Контрольная работа 2 МСО Прекель В.А.

Вариант 1

Задание 1

In [1]:
```
import sympy as sp
```

In [2]:
```
x, y, a = sp.symbols("x y a")
x, y, a
```

Out[2]:
```
(x, y, a)
```

In [3]:
```
f_x = a * (1 - x**2)
f_x
```

Out[3]: $a\left(1 - x^{2}\right)$

Найдём параметр a

In [4]:
```
f_x_int = sp.integrate(f_x, (x, -1, 1))
f_x_int
```

Out[4]: $\frac{4a}{3}$

In [5]:
```
a = sp.solve(sp.Eq(f_x_int, 1))[0]
a
```

Out[5]: $\frac{3}{4}$

Найдём мат. ожидание

In [6]:
```
f_x = a * (1 - x ** 2)
f_x
```

Out[6]: $\frac{3}{4} - \frac{3x^{2}}{4}$

In [7]:
```
m_x = sp.integrate(x * f_x, (x, -1, 1))
m_x
```

Out[7]: 0

Найдём дисперсию

In [8]:
```
d_x = sp.integrate(f_x * (x - m_x) ** 2, (x, -1, 1))
d_x
```

Out[8]: $\frac{1}{5}$

Найдем среднеквадратическое отклонение

In [9]:
```
s = d_x ** (1/2)
s
```

Out[9]: 0.447213595499958

Медиана $F(x) = \frac{1}{2}$:

In [10]:
```
sp.solve(sp.Eq(sp.integrate(f_x, (x, -1, x)), 1/2), x)
```

Out[10]: [-1.73205080756888, 0.0, 1.73205080756888]

Задание 2

Для $|x| \leq 1$

In [11]:
```
F_x_minus1_x = sp.integrate(f_x, (x, -1, x))
F_x_minus1_x
```

Out[11]: $-\frac{x^3}{4} + \frac{3x}{4} + \frac{1}{2}$

Задание 3

In [12]:
```
xi = [-1, 0, 1, 2]
xi
```

Out[12]: [-1, 0, 1, 2]

In [13]:
```
u = sp.symbols("u")
pi = [0.1, 0.4, u, 0.4]
pi
```

Out[13]: [0.1, 0.4, u, 0.4]

In [14]:
```
pi[2] = sp.solve(sum(pi) - 1)[0]
pi
```

Out[14]: [0.1, 0.4, 0.100000000000000, 0.4]

Производящая функция:

$Q(z) =$

In [15]:
```
z = sp.symbols("z")
Q = 0
for i in range(0, 4):
    Q += pi[i] * z**i
Q
```

Out[15]: $0.4z^3 + 0.1z^2 + 0.4z + 0.1$

Математическое ожидание:

In [16]:
```
m = 0
for i in range(len(xi)):
    m += xi[i] * pi[i]
m
```

Out[16]: 0.8

Дисперсия:

In [17]:
```
d = -0.8**2
for i in range(len(xi)):
    d += xi[i] ** 2 * pi[i]
d
```

Out[17]: 1.16

Среднеквадратичное отклонение:

In [18]:
```
from math import sqrt
sigma = sqrt(d)
sigma
```

Out[18]: 1.0770329614269007

Медиана:

In [19]:
```
for i in range(0, len(xi) + 1):
    print(f"F({i}) = ", end='')
    F = 0
    for j in range(i):
        F += pi[j]
    print(F)
```

```
F(0) = 0
F(1) = 0.1
F(2) = 0.5
F(3) = 0.600000000000000
F(4) = 1.00000000000000
```

$F(x) = \frac{1}{2}$ при $x = 2$, поэтому медиана равна 2

In [ ]:
```
```