1. (1 pt) Assume time t runs from zero to 2π and that the unit circle has been labled as a clock. Match each of the pairs of parametric equations with the best description of the curve from the following list. Enter the appropriate letter (A, B, C, D, E, F) in each blank.
A. Starts at 12 o'clock and moves clockwise one time around.
B. Starts at 6 o'clock and moves clockwise one time around.
C. Starts at 3 o'clock and moves clockwise one time around.
D. Starts at 9 o'clock and moves counterclockwise one time around.
E. Starts at 3 o'clock and moves counterclockwise two times around.
F. Starts at 3 o'clock and moves counterclockwise to 9 o'clock.
___1. $x = \sin(t);\ y = \cos(t)$
___2. $x = \cos\dfrac{t}{2};\ y = \sin\frac{t}{2}$
___3. $x = -\sin(t);\ y = -\cos(t)$
___4. $x = \cos(2t);\ y = \sin(2t)$
___5. $x = \cos(t);\ y = -\sin(t)$

2. (1 pt) Find the equation for the line tangent to the parametric curve:

$$x = t^3 - 9t$$
$$y = 9t^2 - t^4$$

at the points where $t = 3$ and $t = -3$.
For $t = 3$, the tangent line (in form $y = mx + b$) is
$y =$ ______________________.
For $t = -3$, the tangent line is
$y =$ ______________________.

3. (1 pt) Find $\dfrac{d^2y}{dx^2}$, as a fuction of t, for the curve given the parametric equations:

$$x = 7 - 9\cos(t)$$
$$y = 4 + \cos^5(t)$$

$\dfrac{d^2y}{dx^2} =$ ______________________.

4. (1 pt) Notice that the curve given by the parametric equations

$$x = 36 - t^2$$
$$y = t^3 - 25t$$

is symmetric about the x-axis. (If t gives us the point (x, y), then $-t$ will give $(x, -y)$).
At which x value is the tangent to this curve horizontal?
$x =$ _____.
At which t value is the tangent to this curve vertical?
$t =$ _____.
The curve makes a loop which lies along the x-axis. What is the total area inside the loop?
Area = _________.

5. (1 pt) Consider the curve given by the parametric equations

$$x = 6(\cos t + t \sin t)$$
$$y = 6(\sin t - t \cos t)$$

What is the length of the curve from $t = 0$ to $t = \frac{11}{8}\pi$?

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6. (1 pt) EXTRA CREDIT PROBLEM:
Let L be the circle in the x-y plane with center the origin and radius 38. Let S be a moveable circle with radius 24 . S is rolled along the inside of L without slipping while L remains fixed. A point P is marked on S before S is rolled and the path of P is studied. The initial position of P is (38,0). The initial position of the center of S is (14,0). After S has moved counterclockwise about the origin through an angle t the position of P is

$$x = 14\cos t + 24\cos\left(\frac{7}{12}t\right)$$
$$y = 14\sin t - 24\sin\left(\frac{7}{12}t\right)$$

How far does P move before it returns to its initial position?
Hint: S makes several complete revolutions about the origin before P returns to (38,0).

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