Math 1710.007, Spring 2012
Review for Exam 2

The second exam is **Wednesday, March 14**. We will have lecture from 6-6:50pm, and the exam will be 7:00-7:50pm. The exam will cover Chapter 3 (Sections 3.1-3.8) and part of Chapter 4 (Sections 4.1-4.3). Calculators are **NOT** permitted on the exam. Good review: problems on this sheet, homework and quiz problems, examples from class, and worked examples from the textbook. The actual exam will be mostly free response questions (i.e. "show your work" problems), but there may also be some multiple choice, matching, or fill in the blank questions. The test may include problems that do not look exactly like the ones on this sheet!

1. (3.1) #39 on p. 110 of the textbook (derivatives from graphs)
2. (3.2) Find f' and f'' for the function:
$$f(x) = x^5 - 2x^3 - 10x + \pi^5$$
3. (3.3) Find the derivative of each function.
   - $y = (3x+1)(5x-4)$
   - $y = x\sin x$
   - $y = \sqrt{x}(\sqrt{x}+1)(\sqrt{x}+2)$
4. (3.3) Find the derivative of each function.
   - $y = \dfrac{1}{1+x^2}$
   - $y = \dfrac{3x+2}{10x+7}$
   - $y = \dfrac{\sin x}{x+1}$
5. (3.3) Let $f(x) = \frac{1}{x}$. Find f', f'', f''', and $f^{(4)}$.
6. (3.4) Let $f(x) = \sin x$. Find f', f'', f''', $f^{(4)}$, and $f^{(39)}$.
7. (3.4) Show how to use the quotient rule to find the derivatives of $\tan x$, $\sec x$, $\cot x$, and $\csc x$.
8. (3.4) Find the derivative of each function.
   - $y = \dfrac{\sin x}{1+\cos x}$
   - $y = \sec x \tan x$
   - $y = \csc^2 x$
   - $y = \sec x \cot x$
9. (3.6) Find the derivative of each function.
   - $y = \sqrt{x^4 + x^2 + 1}$
   - $y = \sec(x^3 + 5)$
   - $y = \cos^9 x$
   - $y = (5x+1)^{100}$
10. (3.6) Find the derivative of each function.
    - $y = \cos^2(3x)$
    - $y = \sin(\sqrt{x^4+1})$
11. (3.3, 3.6) Find the derivative of each function.
    - $y = x^3\cos(5x^2)$
    - $y = (2x-1)^3(7-x^5)^4$
12. (3.5) A stone is thrown vertically upward from the edge of a cliff, and its height (in feet) above ground after t seconds is given by
$$f(t) = -16t^2 + 64t + 32$$
    (a) Determine the velocity of the stone after t seconds.
    (b) When does the stone reach its highest point?
    (c) When does the stone strike the ground?
    (d) With what velocity does the stone strike the ground?
13. (3.7) A graph of the curve $x^3 + y^3 = 2xy$ is illustrated on p.163 of the textbook.
    (a) Use implicit differentiation to find $\dfrac{dy}{dx}$.
    (b) Verify that the point $(1,1)$ lies on the curve.
    (c) Find the equation of the line tangent to the curve at the point $(1,1)$.
14. (3.8) Problems #9, 22, 26, 29 in the textbook. (related rates word problems)
15. (3.1, 4.2) #61, 62 on p.197 of the textbook. Or go to http://rowdy.mscd.edu/~talmanl/MTH1410U08/Pictures_080529 to practice matching functions with their derivatives.
16. (4.1-4.3) Example 1 on p.201 of the textbook (sketching graphs from signs of derivatives)
17. (4.1-4.3) Let $p(x) = (x+1)(2x^2 - 17x + 41)$.
    (a) Find all intercepts.
    (b) Determine the end behavior.
    (c) Find the intervals on which f is above and below the x-axis.

(d) Find the intervals on which f is increasing and decreasing. Find coordinates for any local maxima or minima.

(e) Find the intervals on which f is concave up and concave down. Find coordinates for any inflection points.

(f) Graph!

18. (4.1-4.3) Let $f(x) = \dfrac{x}{x^2+1}$.

    (a) Find all intercepts and vertical asymptotes.

    (b) Determine the end behavior.

    (c) Find the intervals on which f is above and below x-axis.

    (d) Find the intervals on which f is increasing and decreasing. Find coordinates for any local maxima or minima.

    (e) Find the intervals on which f is concave up and concave down. Find coordinates for any inflection points.

    (f) Graph!

19. (4.1-4.3) For each function below: Find the intervals on which f is increasing and decreasing. Find the intervals on which f is concave up and concave down. Sketch a graph of the function.

    - $y = x^{3/5}$
    - $y = x^{4/5}$
    - $y = x^{6/5}$
    - $y = x^{7/5}$

20. (4.1-4.3) Find the absolute max value and absolute min value of the function $f(x) = x^3 - 12x$ on the interval $[0, 4]$.

21. (4.2) The population of a colony of squirrels is given by $P(t) = \dfrac{1500t^2}{2t^2+3}$, where t is measured in months.

    (a) Look at a graph of $P(t)$ and describe what happens to the growth rate of the population over time.

    (b) What is the growth rate after t months?

    (c) When is the growth rate the greatest? What is the growth rate at that time? (Use a graph to check your work, but you should also be able to do this by hand using derivatives.)

22. (4.2) A mass attached to a spring oscillates according to the function $y(t) = 3\sin(2\pi t)$, where t is measured in seconds and $y(t)$ is measured in inches.

    (a) Find the velocity $v(t)$ and acceleration $a(t)$ of the mass at time t.

    (b) Sketch graphs of the position, velocity, and acceleration functions. Find the period and amplitude of each.

    (c) At what times does the mass reach its maximum and minimum position? What is the maximum position? When the mass is at its max or min position, the velocity of the mass is ___.

    (d) At what times does the mass reach its maximum velocity? What is the maximum velocity? When the mass reaches its max or min velocity, the acceleration of the mass is ___.