

Mock Second Test
Monday, June 21, 2004

You are allowed to use a TI-30Xa (or any four-function calculator). No other calculator is allowed. You have one hour. Present your solutions clearly. Show all necessary steps in your method. Include enough comments or diagrams to convince me that you thoroughly understand. Begin each question (as opposed to part of question) on a fresh sheet of paper, use *one* side of the paper only, and ensure that your solutions are stapled together in the proper order at the end of the test.

- In each of the following cases, find the *exact* $\frac{dy}{dx}\big|_{x=a}$ for the given value of a :

<p>(a) $y = x \sin(1/x)$, $a = \frac{3}{\pi}$ [4]</p> <p>(c) $y = e^{-4x} \cos(7x)$, $a = \frac{\pi}{4}$ [4]</p>	<p>(b) $y = \sqrt{\frac{x^3-1}{x^3+1}}$, $a = 2$ [4]</p> <p>(d) $y = \ln(x)^{\cos(x)}$, $a = e$ [4]</p>
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- (a) Find an equation of the tangent to $x^2 + 2xy - y^2 + x = 2$ at $(1, 2)$. [5]

(b) For $\sqrt{x} + \sqrt{y} = 1$ and $0 < c < 1$, find $\frac{d^2y}{dx^2}\bigg|_{(x,y)=(c^2, \{1-c\}^2)}$ [5]
- (a) Prove that the parabola $x = y^2$ is orthogonal to the ellipse $2x^2 + y^2 = 3$. [5]

(b) Find all points on the curve $x^2y^2 + xy = 2$ where the tangent has slope -1 . [5]
- (a) A street light is mounted at the top of a 5-meter pole. A 3-meter tall basketball player jogs directly away from the pole with a speed of 2 meters per second. How fast is the tip of her shadow moving? [7]

(b) Does it matter how far she is from the pole? [0]
- Find the absolute maximum and minimum values of $x^3 - 6x^2 + 9x + 2$ on $[-1, 4]$, together with all corresponding maximizers and minimizers. [7]