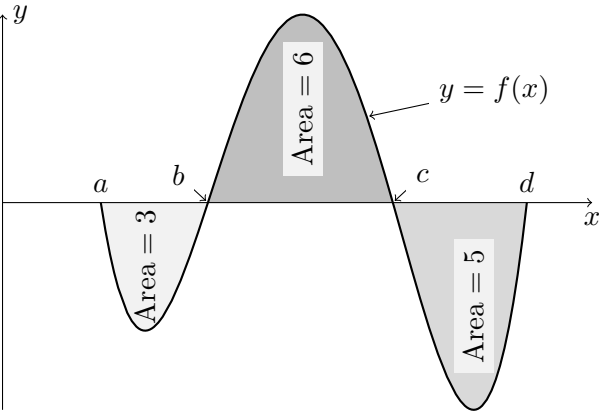


No Calculator permitted in this part. Read the questions carefully. Show all your work and clearly indicate your final answer. Use proper notation.

Problem 1: Use the figure to find the values of the following.



a. $\int_b^d f(x) \, dx =$

b. $\left| \int_a^d f(x) \, dx \right| =$

c. $\int_a^d |f(x)| \, dx =$

Score: ____/3

Problem 2: Use the definition of the definite integral to write $\int_1^4 5 - x^2 \, dx$ as a limit of a Riemann sum for R_n . Draw R_3 on a coordinate system. DO NOT EVALUATE

Score: ____/4

Problem 3: Use the Fundamental Theorem of Calculus to find the following.

a. If $F(x) = \int_{\pi}^{\sqrt[3]{x}} t \, dt$, find $F'(8)$ exactly.

Score: ____/2

b. If $G(x) = \int_{\ln(x)}^{\sin(\pi/6)} e^t - \sin^{-1}(t) \, dt$, find $dG(x)/dx$. Simplify.

Score: ____/2

Problem 4: Integrate each of the following indefinite integrals. Use correct notation and show all steps.

a. $\int \frac{\sqrt{u}-u^2}{u^3} du$

Score: /2

b. $\int \frac{\sin(x)}{4+\cos^2(x)} dx$

Score: /2

c. $\int \frac{e^{-t}}{(5-e^{-t})^4} dt$

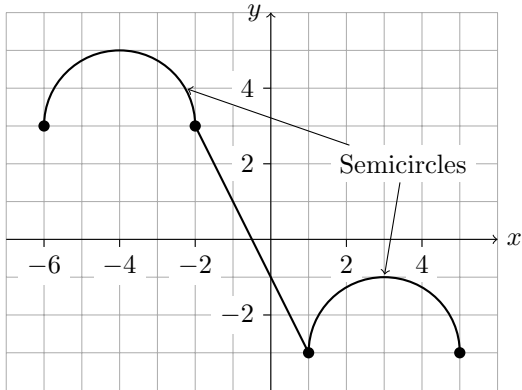
Score: /2

d. $\int \cot(\theta) d\theta$

Score: /2

A TI83 or TI84 Calculator permitted in this part. Read the questions carefully. Show all your work and clearly indicate your final answer. Use proper notation.

Problem 5: Given the graph of f , evaluate the following definite integrals exactly (with π and fractions). Show all steps.



a. $\int_{-6}^{-2} f(x) \, dx$

b. $\int_{-2}^1 |f(x)| \, dx$

c. $\left| \int_{-2}^5 f(x) \, dx \right|$

Score: /6

Problem 6: A car comes to a stop six seconds after the driver applies the brakes. While the brakes are on, the following velocities are recorded. Give an upper estimate for the distance the car travelled after the brakes were applied. Specify which approximation you use for the estimate.

Score: /3

Time since brakes applied (s)	0	2	4	6
Velocity (m/s)	30	17	6	0

Problem 7: Find a function f such that $f(1) = 5$ and the derivative of f is

$$f'(t) = 3\sqrt{t} + 4t^3$$

Problem 8: Water is leaking out of a tank at a rate of $R(t) = \frac{50}{1+t^2}$ litres per hour, t hours after the leak starts. Include units.

Score: /2

- Use your calculator to sketch the graph of $y = R(t)$ over $[0, 4]$.
- At what time was the water leaking out at the fastest rate?
- Use R_{50} to estimate the volume of water that leaked out of the tank in the first hour. Provide 4-decimal place accuracy.
- Find the average rate of leakage in the first four hours. Provide 4-decimal place accuracy.

Score: /8