Learning Outcomes - Students should be able to:

- Construct Standard Cycloids from given data
- Construct a tangent at a point on a cycloid.

Figure 1 shows an image of a racing bicycle. The tyres are inflated through a valve located on the rim of the wheel. A circle and a line representing the wheel and the ground are displayed in Figure 2. Point 'P' represents the valve on the wheel.

Plot the locus of point P as the circle rolls along the line for one complete revolution.

Figure 1 - Racing Bicycle

A cycloid is the path traced out by a _____ on the circumference of a circle as it rolls along a fixed _____ _____ without slipping.

Figure 2

The Roman architect Vitruvius developed machines for measuring distance, one such machine was an Odometer. The diameter of a chariot wheel was 4 feet. If a mark is placed on a wheel where it touches the ground, and the chariot then moves until the mark comes to the ground again, the chariot will have moved 12.6 feet. A device was attached to the axle of the chariot such that when a wheel made one revolution, a drum with 400 teeth on it moved round one notch. A complete rotation of the drum was equivalent to a motion of 400(12.6)= 5,040 feet by the chariot. At this point the device dropped a stone into a bronze bowl, 5040 feet was one Roman mile.

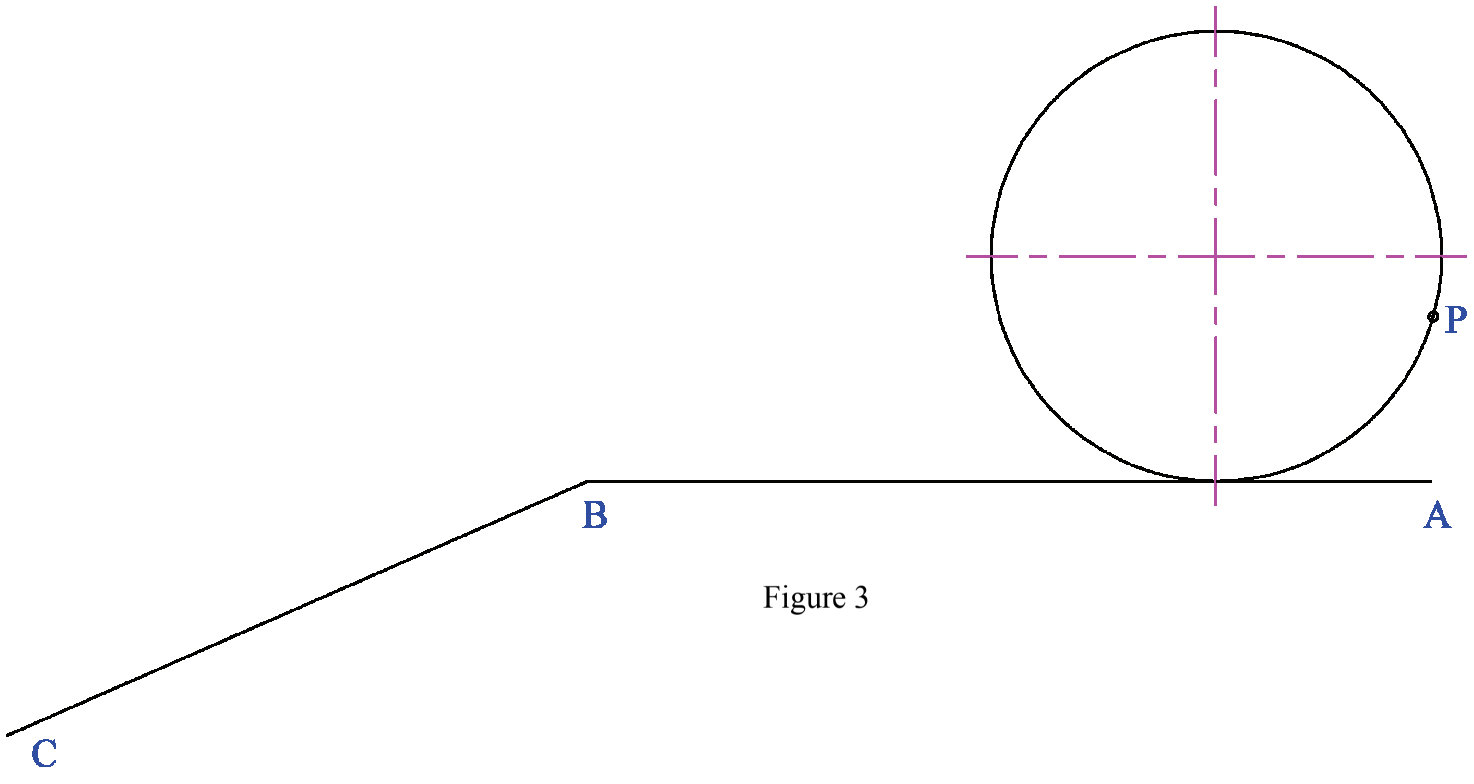


Figure 3

Figure 3 represents the wheel of a Roman chariot. The lines AB and BC represent the ground on which the chariot is travelling.

Plot the locus of point P as the circle rolls along AB and BC, without slipping, until point P comes in contact with the line BC.

TECHNOLOGY SUBJECTS SUPPORT SERVICE

DYNAMIC MECHANISMS

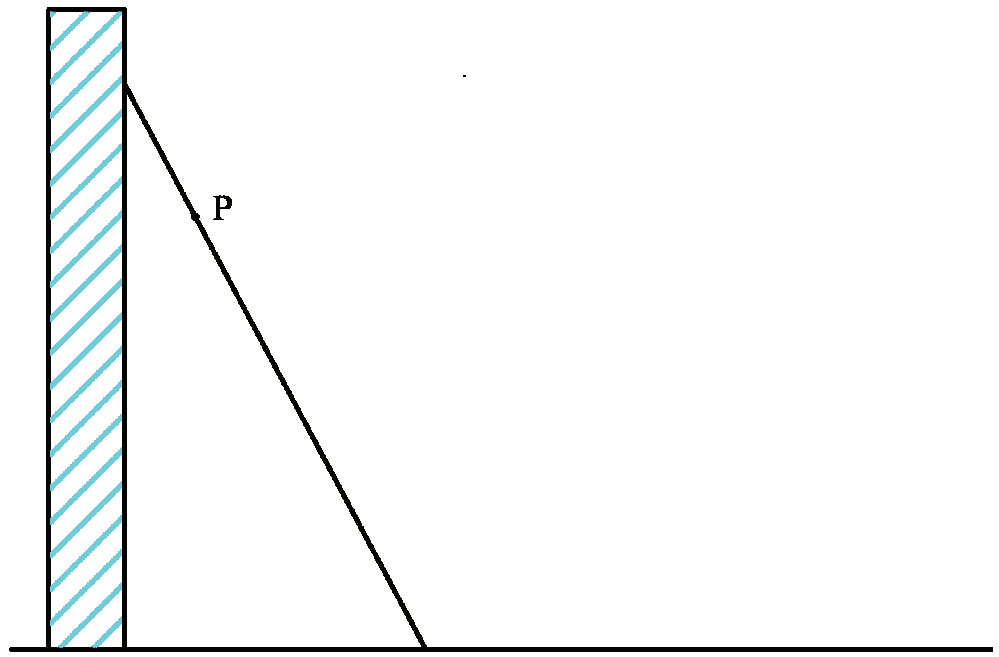
CYCLOIDS

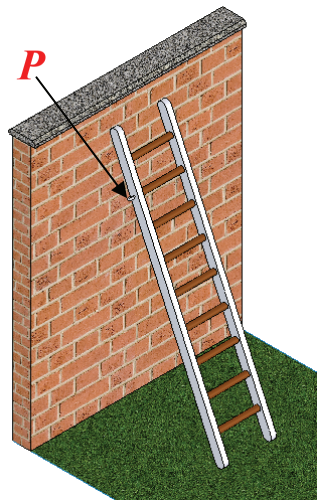
NAME: _____ **DATE:** _____

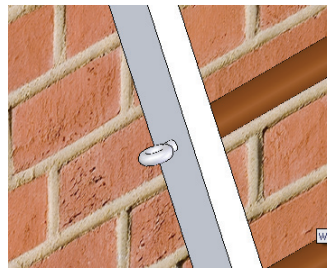
Learning Outcomes - Students should be able to:

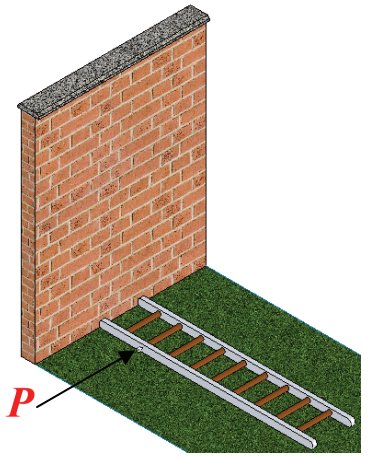
- Construct the locus of a point defined by the movement of a line relative to another line
- Construct an ellipse using a trammel

A ladder is shown leaning against a brick wall. An eyelet for attaching a safety rope is labelled as point ***P*** on the ladder. If the ladder were to slide down the wall and come to a rest on the ground as indicated, plot the locus of the point ***P*** for this movement.







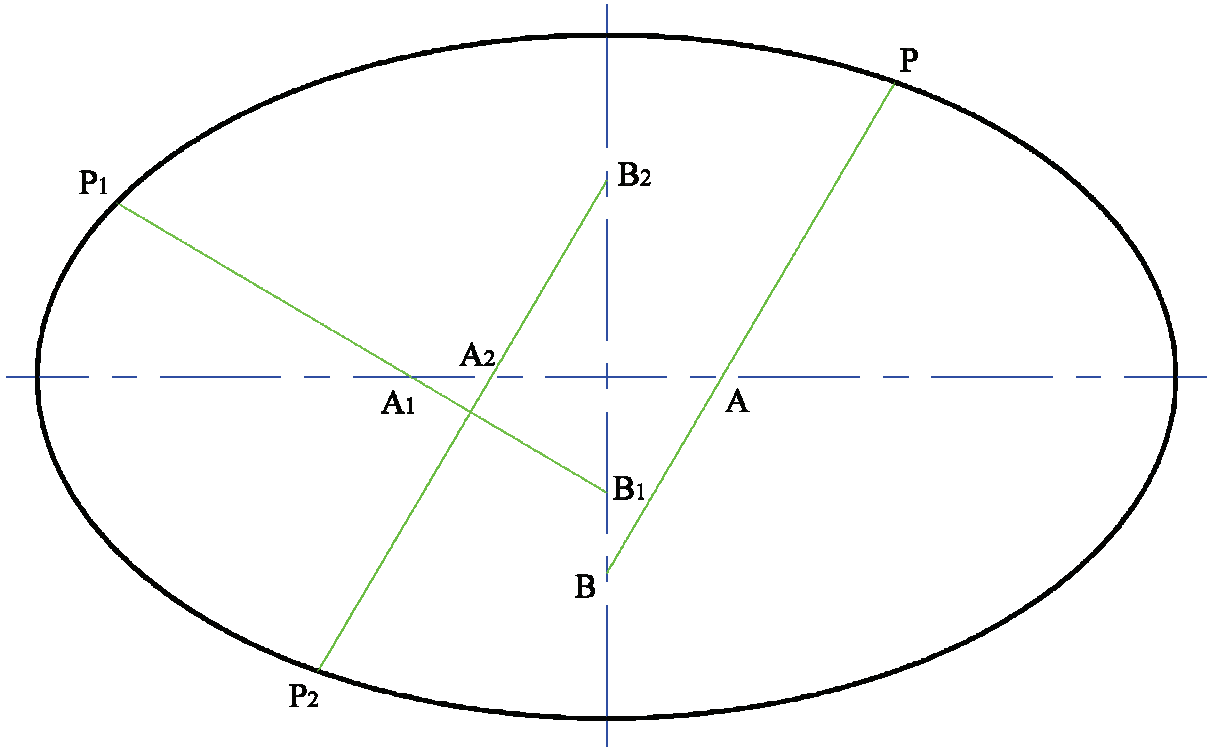


A gardener wishes to mark out an elliptical shaped flowerbed similar to the one in the photograph across. The gardener will use a trammel to mark out the curve.

The major and minor axes are 1.5m and 1.2m respectively. To a scale of 1:10 mark out the ellipse using a trammel on the centrelines drawn below.

Shown below is an ellipse with major and minor axes of 150mm and 90mm, respectively. The line PB is equal in length to half the major axis and is positioned with P on the curve and B on the minor axis. A is the point where the line intersects the major axis.

The measurements PA and PB are recorded in the table across. Fill in the remaining measurements in the table. Do you notice any pattern emerging? What can we conclude from this information?



PA	45	PB	75
P_1A_1		P_1B_1	
P_2A_2		P_2B_2	

TECHNOLOGY SUBJECTS SUPPORT SERVICE

DYNAMIC MECHANISMS

LOCI 1

NAME: _____ **DATE:** _____

Learning Outcomes - Students should be able to:

- Construct the locus of a point in a link mechanism

An interactive toy for a child is pictured in Figure 1. The toy incorporates a mechanism which causes the front loader to raise and lower when the back wheels rotate. Figure 2 shows the front loader in its lowest position. The line diagram for the mechanism is shown below.

(a) Draw the front loader when it is in a fully extended position.
(b) Draw the locus of point P for this movement

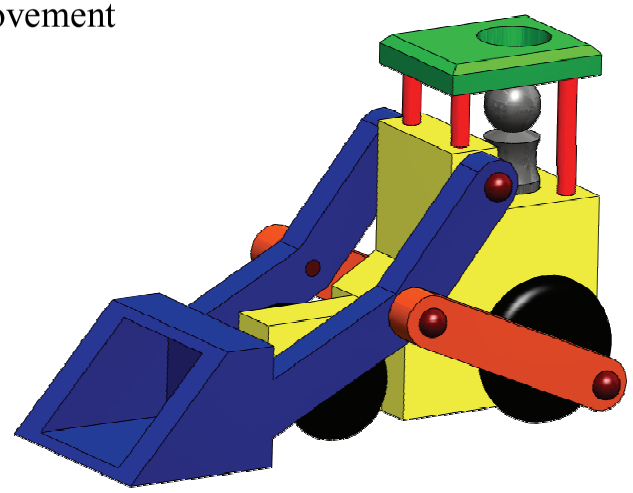


Figure 1 - Interactive Toy

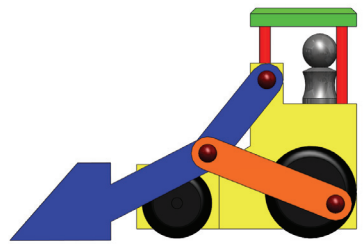


Figure 2 - Loader in lowest position

Daily exercise is an essential component of a healthy lifestyle. Figure 3 displays an image of a ski exercise machine commonly found in the gym. A line diagram representing the movement of the ski machine is captured in figure 4. Point P represents the front of the foot platform and is fixed on BC. Points A and O are fixed, B is a pin joint and C is constrained to travel about O

Plot the locus of point P for the movement of the mechanism.

Figure 3 - Elliptical Exercise Machine

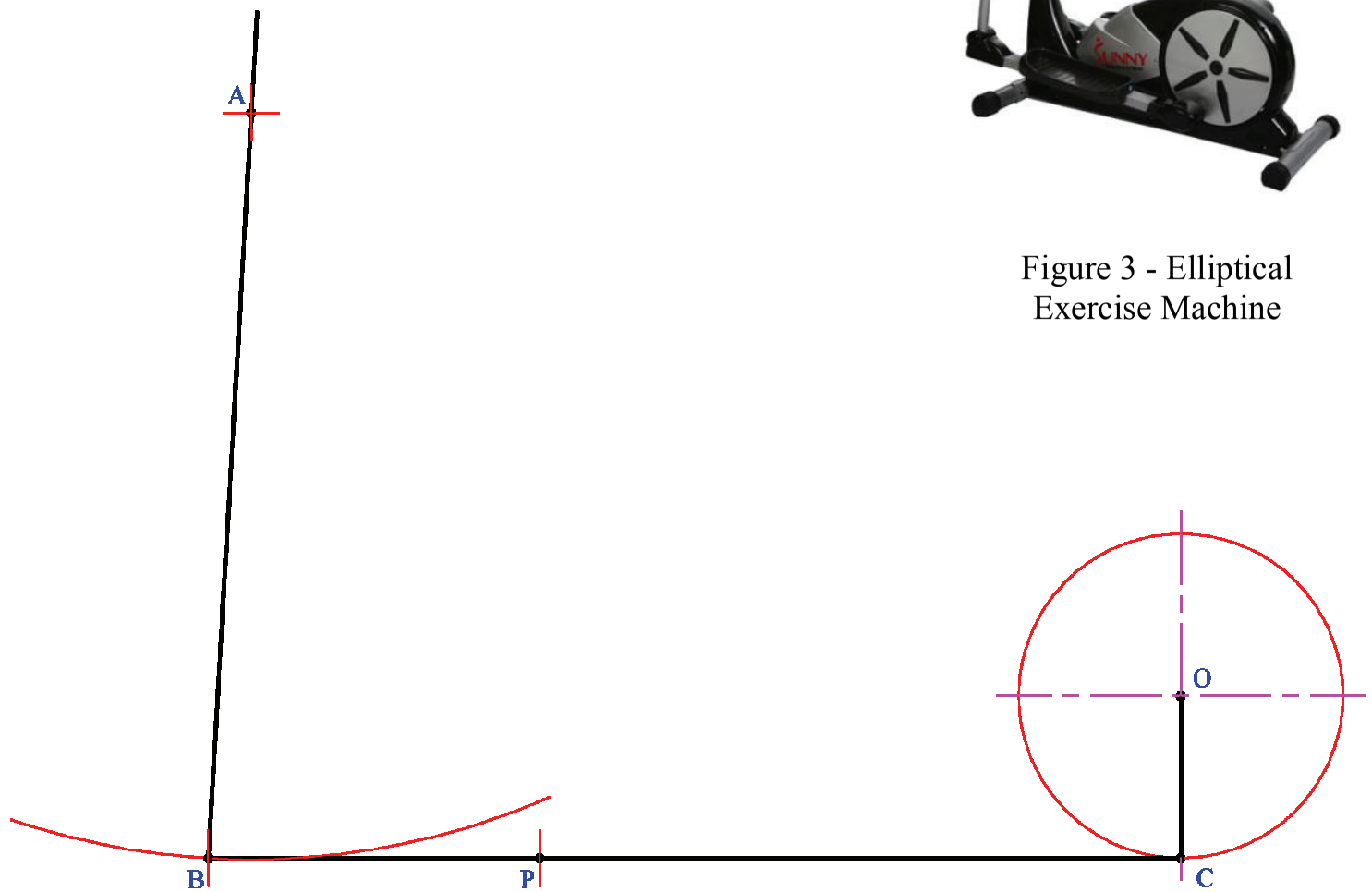


Figure 4

TECHNOLOGY SUBJECTS SUPPORT SERVICE

DYNAMIC MECHANISMS

LOCI 2

NAME: _____ **DATE:** _____

Learning Outcomes - Students should be able to:

- Construct cam profiles and displacement diagrams
- Construct radial plate cams of given uniform velocity, simple harmonic motion, uniform acceleration and retardation to in-line knife edge followers.

Figure 1, across, shows a pinball machine commonly found in amusement arcades. A cam and follower mechanism is used to release the ball to the player.
When a coin is inserted a cam rotates anticlockwise and the follower mechanism raises the ball to the launch pad in front of the plunger. The ball is held momentarily for the plunger to make contact with it; then the mechanism drops back down to receive the next ball.

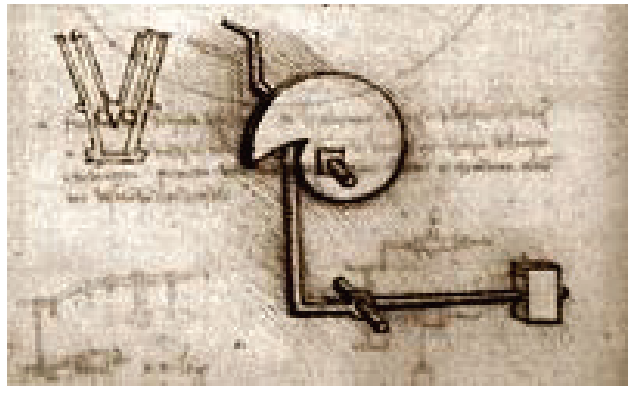
(a) Plot the displacement diagram for the cam given that it imparts the following motion on the follower;

0° to 180° rise of 30mm with uniform acceleration and retardation
180° to 270° dwell
270° to 360° fall of 30mm with uniform velocity

The nearest approach of the follower to the cam centre is 18mm.

(b) Construct the corresponding cam profile to impart this motion

Figure 1 - Pinball Machine



The original Da Vinci sketch of the cam operated hammer. It is believed that he developed the idea of an automatic hammer to help blacksmiths, who used repeated blows of a hammer in the process of forging steel.

Figure 2 - Cam operated Sledge Hammer

Shown in figure 2 is a model of a cam operated sledge hammer based on an idea by Leonardo Da Vinci. The cam, based on an Archimedean spiral, is designed to raise the hammer slowly and then drop it from a height.

Construct the cam profile given a minimum radius vector of 12mm and a maximum radius vector of 60mm.

TECHNOLOGY SUBJECTS SUPPORT SERVICE

DYNAMIC MECHANISMS

CAMS 2

NAME: _____ **DATE:** _____