Final Exam

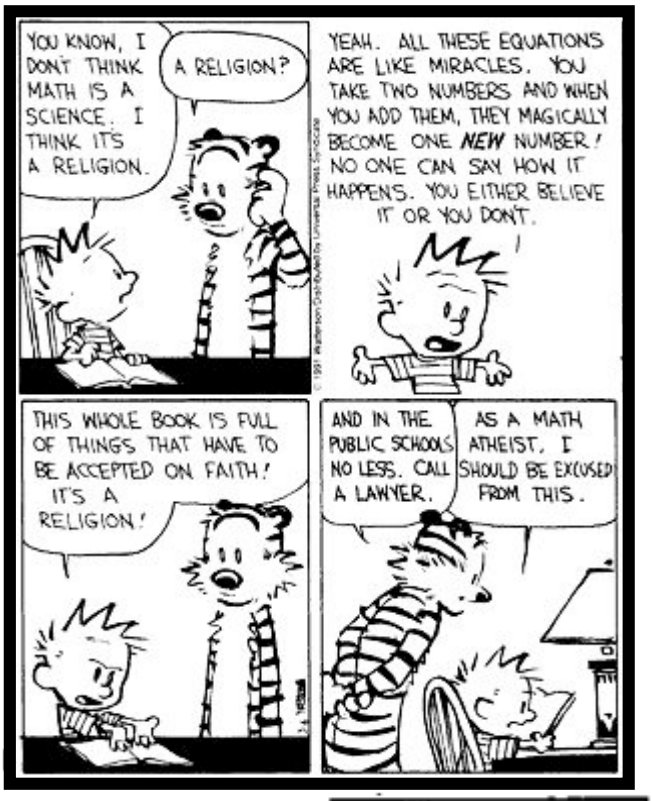
Amber Buntin – Math 105

- ✓ You have 1 hour and 50 minutes to take the exam.
- ✓ You MAY use a calculator, NO cell phones.
- ✓ Please indicate your answers by circling or boxing them.
- ✓ You must **show work and simplify all answers completely** (unless otherwise stated) in order to receive full credit.
- ✓ If you feel that you may be on the wrong track, put an x through work and try problem over on scratch paper. Many times, you are on the right track, but second-guess yourself.
- ✓ You may use a 3X5 index card & may **NOT** use your book, or neighbors during the exam.

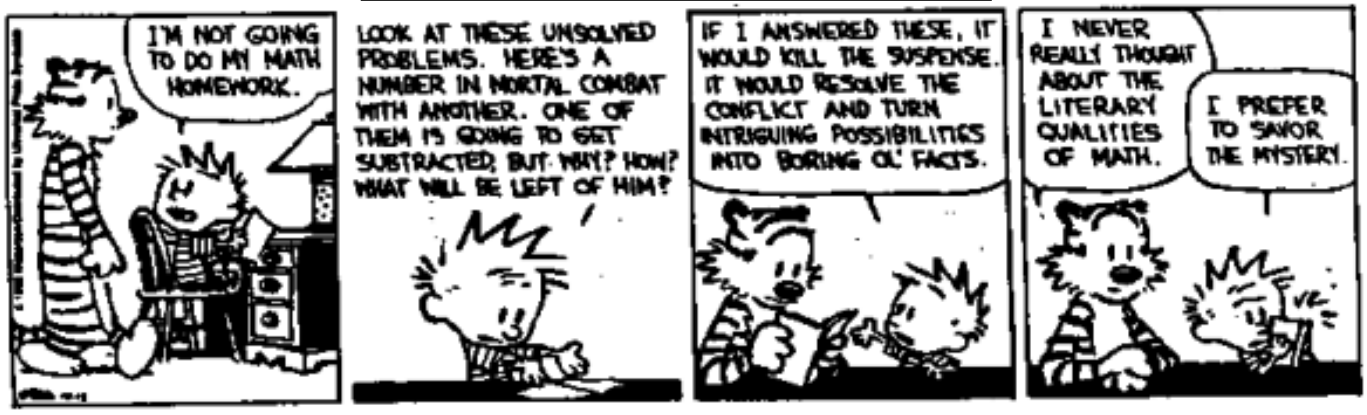
I have read the above guidelines and agree to follow them. Also, the work contained on this exam is my own and I promise to adhere to academic honesty.

Name _____

Signature_____



CALVIN AND HOBBES



1. Showing all work, use **calculus techniques** learned in class to evaluate the following limits. 2

a. $\lim_{x\to -2}\left(-x^2+5x-3\right)$

b. $\lim_{x\to -6}\left(\frac{x^2-36}{x+6}\right)$

c. $\lim_{x\to \infty}\left(\frac{-12x^2-9x}{7-3x^2}\right)$

2. Differentiate the following functions. **No simplifying. Take derivative and STOP.**

a. $f(x)=-3x^7-\frac{4}{x^5}+\sqrt{x}+\pi$

b. $f(x)=7^{5x^3+2x^2+8x-9}$

c. $g(x)=3e^{7x}\cdot\ln(5x^3+4)$

d. $y=\frac{\log_8(12x)}{e^{3x^2+5}}$

3. Use implicit differentiation to compute the derivative of the equation.

$xy + 5x^3 = 6$

4. **Find the equation of the tangent line** (in slope intercept form) through $(0,\ 1)$ for the following function $f(x) = (3x - 1)^4$

5. There are 320 yards of fencing available to enclose a rectangular field. How should this fencing be used so that the enclosed area is as large as possible? (You do NOT need to use the second derivative or a sign chart to show that it is truly a maximum. Only do this if you have time.)

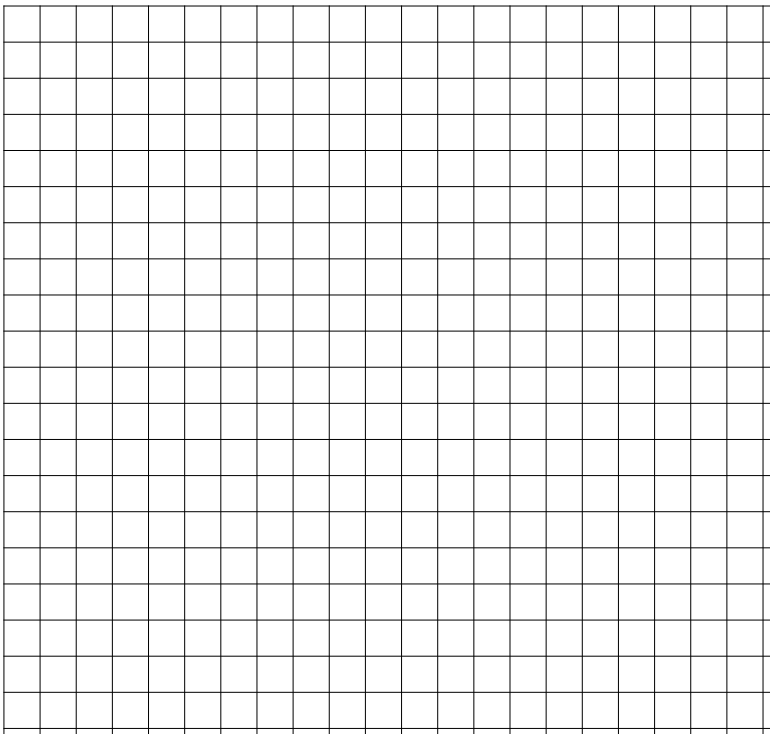
6. Sketch the function $f(x) = x^4 + 8x^3 + 18x^2 - 8$ by completing the steps:

a. Find **the *y* intercept ONLY**. State as an ordered pair.

b. Use the first derivative to find critical points and then identify any maximum or minimum points of the function. State as ordered pairs.

c. Find inflection **point(s),** if any, and state inflection point(s) as an ordered pair(s).

d. Use parts a-c. to sketch *f(x)* fairly accurately labeling max/min/IPs and y-intercept. Remember, you should change the scale if needed in order to make graph look "nice." 5



7. Find the extrema (**absolute** maxima and minima as ordered pairs) of the function $f(x) = 3x^5 - 5x^3$ on the interval $-2 \le x \le 0$

8. Population Growth. It is projected that *t* years from now, the population of a certain town will be approximately P(t) thousand people, where $P(t) = \dfrac{100}{1 + e^{-0.2t}}$

a. What is the current population?
b. At what **rate** will the population be changing 10 years from now?

9. Evaluate the following indefinite integrals and SIMPLIFY completely. 6

a. $\int \left(2x^6 + \frac{4}{x^3} - 5 \right) dx$

b. $\int \left(\frac{e^{4x}}{12} + \sqrt{x} \right) dx$

c. $\int \frac{24t^4 - 2t}{6t^2} \, dt$

It was a pleasure meeting all of you. Have a good break!
Comments/Suggestions:

1. Evaluate the definite integrals. **Leave answers exact** (simplified completely) not as decimals.

a. $\int_0^3 6x^2 + 10x + 2 \; dx$

b. $\int_{-1}^{1} \left(4e^{-x} - e^{x}\right) dx$

6.con't Evaluate the definite integrals. **Leave answers exact** (simplified completely) not as decimals.

c. $\int_1^3 \left(1 + \frac{1}{x} + \frac{1}{x^2}\right) dx$

2. The output of a factory is **changing at a rate**

$$Q'(t) = 2t^3 - 3t^2 + 10t + 3$$

units per hour where t is **the number of hours** after the morning shift begins at 8am.
How many units are produced between $10\,(t = 2)$ and noon $(t = 4)$?