

Math 112 Midterm 2 Practice Problems

Integral Problems

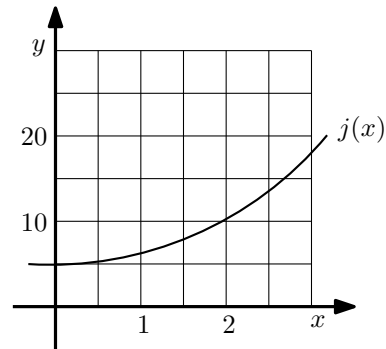
1. Compute the indefinite integral:

$$\int \frac{e^{2x} + 6e^{-2x}}{3e^x} dx.$$

2. We're given the graph of the function $j(x)$ on the right. Using the graph,

(a) Find $\int_1^2 j(x) dx$.

(b) Find $\int_1^2 j'(x) dx$.



3. In the competitive market of disposable quill pens, the supply and demand functions are

$$\text{supply: } s(x) = 4 - \frac{16}{x+4},$$

$$\text{demand: } d(x) = \frac{18}{2x+1}.$$

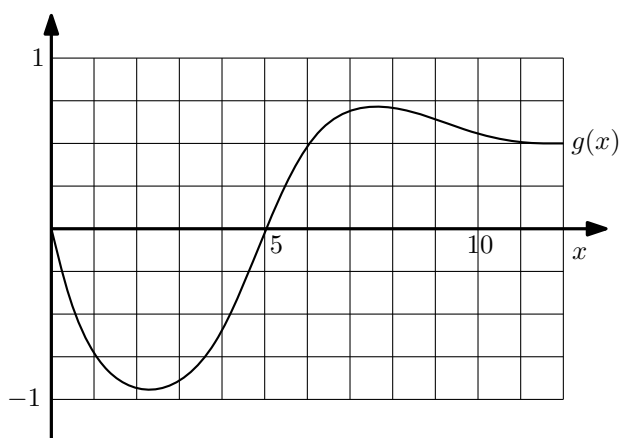
Find the consumer's surplus and the producer's surplus at the equilibrium point.

Optimization (Min/Max) Problems

4. You're handed the function $f(x) = x^3 - 3x^2 + 3x - 1$.

- (a) Find all relative minima and maxima of $f(x)$.
- (b) Find the interval(s) where $f(x)$ is concave up and the interval(s) where it is concave down.
- (c) Find the absolute minimum and maximum value of $f(x)$ on the interval $[0, 2]$.

5. You're given the following graph:



Suppose

$$A(z) = \int_0^z g(z) \, dz.$$

- (a) What is the global minimum and maximum value of $A(z)$ on the interval $[0, 10]$? What about the interval $[0, 12]$?
- (b) What is the global minimum and maximum value of $A'(z)$ on the interval $[0, 3]$?
- (c) What is the global minimum and maximum value of $A''(z)$ on the interval $[0, 3]$?

6. You're given $h(x) = x^3 - 3x^2 + 2x$, and suppose

$$A(z) = \int_0^z h(z) \, dz.$$

- (a) What is the global minimum and maximum value of $A(z)$ on the interval $[0, 3]$? What about the interval $[0, 1.5]$?
- (b) What is the global minimum and maximum value of $A'(z)$ on the interval $[0, 3]$?
- (c) What is the global minimum and maximum value of $A''(z)$ on the interval $[0, 3]$?