MATH-1150 (DUPRÉ) SPRING 2011 QUIZ 4 ANSWERS

Wednesday 7 March 2012

DIRECTIONS

FIRST: PRINT YOUR LAST NAME IN LARGE CAPITAL LETTERS ON THE UPPER RIGHT CORNER OF EACH SHEET TURNED IN.

SECOND: PRINT YOUR FIRST NAME IN CAPITAL LETTERS DIRECTLY UNDERNEATH YOUR LAST NAME ON EACH SHEET TURNED IN.

THIRD: WRITE YOUR CORRECT SPRING 2011 MATH-1150 SECTION NUMBER DIRECTLY UNDERNEATH YOU FIRST NAME ON EACH SHEET TURNED IN.

FOURTH: Write NEATLY and CLEARLY, putting your answers in the space provided. If I cannot read it you do not get credit.

FIFTH: Any failure to follow any part of any of the above directions can result in additional loss of credit.

1 & 2. If $f(x) = [x^7 + 5]^5 - [e^{x^2+3}]$, then $f'(x) = 5[x^7 + 5]^4 \cdot 7x^6 - [e^{x^2+3}] \cdot 2x$

3 & 4. If T is the tangent line to the graph of the equation $x^3 - x^2y + y^3 = 5$ at the point $(2, 1)$,

then an equation for T is: $8(x - 2) - (y - 1) = 0$.

To see why this is true, differentiate both sides of the equation with respect to time, allowing both x and y to be functions of time, t. As usual, we denote time derivatives with overdots. Then

$$0 = \dot{5} = (x^3 - x^2y + y^3)^{\dot{}} = (x^3)^{\dot{}} - (x^2y)^{\dot{}} + (y^3)^{\dot{}} = 3x^2\dot{x} - (2x\dot{x}y + x^2\dot{y}) + 3y^2\dot{y}$$

so

$$[3x^2 - 2xy]\dot{x} + [3y^2 - x^2]\dot{y} = 0.$$

Putting in $x = 2$ and $y = 1$ in this equation then gives $8\dot{x} - \dot{y} = 0$ which means an equation for T is $8(x - 2) - (y - 1) = 0$.

5. A ladybug is crawling along the curve with equation $x^2 + y^4 = 5$. At the instant the ladybug is at the point $(2, 1)$ the rate of increase of y is 4 units per minute. What is the rate of increase of x for the ladybug at the instant the ladybug is at the point $(2, 1)$?

ANSWER: Since x and y are functions of time, t, we differentiate the equation with respect to t getting $2x\dot{x} + 4y^3\dot{y} = 0$, so putting $x = 2,\ y = 1$, and $\dot{y} = 4$, gives the equation $4\dot{x} + 4\dot{y} = 0$, which means $\dot{x} = -\dot{y} = -4$.