

**Math 273 - Fall 2015**  
**Practice Midterm 3**

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- (1) Find the (exact) maximum and minimum values of  $f(x) = x - 2\sin x$  on the interval  $[0, 2\pi]$ .
- (2) Let  $f(x) = x^3 - 4x$ .
  - (a) Find the intervals on which  $f$  is increasing or decreasing.
  - (b) Find the local maxima and minima of  $f$ .
  - (c) Find the intervals on which  $f$  is concave up or concave down.
  - (d) Find the inflection points of  $f$ .
  - (e) Sketch the curve.
- (3) Find the limits of the following functions.
  - (a)  $\lim_{x \rightarrow 0^+} \frac{\sqrt{x}}{\ln x}$ .
  - (b)  $\lim_{x \rightarrow 0} \frac{\sin(x) - x}{e^x x^3 - 1}$ .
  - (c)  $\lim_{x \rightarrow 0} \frac{\sqrt{x}}{\sin(x) - 1}$ .
  - (d)  $\lim_{x \rightarrow 0^+} \frac{\sqrt{x}}{\ln x}$ .
- (4) Find  $f(x)$  given the information below.
  - (a)  $f'(x) = x - \sqrt{x} + 1/x$ .
  - (b)  $f'(x) = \sin(x) + \cos(x)$ .
  - (c)  $f''(x) = 4e^x + 1$ ,  $f'(0) = 1$ ,  $f(0) = 2$ .
- (5) Find the rectangle of largest area that can be inscribed in a semicircle of radius  $r$ .
- (6) Find the point on the line  $y = 2x + 3$  that is closest to the origin.
- (7) A stone is dropped off of a cliff. It accelerates downward due to gravity at 32 ft/sec and hits the ground travelling 120 ft/sec. How high was the cliff?
- (8) Show that the equation  $2x + \cos x = 0$  has exactly one real root.