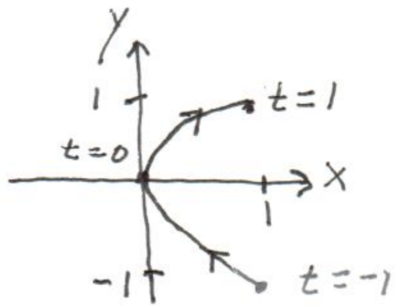
(1)



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(2) $\vec{r}\,'(t) = \langle 2t, 1, \pi\cos(\pi t)\rangle$, so $\vec{r}\,'(1) = \langle 2, 1, -\pi\rangle$.
Also, $\vec{r}(1) = \langle 1, 1, 0\rangle$, so a vector equation for the line is: $\vec{l}(t) = \langle 1,1,0\rangle + t\langle 2, 1, -\pi\rangle$, and parametric equations are:

$$\boxed{\begin{aligned} x(t) &= 1+2t \\ y(t) &= 1+t \\ z(t) &= -\pi t \end{aligned}}$$

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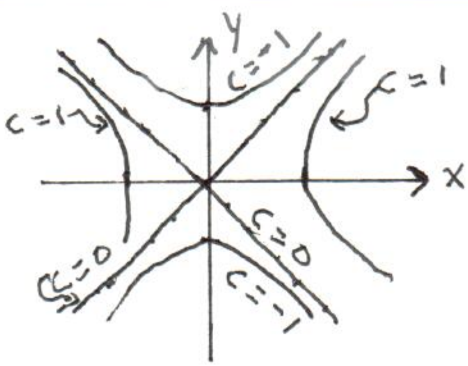
(3)



$x^2 - y^2 = -1 \Leftrightarrow$
$y^2 - x^2 = 1$

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(4) $\dfrac{x^2+6xy+9y^2}{x+3y} = x+3y$ for $x+3y \neq 0$. Therefore,

$$\lim_{(x,y)\to(0,0)} \left(\frac{x^2+6xy+9y^2}{x+3y}\right) = \lim_{(x,y)\to(0,0)} (x+3y) = 0$$

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(5) (a) $\dfrac{\partial f}{\partial x} = (x^2+y) + 2x^2$; $\dfrac{\partial f}{\partial y} = x$

(b) $g_x(x,y) = \cos(xy) - xy\sin(x,y)$, so

$g_x(1,\pi) = \cos(\pi) - \pi\sin(\pi)$
$= \boxed{-1}$

6. $f(1.2, 0.8) \approx 1 + (-1)(1.2-1) + 2(0.8-1)$

$= 1 - 0.2 \cancel{+} - 0.4 = \boxed{0.4}$.

7. $\frac{dg}{dt} = \frac{\partial \cancel{g} f}{\partial x}\frac{dx}{dt} + \frac{\partial \cancel{f}}{\partial y}\frac{dy}{dt} = 2(x-y)50(t-2)^{49} - 2(x-y)(2t+1)$

$x(1) = 1$, $y(1) = 3$, ~~so~~

$g'(1) = 2(1-3)(50)(-1)^{49} - 2(1-3)(2+1)$

$= 2(-2)(50)(-1) - 2(-2)(3)$

$= 200 + 12 = \boxed{212}$