

Name: _____

NON-GRAPHING CALCULATORS ALLOWED

1. [5 points each] Compute the following integrals.

a. $\int \sin 3x \, dx$

b. $\int x^2 \cos(x^3) \, dx$

c. $\int q\sqrt{q+3} \, dq$

d. $\int_{-3}^3 x^3 e^{x^2} \, dx$ (Think!)

e. $\int_0^3 |x^2 - 4x + 3| \, dx$

f. $\int \tan \theta \, d\theta$

2. [5 points] Let $g(x) = \int_0^{x^3} \sec^3(t^2) dt$. Find $\frac{dg}{dx}$.

3. [10 points] Sketch the graph of $y = 8x^2 - x^4$.

- a. Where are the zeros?
- b. What is the absolute maximum value and at which points does it occur?
- c. What are the x -coordinates of the inflection points?

4. [5 points] Recall that $\sum_{i=1}^n i^3 = \frac{n^2(n+1)^2}{2}$. Use this to compute $\lim_{n \rightarrow \infty} \sum_{i=1}^n \frac{i^3}{n^3}$.

5. [10 points] 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 with the largest area?

6. [15 points] Graph $f(x) = \int_0^x g(t) dt$, where $g(t)$ is given by the graph below and answer these questions. Indicate where your graph is concave up and concave down.

What is $f(6)$?

What is $f'(2)$?

What is $f''(2)$?

What is $f'(5)$?

What is $f''(5)$?

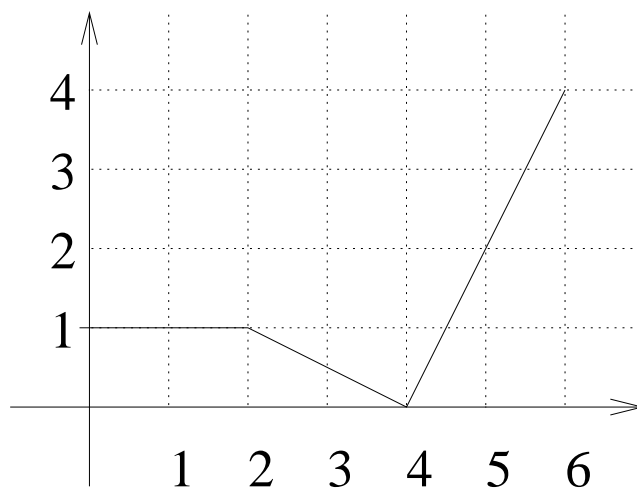


Figure 1: Graph of $g(t)$

7. [5 points] What is the average value of $f(x) = 4 - x^2$ over $[-2, 2]$?
8. [5 points] Let A be the area of the region under the graph of $y = e^{-x}$ from $x = 0$ to $x = 2$. Using right end points find an expression for A as a limit. DO NOT EVALUATE the limit.
9. [10 points] Let $f(x) = \int_0^x (3 - x)e^x dx$ for $x \geq 0$. DO NOT ATTEMPT TO EVALUATE IT.
- a. For what value of x will $f(x)$ be at its maximum value? Explain your reasoning.
- b. What is the x -coordinate of the inflection point of $f(x)$?