Final Exam Review
Math 1100-005

Topics to Study

Limits & Continuity

- take limits, algebraically and graphically, including one-sided limits
- take limits as $x \to \infty$ and $x \to -\infty$ (ie. horizontal asymptotes)

Derivatives

- find the equation for the slope of a tangent line
- state and use the definition of a derivative
- find derivatives of algebraic, exponential & log functions both explicitly & implicitly
- find average, instantaneous and marginal rates of change

First Derivative Test & Extrema

- find critical points, inc/dec intervals, relative AND absolute extrema

Second Derivative Test

- find inflection points & concavity
- use the 2nd derivative test to find relative extrema

Optimization

- maximize/minimize functions & solve optimization problems
- find elasticity AND regions that are elastic/inelastic

Asymptotes & Sketching

- find both vertical and horizontal asymptotes
- sketch a graph if given or by finding
  - intercepts,inc/dec intervals, extrema, concavity, & asymptotes

Integrals

- compute definite & indefinite integrals
- find business functions if given their marginals (ie. cost, revenue, profit, price)
- find average value, annuities, present value, etc. using integrals
- find the area under curve or between 2 curves (including the applications)

How to Study

- REDO all previous reviews
- REDO all previous exams
- REDO all worksheets
- DO the following review

Equations TO KNOW!

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x} \quad \text{(Definition of Derivative)}$$

$$\frac{\Delta y}{\Delta x} = \frac{f(b) - f(a)}{b - a} \quad \text{(Average Rate of Change)}$$

$$\text{Profit} = \text{Total Revenue - Total Cost}$$

$$\text{Revenue} = \text{price*quantity}$$

$$\text{Total Cost} = \text{Fixed Costs + Variable Costs}$$

$$\text{Average Cost} = \frac{\text{Cost}}{\text{quantity}}$$

$$\eta = \frac{\text{change in demand}}{\text{change in price}} = \frac{p/x}{dp/dx} \quad \text{(Price Elasticity of Demand)}$$

$$\text{Average Value of f on [a,b]} = \frac{1}{b-a}\int_a^b f(x)dx$$

$$\text{Consumer Surplus} = \int_0^{x_o} [\text{demand} - p_o]dx$$

$$\text{Producer Surplus} = \int_0^{x_o} [p_o - \text{supply}]dx$$

$$\text{Profit over T years} = \int_0^T [R(t) - C(t)]dt$$

Equations GIVEN

$$\begin{aligned}
\text{Perimeter} &= \text{add up lengths of all sides} \\
\text{Area} &= \text{length*width} \\
\text{Volume} &= \text{length*width*height} \\
\text{Surface Area of Rectangle} &= \text{add up areas of all sides} \\
\text{Distance between}(x_1, y_1)\text{and}(x_2, y_2) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\
\text{Area of Circle} &= \pi r^2 \\
\text{Circumference of Circle} &= 2\pi r \\
\text{Volume of Sphere} &= \frac{4}{3}\pi r^3 \\
\text{Surface Area of Sphere} &= 4\pi r^2 \\
\text{Volume of Cylinder} &= \pi r^2 h \\
\text{Surface Area of Cylinder} &= 2\pi r h + 2\pi r^2 \\
\text{Amount of Annuity} &= e^{rT} \int_0^T c(t) e^{-rt} dt \\
\text{Actual Income over T years} &= \int_0^T c(t) dt \\
\text{Present Value} &= \int_0^T c(t) e^{-rt} dt
\end{aligned}$$

Review Problems for material not covered on previous exams - DON'T ONLY study these!!

1. Evaluate the following integrals:

   (a) $\int_0^2 x^2\sqrt{x^3+1}dx$

   (b) $\int_{-2}^2 x^2 - 3x - 1dx$

   (c) $\int_1^5 x(x+3)^2dx$

   (d) $\int \ln(x-2)dx$

(e) $\int x^2 \ln(x) dx$

(f) $\int_0^2 (x-1)e^{-x} dx$

2. Find the area of the regions bounded by the curves

   (a) $y = x^2 + 3$, $y = x$, $x = -1$, and $x = 1$

(b) $y = 2 - x$, $y = \sqrt{x}$, $x = 0$

3. Find the average value of $f(x) = \frac{x}{2x^2-1}$ on the interval $[1, 3]$.

4. Find the amount of an annuity if the income is given by $c(t) = 3000$ with interest rate 5% for 10 years.

5. Find the producer and consumer surplus if the demand is given by $p_1(x) = 100 - 0.4x^2$ and the supply is given by $p_2(x) = 42x$.

6. Find the present value over 5 years of an income given by $c(t) = 500 + t$ with an annual inflation rate of 3%.