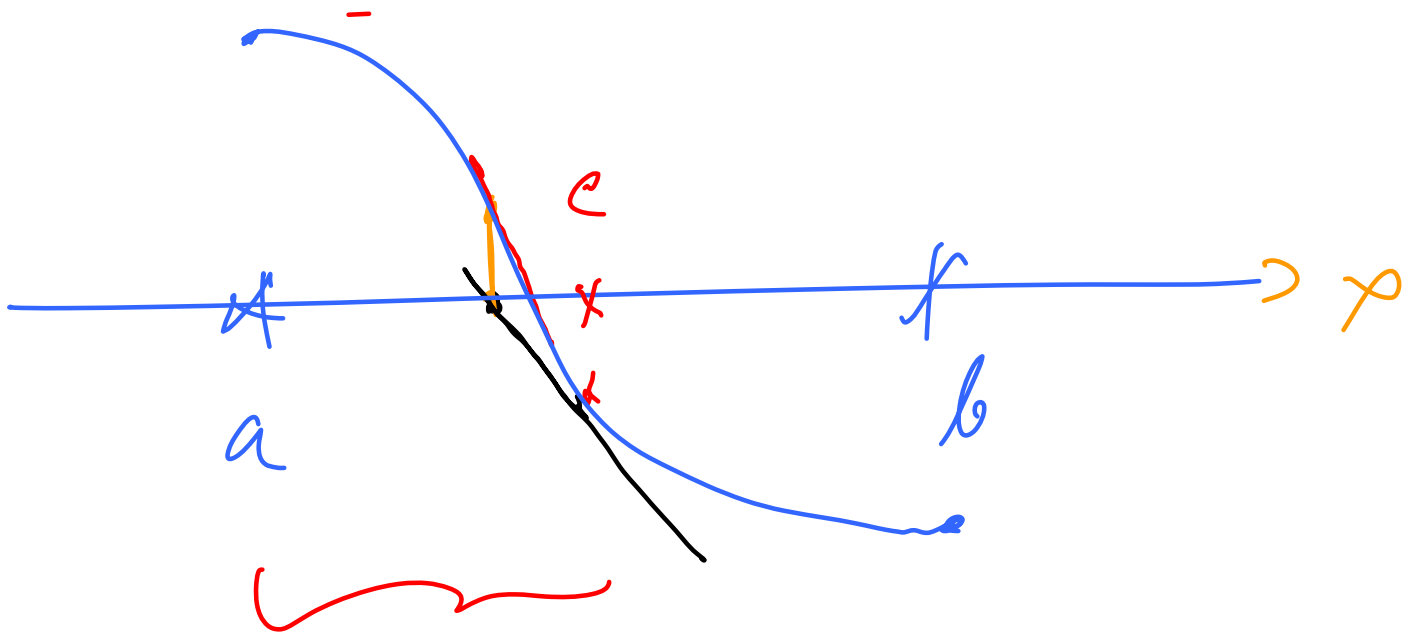
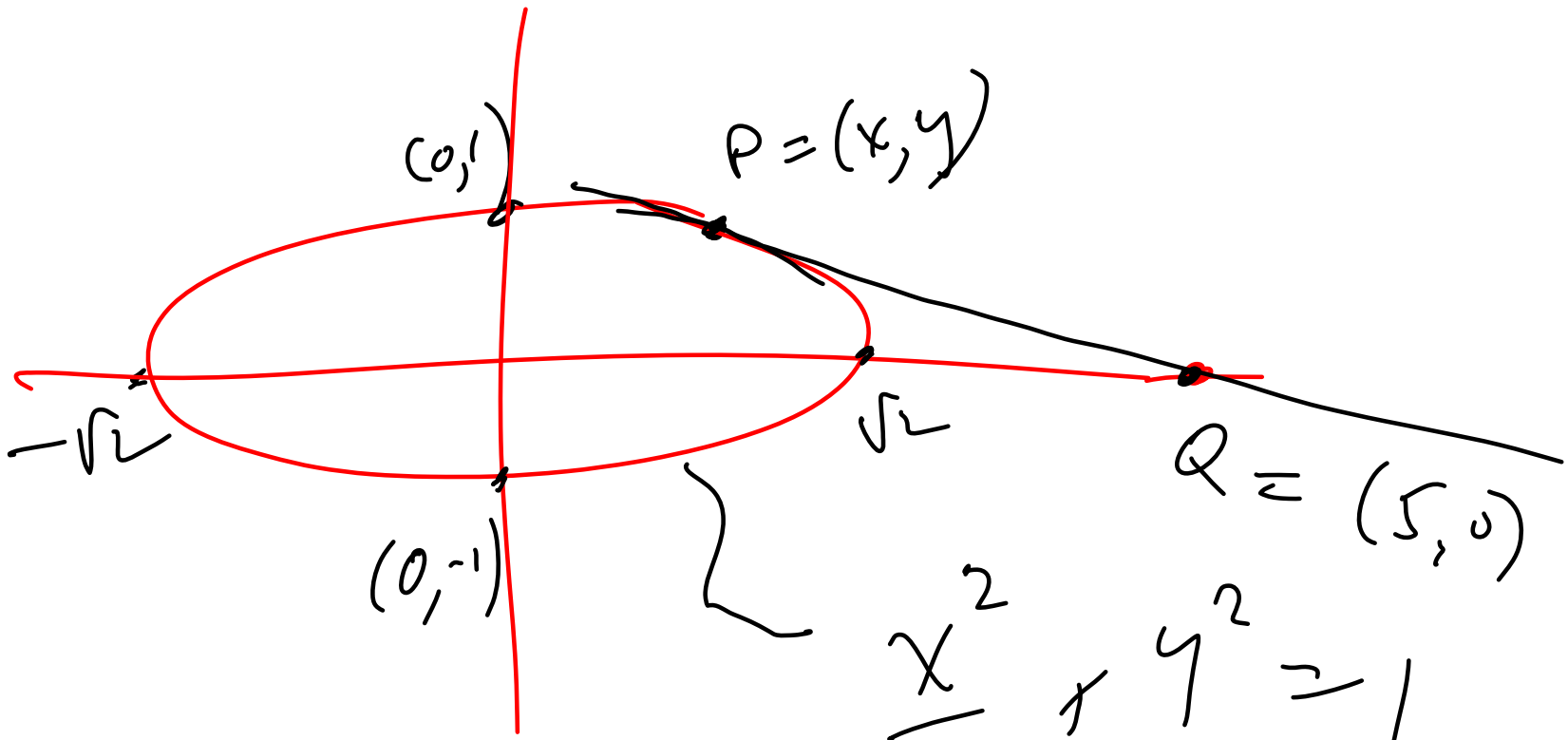
IVT

$y = 3x - 4$



$$\lim_{x \to 0} \frac{e^x - 1}{x^2 \sin\left(\frac{1}{x}\right) + 2x} = \lim_{h \to 0} \frac{e^x - 1}{x\left[x \sin\frac{1}{x} + 2\right]}$$

$$= 1/2$$



$$\frac{x^2}{2} + y^2 = 1$$

$$y^2 = 1 - x^2/2$$

$$y = \sqrt{1 - x^2/2}$$

$$\frac{-\sqrt{1-\frac{x^2}{2}}}{5-x} = \frac{\frac{1}{2}(-x)}{\sqrt{1-x^2/2}}$$

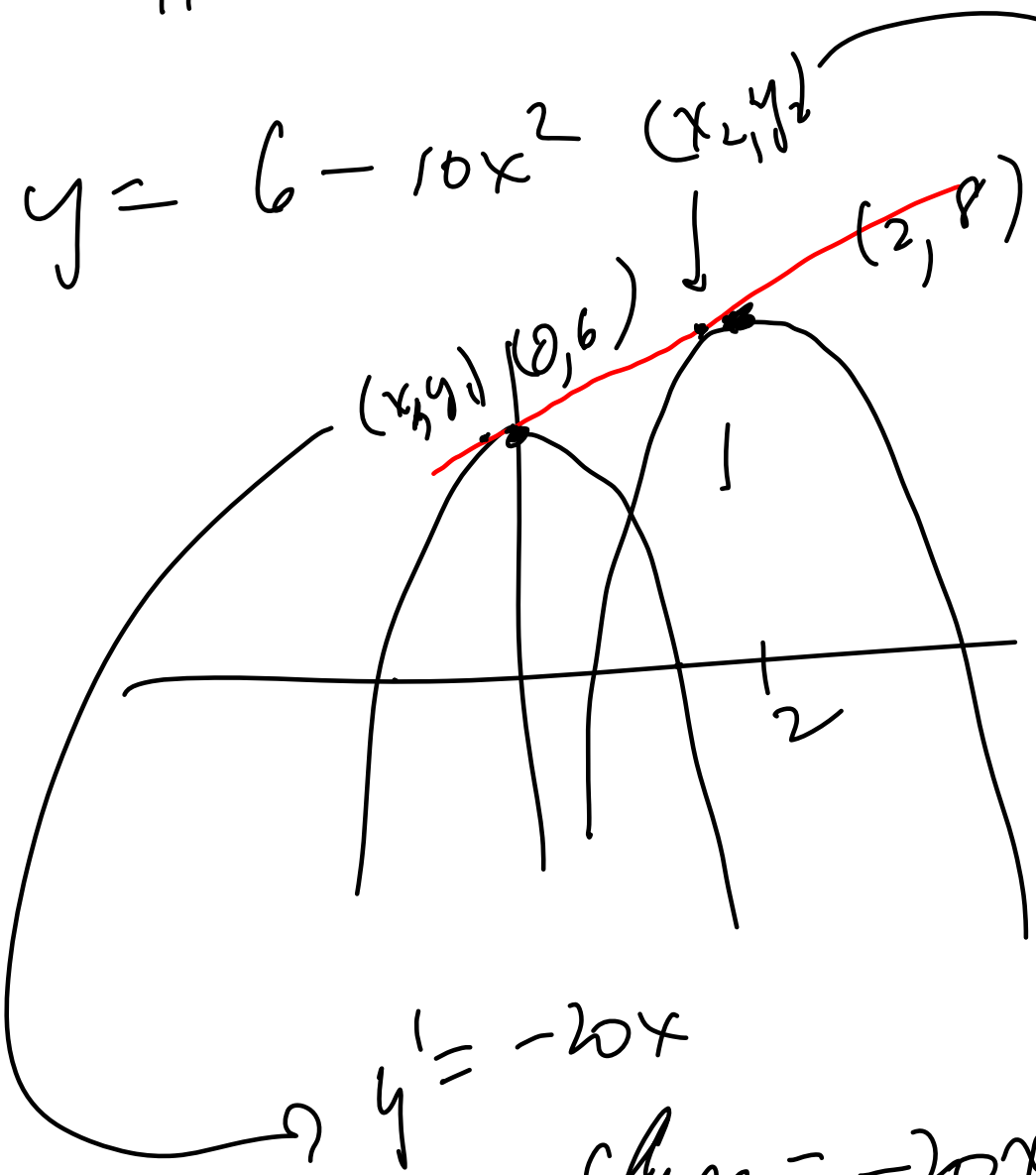
$\frac{d}{dx} e^x$ when $x = 0$ is

$$\lim_{h \to 0} \frac{e^h - e^0}{h} = 1$$

So $\frac{e^x - 1}{x} \to 1$

$y_1 = 6 - 10x_1^2$ $y_2 = 8 - (x_2 - 2)^2$

$y = 6 - 10x^2$ (x_2, y_2) $y = 8 - (x-2)^2$



$y' = -20x$

slope $= -20x_1$

slope $y' = -2(x-2)$

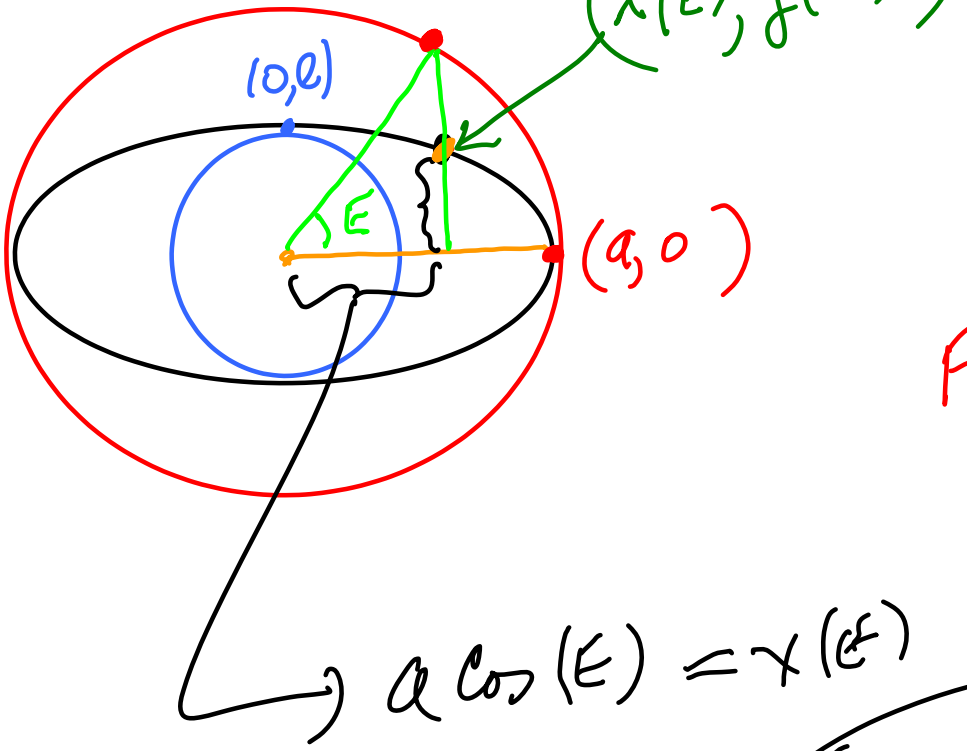
at x_2 slope is

$-2(x_2 - 2)$

slope $= \frac{y_2 - y_1}{x_2 - x_1}$

planet or satellite

10/24



ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

E = eccentric anomaly

(red, blue are circles
black is ellipse)

Find $x(E), y(E)$

$a\cos(E) = x(E)$

$$\frac{(a\cos E)^2}{a^2} + \frac{y^2}{b^2} = 1$$

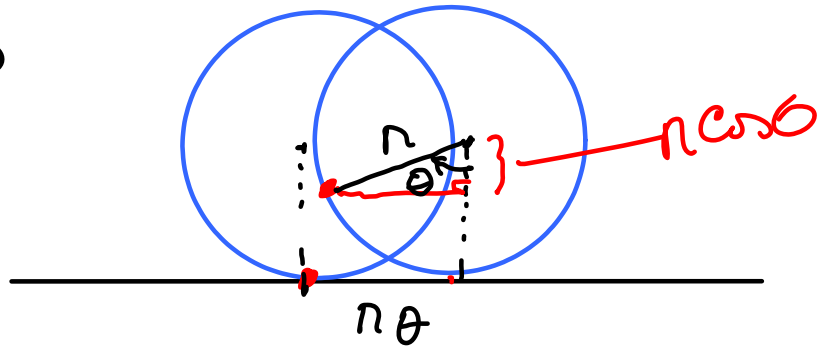
$$\frac{y^2}{b^2} = 1 - \cos^2 E = \sin^2 E \qquad y = \pm b \sin E$$

So $y(E) = b \sin E$

E is a "parameter"

the ellipse is a parametric curve

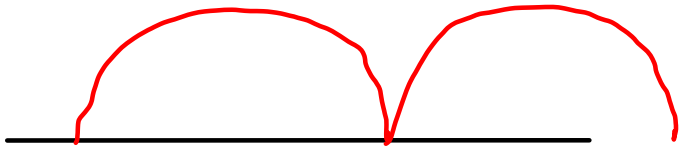
CYCLOID



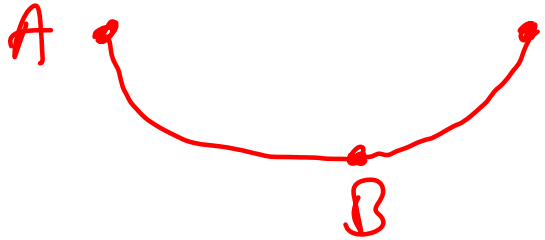
$$y = r - r\cos\theta$$

$$x = r\theta - r\sin\theta$$

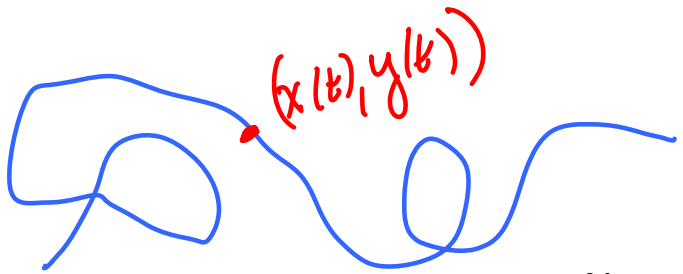
Trace red point



FLIP



FASTEST FROM A TO B



t = time

a "curve" not a graph.

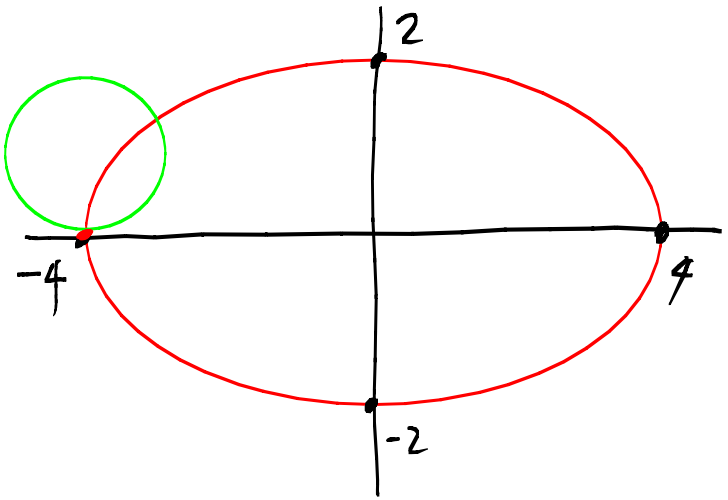
$x_1 = 4\sin t \quad y_1 = 2\cos t$ (x_1, y_1) parametrized curve

$x_2 = -4 + \cos t \quad y_2 = 1 + \sin t$ (x_2, y_2) " "

What are these curves?

$$\left(\frac{x_1}{4}\right)^2 + \left(\frac{y_1}{2}\right)^2 = 1$$

$$(x_2 + 4)^2 + (y_2 - 1)^2 = 1$$



Do they intersect?

If parametrized curves represent particles at time t, Do they collide?

Reword: Is there a time t with $x_1 = x_2$ and $y_1 = y_2$?

① $4\sin t = -4 + \cos t$

② $2\cos t = 1 + \sin t$

$2\cos t - 1 = \sin t$

$4(2\cos t - 1) = -4 + \cos t$

$8\cos t - 4 = -4 + \cos t$

$8\cos t = \cos t$

$7\cos t = 0$

$\cos t = 0$

$4\sin t = -4$

$\sin t = -1$

$t = \frac{3\pi}{2} + k2\pi$

k integer