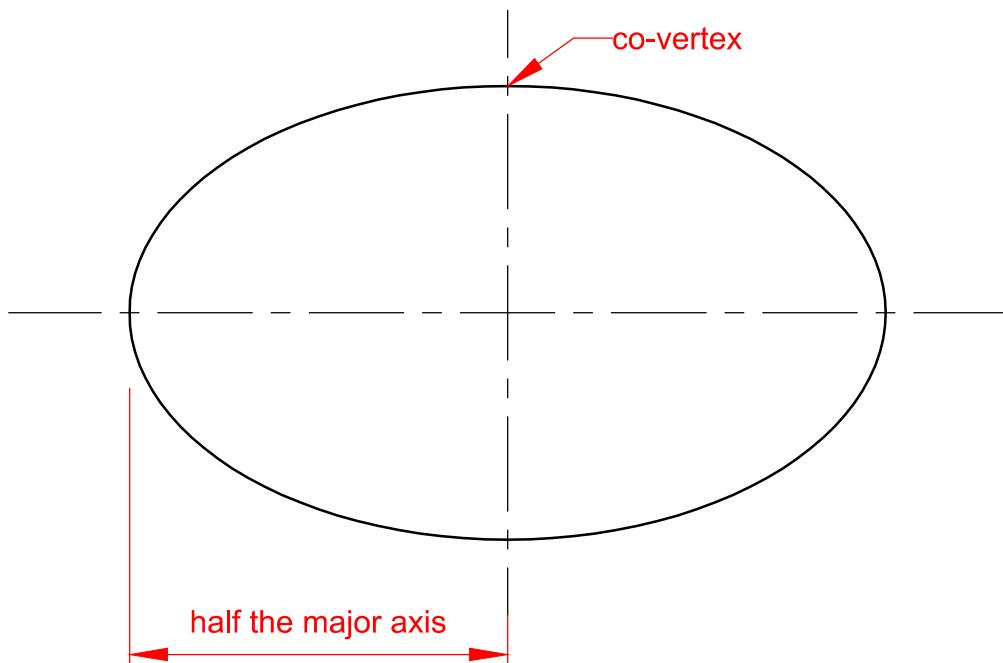
(to be done after the lesson)

	Well Achieved 	Achieved 	Almost There 	Need more Effort 
I can construct an ellipse				
I can construct the normal to an ellipse				
I can construct the tangent to an ellipse				
I can apply the tangent of an ellipse to new designs and situations				

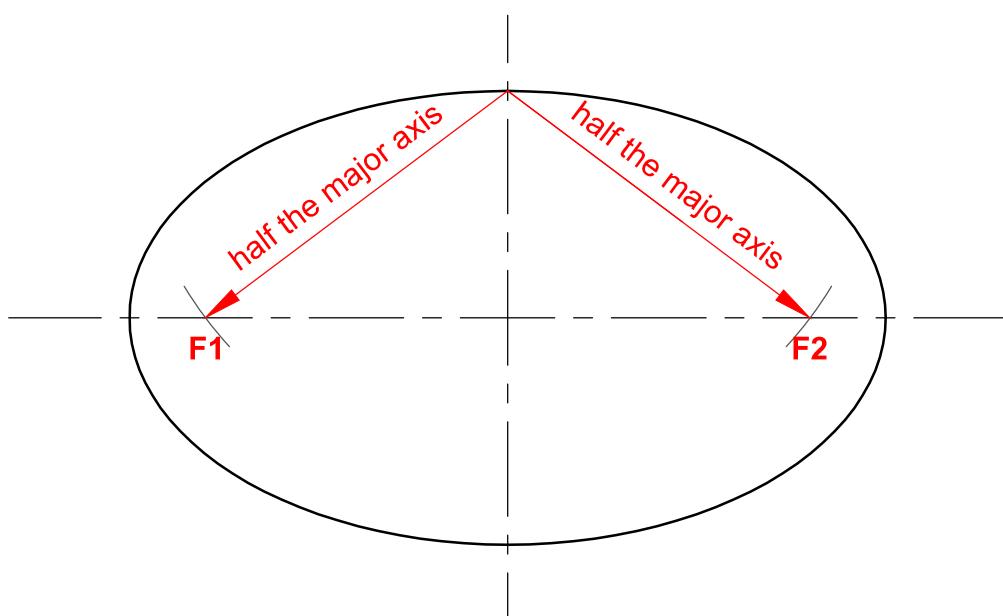
The Foci of an ellipse

The foci of an **Ellipse** can be found by drawing an arc from the minor axis onto the major axis. This radius must be equal to **half the major axis**. The following video illustrates the whole process of this tutorial: <https://youtu.be/PWfNtZUtoUA>

Using the following labeled parts on the ellipse,



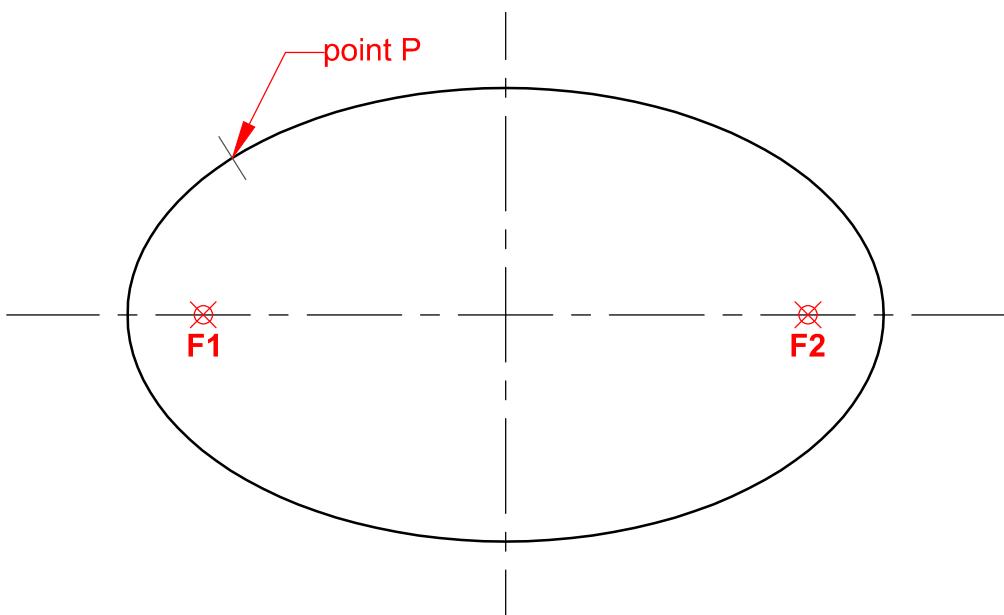
We can locate the foci of an ellipse using the radius as shown.



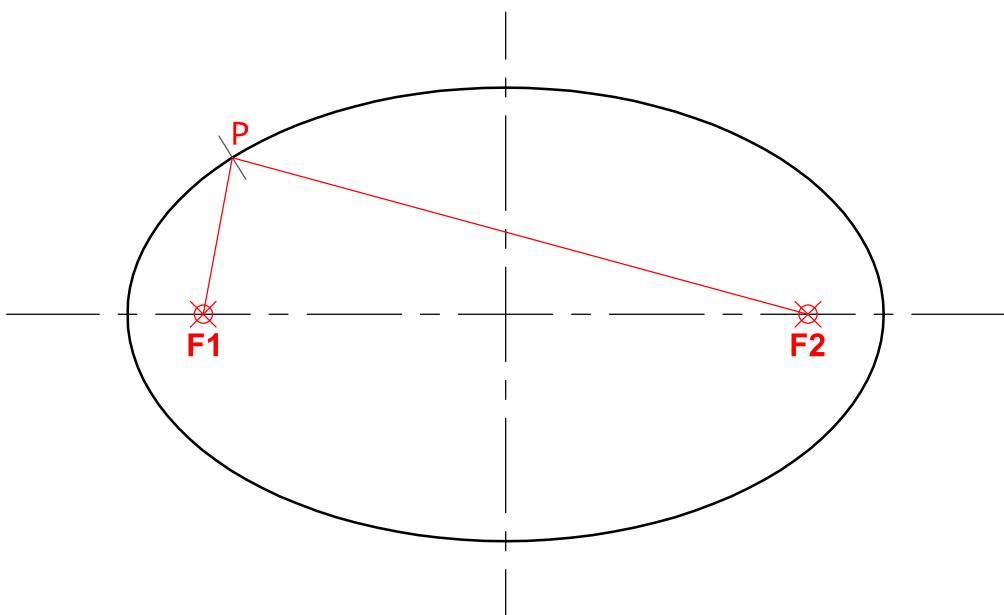
Constructing a normal to an ellipse

A normal to an **Ellipse** can be constructed by bisecting the angle between the two foci and the point of the normal. It is important to note that a normal is always at right angle to an ellipse or a circle.

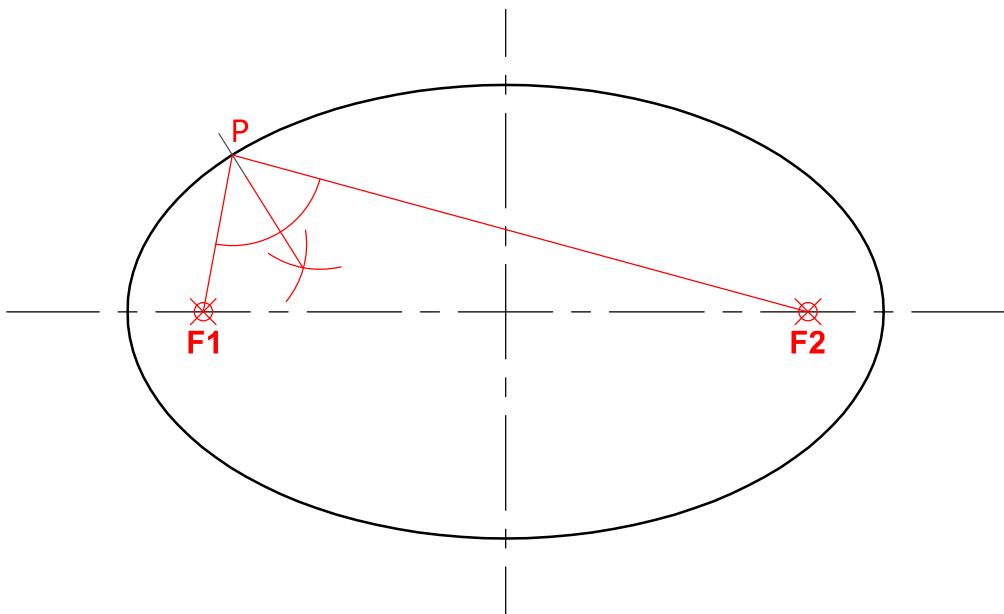
Let us take point **P** on the ellipse as the point where we need to construct the normal, and **F1** & **F2** as the foci;



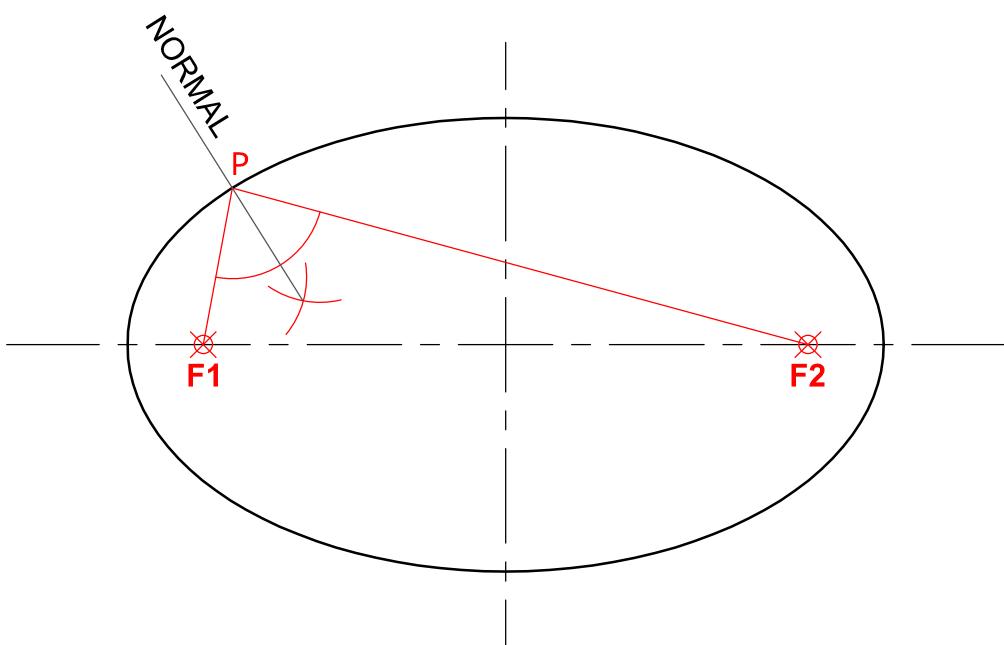
Step 1: Join **F1** & **F2** to point **P** .



Step 2: Bisect the angle at point **P**. The following video illustrates the bisection of an angle: <https://youtu.be/g7RjgxrEyLA>



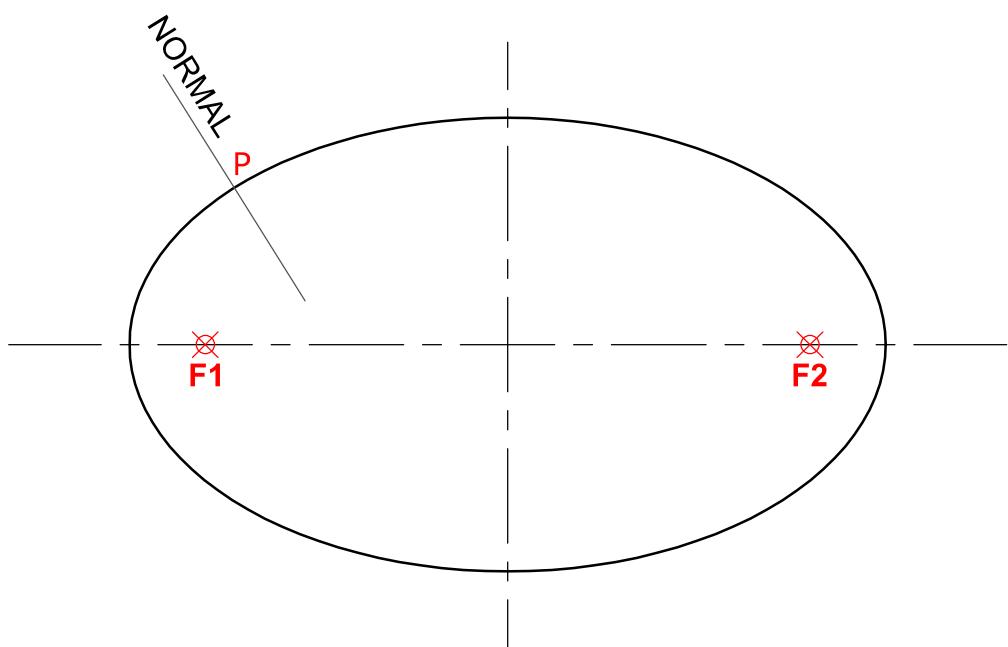
Step 4: The line bisecting the angle is the **Normal**.



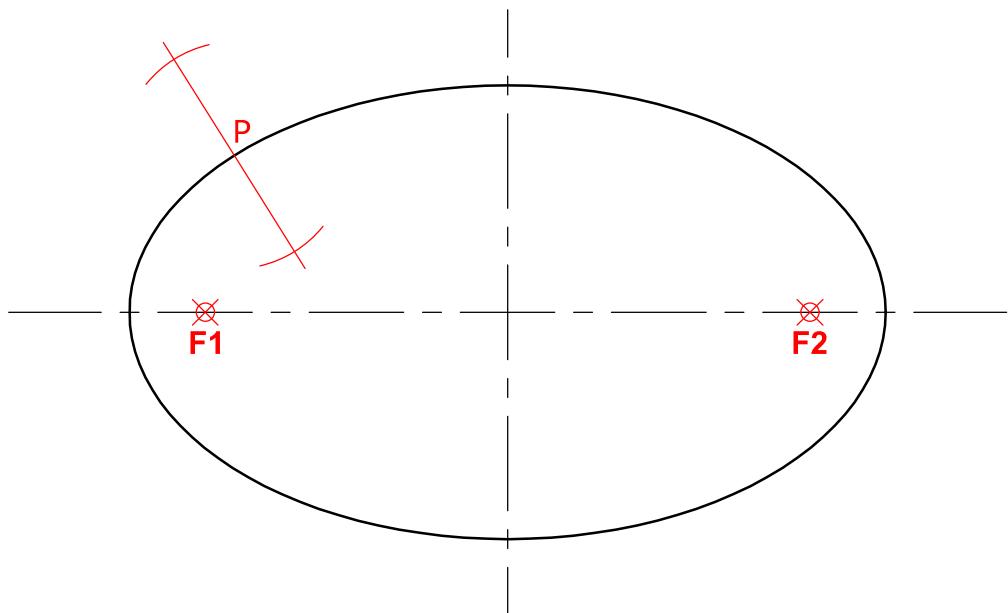
Constructing a tangent to an ellipse

A tangent to an **Ellipse** can be constructed by erecting a perpendicular to the normal.

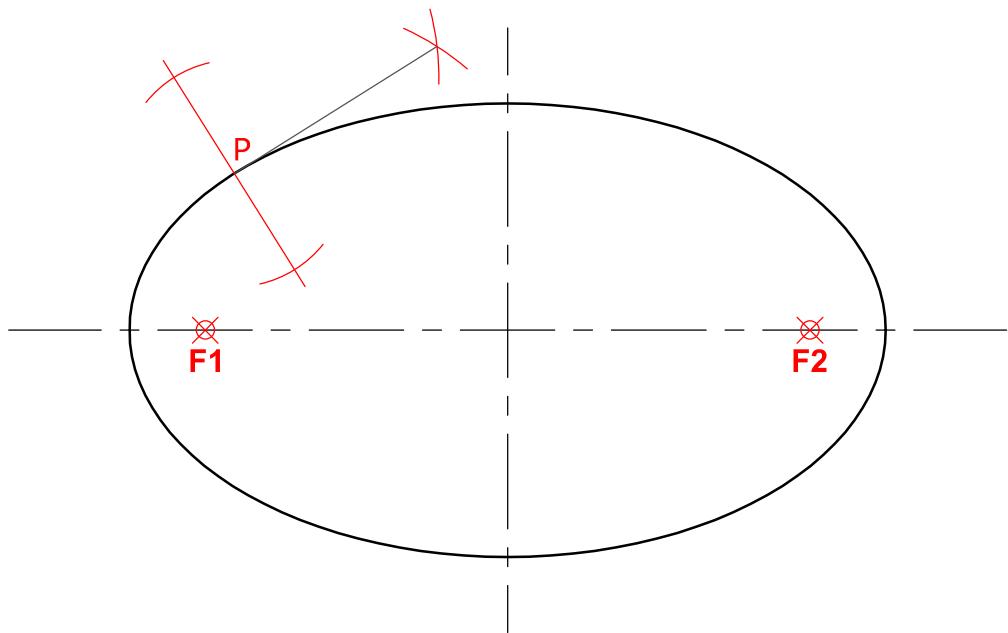
Let us take point **P** and the following normal on the ellipse to construct the tangent;



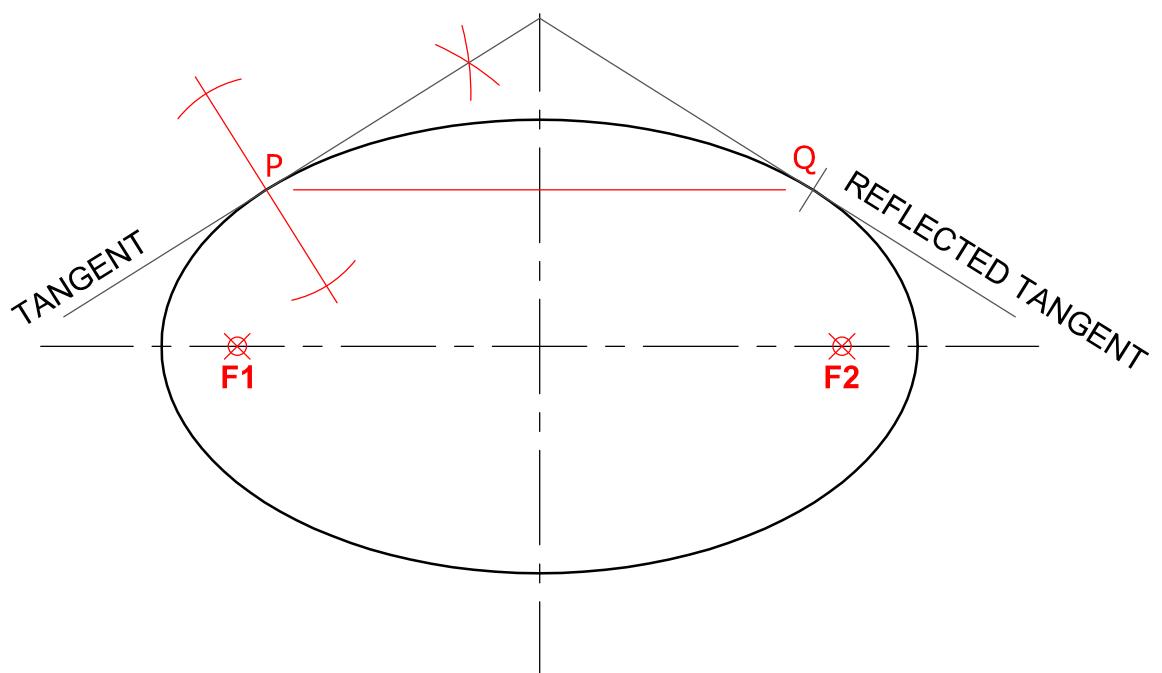
Step 1: Draw two equal arcs on the normal.



Step 2: Erect a perpendicular from point P using the two arcs. The following video illustrates how to erect a perpendicular:
<https://youtu.be/4TcJuM3X0LI>



Step 3: Extend the **Tangent**. If point Q is in line to point P, you can also reflect it and create some interesting designs.



Note: You can use this method to draw a tangent on any point on the ellipse.