1) Consider the curve with parametric equation

$$x = 1 + \sin\ t, y = \cos\ t - 2, 0 \leq t \leq \pi.$$

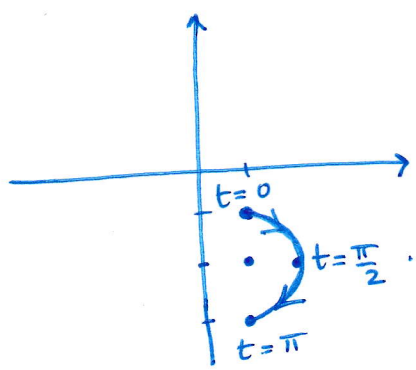
Determine the Cartesian equation satisfied by this curve and sketch the curve indicating the direction of travel.

$\sin(t) = x-1$, $\cos(t) = y+2$

$\sin^2(t) + \cos^2(t) = \boxed{(x-1)^2 + (y+2)^2 = 1}$

this is the equation of the circle centered at $(1,-2)$ with radius $r=1$.

t	x	y
0	1	-1
$\frac{\pi}{2}$	2	-2
π	1	-3



2) Identify the symmetries of the following polar curve and then sketch it.

$$r = 1 - \sin\,\theta.$$

(a) $r(-\theta) = 1 - \sin(-\theta) = 1 + \sin(\theta) \neq r(\theta)$

$\Rightarrow$ no symmetry about x-axis

(b) $r(\pi - \theta) = 1 - \sin(\pi - \theta) = 1 - \sin(\theta) = r(\theta)$

Symmetry about $\theta = \frac{\pi}{2}$ (y-axis)

(c) $r(\pi + \theta) = 1 - \sin(\pi + \theta) = 1 + \sin(\theta) \neq r(\theta)$

no symmetry about the pole.

θ	r
0	1
$\frac{\pi}{2}$	0
π	1
$\frac{3\pi}{2}$	2

Cardioid