

No books, notes or graphing calculators. SHOW ALL YOUR WORK. ANSWER ALL QUESTIONS.  
There are 2 problems: do not forget to do the problem of the back side!

(11) 1. Do NOT compute any derivatives for this problem: do pictures only, and answer questions based on the graphs that you obtain.

(a) Let  $f(x) = \sin x$ . Graph the function  $f(x)$  on the interval  $[0, 2\pi]$ .

(b) Let  $g(x) = f'(x)$ . Sketch the graph of  $g(x)$  on the interval  $[0, 2\pi]$ . Label the points where  $g(x)$  is 0.

(c) Let  $h(x) = g'(x)$ . Sketch the graph of  $h(x)$  on the interval  $[0, 2\pi]$ . Label the points where  $h(x)$  is 0.

(d) Now graph  $y(x) = -h(x)$  on the same interval. How does this graph compare to the graph of  $f(x)$ ?

(9) 2. Compute the derivatives of the following functions. Do NOT use the quotient rule. For each function write down where the function is differentiable.

(a)  $f(x) = x^{239} - 6x^7 + \frac{1}{x^2}$

(b)  $f(x) = \sqrt{x^7}$

(c)  $f(x) = \frac{x^2 - 2x + 1}{x - 1}$