

Sample Problems for Exam 3

Calculus I, MTH 231, Spring 2019
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- Exam 3 will be held in class on Monday May 13th.
 - Review for Exam 3 will be held on Wednesday May 8th.
 - Syllabus for Exam 3: Sections 4.6, 4.7, 5.1 - 5.5, 5.7
 - Best way to prepare for the exam is to solve the Classworks, Sample problems and Webwork Problems.
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1. For the functions below:

- (a) Find intervals of increase and decrease.
- (b) Find intervals of concavity.
- (c) Find the transition points.
- (d) Find asymptotes if any.
- (e) Sketch the graph using all this information.

(a) $f(x) = x^3 - 2x^2 + 3$

(c) $f(x) = x - 2 \sin x$ on $[0, \pi]$

(b) $f(x) = \frac{2x - 2}{4 - x}$

(d) $f(x) = xe^x$

2. Use L'Hopital's Rule to evaluate the limit.

(a) $\lim_{x \rightarrow \infty} \frac{3x^2 + 4}{3 - 7x^2}$

(c) $\lim_{x \rightarrow 0^+} \sqrt{x} \ln x$

(b) $\lim_{x \rightarrow \infty} \frac{x^3 + 3x^2 + 5x - 1}{e^{4x+1}}$

(d) $\lim_{x \rightarrow 0} \frac{e^x - 1}{\sin x}$

3. A farmer wants to construct a rectangular enclosure of area 1000 square feet of land which has a river on one of the sides (no fencing along the river). Find the dimensions which will minimize the fencing.
4. A box with a square base (and top) is constructed out of two types of metal. The metal for the top and bottom cost $\$1/ft^2$ and the metal on the sides costs $\$2/ft^2$. Find the dimensions that minimize cost if the box has a volume of $20 ft^3$.
5. Compute the following Riemann sums.
- (a) R_3 and L_3 for $f(x) = x^2 + 4x$ on the interval $[1, 4]$. Write endpoints of subintervals and Δx .
 - (b) R_6 and L_6 for $f(x) = (1 + x^2)^{-1}$ on the interval $[0, 1]$. Write endpoints of subintervals and Δx .

6. Find R_N for $f(x) = 3x^2 + 2$ from $[0, 3]$ and use it to evaluate $\int_0^3 f(x) dx$. Use the summation identities $\sum_{i=1}^n j^2 = \frac{n(n+1)(2n+1)}{6}$.

7. Evaluate the following indefinite integrals.

(a) $\int \cos(4 - 7t) dt$

(e) $\int \frac{7s^4 + 2s}{\sqrt{s}} ds$

(b) $\int 13t^{4/9} - \frac{7}{t^{15/9}} dt$

(f) $\int \cos y \sin^3 y dy$ (Substitution)

(c) $\int \frac{2}{5u + 2} du$ (Substitution)

(g) $\int x^2 e^{x^3} dx$ (Substitution)

(d) $\int \sin x \sqrt{4 - \cos x} dx$ (Substitution)

(h) $\int \frac{\ln x}{x} dx$

8. Evaluate the following definite integrals.

(a) $\int_0^1 (4x^3 - 2x^5) dx$

(e) $\int_1^e \frac{\ln x}{x} dx$ (Substitution)

(b) $\int_1^4 r^{-2} dr$

(f) $\int_1^2 t\sqrt{t^2 + 2} dt$ (Substitution)

(c) $\int_0^{\pi/4} \sec t \tan t dt$

(g) $\int_{-4}^{-2} \frac{12x}{(x^2 + 2)^3} dx$ (Substitution)

(d) $\int_6^2 \sqrt{4y + 1} dy$ (Substitution)

(h) $\int_0^1 (3x^2 + 1)(x^3 + x - 1)^5 dx$ (Substitution)

9. Find y' .

(a) $y = \int_3^x \sin(t^3) dt$

(b) $y = \int_0^{\sin x} t^3 dt$

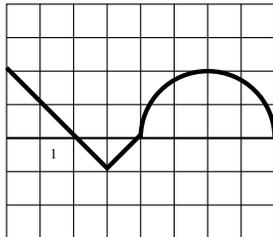
(c) $y = \int_{4x^2}^9 \frac{1}{t} dt$

10. Graphs of functions f, g and h are given below. Evaluate the following integrals:

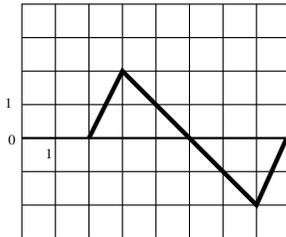
(a) $\int_0^6 f(x) dx$

(b) $\int_2^8 g(x) dx$

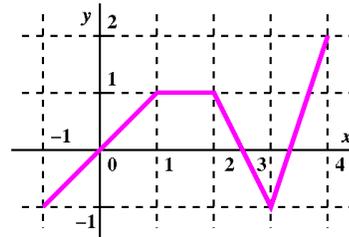
(c) $\int_{-1}^4 h(x) dx$



Graph $y = f(x)$



Graph $y = g(x)$



Graph $y = h(x)$