Sheet 3 - Raytracing

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Practical part

Please find the solution in the accompanying .py file.

Theoretical Part

Assignment 3) Cumulative Distribution Function

The cumulative distribution function F of f is defined as the integral

$$F(x) = \int_{-\infty}^{x} f(x')\,dx',$$

which can be interpreted as the probability of a random variable X with probability distribution f having a value $X \leq x$. We can use this fact to get

$$\begin{aligned} P(0 < X < 1.5) = F(1.5) &= \int_{-\infty}^{1.5} f(x)\,dx = \int_{0}^{1} x\,dx + \int_{1}^{1.5} -x + 2\,dx \\ &= \left[\frac{1}{2}x^2\right]_0^1 + \left[-\frac{1}{2}x^2 + 2x\right]_1^{1.5} \\ &= \frac{1}{2} - \frac{1}{2}\cdot\frac{9}{4} + 2\cdot\frac{3}{2} - \left(-\frac{1}{2} + 2\right) \\ &= \frac{1}{2} - \frac{9}{8} + 3 + \frac{1}{2} - 2 = \frac{7}{8}. \end{aligned}$$