

MA1M01: Model exam I

Problem 1 Consider the function

$$f(x) = \frac{2x^2 - 2}{x^2 - 3x + 2}$$

1. Determine the Domain of the function.
2. Determine the horizontal and vertical asymptotes.
3. Determine the local maxima and minima.
4. Sketch the function.

Problem 2 We pay 0.5eur for printing a page of 0.0625 square meters of paper. If we want to leave a left/right margin of 5cm, and a top/bottom margin of 7cm, what should be the horizontal and vertical dimensions of the paper in order to maximize the printing surface?

Problem 3 A differentiable function $f(x)$ in $[0, 1]$ obeys the properties

1. $f(0) = 0$
2. $f'(x) \leq 1$ for $x \in [0, 1]$

Show that the maximum possible value for

$$\int_0^1 f(x) dx$$

is $1/2$.

Problem 4 Find the volume of the surface of revolution of the function

$$f(x) = \sin x \sqrt{\cos x}$$

from $x = 0$ to $x = \pi/2$