Summer Math for AP Calculus
Centennial High School

The following problems are **due** on the **first day** of class. Student's work will be assessed initially on completion of work. It may be revised during the first week of school, at which time a letter grade will be determined. A **test** will be given on the **first week of school** based on these problems. These problems are considered to be review problems from Pre-Calculus. If you are struggling with these problems then you are encouraged to spend more time than the average student on your daily homework in this AP Calculus class.

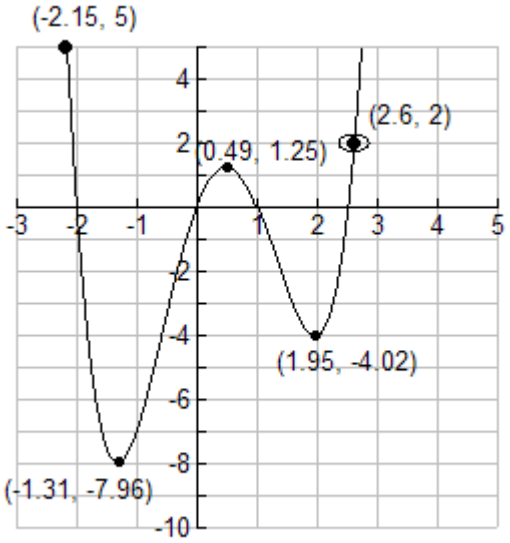
It is recommended that you work on these problems closer to the start of school but not at the last minute so the ideas are fresh when you return to school. Each solution must be complete, showing the work required to find the answers and any rationale used to reach the solution. TI-89 should be used for problems designated as calculator problems. The manual should provide enough support for these problems. The manual is also available at http://education.ti.com/us/product/tech/89/guide/89guideus.html.

Problems designated as non-calculator **should be solved without the use of the calculator** and must contain all necessary steps to find the solution.

PROBLEMS:

1. (Non-calculator) Use the function $f(x)=\dfrac{2x-5}{x^2-4}$:
   a) Find the domain
   b) Write an equation for all vertical & horizontal asymptotes of *f(x).*
   c) Find all *x* & *y*-intercepts of *f*.
2. (Calculator) Given $f(x)=\begin{cases}4x^2, & x<3\\ 24x-36, & x\geq 3\end{cases}$
   a) Sketch the graph of *f(x)*
   b) Show the entries in the Y= menu and give your window.
   c) Is the graph continuous at *x* = 3? Explain why or why not.
3. (Calculator) Let *f* be the function given by $f(x)=\dfrac{9x^2-36}{x+2}$
   a) Sketch the graph of the function.
   b) Find the zeros of the function.
   c) Find the point of removable discontinuity. Use algebra to show why the removable discontinuity occurs.
4. (Non-calculator) Let *f* be the function given by $f(x)=\ln\left(\dfrac{x}{x-1}\right)$
   a) What is the domain of *f*?
   b) Write an expression for $f^{-1}(x)$, where f^{-1} denotes the inverse function of *f*.
5. (Non-calculator) Let *f* be the function defined by $f(x)=7-15x+9x^2-x^3$ for all real numbers *x*.
   a) Find the zeros of *f*.
   b) Describe the end behavior of the function (using limit notation)
   c) Use your answers to parts (a) and (b) to sketch a possible graph of the function.
6. (Calculator) Let *R* be the region enclosed by the graphs of $y=e^x$, $y=(x-1)^2$, and the line *x* = 1.
   a) Sketch the graph and give the window. b) Find the points of intersection defining the region.
7. Use the graph below.

a) Give the ordered pair(s) of any relative (local) maxima.
b) Give the ordered pair(s) of any relative (local) minima.
c) Give the absolute maximum value of the function.
d) Give the absolute minimum value of the function.
e) Give the ordered pair(s) of any points of inflection.
f) Give the interval(s) over which the function is increasing.
g) Give the interval(s) over which the function is decreasing.
h) Give the interval(s) over which the function is concave up.
i) Give the interval(s) over which the function is concave down.



8. (Calculator) Let f be $f(x) = \sin^2 x - \sin x$ for $0 \le x \le \frac{3\pi}{2}$.
   a) Sketch the graph and give the window. Calculator should be in radians.
   b) Using ALGEBRA & TRIGONOMETRY, find the x-intercepts of the graph. Verify your answers graphically.
   c) Find the intervals on which f is increasing.
   d) Find the absolute maximum value and the absolute minimum value of f. Justify your answer.
9. (Non-calculator) If $h(x)=f(g(x))$ then determine $f(x)$ and $g(x)$ for each of the following:
   a) $h(x) = \sin(3x-5)$
   b) $h(x) = (2x+6)^2$
   c) $h(x) = \tan^2 x$
10. (Non-calculator) Given each of the functions below, simplify $\frac{f(a+h)-f(a)}{h}$.
   a) $f(x) = x+5$, $a=4$
   b) $f(x) = x^2 - 4x + 6$, $a=1$
   c) $f(x) = x^3$, $a= -2$
11. (Non-calculator) Draw the unit circle. Label angles in radians and exact values of ordered pairs for all 16 points.