SAMPLE MIDTERM 2, MAT 131, Spring 2001

The second midterm will be on Thursday, April 5 from 8:30 pm to 10:00 pm. Room assignments are the same as for the first midterm.

Location	Sections
Old Chemistry 116	1,2,5
Harriman hall 137	3,4,6
Old Enginering 143	7,8

the following gives a rough idea of the type of problems and topics covered on the midterm but it is not an exact match. The number and type of problems may be different on the actual exam.

1. Place the letter corresponding to the correct answer in the box next to each question.

   (i) ☐ What is the slope of the curve given by $x^3 + y^3 - 9xy = 0$ at the point $(x, y) = (2, 4)$? **(a)** 1 **(b)** $\frac{24}{30}$ **(c)** $\frac{3}{4}$ **(d)** $\frac{9}{18}$ **(e)** $\frac{6}{5}$ **(f)** none of these.

   (ii) ☐ Suppose $f(x) = |x^2 - 2x|$. The set of critical points of f is
   (a) $\{0\}$ **(b)** $\{1\}$ **(c)** $\{0, 1, 2\}$ **(d)** $\{2\}$ **(e)** $\{0, 2\}$ **(f)** none of these.

   (iii) ☐ Suppose $g'(x) = \sin^{1999}(x)$. The absolute maximum of g on $[0, 2\pi]$ occurs at
   (a) 0 **(b)** $\pi/4$ **(c)** $\pi/2$ **(d)** π **(e)** 2π **(f)** none of these.

   (iv) ☐ Find $\frac{dy}{dx}$ at the point $(3, 5)$ if $y^2 + y - 3 = x^3$.
   (a) 3 **(b)** 75/7 **(c)** 9/11 **(d)** 27/11 **(e)** 0 **(f)** none of these.

   (v) ☐ Find the linearization of $f(x) = x^3 - x$ at $x = 1$.
   (a) $L(x) = 2x$ **(b)** $L(x) = 2(x + 1)$ **(c)** $L(x) = -2(x - 1) + 1$ **(d)** $L(x) = 2x + 1$ **(e)** $L(x) = 2(x - 1)$ **(f)** none of these.

   (vi) ☐ Use differentials to estimate the change in the surface area of a cube $S = 6x^2$ when the edge length goes from x_0 to $x_0 + dx$
   (a) $6dx$ **(b)** $6x_0dx$ **(c)** $12x_0dx$ **(d)** $12dx$ **(e)** $18x_0dx$ **(f)** none of these.

   (vii) ☐ Suppose $f'(x) = x^2 \sin^{10}(x)$. Then on the interval $[0, \frac{1}{2}\pi]$ the function f is
   (a) increasing and concave down **(b)** increasing and concave up **(c)** decreasing and concave down **(d)** decreasing and concave up **(e)** constant **(f)** none of these.

   (viii) ☐ The function $f(x) = x^3 - 3x^2 + 1$ has a point of inflection at $x =$?
   (a) -2 **(b)** -1 **(c)** 0 **(d)** 1 **(e)** 2 **(f)** none of these.

(ix) $\square$ The derivative of $xh(x^2)$ is
(a) $1+2xh'(x^2)$ **(b)** $h'(x^2)2x$ **(c)** $2x+xh'(x^2)$ **(d)** $xh(x^2)+x^2h'(x)$ **(e)** $h(x^2)+2x^2h'(x)$ **(f)** none of these.

(x) $\square$ The derivative of $f(x) = x^2 + x^3$ at $x = 2$ is
(a) 12 **(b)** 13 **(c)** 14 **(d)** 15 **(e)** 16 **(f)** none of these.

(xi) $\square$ Suppose $f(1) = 3.4$ and $f(1.1) = 3.6$. Then the best estimate for $f'(1)$ is
(a) 3.5 **(b)** 3.4 **(c)** 2.0 **(d)** 20 **(e)** .2 **(f)** .002

(xii) $\square$ A ball dropped from rest takes 3 seconds to hit the ground. From what height was it droped (in feet)?
(a) 48 **(b)** 90 **(c)** 144 **(d)** 256 **(e)** 288 **(f)** none of these

(xiii) $\square$ What is the limit of $\frac{x^2+\cos x}{2x^2+x+\sin x}$ as $x \to \infty$?
(a) 0 **(b)** $\frac{1}{2}$ **(c)** 1 **(d)** 2 **(e)** ∞ **(f)** the limit fails to exist

2. For each of the following functions, find the derivative function.
   (i) $x^{10} + x^{1/2}$
   (ii) $\tan(x)$
   (iii) $e^{x^2}\ln(1 + x^2)$
   (iv) $(\cos(x) + \sin(x))^3$
   (v) $x^{\sin x}$

3. Find $\frac{dy}{dx}$ if $xy^2 + x^2y + \sin(xy) = 1$

4. Compute the derivative of $f(x) = \sqrt{x}$ using the quotient definition of derivative.

5. Two people start at the same point. One walks east at 3 mi/hr and the other walks northeast at 2 mi/hr. How fast is the distance btween them changing after 15 minutes?

6. Find the linearization of $f(x) = (1 + 3x)^{1/3}$. Use it to approximate $(1.03)^{1/3}$.