Varbūtība

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↗ 5.1. uzdevums

1)

uztaisīt blīvuma f-jas grafiku

$$\int_{-\infty}^{+\infty} f(x)dx = 1$$
$$\int_{0}^{1} a(1 - x^3)dx = 1$$
$$a\int_{0}^{1}(1 - x^3)dx = a\left(\int_{0}^{1} 1dx - \int_{0}^{1} x^3dx\right) = a \cdot (x - \frac{x^4}{4})\Big|_{0}^{1} =$$
$$= a(\frac{3}{4} - 0)$$
$$1 = a\frac{3}{4}$$
$$a = \frac{4}{3}$$

2)

$$F(x) = \begin{cases} \int_{-\infty}^{x} 0dx & = 0 & x \le 0 \\ \int_{-\infty}^{0} 0dx + \int_{0}^{x} \frac{4}{3}(1 - x^3)dx & = \frac{4}{3}(x - \frac{x^4}{4}) & 0 < x \le 1 \\ \int_{-\infty}^{0} 0dx + \int_{0}^{1} \frac{4}{3}(1 - x^3)dx + \int_{1}^{x} 0dx & = 1 & x > 1 \end{cases}$$

3)

$$\boxed{P(x_1 < X < x_2) = F(x_2) - F(x_1)}$$

$$P(\tfrac{1}{3} < X < \tfrac{2}{3}) = F(\tfrac{2}{3}) - F(\tfrac{1}{3}) = \frac{4}{3}\left(\frac{2}{3} - \frac{1}{4}(\tfrac{2}{3})^4\right) - \frac{4}{3}\left(\frac{1}{3} - \frac{1}{4}(\tfrac{1}{3})^4\right) \approx 0,38$$

4)

$$\boxed{P(X < x) = F(x)}$$

$$P(X < 0,5) = F(0,5) = \frac{4}{3}\left(0,5 - \frac{1}{4}(0,5)^4\right) \approx 0,65$$

2)

$$f(x) = F'(x) \begin{cases} 0 & x \le 0 \\ 0,2 + 2bx & 0 < x \le 10 \\ 0 & x > 10 \end{cases}$$

3)

$$E(X) = \int_{-\infty}^{+\infty} x \cdot f(x)dx =$$
$$= \int_{-\infty}^{0} x \cdot 0 dx + \int_{0}^{10} x \cdot (0,2 + 2bx)dx + \int_{10}^{+\infty} x \cdot 0 dx \approx 3,3(3)$$

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1)

$f(x) :$ 🌱 Desmos
$A = 3$

2)

$$E(X) = 1,5$$

3)

$$D(X) = E(X^2) - E^2(X)$$
$$E(X^2) = \int_{1}^{\infty} x^2 \frac{3}{x^4}dx = 3\int_{1}^{\infty} \frac{1}{x^2}dx = 3\left(-\frac{1}{x}\Big|_{1}^{\infty}\right) = 3$$
$$D(X) = 3 - 1,5^2 = 0,75$$

4)

$$\sigma = \sqrt{D(X)} \approx 0,866$$

5)

$$F(X) = \int f(x)dx = \begin{cases} 0 & x < 1 \\ \frac{1}{x^3} & x \ge 1 \end{cases}$$

6)