MAC2311C/Calculus 1 SI Final Exam Review

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Disclaimer: This exam review was created by student who does not know how your *actual exam* will look like. The topics contained in this review are from your lectures and homework, but it does not mean this will be exactly the topics you see in your exam. These questions are made for practice. MAKE SURE THIS IS NOT YOUR ONLY STUDY TOOL.

Since we have so many topics in the course, I made a Poll so you guys could choose some topics from the previous exams to cover in this review. **You would have to study the topics not covered from previous exam reviews and other sources.**

Topics on this review:

1. Net Change Theorem
2. U-sub with indefinite integrals
3. U-sub with definite integrals
4. Riemann Sums
5. Optimization
6. Squeeze Theorem
7. Implicit Differentiation

1. Net Change Theorem

Given a velocity function $v(t) = 3t - 5$ (in meters per second) for a particle in motion from time t=0 to time t=3, find the net displacement of the particle and the total distance traveled.

If the motor on a motorboat is started at t=0 and the boat consumes gasoline at the rate of $5 - t^3$ gal/hr, how much gasoline is used in the first 2 hours?

2. U-substitution with indefinite integrals

$\int (8x - 12)(4x^2 - 12x)^4$

$\int 9x^2 \sin(2 + 6x^3)\, dx$

$\int (cos(3t) - t^2)(\sin(3t) - t^3)^5 dt$

$$\int \frac{lnx}{x} dx$$

$$\int e^{sinx} cosx \, dx$$

3. U-sub with definite integrals

$$\int_0^1 3(4x + x^4)(10x^2 + x^5 - 2)^6 dx$$

$$\int_0^{\frac{\pi}{4}} \frac{8\cos(2t)}{\sqrt{9 - 5\sin(2t)}} dx$$

$$\int_1^4 \sqrt{x} e^{1-\sqrt{x^3}} dx$$

$$\int_1^5 \frac{2x^3 + x}{x^4 + x^2 + 1} - \frac{x}{x^2 - 4} dx$$

$$\int_{-2}^{0} t\sqrt{3+t^2} + \frac{3}{(6t-1)^2}\,dt$$

4. Riemann Sums

a) Approximate the area under the curve:

$$f(x) = \sqrt{x+1}, \quad [-1,0]$$

With a Riemann Sum, using 4 sub-intervals and left endpoints, right endpoints, and mid points.

b) What can you say about the choice of endpoints if you want to Overestimate or Underestimate an area? What does it have to do with it in case the function is decreasing or decreasing? Draw an increasing and decreasing function and test the endpoints.

Can you tell whether the function in part A is increasing or decreasing by using the different endpoints?

c) Express the following definite integrals as a limit of Riemann Sums, using left-endpoint, right endpoint and middle-point approximation:

$$\int_0^2 x^2 lnx \ dx$$

5. Optimization

A company finds that if they price their product at $60, they can sell 500 items of it. For every dollar increase in the price, the number of items sold will decrease by 5.

a) Let x be the increase in price from $60. Define the revenue function, R(x) to be the sales revenue that results in such pricing. Find a formula for R(x).

b) What price would guarantee an income of $31500?

c) Find the price that guarantees the maximum revenue.

d) Find the maximum revenue.

6. Squeeze Theorem

   a) Find

$$\lim_{x \to 0} x^2 \cos\left(\frac{1}{x^2}\right)$$

b) Let f, g, and h be the functions defined by $f(x) = \frac{1-cosx}{2x}$, $g(x) = x^3 \sin\left(\frac{1}{x}\right)$ and $h(x) = \frac{x}{sinx}$ for $x \neq 0$. All the following inequalities are true for $x \neq 0$. State whether each inequality can be used with the squeeze theorem to find the limit of the function as x approaches 0?

4. $-\frac{1}{2} \leq f(x) \leq x^2 + \frac{1}{2}$	5. $-x^3 \leq g(x) \leq x^3$	6. $1 - x^2 \leq h(x) \leq x^2 + 1$

7. Implicit Differentiation

a) Find dy/dx by implicit differentiation

$$5 = \frac{3x + 2y}{cosy^2}$$

$$y^2 e^{2x} = 3y + x^2$$

$$xlny = 2x^3 - 2y$$

b) Find dy/dx by implicit differentiation and evaluate the derivative at the given point.

$$y^3 - x^2 = 4, (2,2)$$

$(x^2 + 4)y = 8, (2,1)$