

Group: _____ Present: _____

1. Cycloid - the path of a point on the perimeter of a circle rolling along a plane. General equation: $x = a(t - \sin(t))$, $y = a(1 - \cos(t))$, where a is the radius of the rolling circle.

With your calculator in RADIAN and PARAMETRIC mode, graph $X_{1T} = T - \sin(T)$, $Y_{1T} = 1 - \cos(T)$, using the window $T \in [0, 2\pi, \frac{\pi}{24}]$, $X \in [0, 13, 1]$, $Y \in [0, 4, 1]$. Use ZSQUARE after the graph is sketched. The curve shown is the path traced by a point on a rolling circle. Change TMAX to 4π to see the path for two revolutions of the circle.

Sketch what you see here:

Spirograph curves

2. Hypocycloid - the path of a point on the perimeter of a circle which is rolling around the inside of a fixed circle. General equation: $x = (a - b)\cos(t) + b\cos(\frac{a-b}{b}t)$, $y = (a - b)\sin(t) - b\sin(\frac{a-b}{b}t)$, where a is the radius of the fixed circle, and b is the radius of the rolling circle.

Graph $X_{1T} = 1.5\cos(T) + 0.5\cos(3T)$, $Y_{1T} = 1.5\sin(T) - 0.5\sin(3T)$ for $T \in [0, 2\pi, \frac{\pi}{24}]$ in the ZDECIMAL window. (Here $a = 2$, $b = 0.5$)

Next graph $X_{1T} = \cos(T) + 1.5\cos(\frac{2T}{3})$, $Y_{1T} = \sin(T) - 1.5\sin(\frac{2T}{3})$ for $T \in [0, 6\pi, \frac{\pi}{12}]$. (Here $a = 2$, $b = 1.5$, and the small circle needs to go around the inside of the fixed circle three times to close the curve.)

Sketch both curves here:

3. Epicycloid - the path of a point on the perimeter of a circle which is rolling around the outside of a fixed circle. General equation: $x = (a + b)\cos(t) - b\cos(\frac{a+b}{b}t)$, $y = (a + b)\sin(t) - b\sin(\frac{a+b}{b}t)$, where a is the radius of the fixed circle, and b is the radius of the rolling circle.

Graph $X_{1T} = 2\cos(T) - 0.5\cos(4T)$, $Y_{1T} = 2\sin(T) - 0.5\sin(4T)$ for $T \in [0, 2\pi, \frac{\pi}{24}]$ in the ZDECIMAL window. (Here $a = 1.5$, $b = 0.5$)

Next graph $X_{1T} = 2.2\cos(T) - 0.8\cos(\frac{11T}{4})$, $Y_{1T} = 2.2\sin(T) - 0.8\sin(\frac{11T}{4})$ for $T \in [0, 8\pi, \frac{\pi}{12}]$. (Here $a = 1.4$, $b = 0.8$, and the small circle needs to go around the outside of the fixed circle four times to close the curve.)

Sketch both curves here: