1 Optimization (1 pt.)

Consider the spatial proximity model of voting, which assumes that a voter votes for the political party that takes the closest issue position to his or her own most preferred issue position. Suppose the party’s issue position is represented by \( p \) and the voter’s issue position is \( x \). We might represent the voter’s utility from choosing a certain party as: \( u(p) = -(x - p)^2 \).

Suppose the party wants to choose a position \( p \) maximizes the median voter’s utility of choosing it. Find the value of \( p \) that does that. Use calculus to find your answer, showing that the first and second order conditions are both satisfied.

2 Evaluate the following integrals (2 pts.)

a) \( \int_6^8 x^3 \, dx \)

b) \( \int_0^4 \left( \frac{1}{1 + x} + 2x \right) \, dx \) \( (x \neq -1) \)

c) \( \int_1^2 (2x^3 - 1)(6x^2) \, dx \)

d) \( \int (x + 3)e^{x^2 + 6x} \, dx \)

e) \( \int_x^e x \sqrt{x + 1} \, dx \)

f) \( \int_1^e x \ln x \, dx \)

g) \( \int_1^e \frac{\sqrt{1 + \ln x}}{x} \, dx \)

h) \( \int x a^x \, dx \), where \( a \) is some constant.

3 R work (1 pt.)

Consider the problem from Question #2.f. In R, define the function: \( x \ln x \). Plot this function over the domain \( x \in (0, 3] \). Draw a polygon of the area under the curve over the domain \( x \in [1, e] \). Compute the integral from #2.f using the `integrate` command.