

# Math 141 Sample Midterm 2

**1.** Let  $f(x) = x^3 - x + 3$  on  $[-2, 0]$ . Carefully state the Mean Value Theorem, including all hypothesis (when it can be used), and then find the number  $c$  given by the Mean Value Theorem.

**2.** Let  $f(x) = \frac{x}{\sqrt{2}} + \cos x$  on the interval  $[0, 2\pi]$ .

- a. Where is  $f(x)$  increasing?
- b. Where is  $f(x)$  concave up?
- c. Does the mean value theorem apply here? What does it say exactly in this case?

**3.** Draw the graph of one function  $g$  with all of the following properties:

- a.  $g$  is continuous on  $(-4, 4)$ .
- b.  $g'(-1)$  does not exist.
- c.  $g'(1) = -1$ .
- d.  $g'(x) < 0$  for all  $x$  satisfying  $0 \leq x \leq 2$ .
- e. The line tangent to the graph of  $g(x)$  at  $x = 3$  is equal to  $-x + 2$ .

**4.** A farmer has 2400 ft of fencing and wants to fence a rectangular field that borders of a straight river (no fencing is needed along the river). What are the dimensions of the field of largest area?

**5.** Find the point on the graph of  $f(x) = \sqrt{4x + 9}$  closest to the point  $(1, 0)$ .

**6.** Apply Newton's method a few times to  $x^5 - x + 1$  in order to find where the function is equal to 0.