MATH 142, Section ______ Quiz 2 (Sections 3.1 – 3.3)

Due Friday, Sept. 27, 2014 at the beginning of class

NAME (print): Key

Instructions:

- For problems 1 – 3 mark only one choice. Wrong answer will receive no credit. Each problem is worth 2 points.
- For Problem 4 present your solutions in the space provided. **Show all your work** neatly and concisely and **clearly indicate your final answer**. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading to it. Credit will not be given for an answer not supported by work.
- STAPLE ALL THE SHEETS.

---

1. Let $f(x) = \begin{cases} 2x+1, & \text{if } x \le 1 \\ kx^2 - 1, & \text{if } x > 1 \end{cases}$

   Find k so that $f(x)$ is continuous everywhere.

   (a) 0
   (b) 4
   (c) 1
   (d) 3
   (e) None of these

$f(x)$ is continuous at $x=a$ if $\lim_{x\to a^-} f(x) = \lim_{x\to a^+} f(x) = f(a)$

- $2x+1$ is continuous for all x, so $f(x)$ is cont. on $(-\infty, 1)$.
- kx^2-1 is continuous for all x, so $f(x)$ is cont. on $(1,\infty)$.
- $x=1$

$\lim_{x\to 1^-} f(x) = 3$, $\lim_{x\to 1^+} f(x) = k-1$, $f(1)=3$

$\lim_{x\to 1^-} f(x) = \lim_{x\to 1^+} f(x)$, so $k-1=3$

$\boxed{k=4}$

2. Find $\lim\limits_{h\to 0} \dfrac{(2+h)^2-4}{h}$.

   (a) 1
   (b) 0
   (c) 3
   (d) 4
   (e) None of these

$= \lim\limits_{h\to 0} \dfrac{\cancel{4}+4h+h^2-\cancel{4}}{h} = \lim\limits_{h\to 0} \dfrac{4h+h^2}{h} = \left/ \dfrac{0}{0} \right/ = \lim\limits_{h\to 0} \dfrac{\cancel{h}(4+h)}{\cancel{h}}$

$= \lim\limits_{h\to 0} (4+h) = \boxed{4}$

[more problems on back]

3. Find the equation of the line tangent to the curve $y = -16x^2 + 64x$ at the point (1,48).

(a) $y = 16x - 32$

(b) $y = 48x + 1$

(c) $y = 32x + 16$

(d) $y = x + 48$

(e) None of these

Equation: $y - y_0 = m(x - x_0)$

$y_0 = 48, \quad x_0 = 1$

$m = f'(1)$, where $f(x) = -16x^2 + 64x$

$f'(x) = -32x + 64$

$f'(1) = -32 + 64 = 32$

Equation: $y - 48 = 32(x-1)$ or $\boxed{y = 32x + 16}$

---

4. *[4 pts]* Find the defivative of the function $f(x) = 2x^2 - x$ using the limit definition of $f'(x)$.

$$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h} \quad [0.5\text{ pt}]$$

$$f(x+h) = 2(x+h)^2 - (x+h)$$

$$= 2(x^2 + 2xh + h^2) - x - h = 2x^2 + 4xh + 2h^2 - x - h \quad [0.5\text{pt}]$$

$$f'(x) = \lim_{h\to 0} \frac{\cancel{2x^2} + 4xh + 2h^2 - \cancel{x} - h - (\cancel{2x^2} - \cancel{x})}{h} \quad [0.5\text{pt}]$$

$$= \lim_{h\to 0} \frac{4xh + 2h^2 - h}{h} \; [1\text{pt}] = \left| \frac{0}{0} \right| = \lim_{h\to 0} \frac{\cancel{h}(4x + 2h - 1)}{\cancel{h}} \; [1\text{pt}]$$

$$= \lim_{h\to 0} (4x + 2h - 1) = \boxed{4x - 1} \; [0.5\text{ pt}]$$

If a student did the derivative $f'(x) = 4x - 1$, give 1pt.