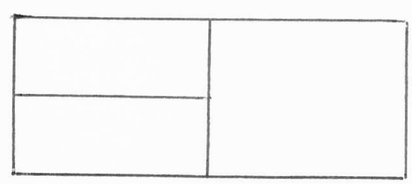
MAT 161-004 and MAT 161-300
Practice problems for the Final Exam

1. Find the equation of the tangent line to the graph of $f(x) = x^3 - x$ at the point where $x = 2$.
2. Find a) $\lim_{x\to 3} \frac{x-3}{9-x^2}$ b) $\lim_{x\to 0} \frac{cos2x-1}{x^2}$
3. Differentiate a) $sin^3(-2x)$ b) $\frac{log_2(x^3)}{x}$
4. Find $\frac{dy}{dx}$ if $y^3 - 2xy = e^y + x^3$
5. Find the linearization of $f(x) = \sqrt{x-1}$ at $a = 5$.
6. Use Newton's Method to find (to 20 digit accuracy) a solution to $x^3 = 2^x$
7. Let $y = (\sec x)^x$ Use logarithmic differentiation to find y'.
8. If the radius of a sphere increases at the rate of 3 in./sec, how fast is the volume changing when $r = 6$ in.? (The volume of a sphere is given by $V = \frac{4}{3}\pi r^3$.)
9. Find the inflection points and the absolute minimum value of $f(x) = \frac{e^{x^2}}{1+2x^2}$
10. Evaluate a) $\int \frac{x\,dx}{\sec(3-x^2)}$ b) $\int_0^4 |x-3|\,dx$
11. An object's position at time *t* is $s(t) = 2t^4 - 12t + 1$. Is the object speeding up or slowing down when $t = 1$? Also find the average position in the time interval $[0,3]$.
12. Find the exact area enclosed by one period of $y = 2\sin(x)$ and $y = 1$. Also revolve that region about the x-axis and find the resulting volume.
13. Find by hand the absolute maximum and absolute minimum values of $f(x) = 2x - x^3$ on the closed interval $[-1,2]$.
14. An aquarium with a rectangular base measuring 3 ft. by 4 ft. and a height of 2 ft. is full of water. Find the work required to pump half the water out over the top of the tank. (Water weighs 62.5 lb./ft^3.)
15. What is the maximum total area one can enclose with exactly 100 feet of fence by dividing a rectangle in half and then dividing one of the halves in half as shown in the diagram?



16. Use the Midpoint Rule to approximate $\int_0^{20} (g(x))^2\,dx$ given:

x	0	2	4	6	8	10	12	14	16	18	20
g(x)	2	3	2	1	2	4	5	6	5	4	3