1) $x = \ln t$, $y = t$, $t > 0$

$t = e^x$ $y = e^x$ (C)

2) $xy = 10$. $x = 2$ $\frac{dy}{dt} = 3$

$x\frac{dy}{dt} + y\frac{dx}{dt} = 0$

$2(3) + 5\frac{dx}{dt} = 0$

$\frac{dx}{dt} = -\frac{6}{5}$

3) $\frac{dx}{dt} = \frac{1}{t+1}$ $\frac{dy}{dt} = 2t$

a)

$x = \int \frac{1}{t+1}\,dt$ $y = \int 2t\,dt$

$x = \ln|t+1| + C$ $y = t^2 + C$

$\ln 2 = \ln 2 + C$ $0 = 1 + C$

$0 = C$ $-1 = C$

$x = \ln(t+1)$ $y = t^2 - 1$

b)

$x = \ln(t+1)$ $y = (e^x - 1)^2 - 1$

$e^x = t + 1$ $y = e^{2x} - 2e^x$, $x \geq 0$

$e^x - 1 = t$

c) $\frac{\Delta y}{\Delta x} = \frac{y(4) - y(0)}{x(4) - x(0)}$

$= \frac{15 - (-1)}{\ln 5 - \ln 1}$

$= \frac{16}{\ln 5}$

d) $\frac{dy}{dx} = \frac{2t}{1/t+1} = 2t(t+1)$

$\left.\frac{dy}{dx}\right|_{t=1} = 4$

4) $x = 3t + 1$ $y = 9 - 4t$

$\frac{dx}{dt} = 3$ $\frac{dy}{dt} = -4$

$L = \int_0^2 \sqrt{3^2 + (-4)^2}\,dt$

$= \int_0^2 \sqrt{25}\,dt$

$= 10$

5) $x = 2t^2$ $y = 3t^2 - 1$

$\frac{dx}{dt} = 4t$ $\frac{dy}{dt} = 6t$

$L = \int_0^4 \sqrt{16t^2 + 36t^2}\,dt$

$= \int_0^4 \sqrt{52t^2}\,dt$

$= \int_0^4 t\sqrt{52}\,dt$

$= \frac{\sqrt{52}}{2}t^2 \Big|_0^4$

$= 8\sqrt{52}$

$= \boxed{16\sqrt{13}}$

6) $x = \sin 3t \quad y = \cos 3t$

$\frac{dx}{dt} = 3\cos 3t \quad \frac{dy}{dt} = -3\sin 3t$

$L = \int_0^{\pi} \sqrt{9\cos^2 3t + 9\sin^2 3t}\, dt$

$= \int_0^{\pi} \sqrt{9(\cos^2 3t + \sin^2 3t)}\, dt$

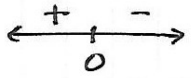
$= \int_0^{\pi} 3\, dt$

$= 3\pi$

7) $x = t^9, \quad y = 4 - t^2$

$\frac{dy}{dt} = -2t = 0$

$t = 0$



MAX for y-value when $t = 0$

$\boxed{y(0) = 4}$

8) $x = \cos^3 t \quad y = \sin^3 t$

$\frac{dx}{dt} = -3\cos^2 t \sin t$

$\frac{dy}{dt} = 3\sin^2 t \cos t$

$L = \int_0^{2\pi} \sqrt{9\cos^4 t \sin^2 t + 9\sin^4 t \cos^2 t}\, dt$

$= \int_0^{2\pi} \sqrt{9\cos^2 t \sin^2 t (\cos^2 t + \sin^2 t)}\, dt$

$= \int_0^{2\pi} \sqrt{9\cos^2 t \sin^2 t}\, dt = 6$

CALCULATOR!

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

lowest → Abs min y-value

$\frac{dy}{dt} = 2t + 1 = 0$

$t = -1/2$

t	y	
-2	2	
0	0	← lowest
2	6	

$x(0) = 1$

point: $(1, 0)$

10) $x = 2\sin t \quad y = \cos t$

rightmost - abs max x-value

$\frac{dx}{dt} = 2\cos t = 0$

$t = \frac{\pi}{2}$

t	x	
0	0	
$\pi/2$	2	← max
π	0	

$y(\frac{\pi}{2}) = 0$

point: $(2, 0)$

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

leftmost → abs min x-value

$\frac{dx}{dt} = 2t + 2 = 0$

$t = -1$

t	x	
-2	0	
-1	-1	← min
3	15	

$y(-1) = 6$

point: $(-1, 6)$