

10/15 HW

$$x = \cos 3\theta \quad y = \sin 2\theta$$

✓ This gets slope = 0
b/c is numerator
of slope equation

$$\frac{dy}{dx} = \frac{2 \cos 2\theta}{3 \sin 3\theta}$$

$$2 \cos 2\theta = 0$$

$$\cos 2\theta = 0$$

4π b/c dividing
by 2
↓

$$2\theta = \cos^{-1}(0)$$

$$\theta = \frac{\cos^{-1}(0)}{2}$$

cos = 0 from 0 - 4π @

$$\pi/2, 3\pi/2, 5\pi/2, 7\pi/2$$

so after dividing by 2,

$$\theta = \pi/4, 3\pi/4, 5\pi/4, 7\pi/4$$

✓ This gets slope = ∞
b/c is denom. of
slope eqn

6π b/c dividing
by 3
↓

$$3 \sin 3\theta = 0$$

$$\sin 3\theta = 0$$

$$\theta = \frac{\sin^{-1}(0)}{3}$$

sin = 0 from 0 - 6π @

$$0, \pi, 2\pi, 3\pi, 4\pi, 5\pi, 6\pi$$

so after dividing by 3,

$$\theta = 0, \pi/3, 2\pi/3, \pi, 4\pi/3, 5\pi/3, 2\pi$$

These get the same

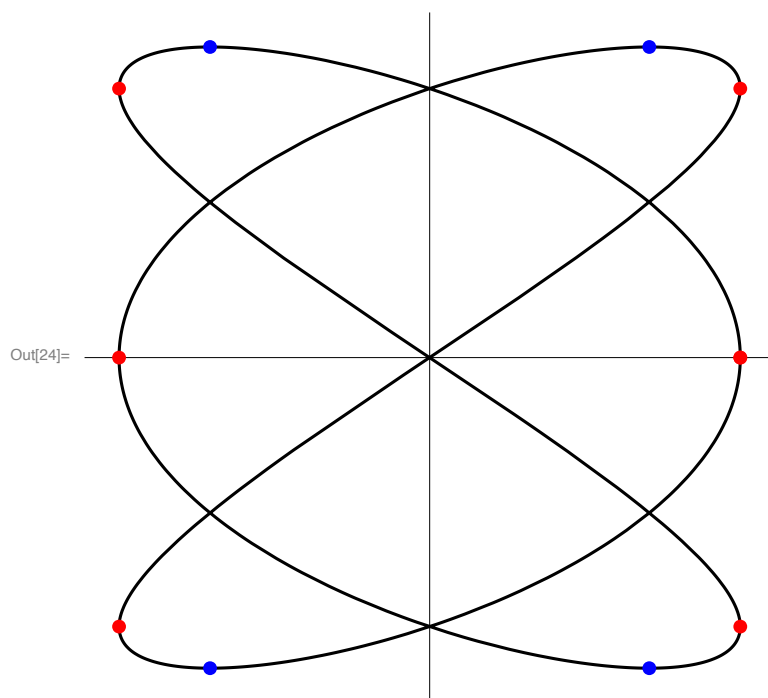
point, so take out 2π to make it easier

$$\theta = \pi/4, 3\pi/4, 5\pi/4, 7\pi/4, 0, \pi/3, 2\pi/3, \pi, 4\pi/3, 5\pi/3$$

```

In[24]:= ParametricPlot[
  {Cos[3 x], Sin[2 x]},
  {x, 0, 2 Pi},
  PlotStyle -> Black,
  Ticks -> None,
  Epilog -> {
    PointSize@0.02,
    Blue,
    Point[{Cos[3 #], Sin[2 #]}] & /@ {Pi/4, 3 Pi/4, 5 Pi/4, 7 Pi/4},
    Red,
    Point[{Cos[3 #], Sin[2 #]}] & /@ {0, Pi/3, 2 Pi/3, Pi, 4 Pi/3, 5 Pi/3, 2 Pi}
  }
]

```

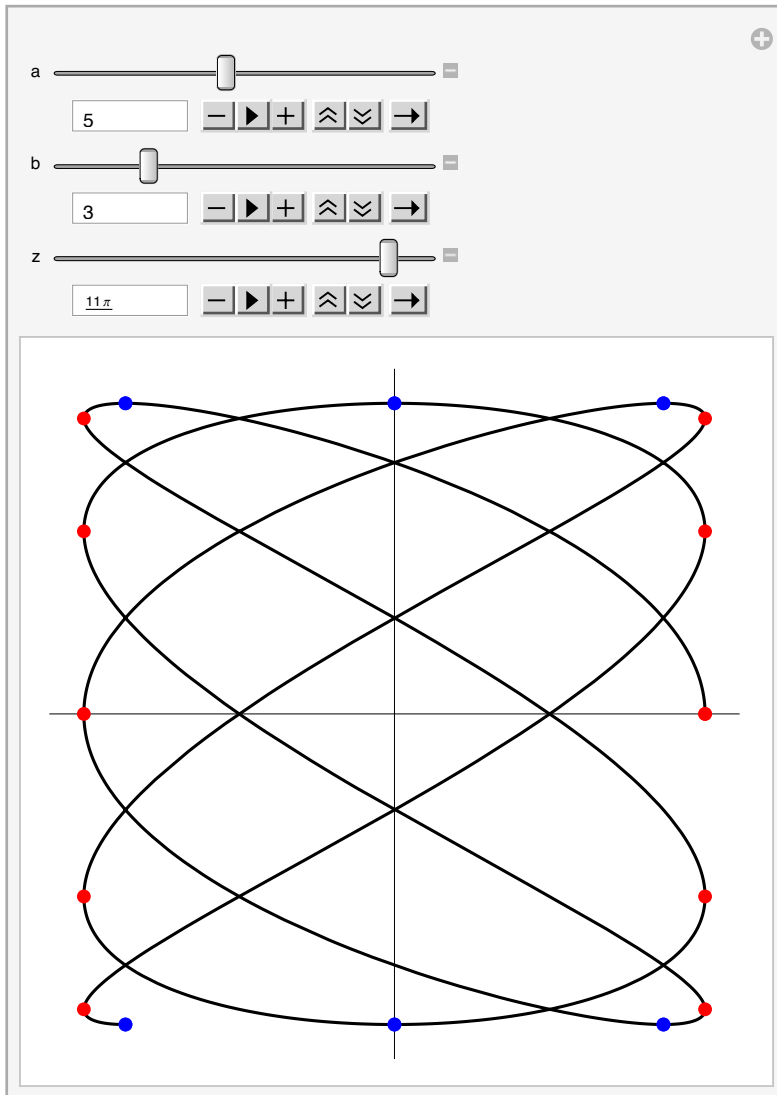


```

In[45]:= Manipulate[
  With[
    {zeroslope =
      Flatten @ Values[
        NSolve[D[Sin[b x], x] == 0 && 0 ≤ x ≤ 4 Pi,
          x
        ]
      ],
    infslope = Flatten @ Values[
      NSolve[D[Cos[a x], x] == 0 && 0 ≤ x ≤ 2 Pi,
        x
      ]
    ]
  ],
  ParametricPlot[
    {Cos[a x], Sin[b x]},
    {x, 0, z},
    PlotStyle → Black,
    Ticks → None,
    Epilog → {
      PointSize@0.02,
      Blue,
      Table[
        Point[{
          {Cos[a zeroslope[[n]]], Sin[b zeroslope[[n]]]}
        ]],
        {n, 1, Length[zeroslope]}
      ],
      Red,
      Table[
        Point[{
          {Cos[a infslope[[n]]], Sin[b infslope[[n]]]}
        ]],
        {n, 1, Length[infslope]}
      ]
    }
  ],
  {{a, 5}, 1, 10, Appearance → Labeled},
  {{b, 3}, 1, 10},
  {{z, 11 Pi/6}, 0, 2 Pi}
]

```

Out[45]=



```

In[44]:= Manipulate[
  With[
    {zeroslope =
      Flatten @ Values[
        NSolve[D[Sin[x] Cos[a x/b], x] == 0 && 0 ≤ x ≤ 8 Pi,
          x
        ]
      ],
    infslope = Flatten @ Values[
      NSolve[D[Cos[x] Cos[a x/b], x] == 0 && 0 ≤ x ≤ 8 Pi,
        x
      ]
    ]
  ],
],

```

```

ParametricPlot[
  {Cos[x] Cos[a x / b], Sin[x] Cos[a x / b]},
  {x, 0, z},
  PlotStyle -> Black,
  Ticks -> None,
  Epilog -> {
    PointSize@0.02,
    Blue,
    Table[
      Point[{
        {Cos[zeroslope[[n]]] Cos[a zeroslope[[n]] / b],
        Sin[zeroslope[[n]]] Cos[a zeroslope[[n]] / b]}
      ]],
      {n, 1, Length[zeroslope]}
    ],
    Red,
    Table[
      Point[{
        {Cos[infslope[[n]]] Cos[a infslope[[n]] / b],
        Sin[infslope[[n]]] Cos[a infslope[[n]] / b]}
      ]],
      {n, 1, Length[infslope]}
    ]
  ]
],
{{a, 7}, 1, 10},
{{b, 4}, 1, 10},
{{z, 8 Pi}, 0, 8 Pi}
]

```

Out[44]=

