Final Exam, Monday 23 May 2016
Math 205

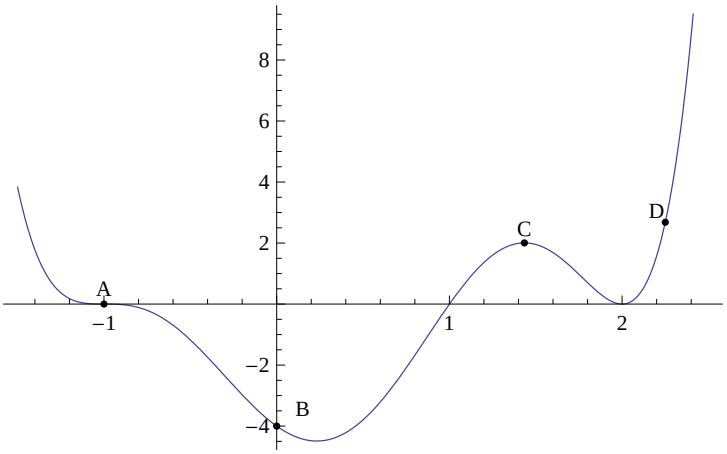
Name: _____ **Instructor:** _____

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	TOTAL

Please leave these boxes blank!

Instructions: Please answer **9 out of 11** of the following questions. Please write **SKIP** at the top of the page of the problem you would like to skip. Read each question carefully, show all work, and check afterwards that you have answered all of each question correctly. **Important: No books, calculators, blank papers or notes are allowed. Turn off cell phones, alarms, and anything else that makes noises.** You must show **all** your work to receive credit. Any crossed out work will be disregarded (even if correct). Write **one** clear answer with a coherent derivation for each question. Good luck!

[1] (20 pts) Below is the graph of a function $y = f(x)$. Fill in the chart with POS, NEG or 0 to indicate whether f, f' and f'' are positive, negative or zero at each of the indicated points A, B, C and D. (One point for each entry in first column and two points for each entry in 2nd and 3rd columns.)



	f	f'	f''
A			
B			
C			
D			

[1] (20 pts)

Please leave blank!

[2] (20 pts) Compute the derivatives of the functions below. Use the back of the page to continue your work if necessary.

$$\text{(a) } f(x) = \ln(2x^2 - x), \qquad \text{(b) } g(x) = \frac{e^x + e^{-x}}{x^2}$$

$$\text{(c) } h(x) = (3x^2 - 2x + 5)^7, \qquad \text{(d) } j(x) = x\left[x^3 + \ln(4x^2)\right]$$

[2] (20 pts)

Please leave blank!

[3] (20 pts) Compute the following indefinite integrals. Continue on back if necessary.

(a) $\int (3x-6)(\sqrt{x}+4)\,dx,$ (b) $\int \left(17e^{33x}+\frac{17}{5e^{4x}}\right)\,dx,$ (c) $\int x^3 e^{x^4}\,dx$

[3] (20 pts)

Please leave blank!

[4] (20 pts) Compute each of the integrals below. Simplify your answer as much as possible.

$$\text{(a)} \int_2^{10} \frac{x}{3x^2 - 11}\, dx, \qquad \text{(b)} \int_1^{e} \frac{\ln(x^2)}{2x}\, dx, \qquad \text{(c)} \int_1^{3} \frac{e^x}{e^x + 1}\, dx.$$

Continue on back if necessary.

[4] (20 pts)

Please leave blank!

[5] (20 pts) A curve is defined by the equation

$$x^2y^2 - 2x = 4 - 4y.$$

Find the equation of the tangent line at the point $(2, -2)$.

[5] (20 pts)

Please leave blank!

[6] (20 pts) A car is traveling at 50 mph due south at a point 1/2 mile north of an intersection. Another car is traveling at 40 mph due west at a point 1/4 mile east of the same intersection. At what rate is the distance between the two cars changing?

[6] (20 pts)

Please leave blank!

[**7**] **(20pts)** A bacteria culture starts with 500 bacteria and grows at a rate proportional to its size. After 3 hours there are 8000 bacteria. Find an expression for the population after t hours. Find the number of bacteria after 4 hours.

[**7**] (20 pts)

Please leave blank!

[8] (20 pts) A farmer has 2400 ft of fencing and wants to fence off a rectangular field that borders a straight river. He needs no fence along the river. What are the dimensions of the field that has the largest area?

[8] (20 pts)

Please leave blank!

[9] (20 pts) Find the area enclosed by the graphs of

$$y = 3 - x \quad \text{and} \quad y = x^2 - 9.$$

Express your answer as a rational number in lowest terms.

[9] (20 pts)

Please leave blank!

[10] (20 pts) Use a Riemann sum with 4 subintervals and left endpoints to estimate the integral

$$\int_1^3 9^x \, dx.$$

Express your answer as a rational number in lowest terms.

[10] (20 pts)

Please leave blank!

[11] (20 pts) For the polynomial function (with domain all real numbers)

$$f(x) = x^3 - 3x^2 + 4 = (x+1)(x-2)^2,$$

find: x- and y- intercepts; intervals of increase/decrease and local extrema; the intervals on which the function is concave up and concave down. Use this information to sketch a graph of the function.

[11] (20 pts)

Please leave blank!