TEST 2 PRACTICE PROBLEMS
CALCULUS I (MATH 201)
FALL 2014

1) Use the limit definition of the derivative to differentiate the following:

1. $f(x) = \sqrt{x}$
2. $f(x) = \dfrac{x-1}{x+2}$
3. $f(x) = \dfrac{1}{\sqrt{x}}$
4. ♠ $f(x) = \sin(2x)$

2) Differentiate the following

1. $y = 2014 + e^{\pi}$
2. $y = 4x^2 + \sqrt{x} + \sqrt[5]{x} + \dfrac{1}{\sqrt{x}}$
3. $y = e^{x+1} + 3^x$
4. $y = 8^x + \log_8(x)$
5. $y = \sin(x)e^x$
6. $y = \tan(x)5^x$
7. $y = \cos(3x)\tan(x)$
8. $y = x\tan^{-1}(x)$
9. $y = \sin^{-1}(x)\ln(x)$
10. $y = \dfrac{\sqrt{x}}{1+e^x}$
11. $y = \dfrac{x}{\sqrt{1+2\cosh(x)}}$
12. $y = \dfrac{\sec(x)}{\csc(x)+\cot(x)}$
13. $y = \dfrac{3^x}{2^x}$
14. $y = \sin(3x^2+7)$
15. $y = \sin^3(x)$
16. $y = \sin^3(5x+3)$
17. $y = \sinh(e^x - 3\sin(x))$
18. $y = \sqrt{1-x^2}$
19. $y = \sqrt{\tan^{-1}(x)}$
20. $y = \sqrt{x+\sin(x)}$
21. $y = \ln(1-x)$
22. $y = \ln(x-1)$
23. $y = \ln(\sin(x))$
24. $y = \sin(\ln(x))$
25. $y = \sin(\sin(x))$
26. $y = \ln(\ln(\sin(x)))$
27. $y = e^{3x}$
28. $y = e^{x^3-\cos(x)}$
29. $y = \sqrt{e^{\sin(x)}}$
30. $y = \sec(\ln(x))$
31. $y = \tan^{-1}(3-x)$
32. $y = \tan^{-1}(\sin(x)-\cos(x))$
33. $y = xe^{3x}\sin(x)$
34. $y = \sqrt{x-1}3^x\csc(x)$
35. $y = \sqrt{\dfrac{x-1}{x+1}}$
36. $y = x^x$
37. $y = (\ln(x))^{\sin(x)}$
38. $y = (\tan^{-1}(x))^{\sqrt{x^2-1}}$
39. $y = \dfrac{\sqrt{x+1}\sin^5(x)e^{2x+1}}{(1-9x)^{100}(x^2+\sin(x))}$

3) Find the 50th derivative of the following:

1. $y = \sin(3x)$
2. $y = \sinh(3x)$
3. $y = \cosh(2x-2014)$

4) Let $f(x) = \sec(x)$:
   a) Find $f''(x)$
   b) Compute $f''(\pi/4)$
5) Find an equation for the tangent line to the curve at the given point:
   1. $y = \sqrt{x-1}, \quad (2,1)$
   2. $y = \dfrac{2}{\sin(x)+\cos(x)}, \quad (0,2)$
   3. $y = \sin(\sin(x)), \quad (\pi, 0)$
6) Use implicit differentiation to find $\frac{dy}{dx}$:
   1. $x^5 + y^5 = 2014$
   2. $e^{x-y} = \sin(x)y$
   3. $\cos(xy) = x^2 - y^2 + 2y$
7) Consider the hyperbola:

$$x^2 + 2xy - y^2 + x = 6$$

   a) Use implicit differentiation to find $\frac{dy}{dx}$
   b) Find an equation of the tangent line to the curve at the point $(2,0)$
8) Consider the ellipse:

$$x^2 + 2x + 2y^2 = 8$$

   a) Use implicit differentiation to find $\frac{dy}{dx}$
   b) Find an equation of the tangent line to the curve at the point $(0,2)$
9) Compute the following limits:

   1. $\displaystyle\lim_{x\to 0} \frac{\sin(5x)}{x}$
   2. $\displaystyle\lim_{x\to 0} \frac{\sin(2x)}{\sin(5x)}$
   3. $\displaystyle\lim_{x\to 0} \frac{x}{\sin(5x)}$
   4. $\displaystyle\lim_{x\to 0} \frac{\sin^2(2x)}{x^2}$

10) An moving object has position function $s(t) = \frac{1}{3}t^3 - \frac{5}{2}t^2 + 6t + 10$ meters, where $t \geq 0$ is in seconds.
   1. Find the velocity function $v(t)$
   2. What is the velocity after 1 second?
   3. At what time(s) is the velocity 0?
   4. Find the acceleration function $a(t)$
   5. Find the jerk function $j(t) = s'''(t)$
11) Try the related rates problems from the homework again: Section 3.9, p.245 - 3,5,20,27,28,39 and also the examples from that section. Any other problems at the end of the chapter are also good practice.
12) Additional practice problems: see Chapter 3 review on page 261.

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