

$$1) \quad x = t + 2 \quad y = t^2 + 3$$

$$x - 2 = t$$

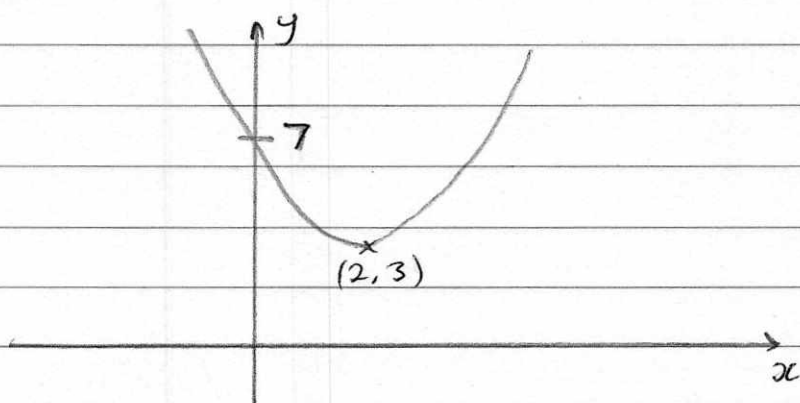
$$y = (x - 2)^2 + 3$$

b/ Crosses y when $x = 0$

$$y = (-2)^2 + 3$$

$$= 7$$

min point at $(2, 3)$



2a/ Crosses x when $y = 0$

$$0 = t^2 - 1$$

$$1 = t^2$$

$$t = \pm 1$$

$$x = 2(1) + 1$$

$$x = 2(-1) + 1$$

$$= 3$$

$$= -1$$

Crosses x when $y = 0$

$$0 = 2t + 1$$

$$-\frac{1}{2} = t$$

$$y = \left(-\frac{1}{2}\right)^2 - 1$$

$$= -\frac{3}{4}$$

$$(-1, 0) \quad (3, 0) \quad (0, -\frac{3}{4})$$

b/ $\frac{dy}{dt} = 2t$ $\frac{dx}{dt} = 2$

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{2t}{2} = t$$

3a/

$$x = \tan^2 t$$
$$\frac{dx}{dt} = 2 \tan t \sec^2 t$$

$$y = \cos t$$
$$\frac{dy}{dt} = -\sin t$$

$$\frac{dy}{dx} = \frac{-\sin t}{2 \tan t \sec^2 t}$$

$$= -\frac{1}{2} \sin t \cot t \cos^2 t$$

$$= -\frac{1}{2} \sin t \frac{\cos t}{\sin t} \cos^2 t$$

$$= -\frac{1}{2} \cos^3 t$$

b/

when $t = \frac{\pi}{4}$ $\frac{dy}{dx} = -\frac{1}{2} \left(\cos \frac{\pi}{4} \right)^3$

$$= -\frac{\sqrt{2}}{8}$$

$$y = -\frac{\sqrt{2}}{8} x + c$$

when $t = \frac{\pi}{4}$ $x = \left(\tan \frac{\pi}{4} \right)^2 = 1$

$$\frac{\sqrt{2}}{2} = -\frac{\sqrt{2}}{8} + c$$

$$y = \cos \frac{\pi}{4} = \frac{\sqrt{2}}{2}$$

$$c = \frac{5\sqrt{2}}{8}$$

$$y = -\frac{\sqrt{2}}{8} x + \frac{5\sqrt{2}}{8}$$

c/

$$1 + \tan^2 t = \sec^2 t$$

$$x = \tan^2 t$$

$$y = \cos t$$

$$y^2 = \cos^2 t$$

$$\frac{1}{y^2} = \sec^2 t$$

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

4a)

$$x = \sin^2 t$$

$$y = \sin 2t$$

$$\frac{dx}{dt} = 2 \sin t \cos t$$

$$\frac{dy}{dt} = 2 \cos 2t$$

$$\frac{dy}{dx} = \frac{2 \cos 2t}{2 \sin t \cos t}$$

$$= \frac{\cos 2t}{\sin t \cos t}$$

$$b) \quad t = \frac{\pi}{6} \quad x = \frac{1}{4} \quad y = \frac{\sqrt{3}}{2}$$

$$\frac{dy}{dx} = \frac{\cos(\frac{\pi}{3})}{\sin(\frac{\pi}{6}) \cos(\frac{\pi}{6})} = \frac{2\sqrt{3}}{3}$$

$$y = -\frac{3}{2\sqrt{3}} x + c$$

$$y = -\frac{\sqrt{3}}{2} x + c$$

$$\frac{\sqrt{3}}{2} = -\frac{\sqrt{3}}{8} + c$$

$$c = \frac{5\sqrt{3}}{8}$$

$$y = -\frac{\sqrt{3}}{2} x + \frac{5\sqrt{3}}{8}$$

$$c) \quad \sin^2 t + \cos^2 t = 1$$

$$x = \sin^2 t$$

$$y = \sin 2t$$

$$y = 2 \sin t \cos t$$

$$y^2 = 4 \sin^2 t \cos^2 t$$

$$y^2 = \cos^2 t$$

$$4 \sin^2 t$$

$$x + \frac{y^2}{4x} = 1$$

$$\underline{\underline{4x^2 + y^2 = 4x}}$$

5a/ crosses x when $y=0$

crosses y when $x=0$

$$y = t^2 - 5$$

$$0 = t^2 - 5$$

$$5 = t^2$$

$$t = \pm\sqrt{5}$$

$$t = \sqrt{5}$$

$$x = \ln(\sqrt{5} + 1)$$

$$(\ln \sqrt{5} + 1, 0)$$

$$x = \ln(t + 1)$$

$$0 = \ln(t + 1)$$

$$e^0 = t + 1$$

$$1 = t + 1$$

$$t = 0$$

$$y = (0)^2 - 5$$

$$= -5$$

$$(0, -5)$$

b/ $\frac{dy}{dt} = 2t$

$$\frac{dx}{dt} = \frac{1}{t+1}$$

$$\frac{dy}{dx} = 2t \div \frac{1}{t+1}$$

$$= 2t(t+1)$$

$$= 2t^2 + 2t$$

when $t=3$ $y=4$ $x = \ln 4$

$$\frac{dy}{dx} = 2(3)^2 + 2(3)$$

$$= 24$$

$$y = 24x + c$$

$$4 = 24 \ln 4 + c$$

$$4 - 24 \ln 4 = c$$

$$y = 24x + 4 - 24 \ln 4$$

$$= 24x + 4 - 48 \ln 2$$