

# Mathematische Statistik

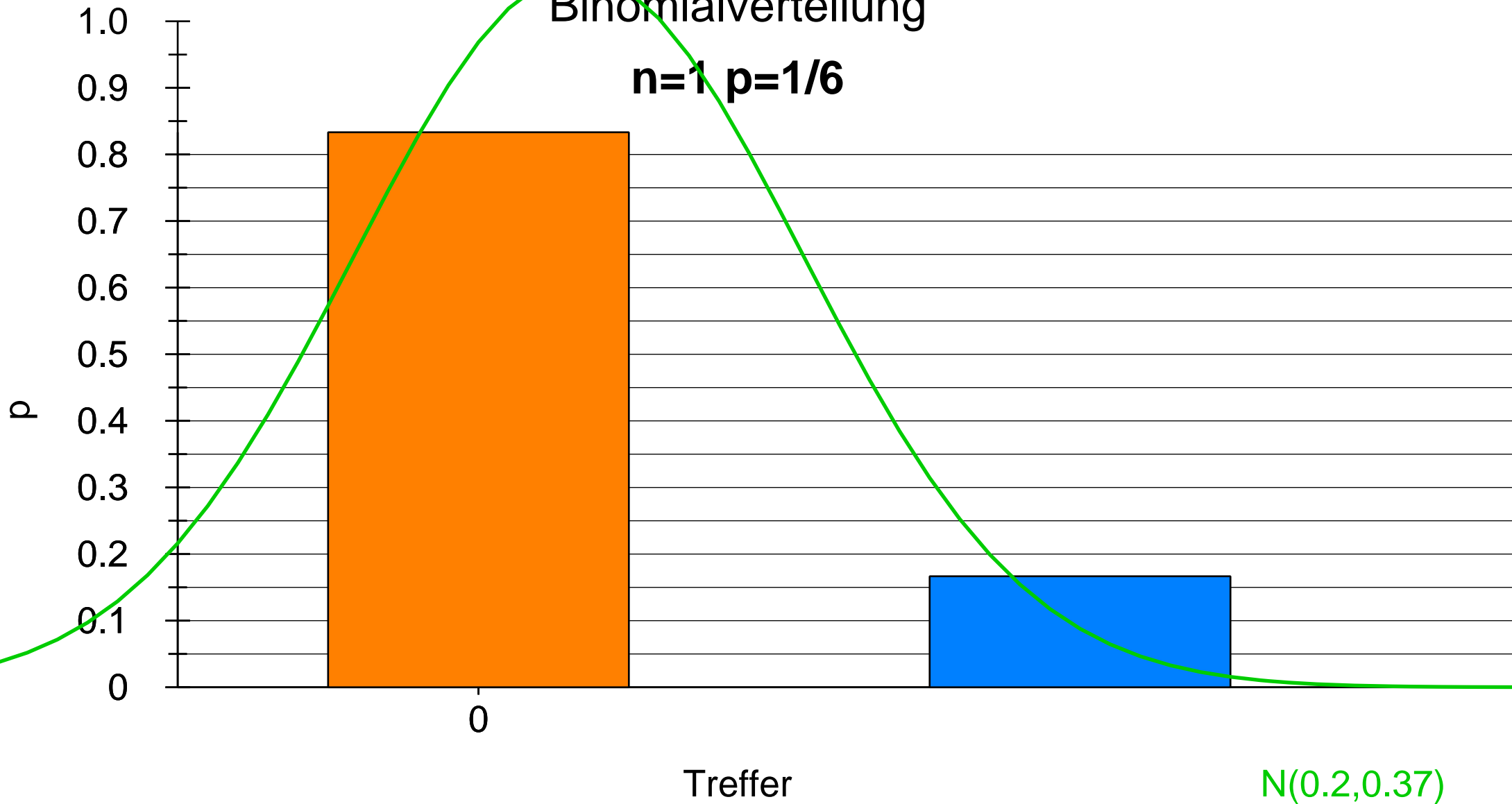
# Binomialverteilung

*G. Wegener*

Hannover, im Oktober 2017,  
alle Rechte vorbehalten.

Mathematische Statistik  
Binomialverteilung

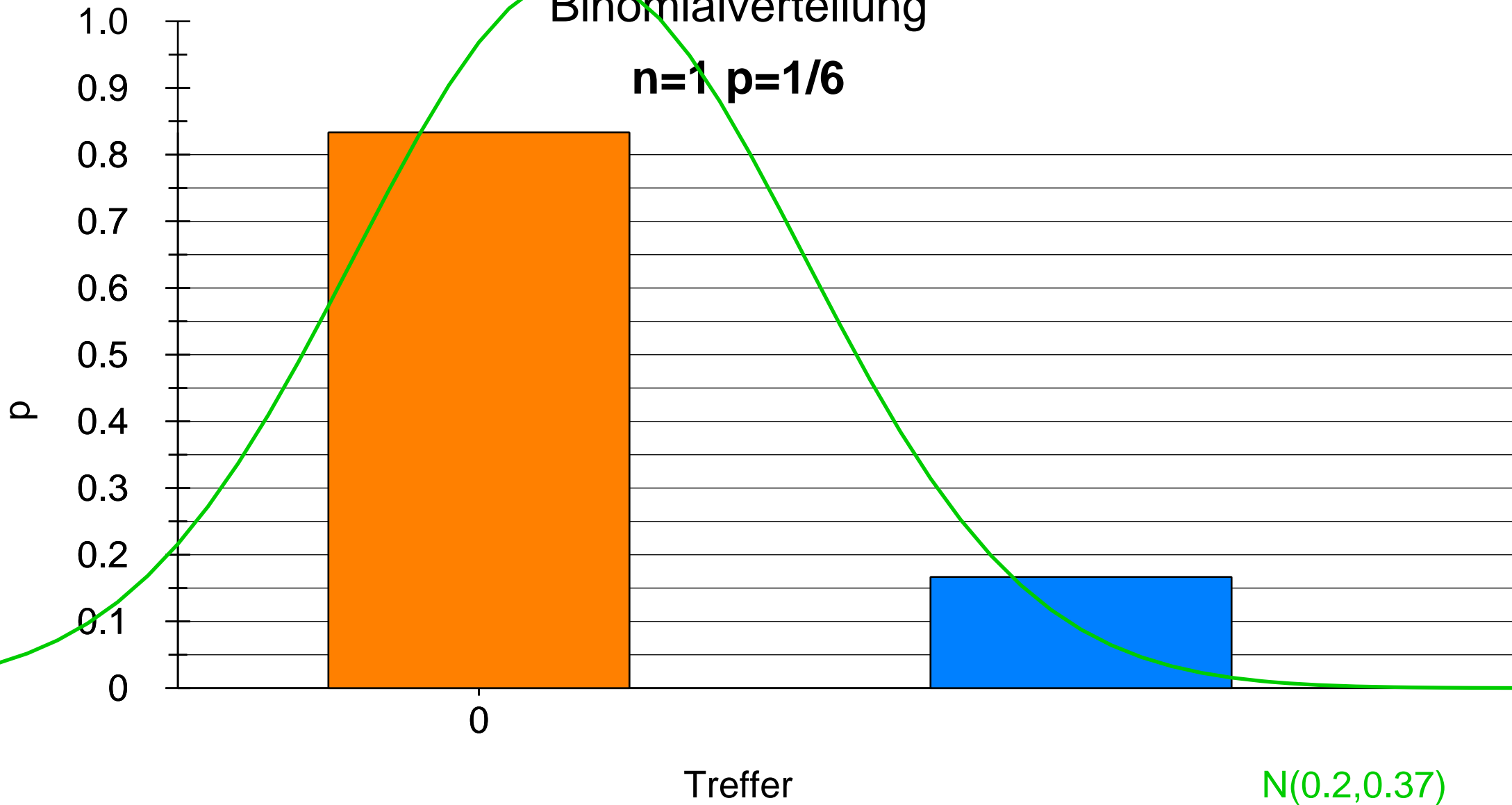
$n=1$   $p=1/6$



$N(0.2, 0.37)$

Mathematische Statistik  
Binomialverteilung

$n=1$   $p=1/6$

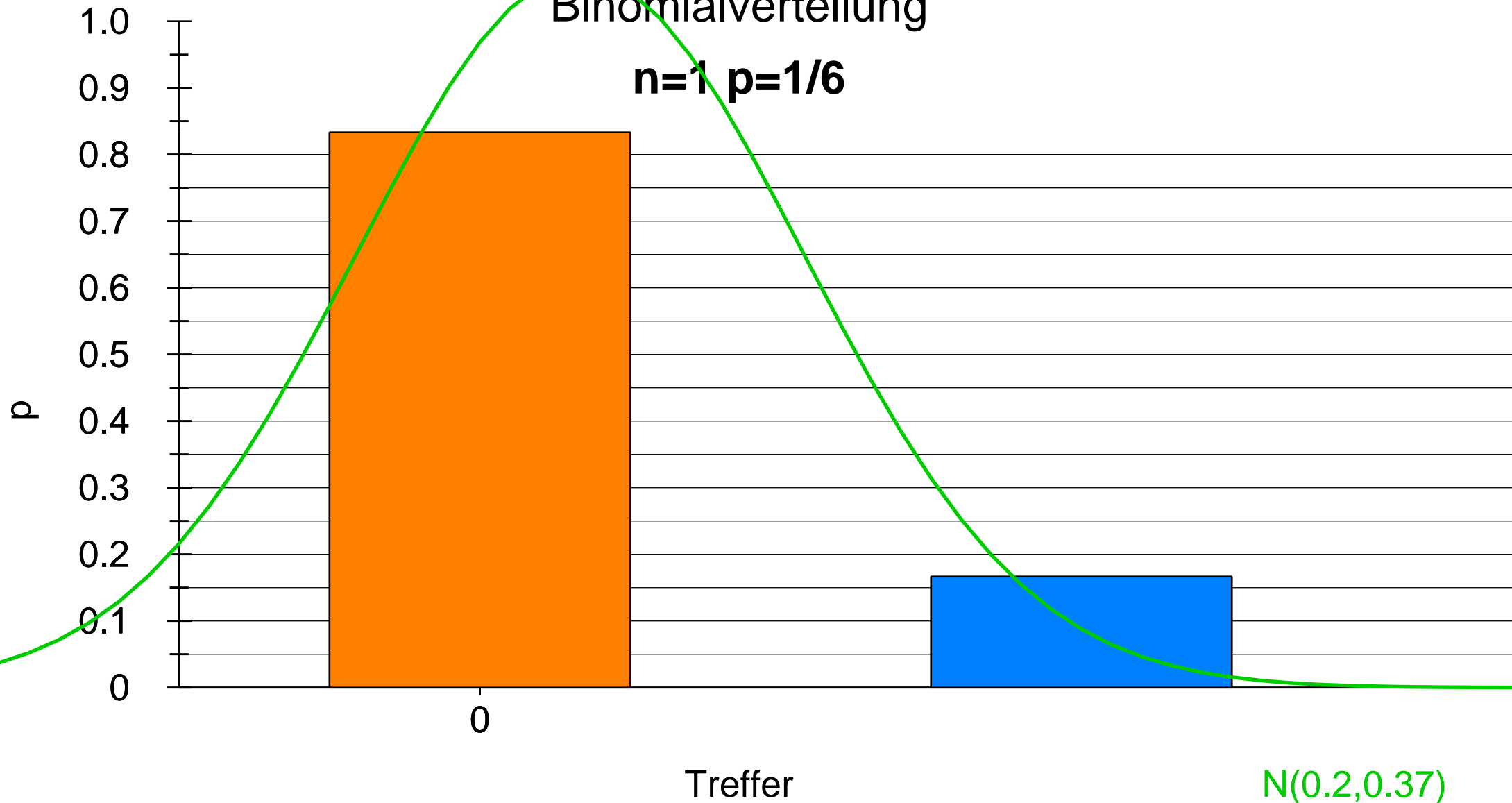


$N(0.2, 0.37)$

# Mathematische Statistik

## Binomialverteilung

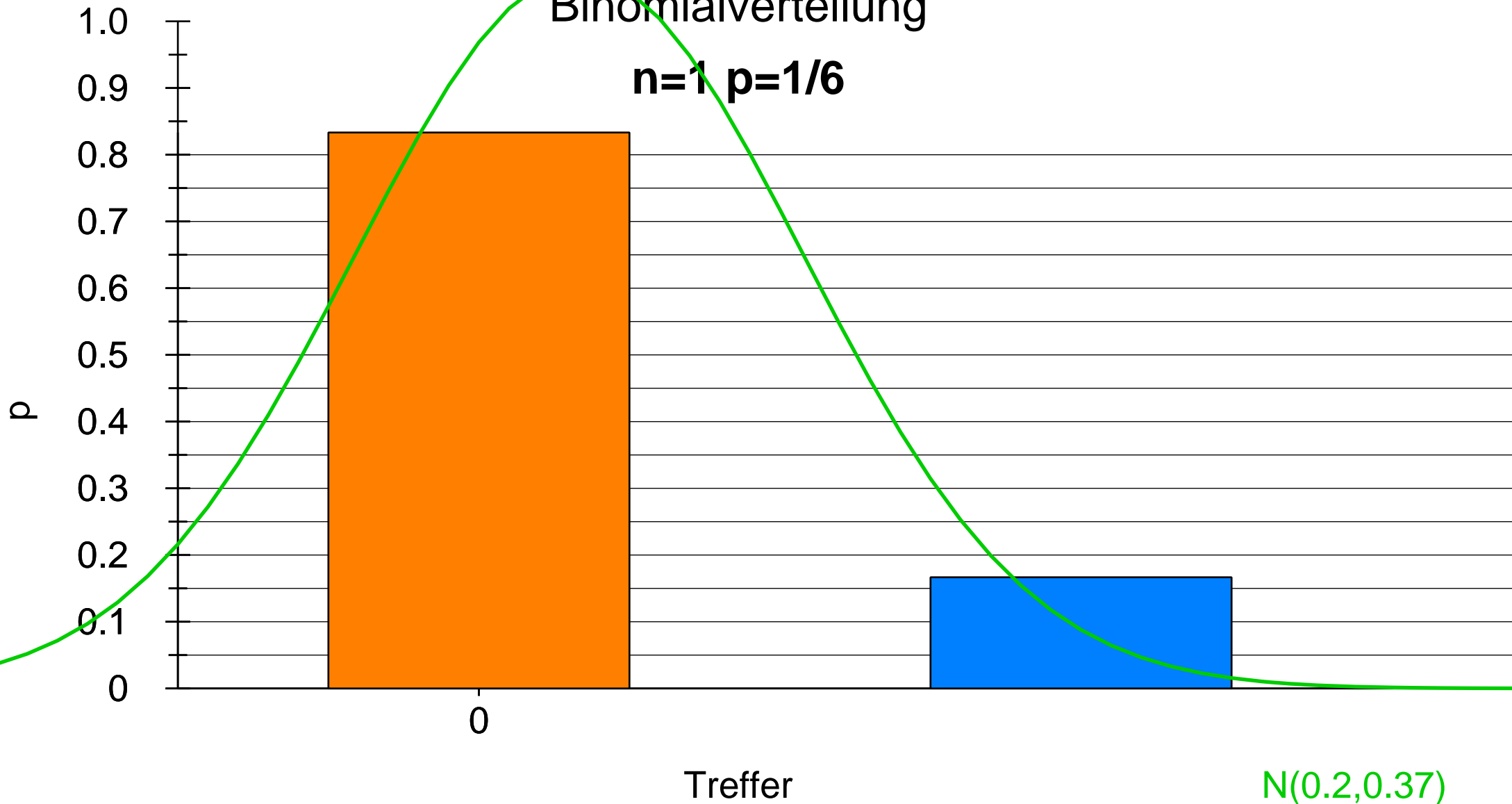
$n=1$   $p=1/6$



# Mathematische Statistik

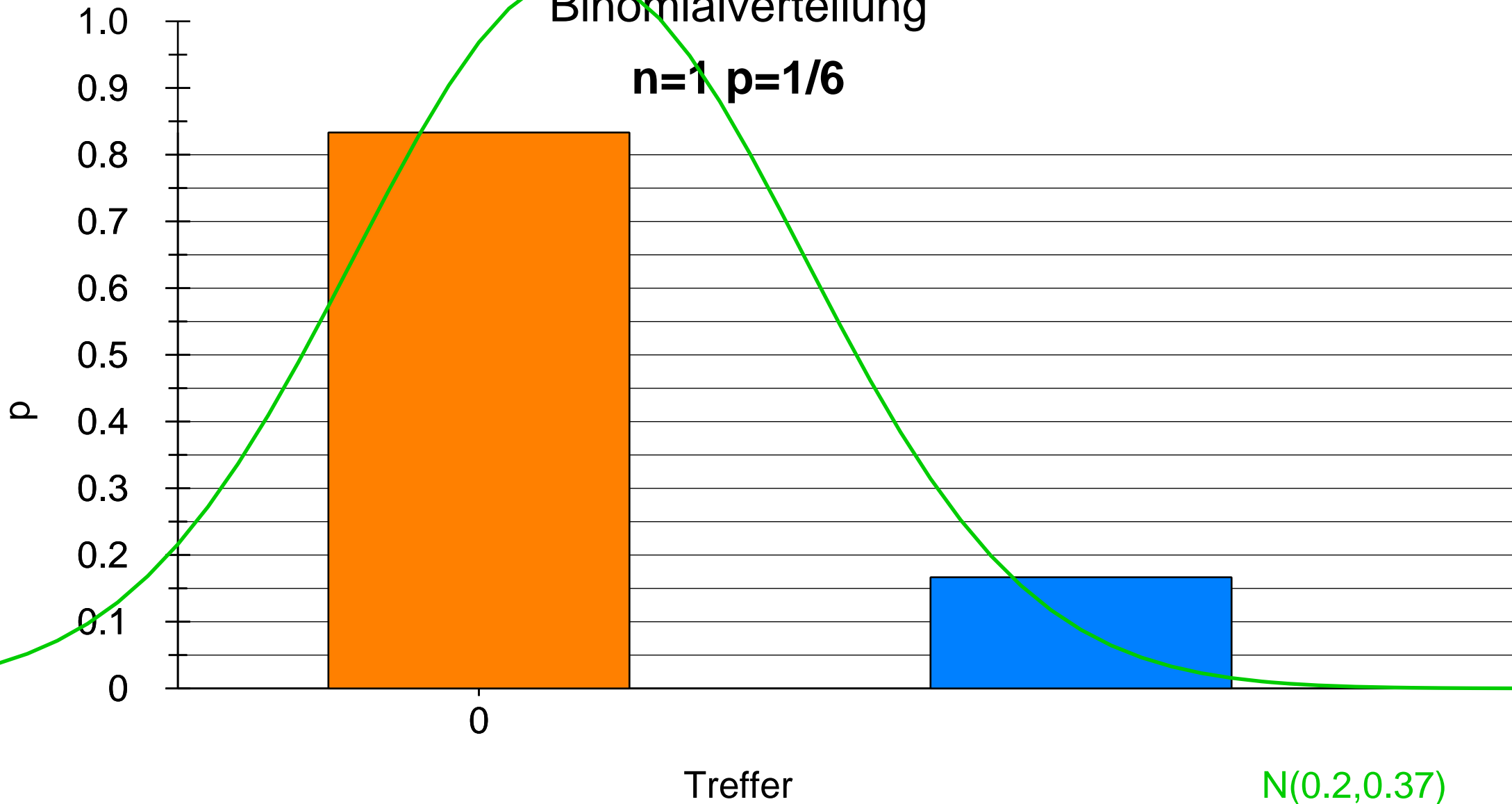
## Binomialverteilung

$n=1$   $p=1/6$



Mathematische Statistik  
Binomialverteilung

$n=1$   $p=1/6$

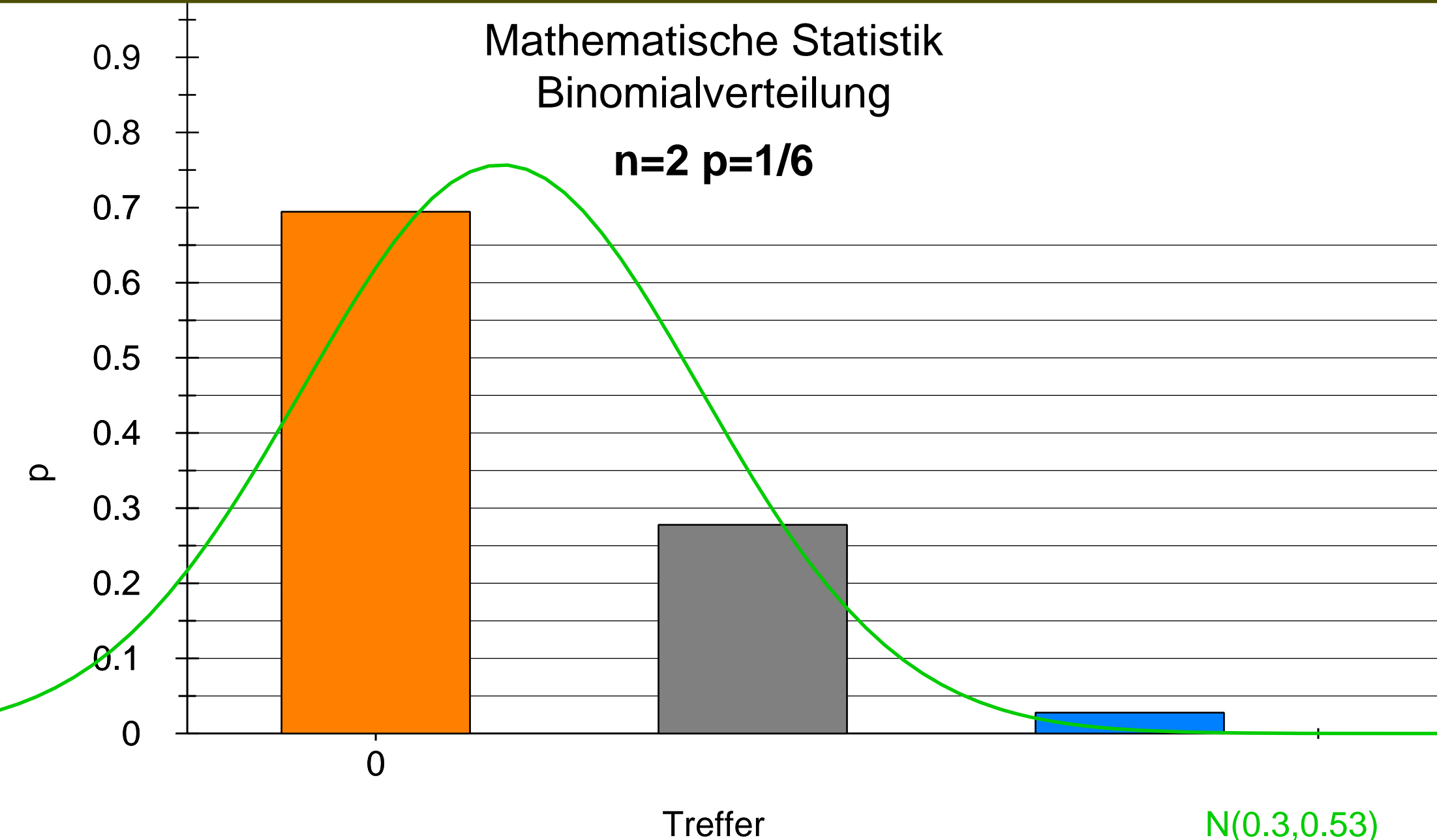


$N(0.2, 0.37)$

# Mathematische Statistik

## Binomialverteilung

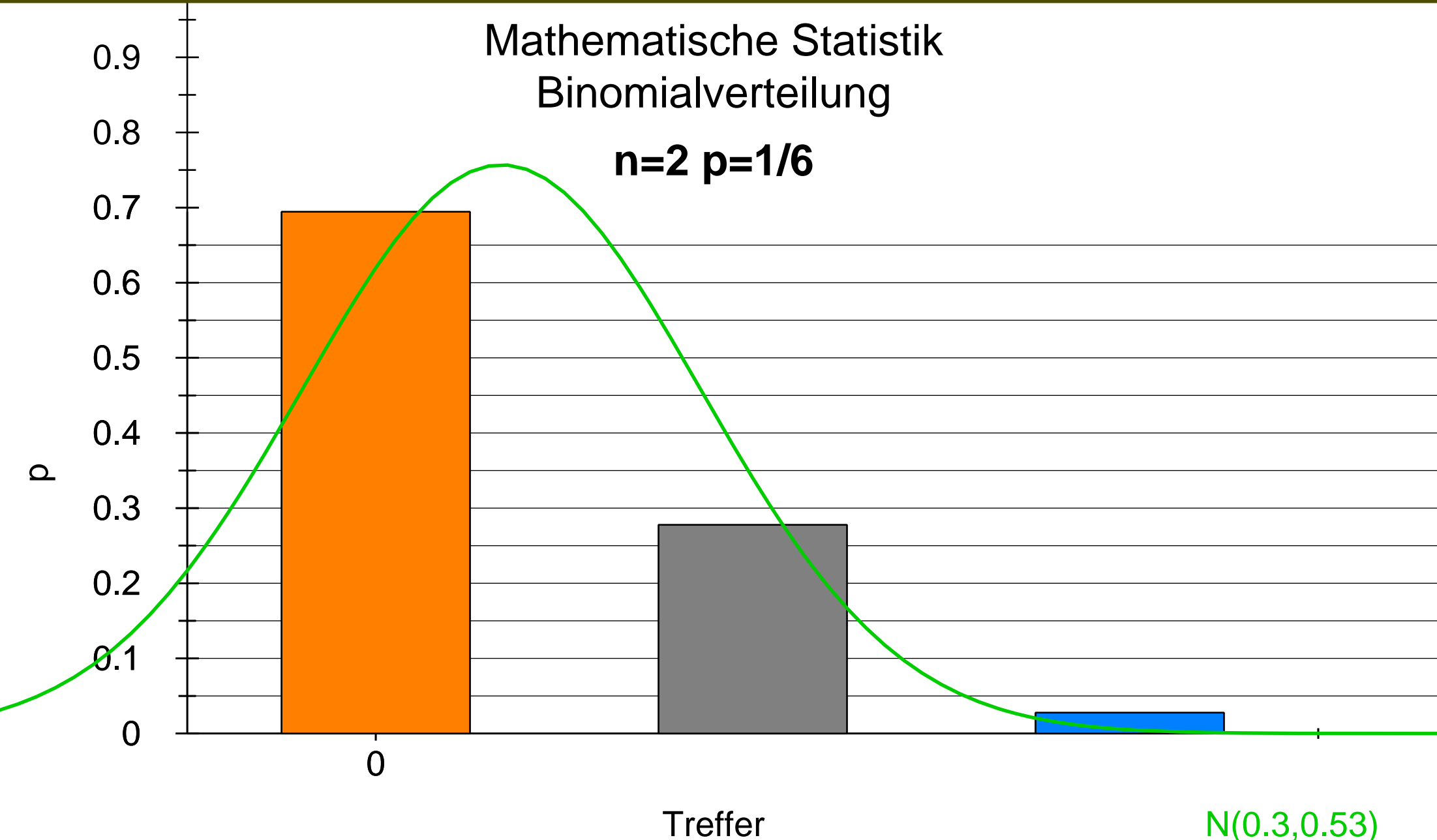
**$n=2$   $p=1/6$**



$N(0.3, 0.53)$

Mathematische Statistik  
Binomialverteilung

**n=2 p=1/6**

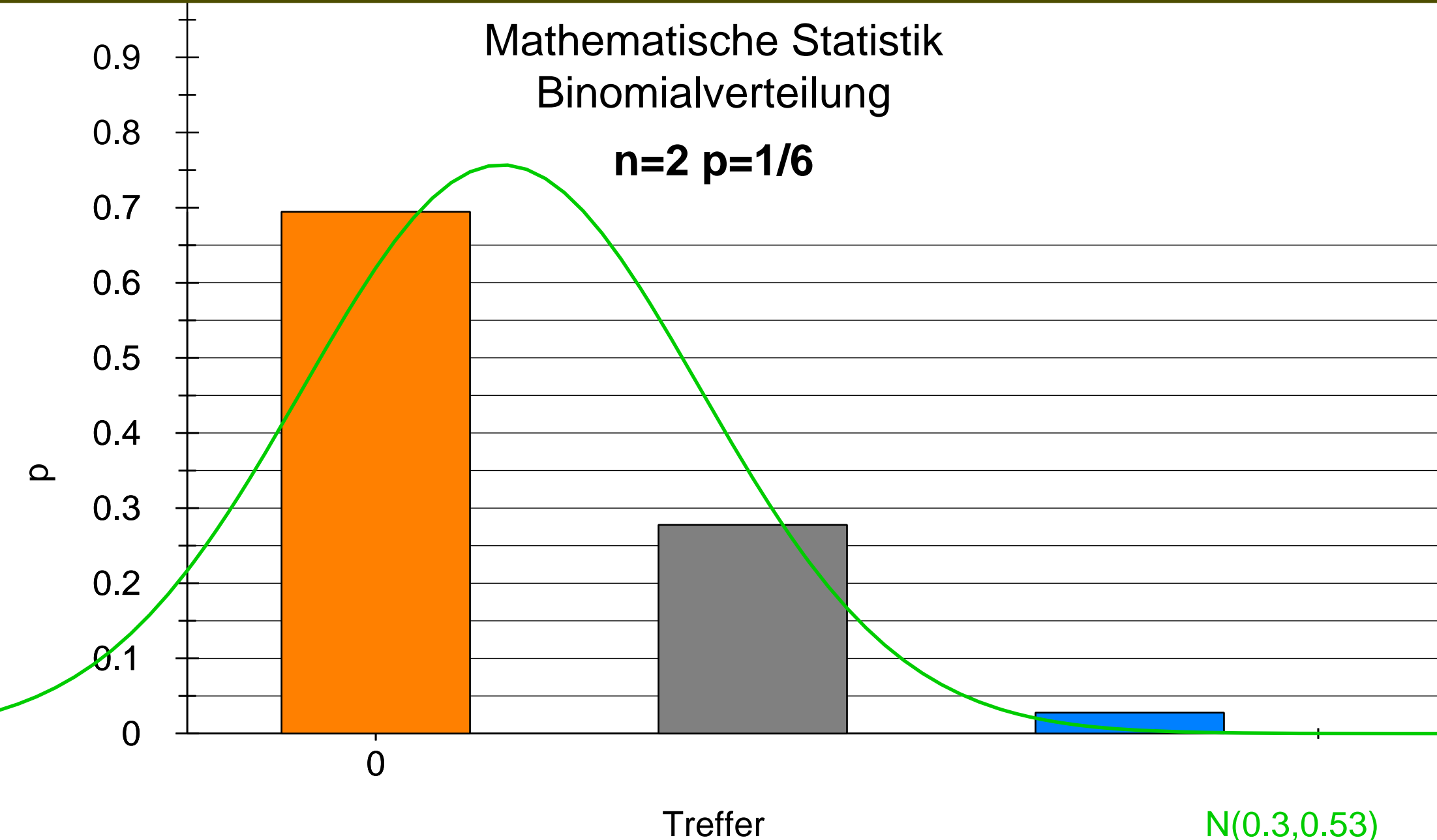


N(0.3, 0.53)



Mathematische Statistik  
Binomialverteilung

**n=2 p=1/6**



$N(0.3, 0.53)$

# Mathematische Statistik Binomialverteilung

**$n=2$   $p=1/6$**

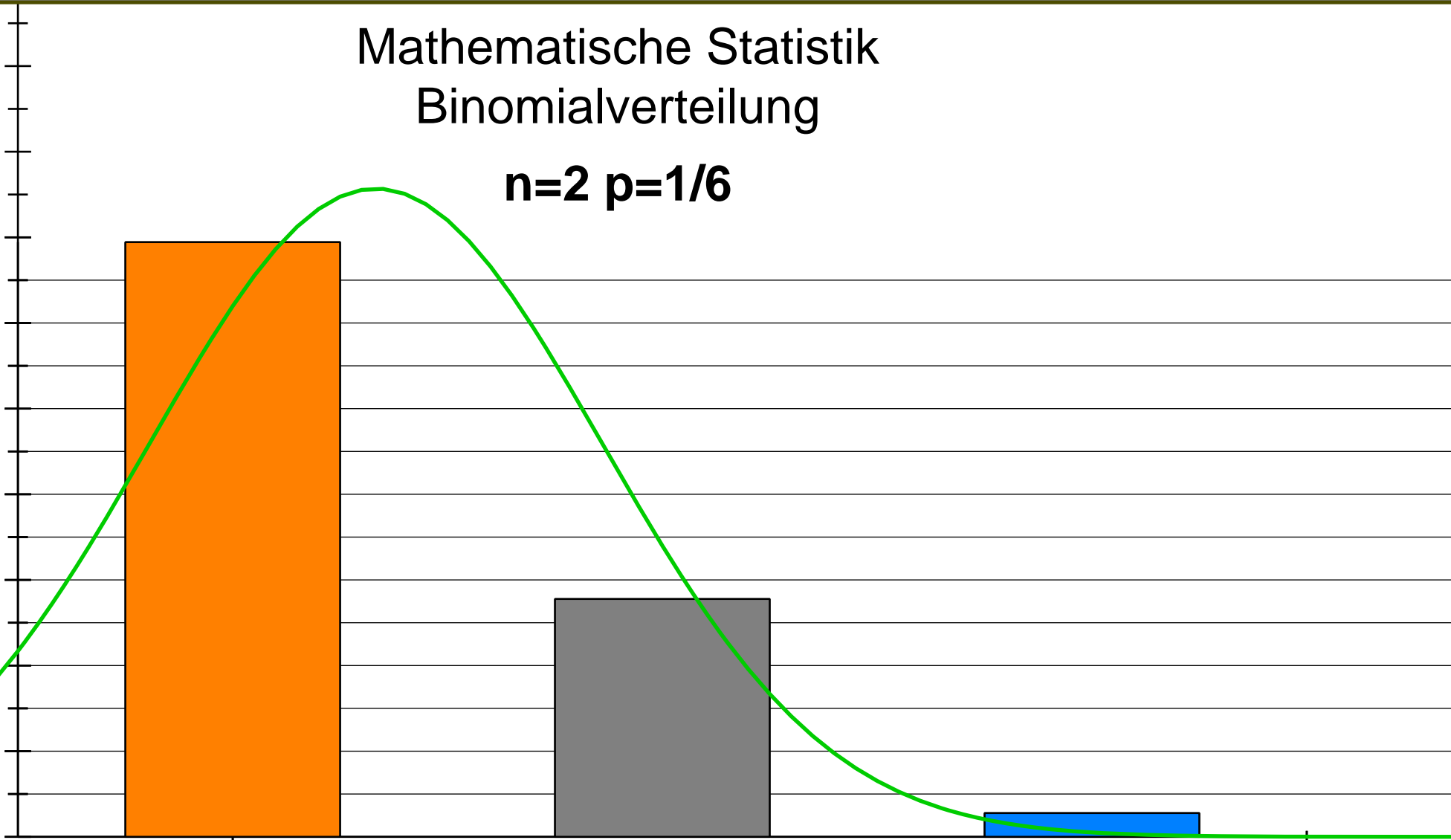
$p$

0.9  
0.8  
0.7  
0.6  
0.5  
0.4  
0.3  
0.2  
0.1  
0

0

Treffer

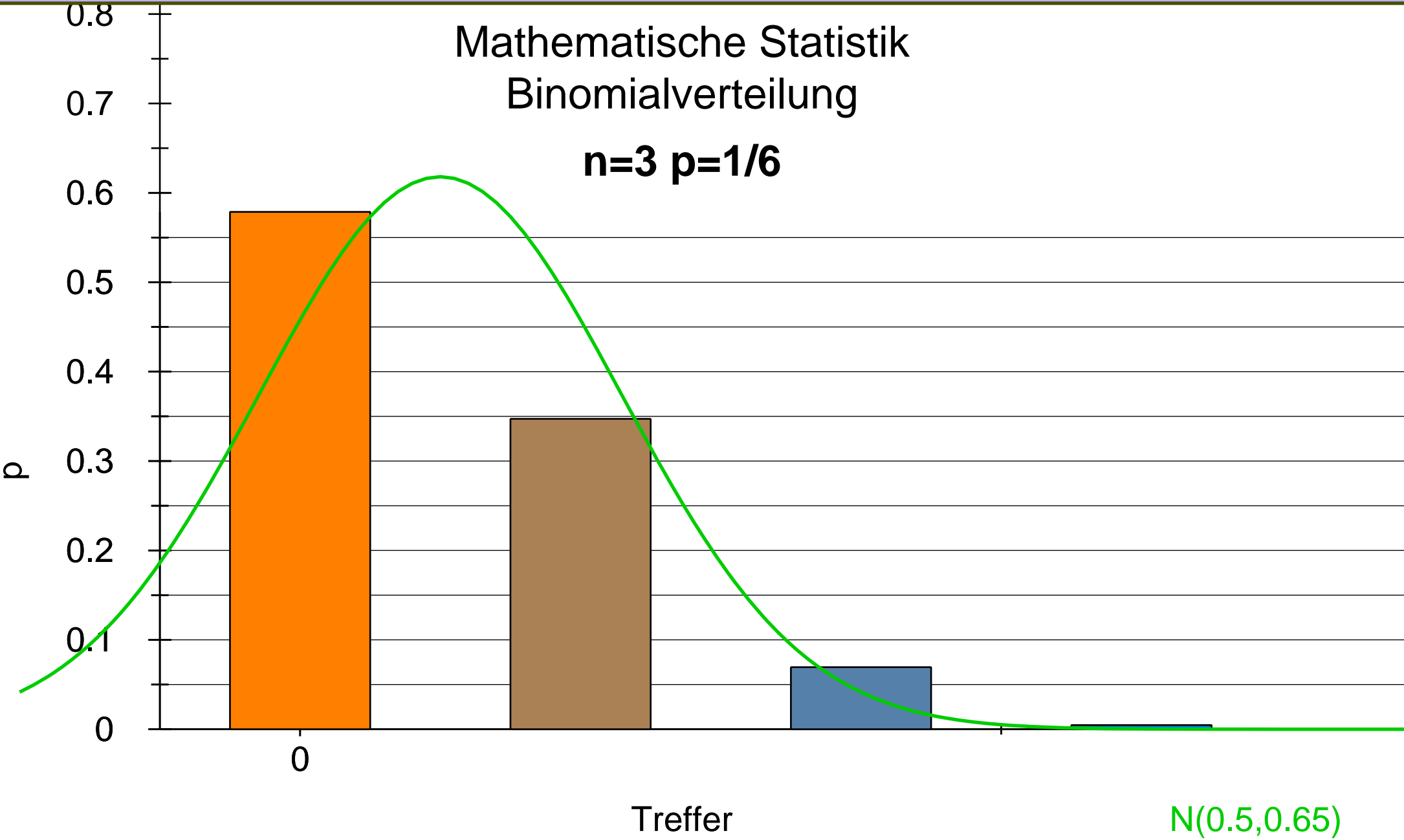
$N(0.3, 0.53)$



# Mathematische Statistik

## Binomialverteilung

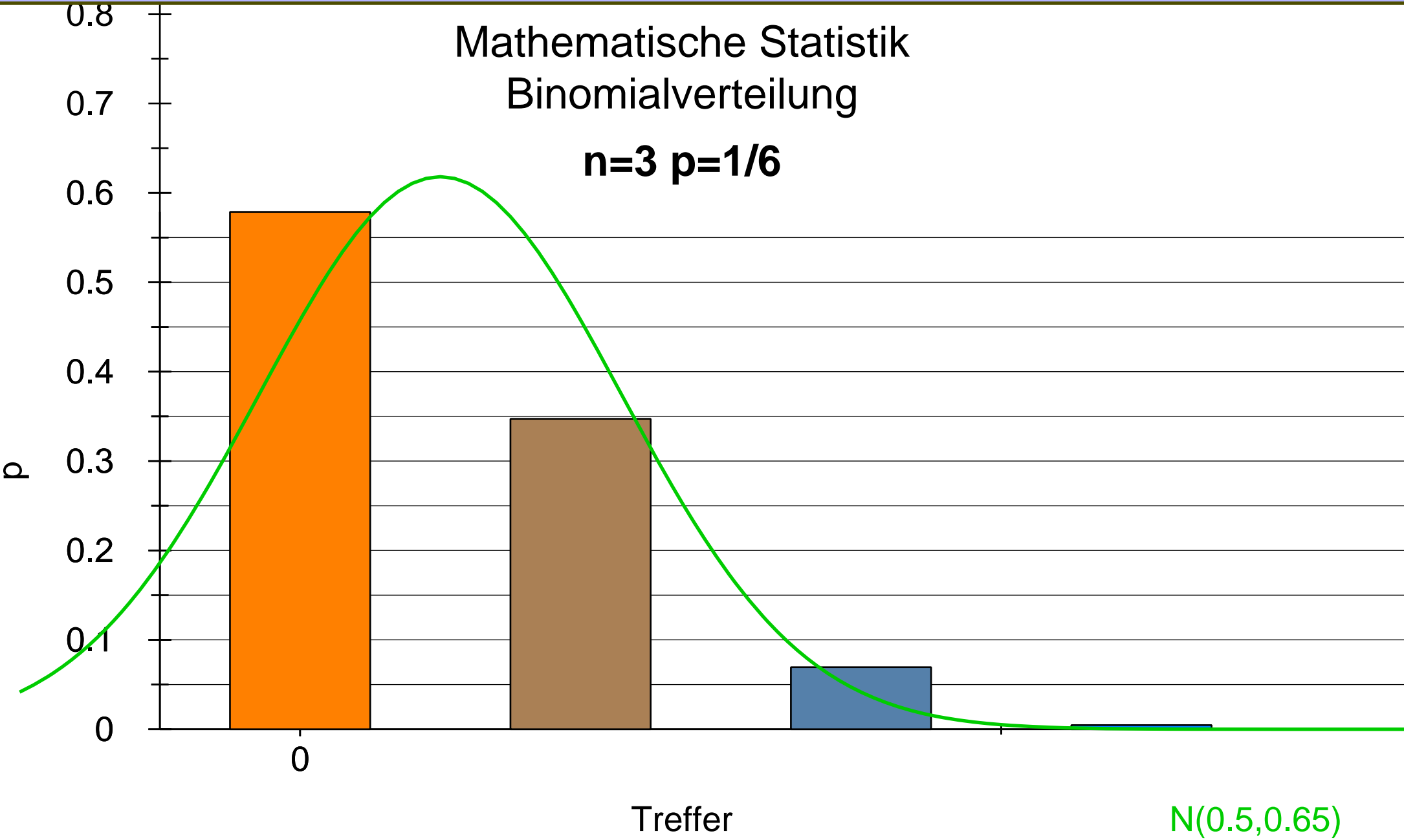
**$n=3$   $p=1/6$**



# Mathematische Statistik

## Binomialverteilung

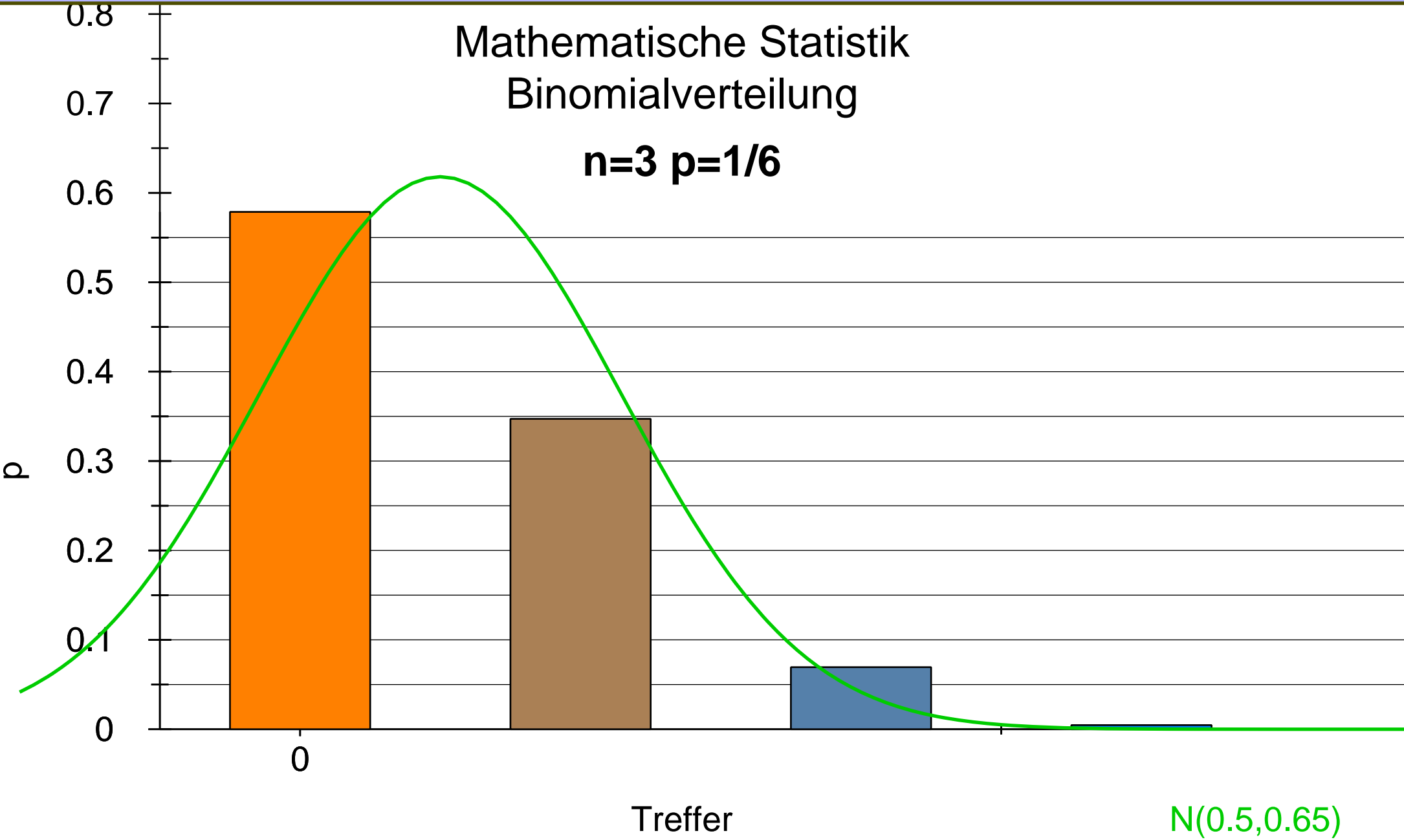
**$n=3$   $p=1/6$**



# Mathematische Statistik

## Binomialverteilung

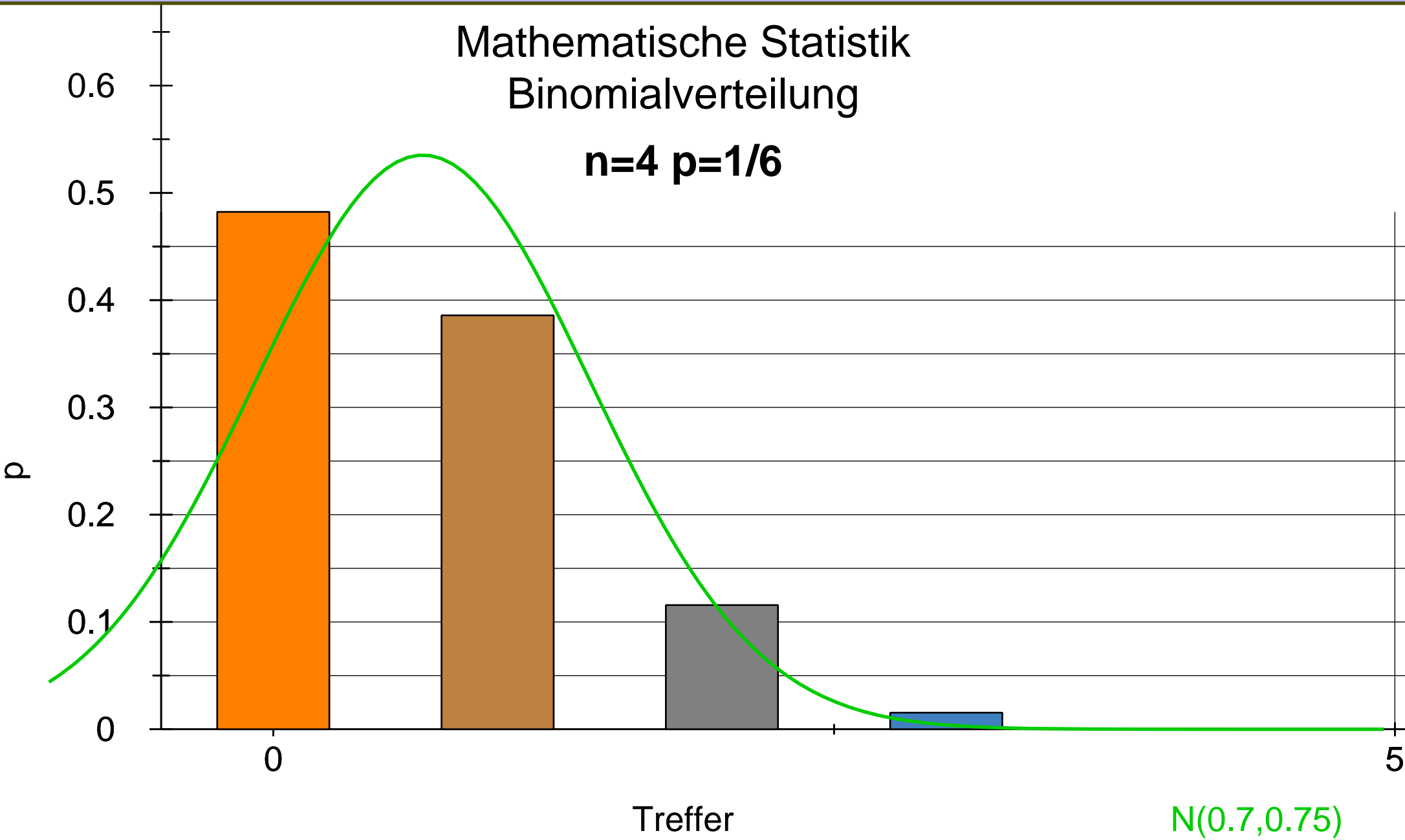
**$n=3$   $p=1/6$**



# Mathematische Statistik

## Binomialverteilung

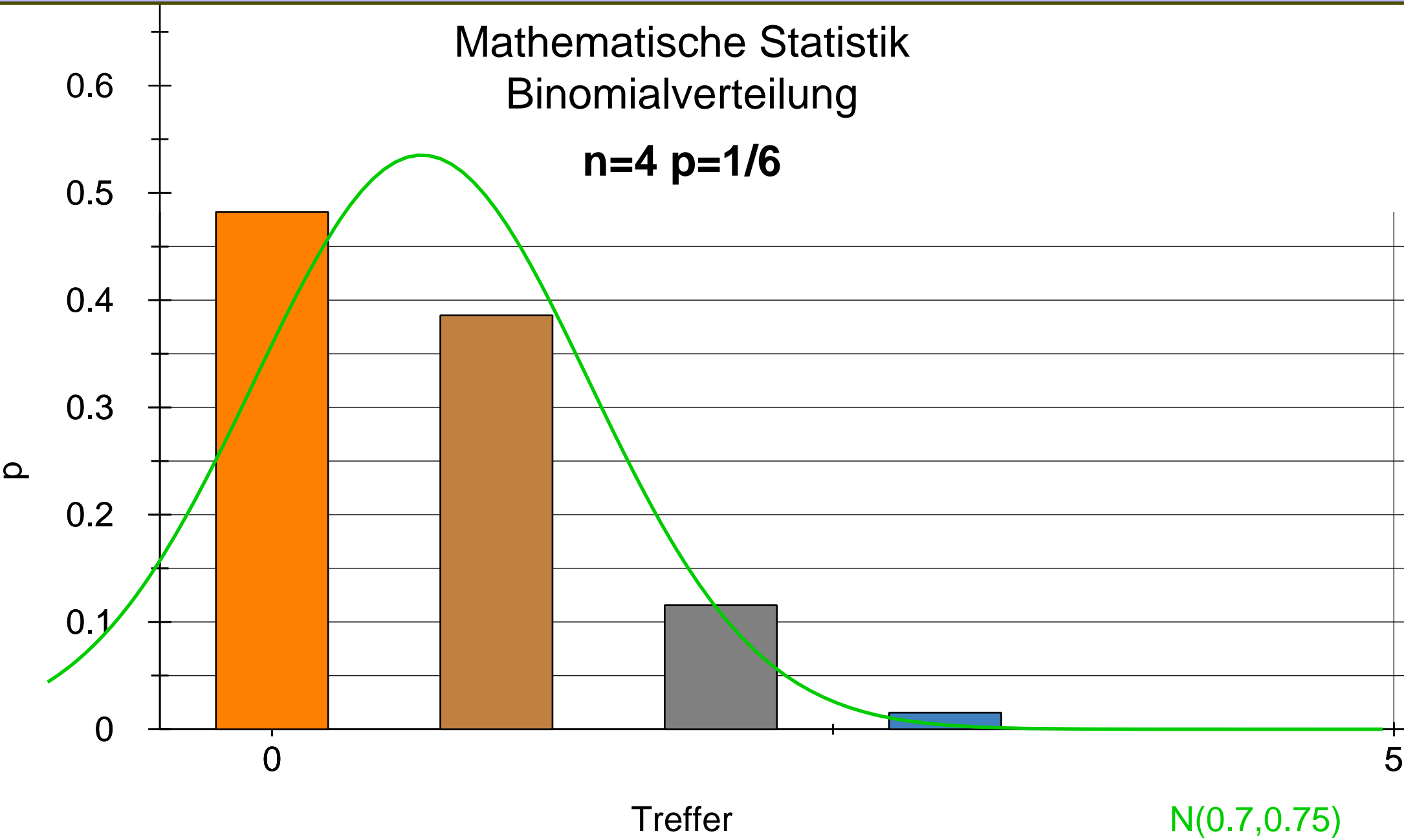
**n=4 p=1/6**



# Mathematische Statistik

## Binomialverteilung

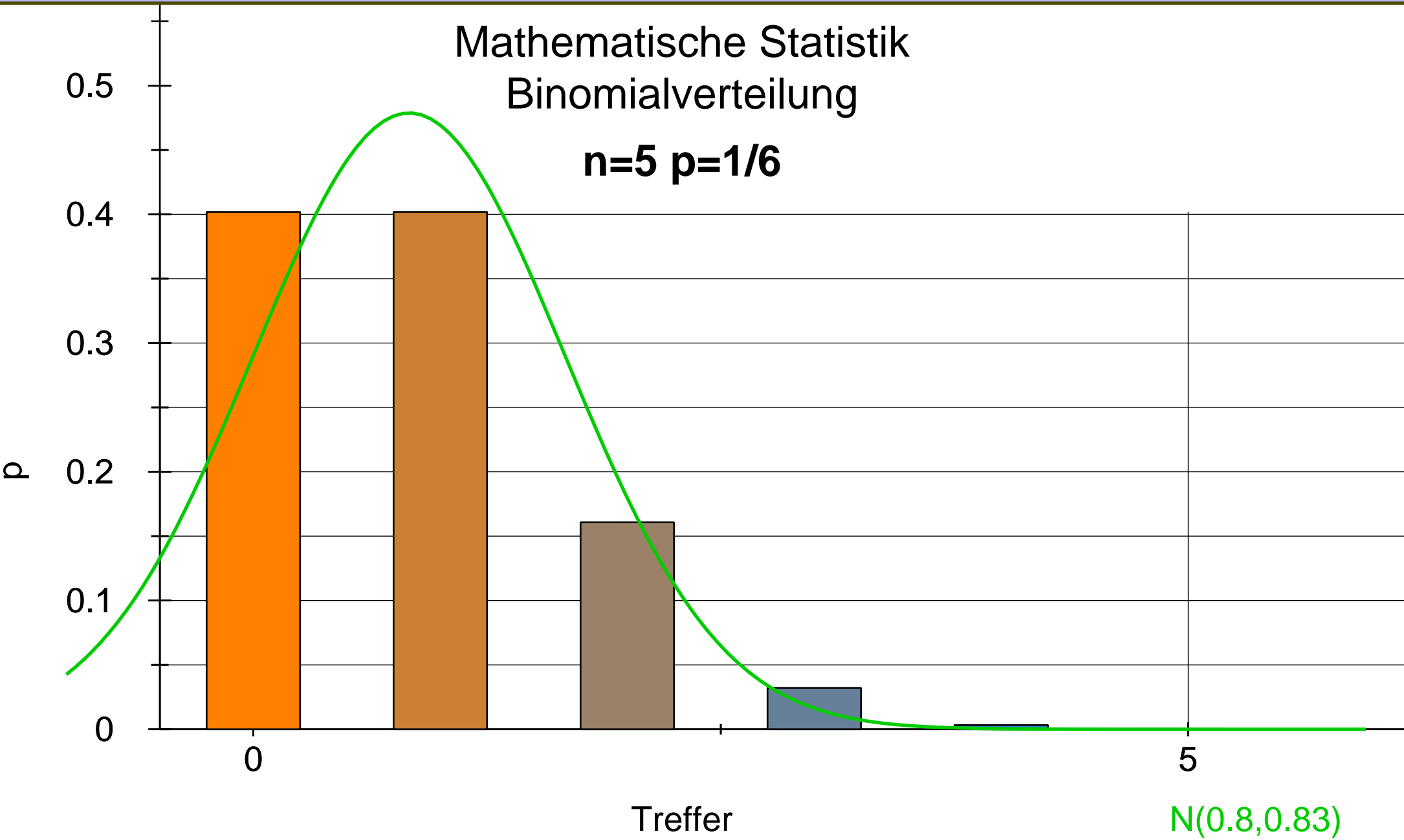
**$n=4$   $p=1/6$**



# Mathematische Statistik

## Binomialverteilung

**$n=5$   $p=1/6$**

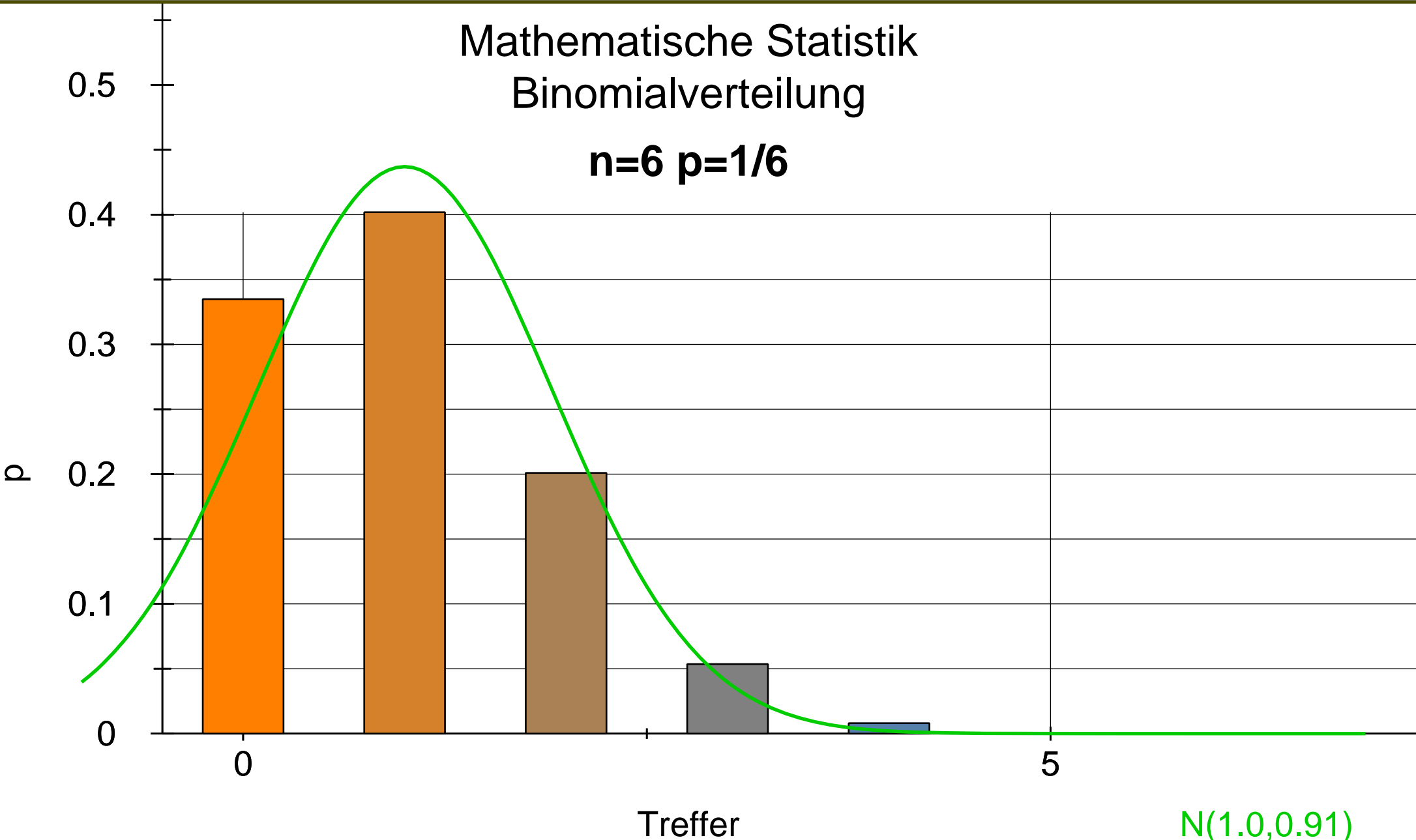


$N(0.8, 0.83)$



Mathematische Statistik  
Binomialverteilung

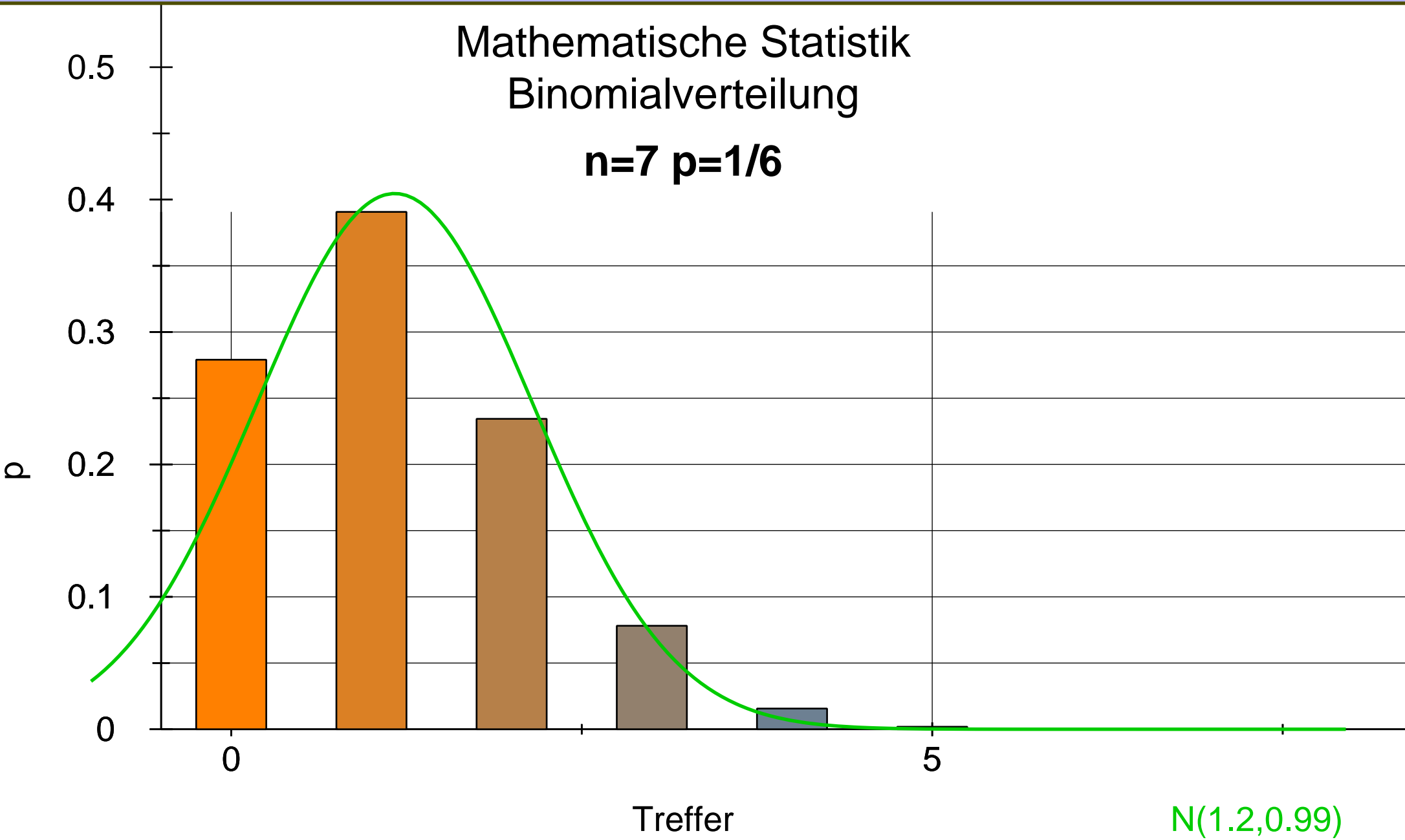
**n=6 p=1/6**



# Mathematische Statistik

## Binomialverteilung

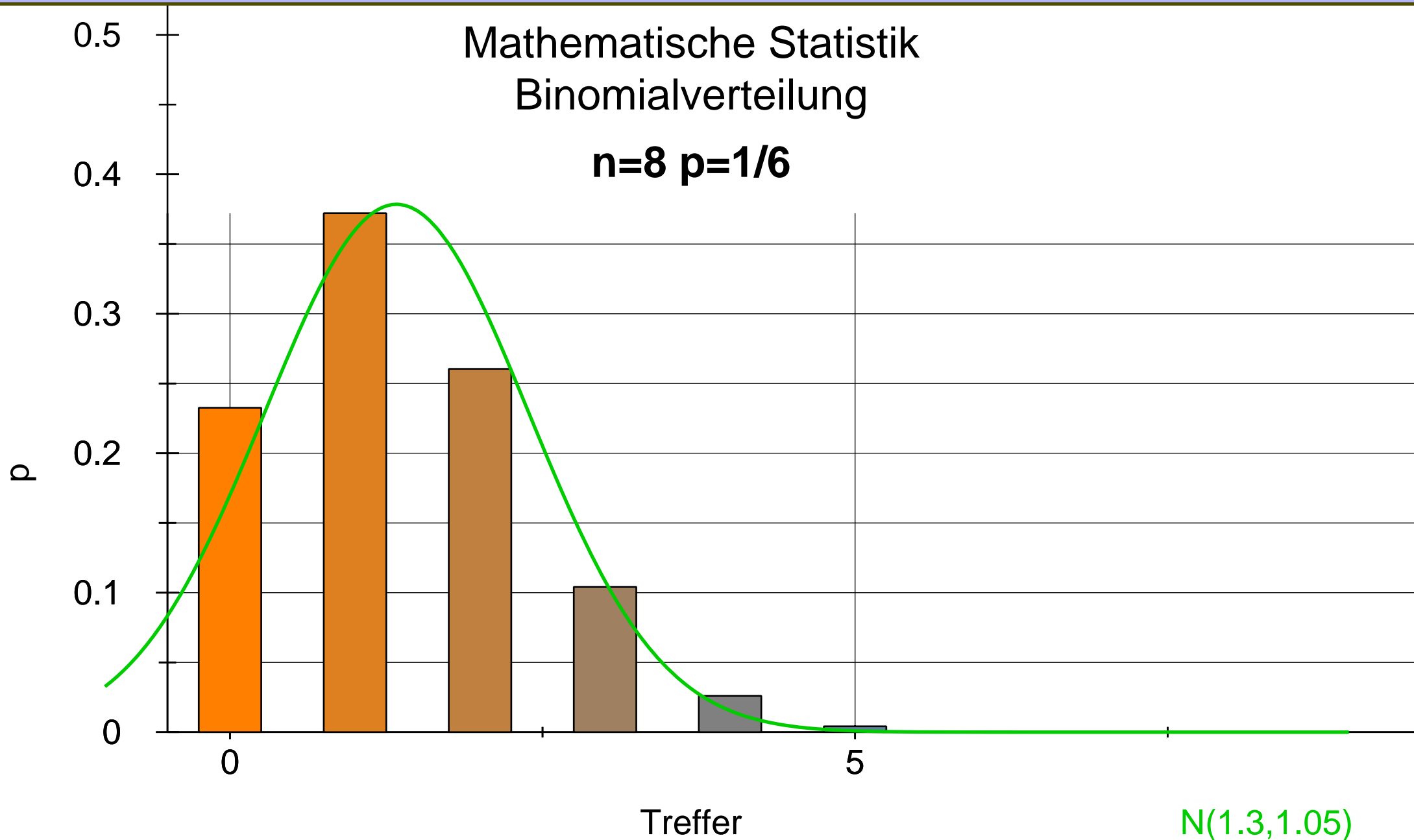
**$n=7$   $p=1/6$**



$N(1.2, 0.99)$

# Mathematische Statistik Binomialverteilung

**$n=8$   $p=1/6$**

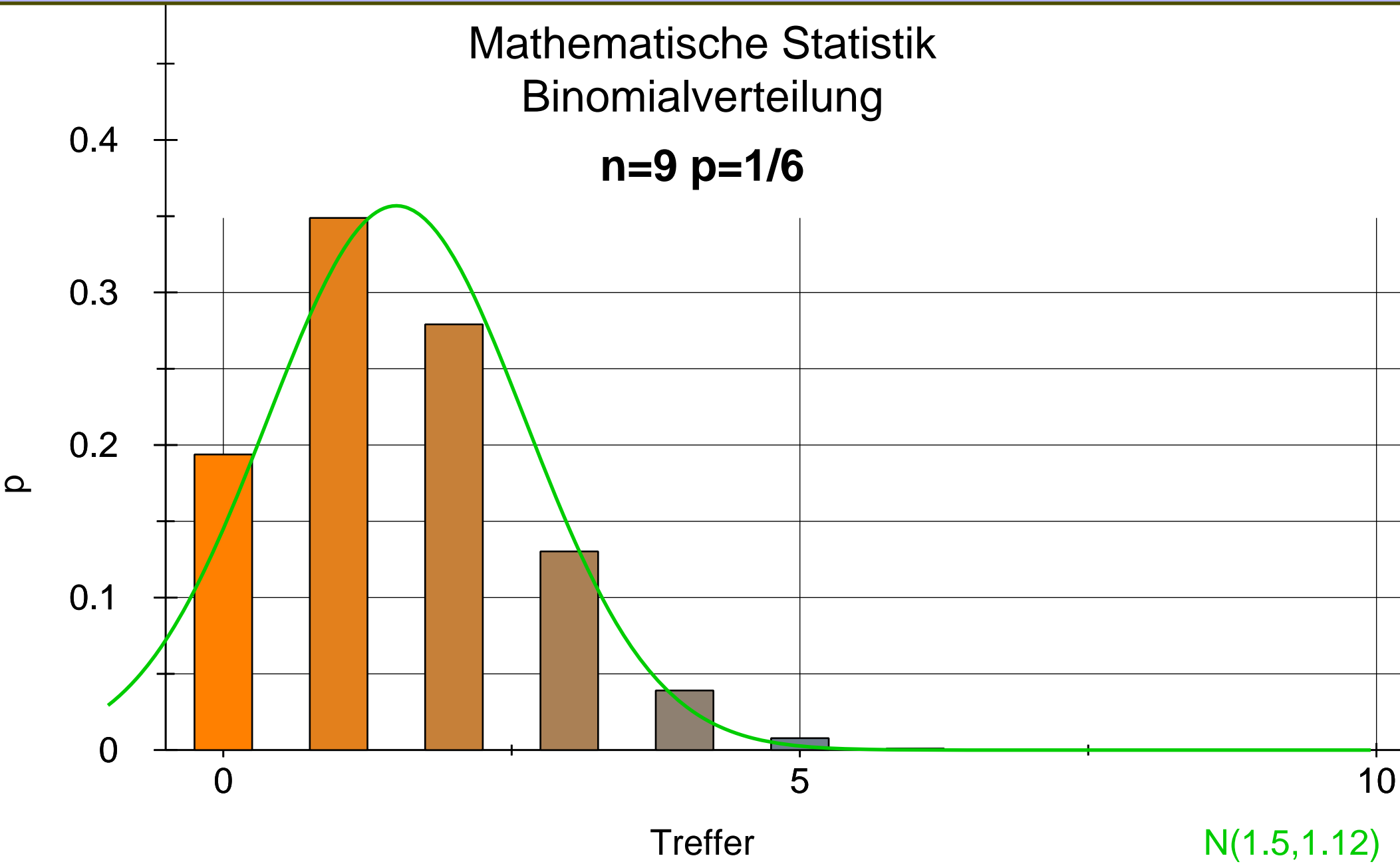


$N(1.3, 1.05)$

# Mathematische Statistik

## Binomialverteilung

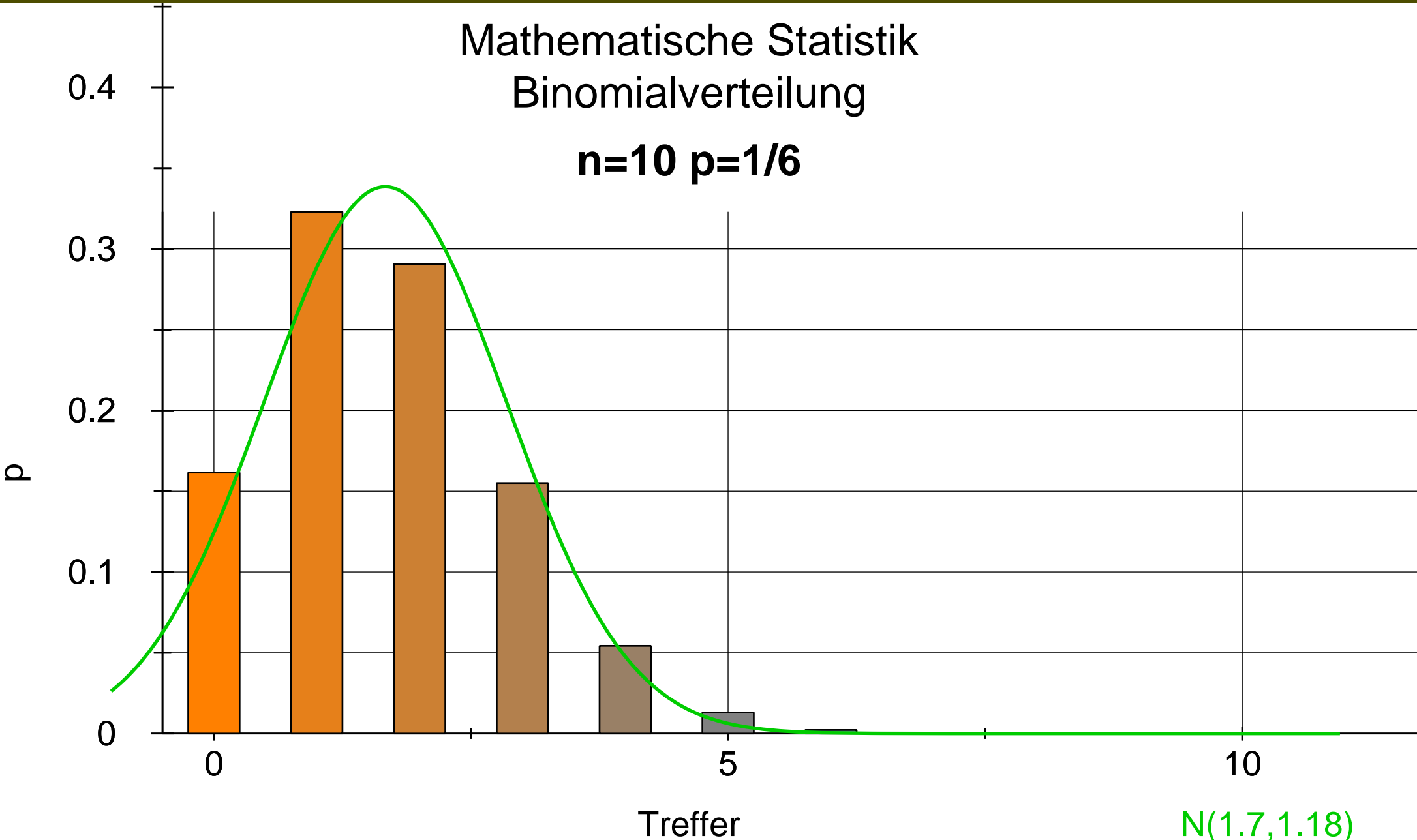
**$n=9$   $p=1/6$**



# Mathematische Statistik

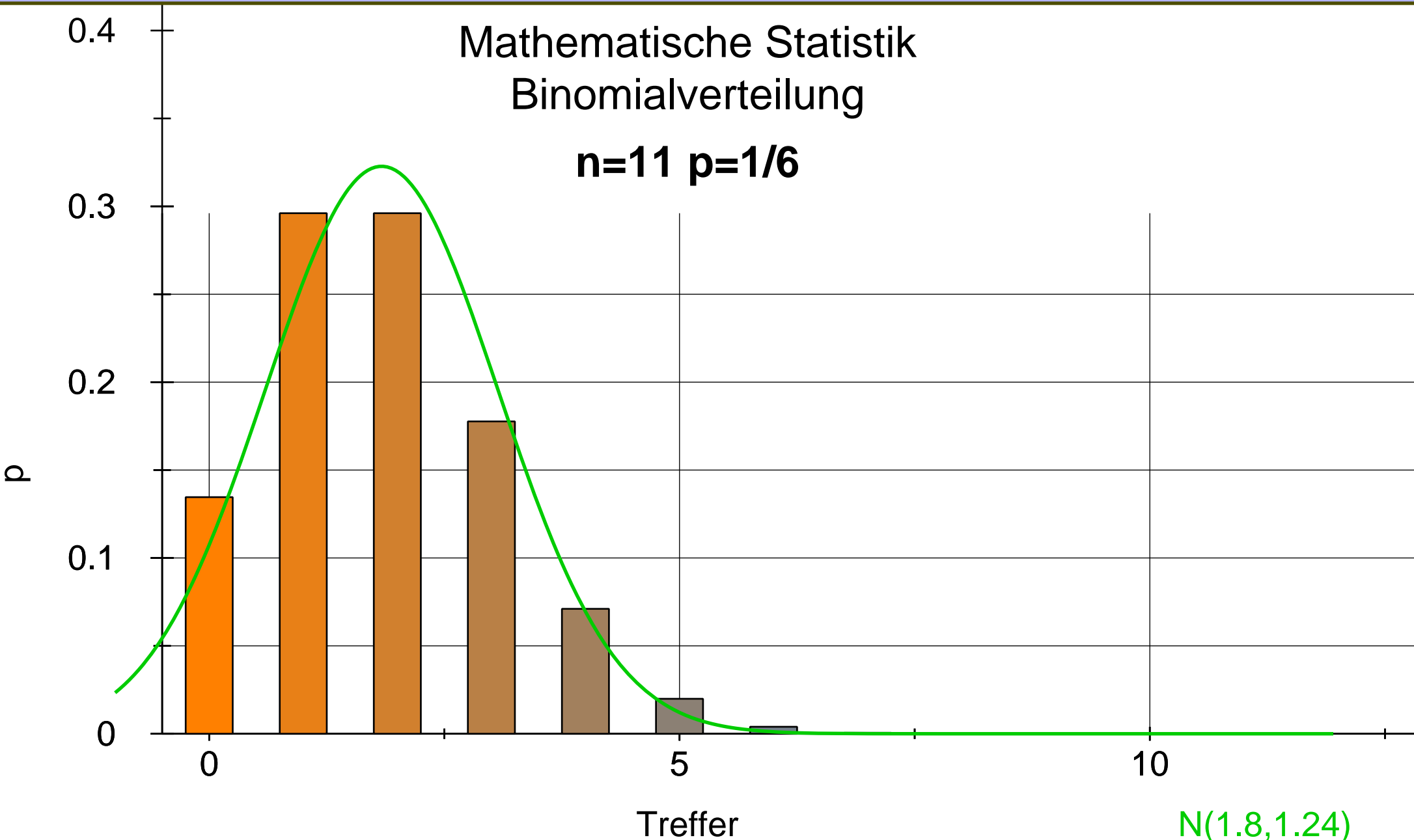
## Binomialverteilung

**n=10 p=1/6**



Mathematische Statistik  
Binomialverteilung

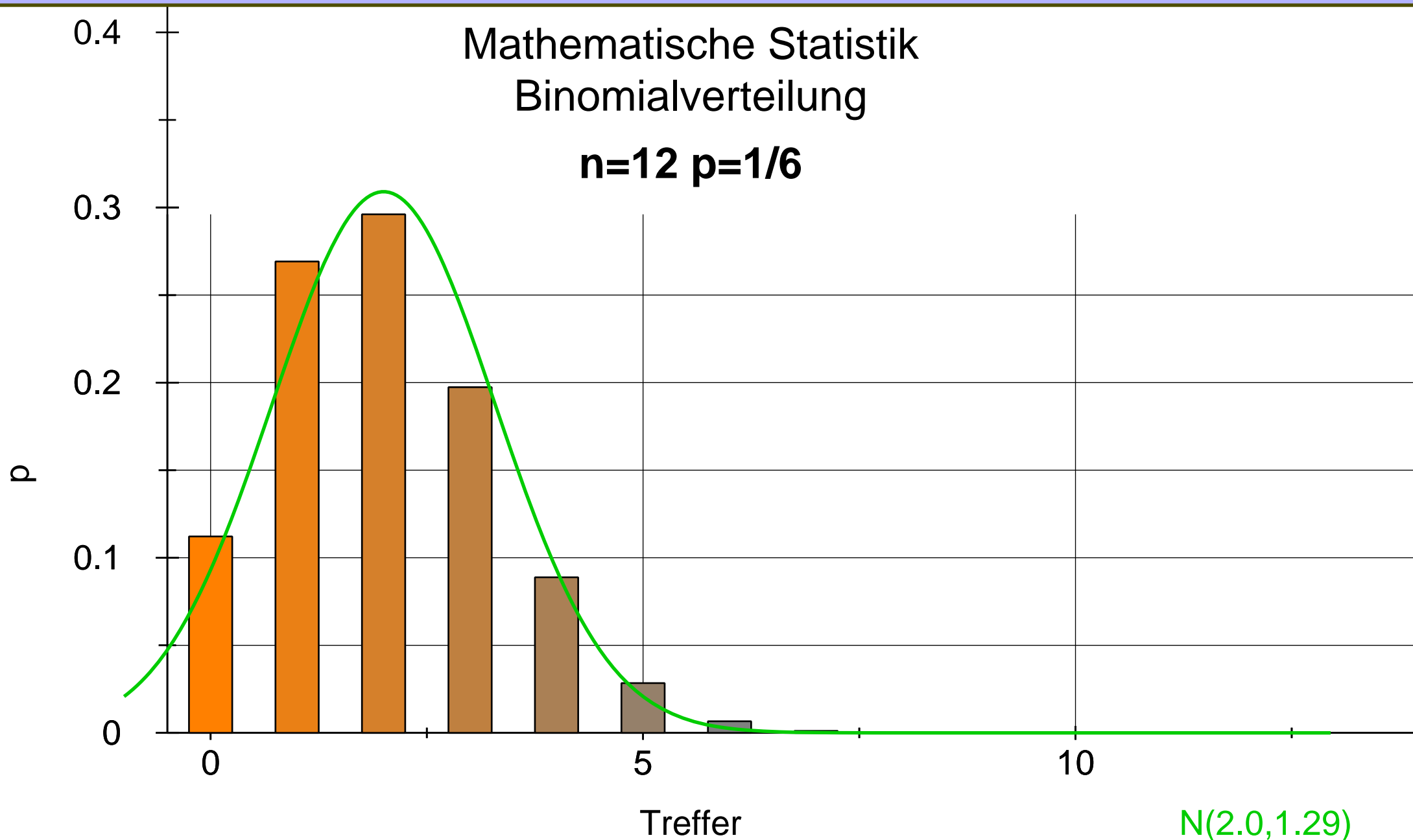
**n=11 p=1/6**



# Mathematische Statistik

## Binomialverteilung

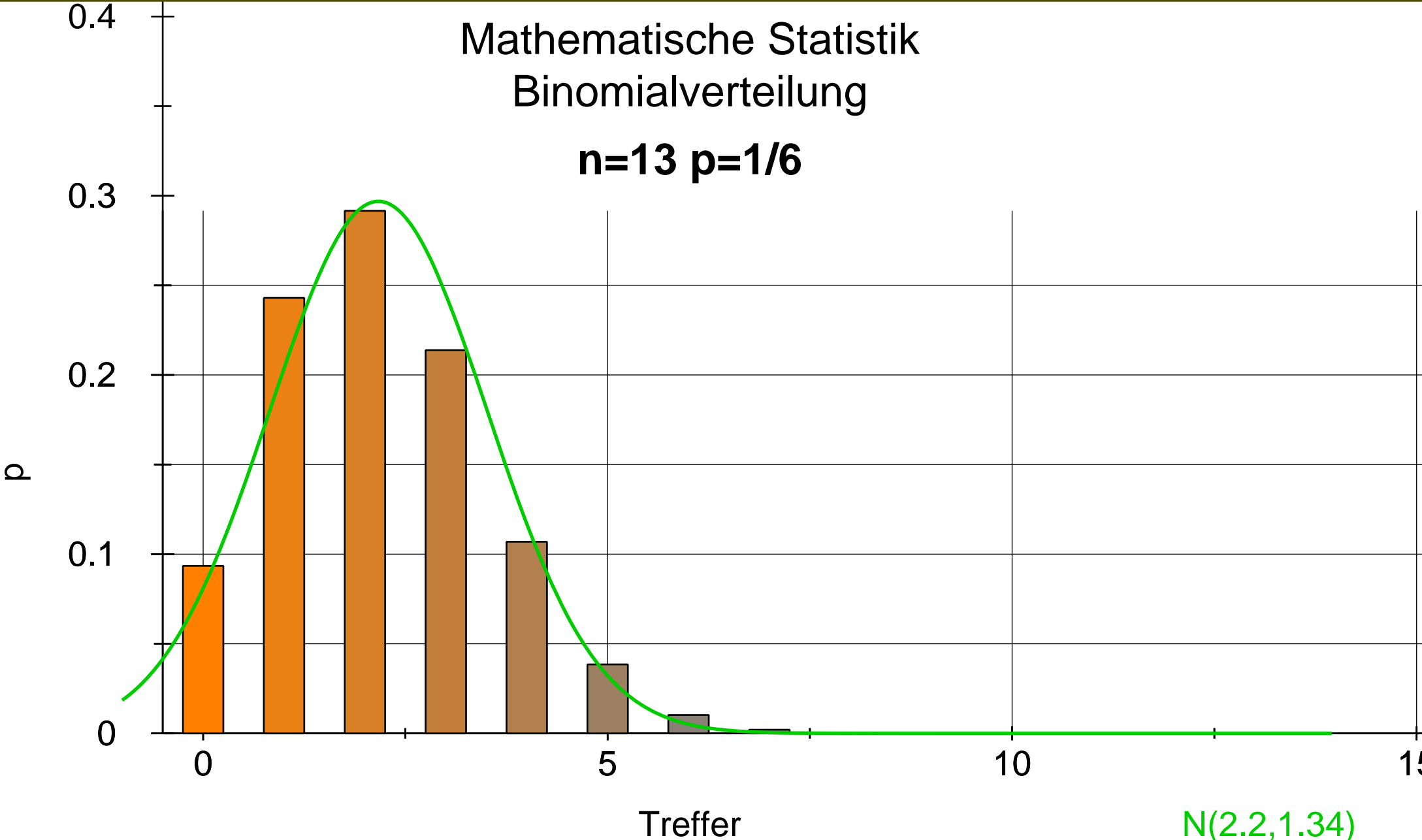
**$n=12$   $p=1/6$**



$N(2.0, 1.29)$

Mathematische Statistik  
Binomialverteilung

**n=13 p=1/6**



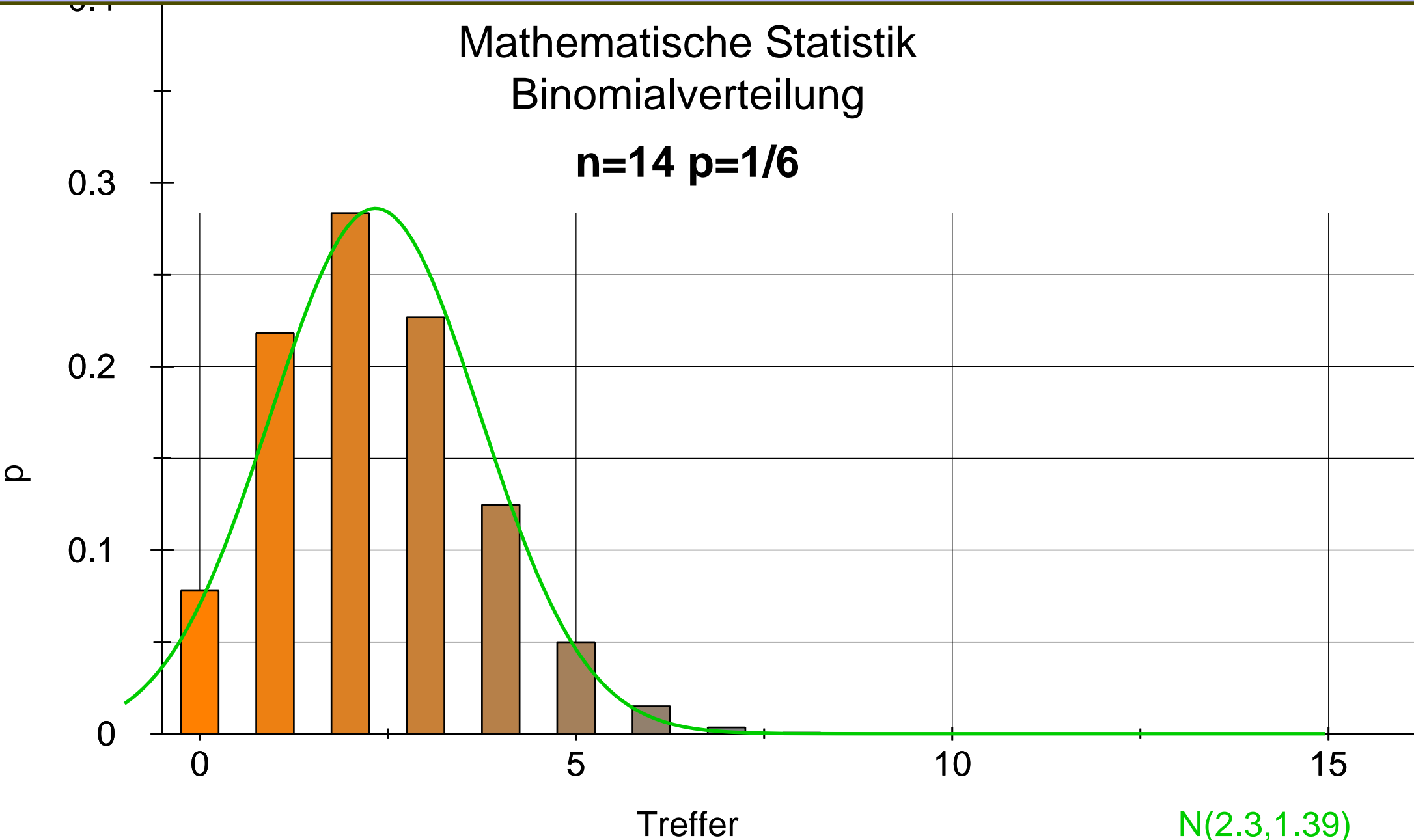
$N(2.2, 1.34)$



# Mathematische Statistik

## Binomialverteilung

**n=14 p=1/6**

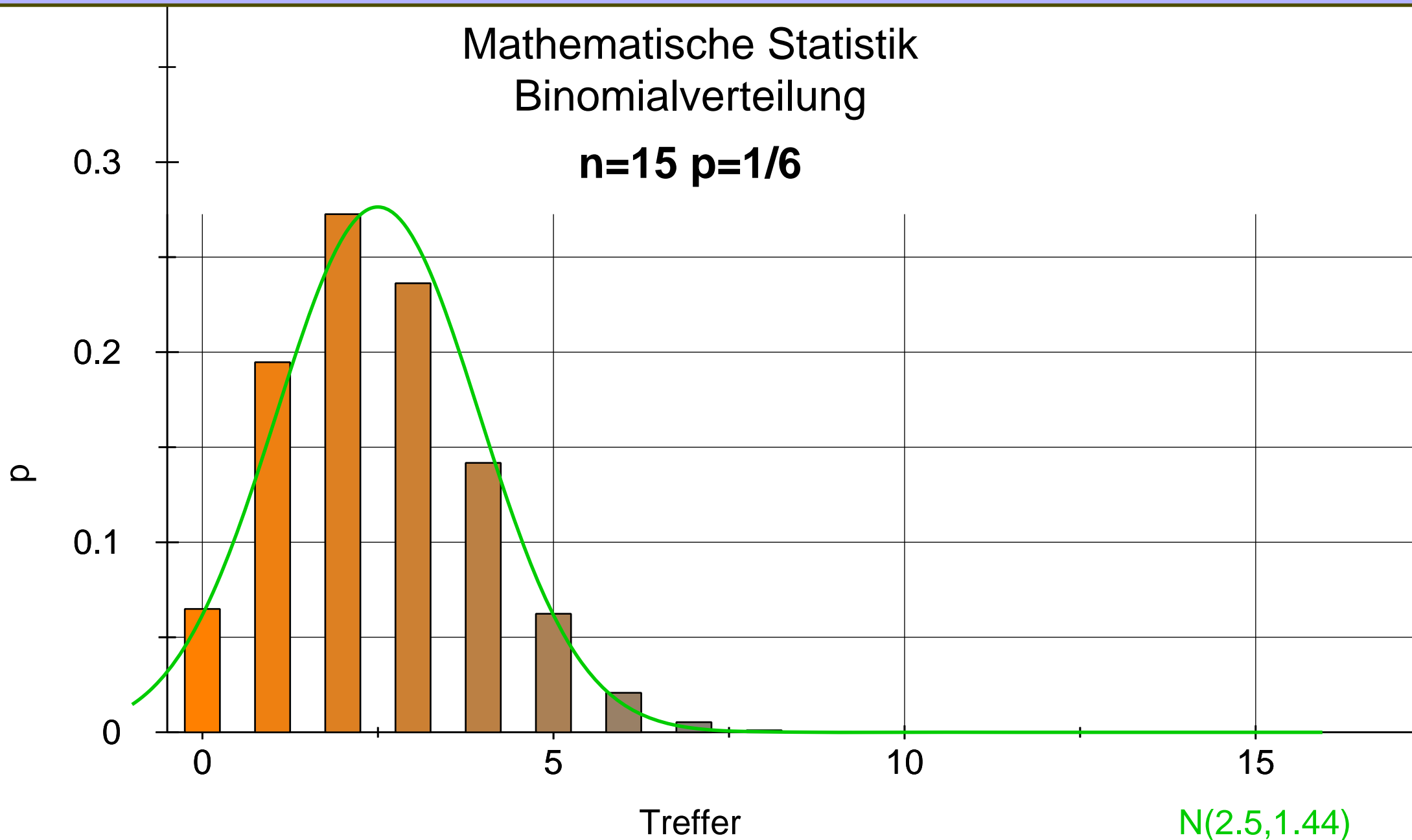


$N(2.3, 1.39)$

# Mathematische Statistik

## Binomialverteilung

**$n=15$   $p=1/6$**

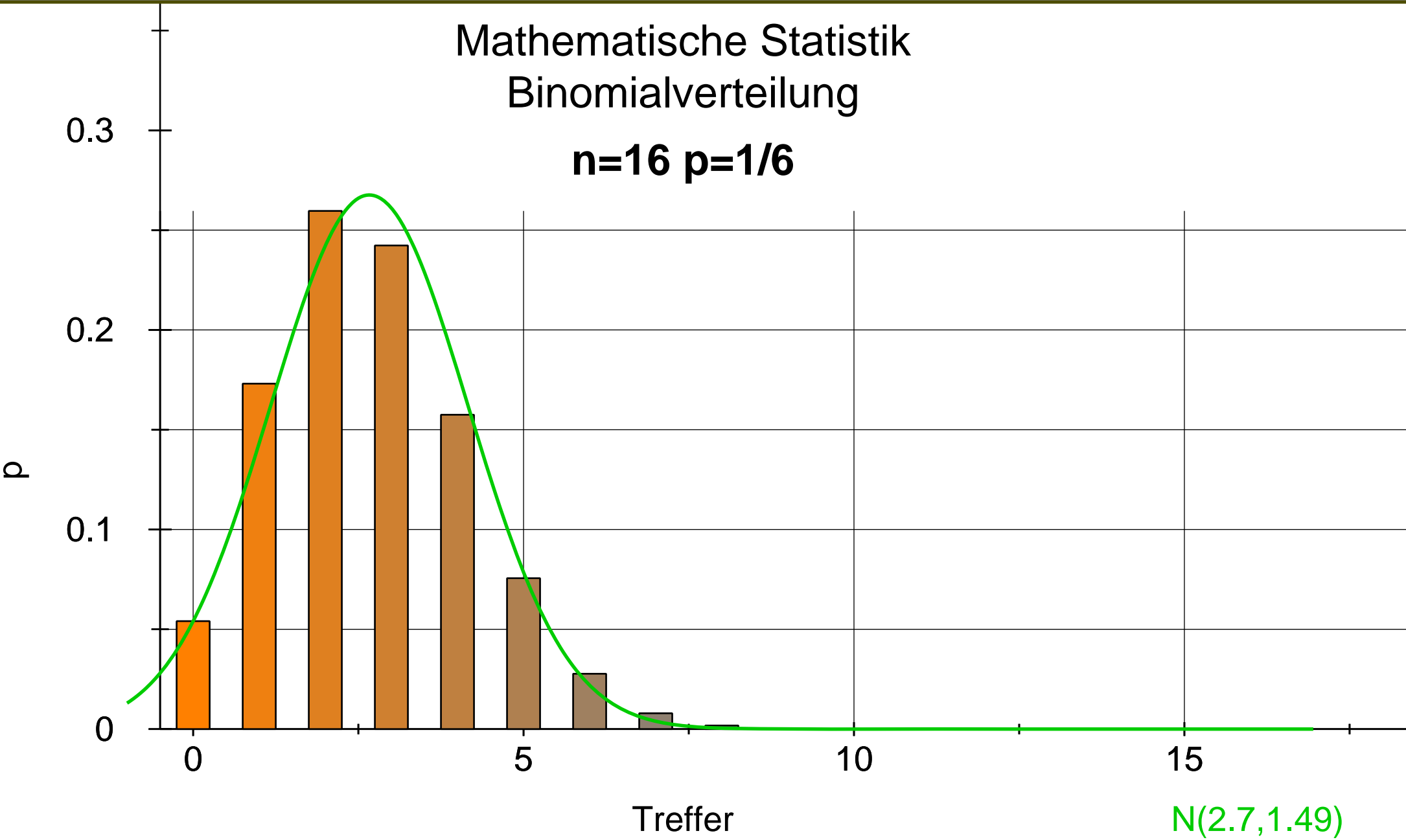


$N(2.5, 1.44)$

# Mathematische Statistik

## Binomialverteilung

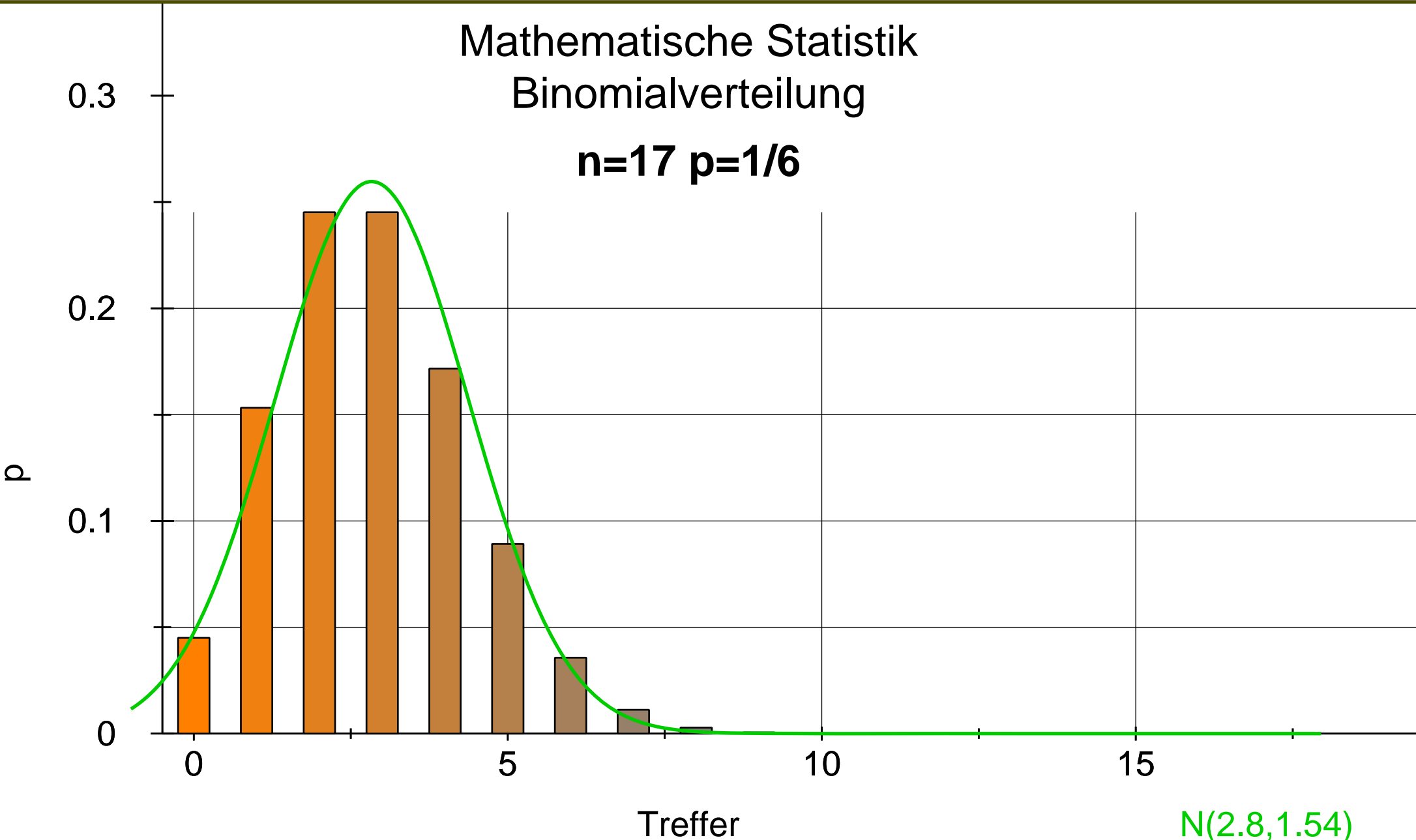
**n=16 p=1/6**



# Mathematische Statistik

## Binomialverteilung

**n=17 p=1/6**

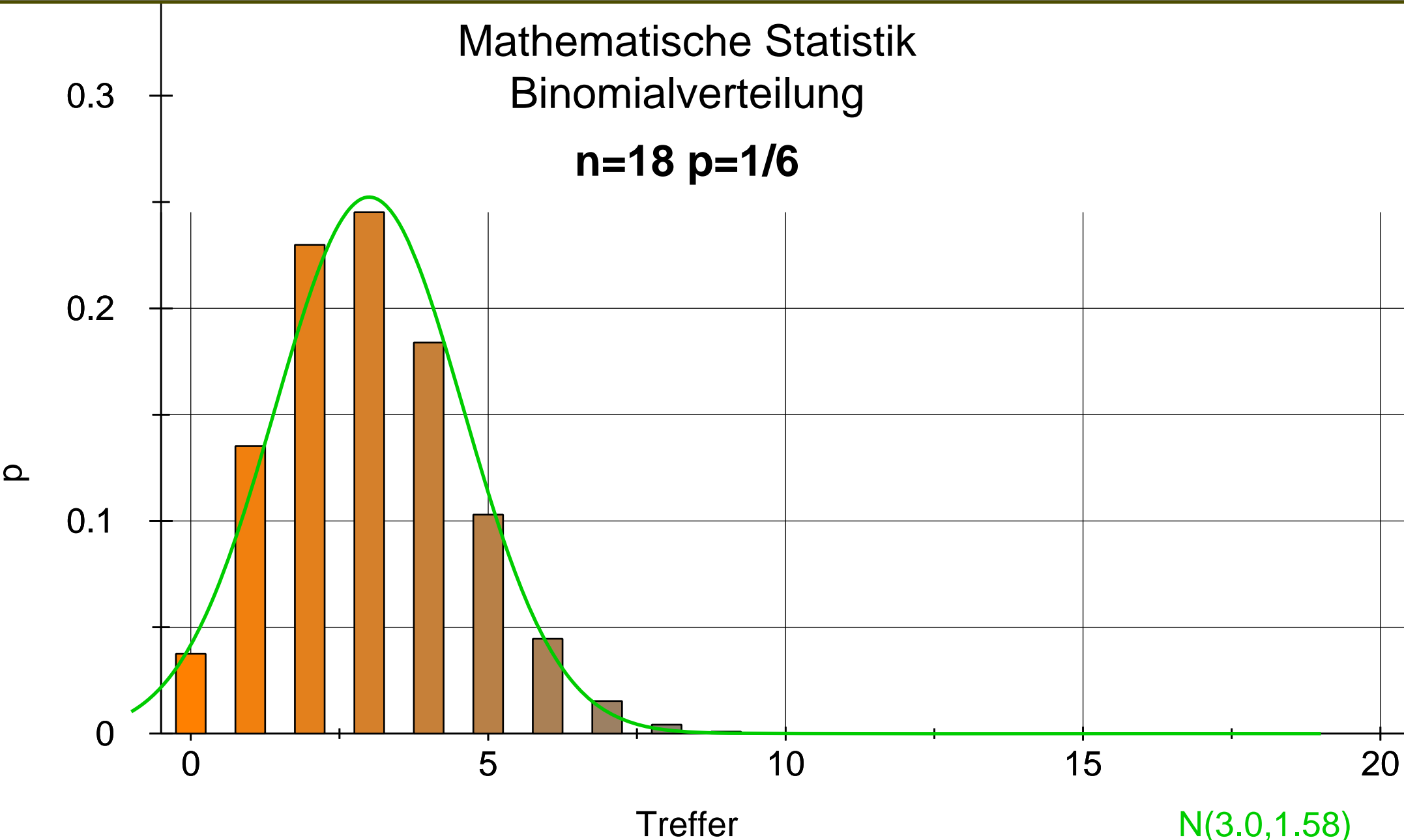


$N(2.8, 1.54)$

# Mathematische Statistik

## Binomialverteilung

**n=18 p=1/6**

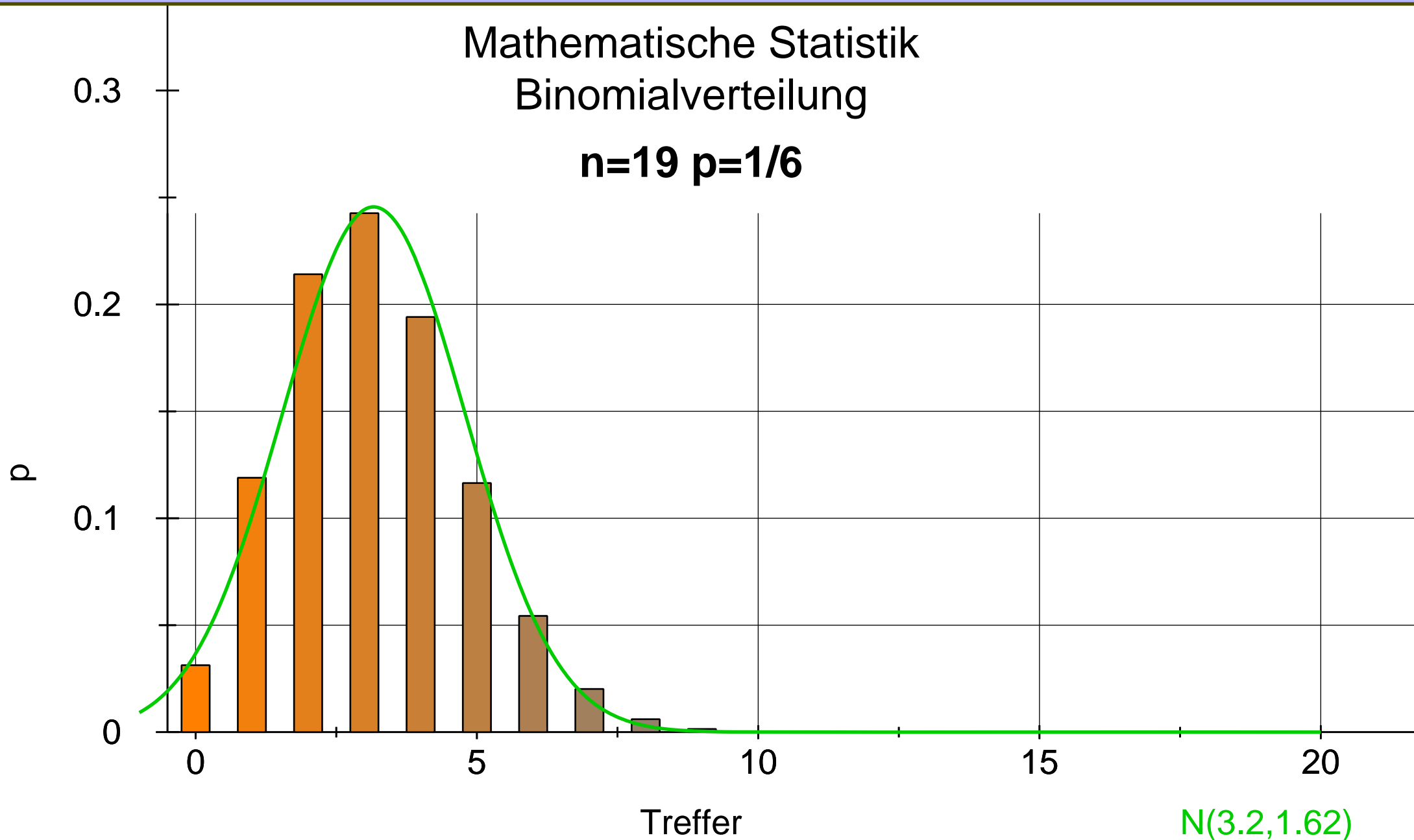


$N(3.0, 1.58)$

# Mathematische Statistik

## Binomialverteilung

**$n=19$   $p=1/6$**

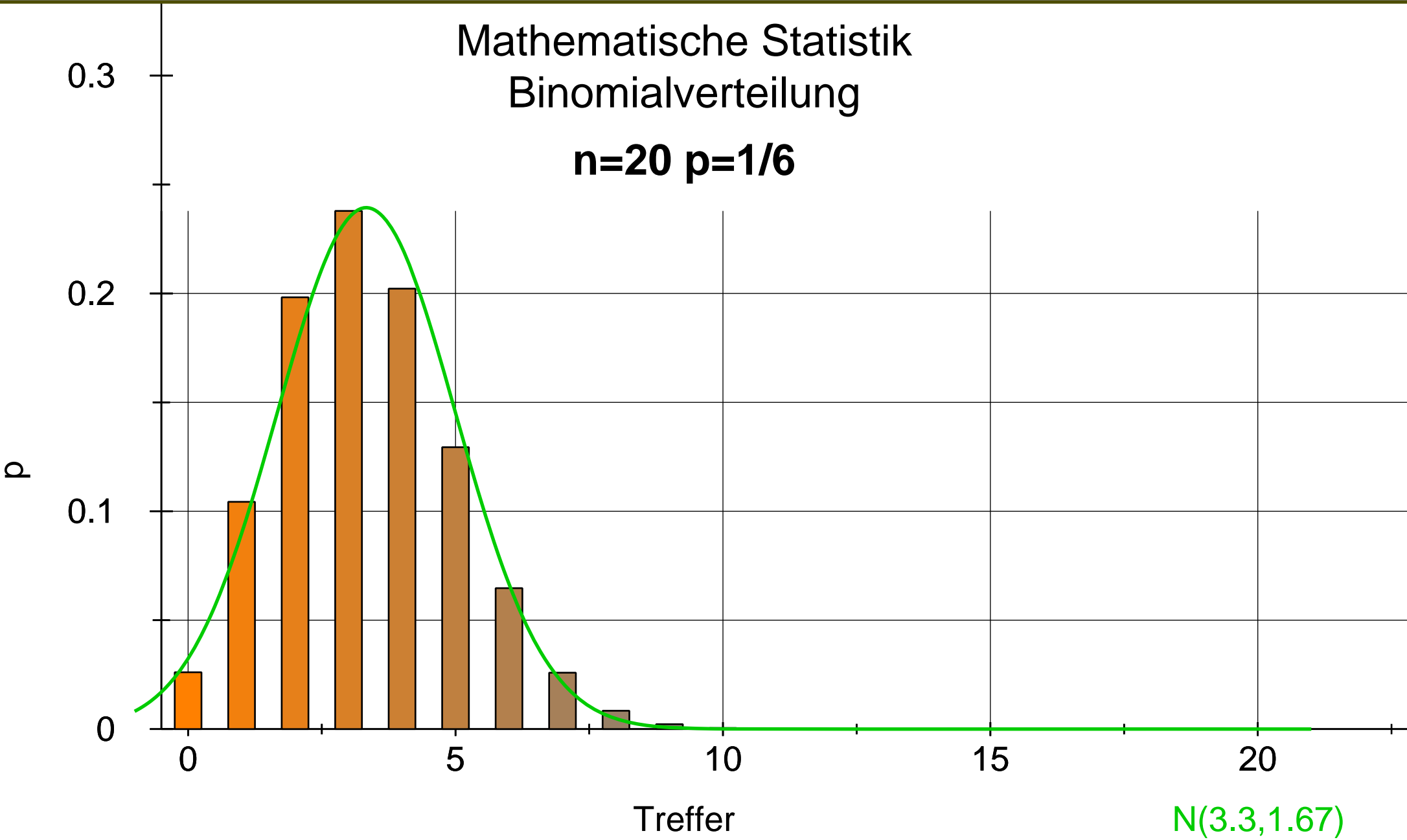


$N(3.2, 1.62)$

# Mathematische Statistik

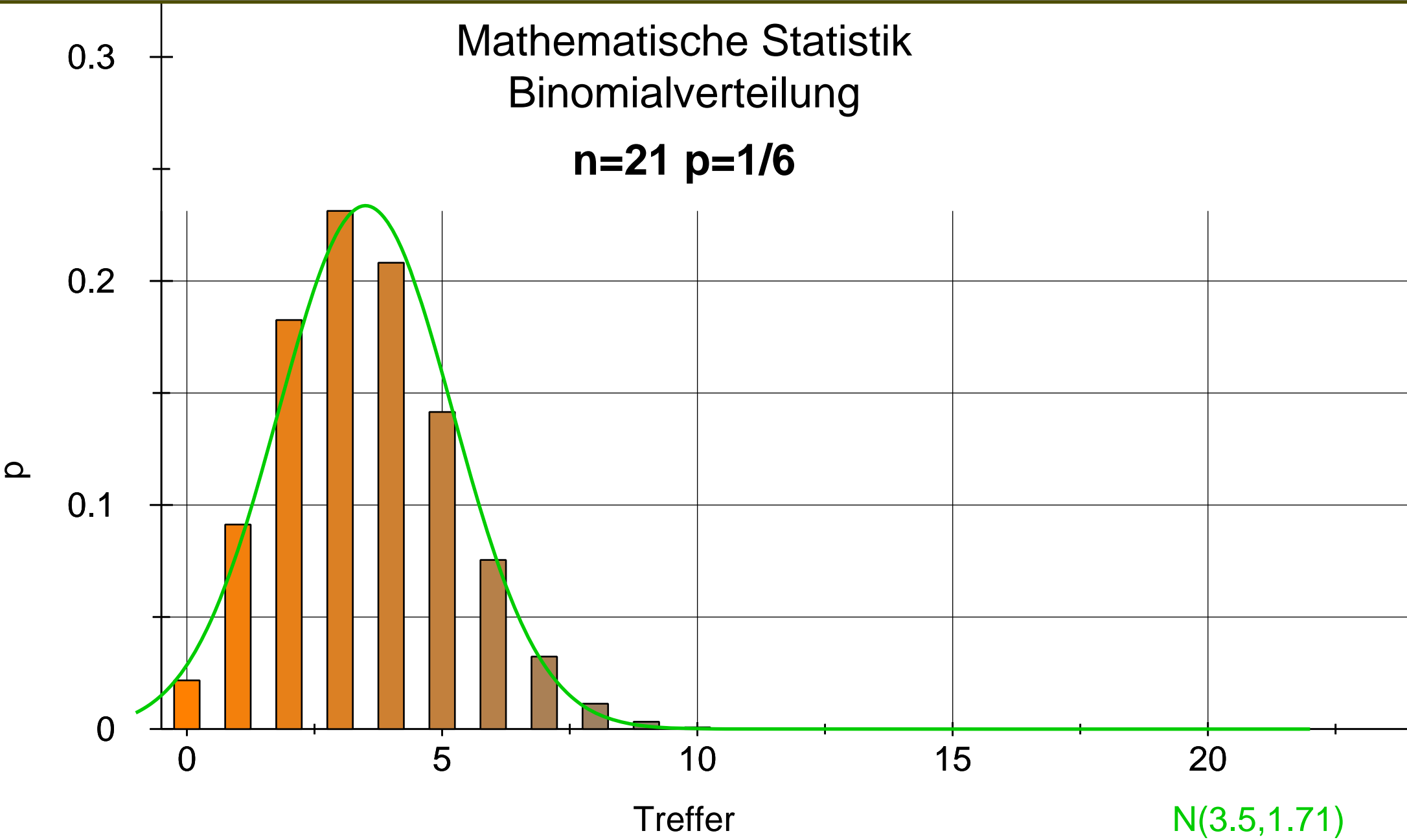
## Binomialverteilung

**n=20 p=1/6**



Mathematische Statistik  
Binomialverteilung

**n=21 p=1/6**

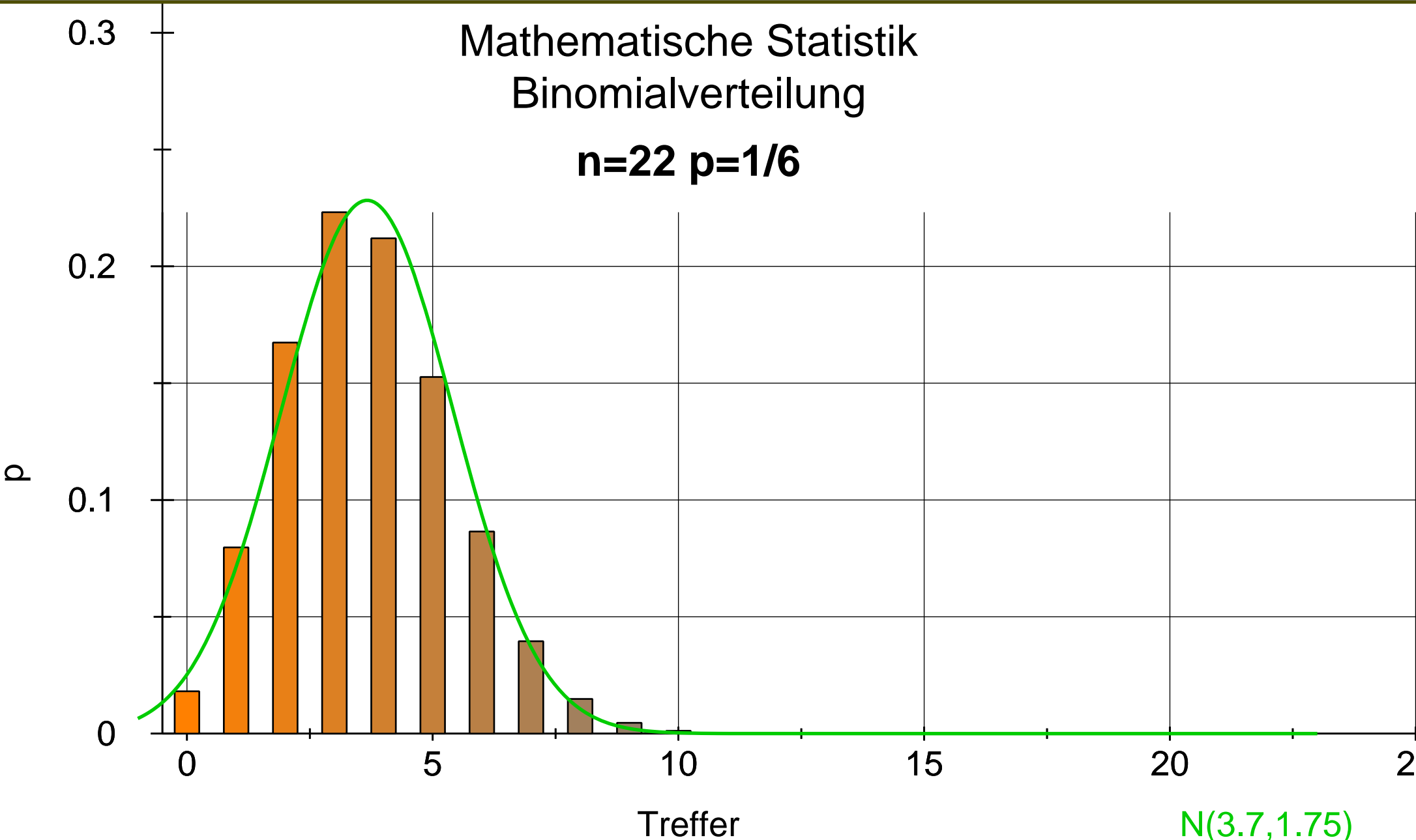


$N(3.5, 1.71)$



Mathematische Statistik  
Binomialverteilung

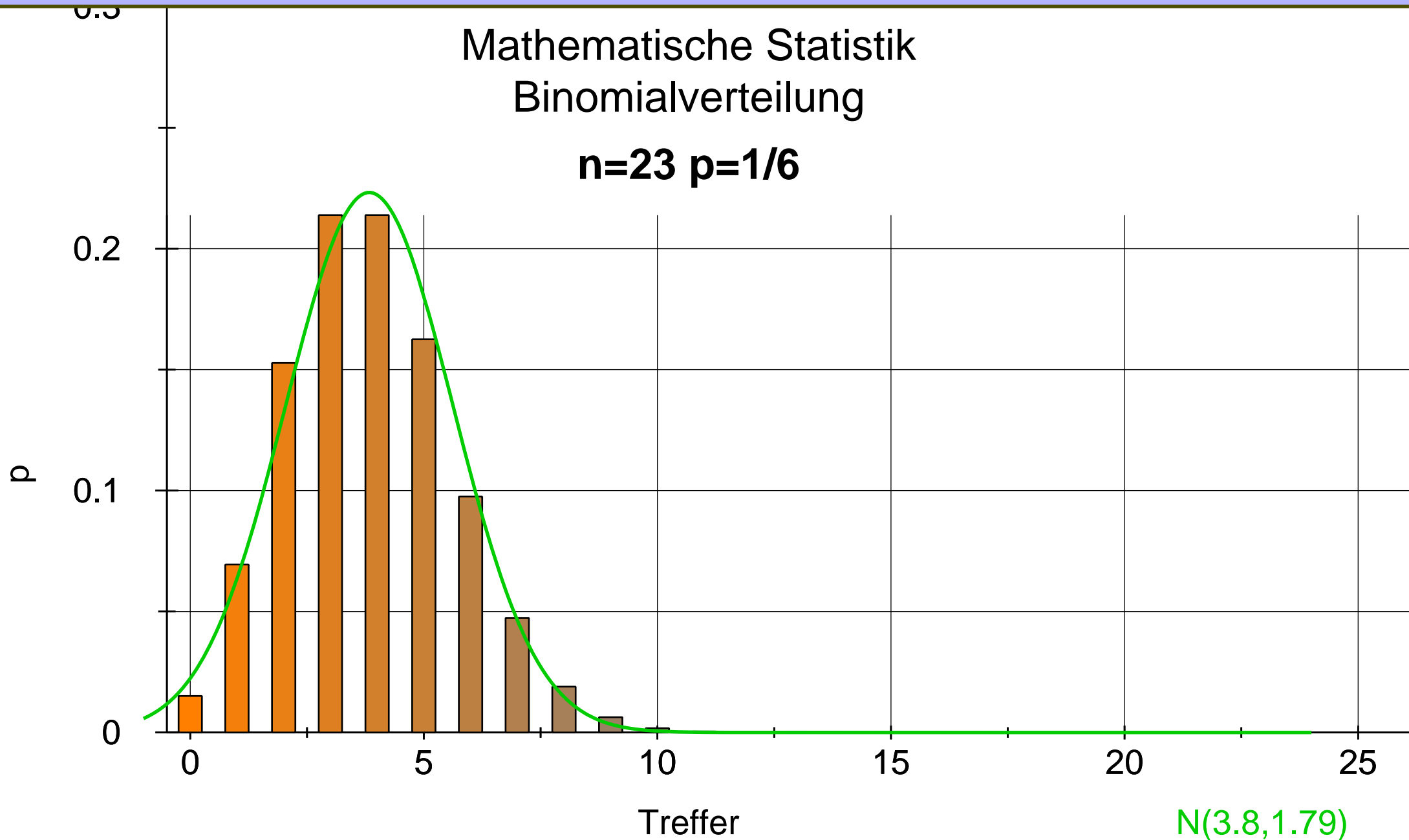
**n=22 p=1/6**



$N(3.7, 1.75)$

# Mathematische Statistik Binomialverteilung

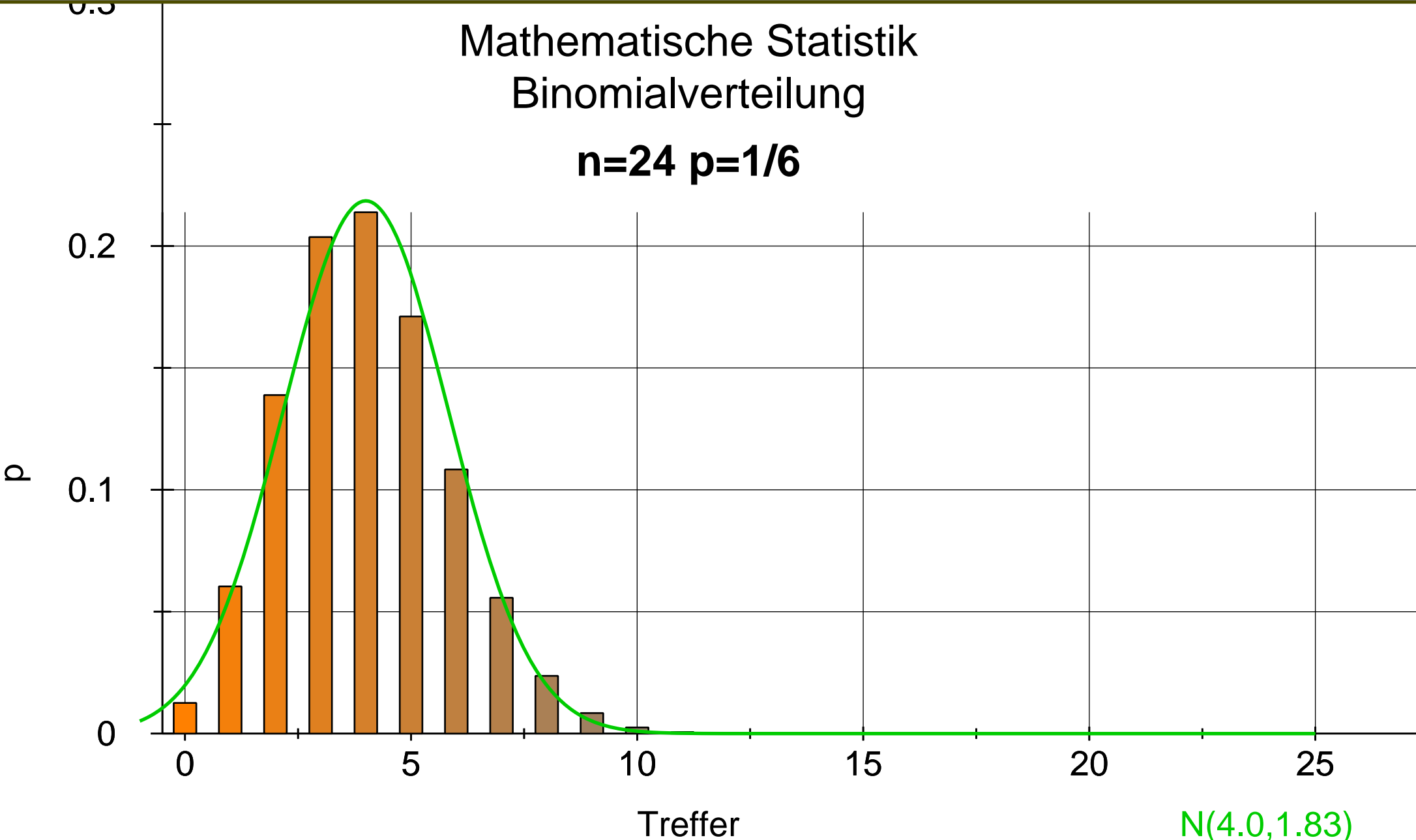
**n=23 p=1/6**



$N(3.8, 1.79)$

Mathematische Statistik  
Binomialverteilung

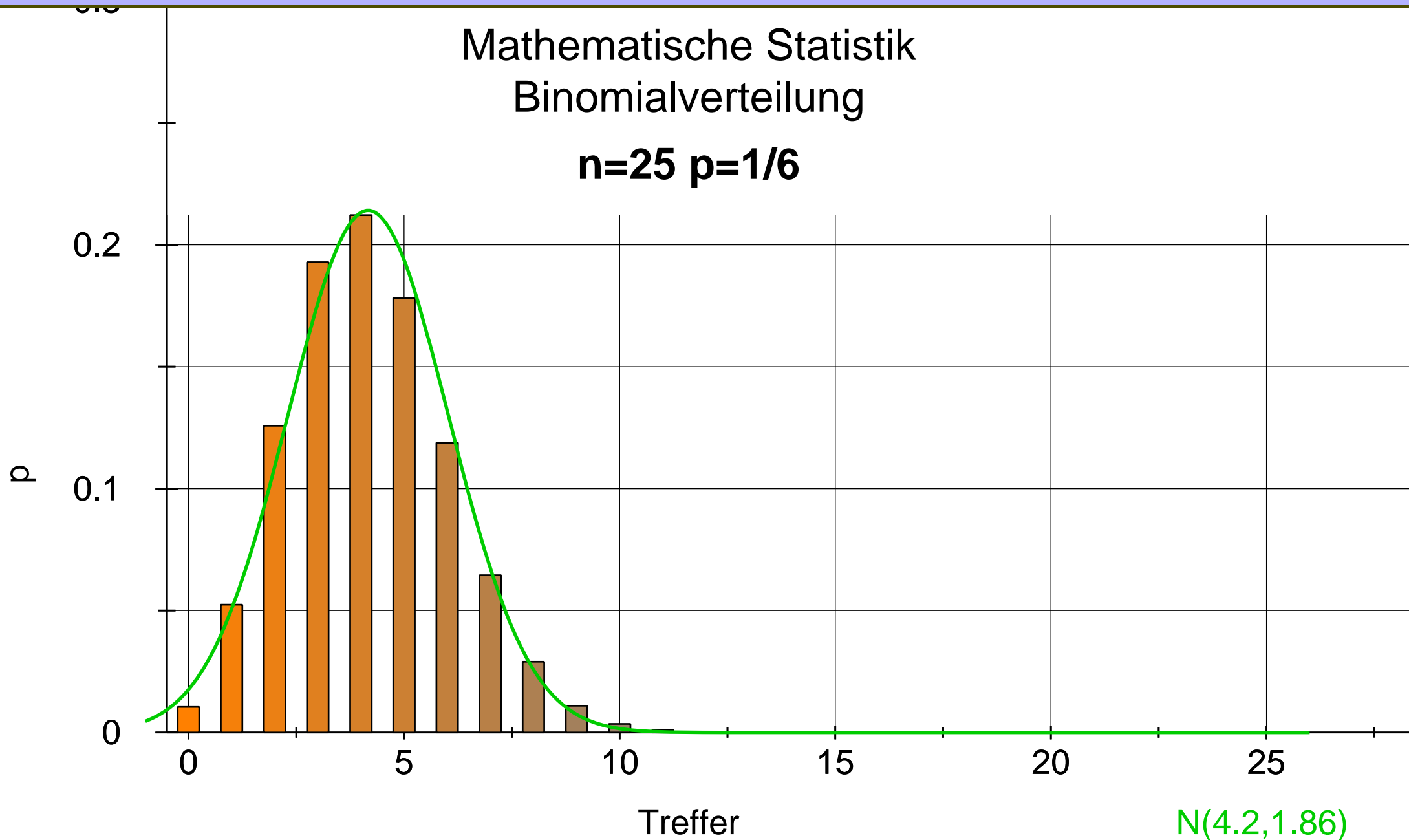
**n=24 p=1/6**



N(4.0, 1.83)

# Mathematische Statistik Binomialverteilung

**$n=25$   $p=1/6$**

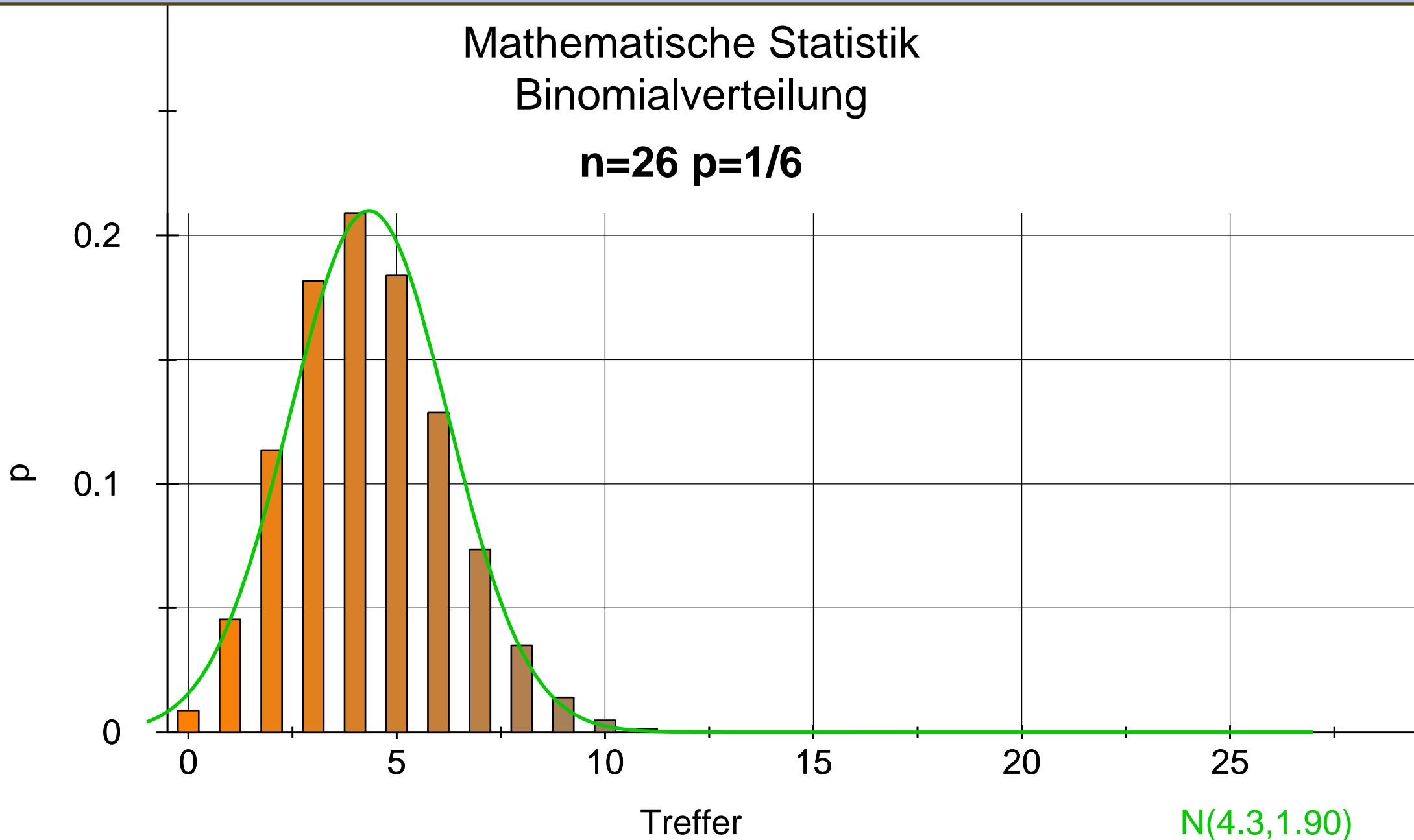


$N(4.2, 1.86)$

# Mathematische Statistik

## Binomialverteilung

**n=26 p=1/6**

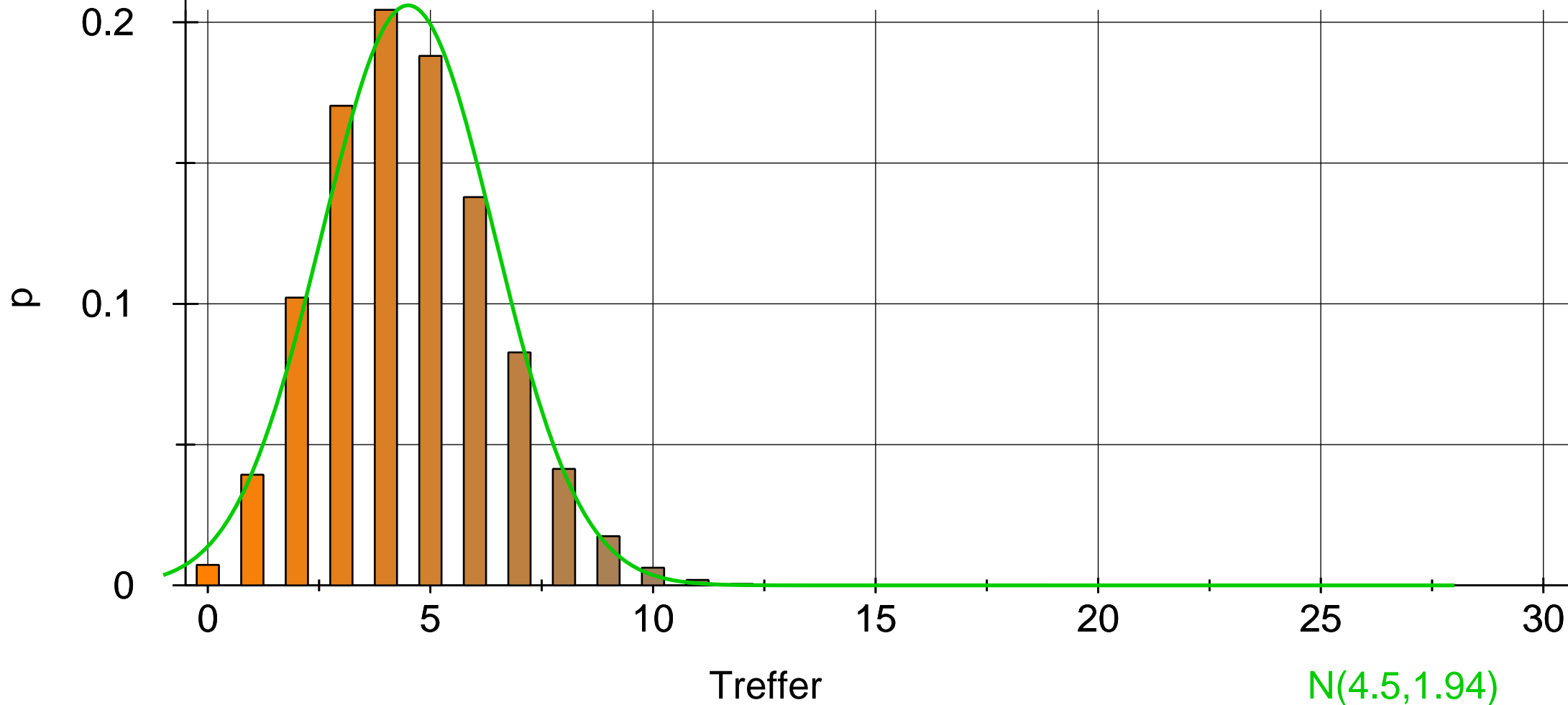


$N(4.3, 1.90)$

# Mathematische Statistik

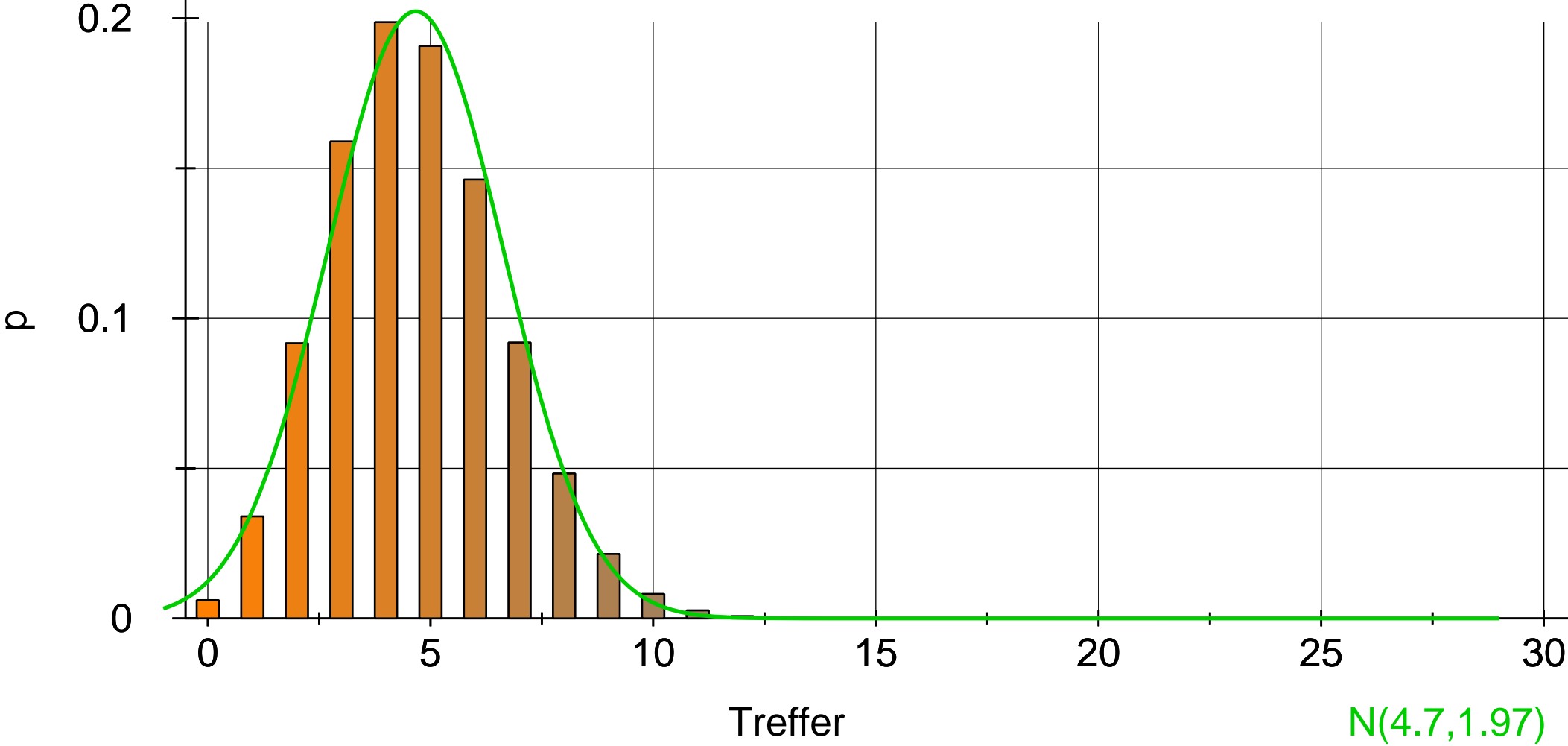
## Binomialverteilung

**n=27 p=1/6**



Mathematische Statistik  
Binomialverteilung

**n=28 p=1/6**

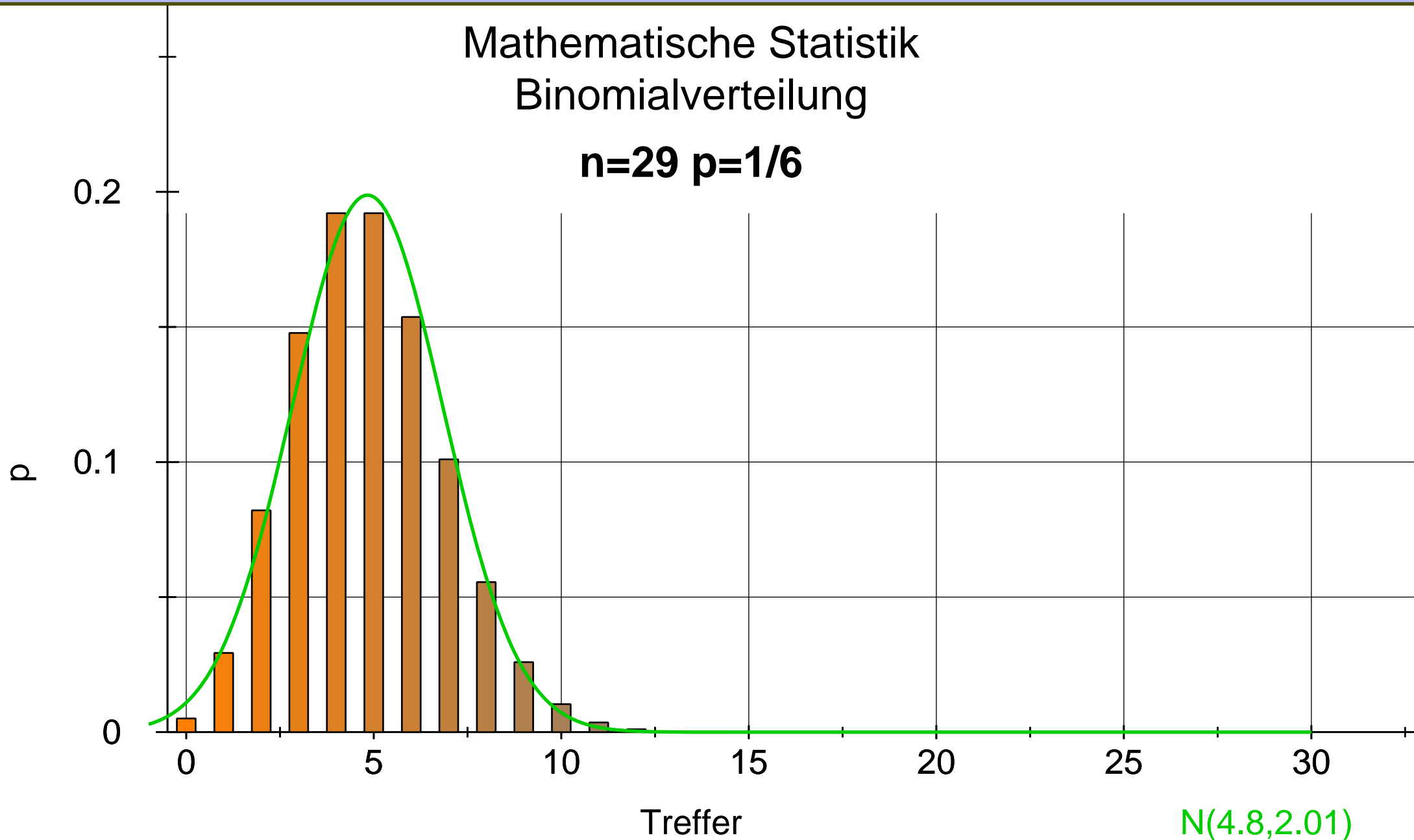


$N(4.7, 1.97)$

# Mathematische Statistik

## Binomialverteilung

**n=29 p=1/6**



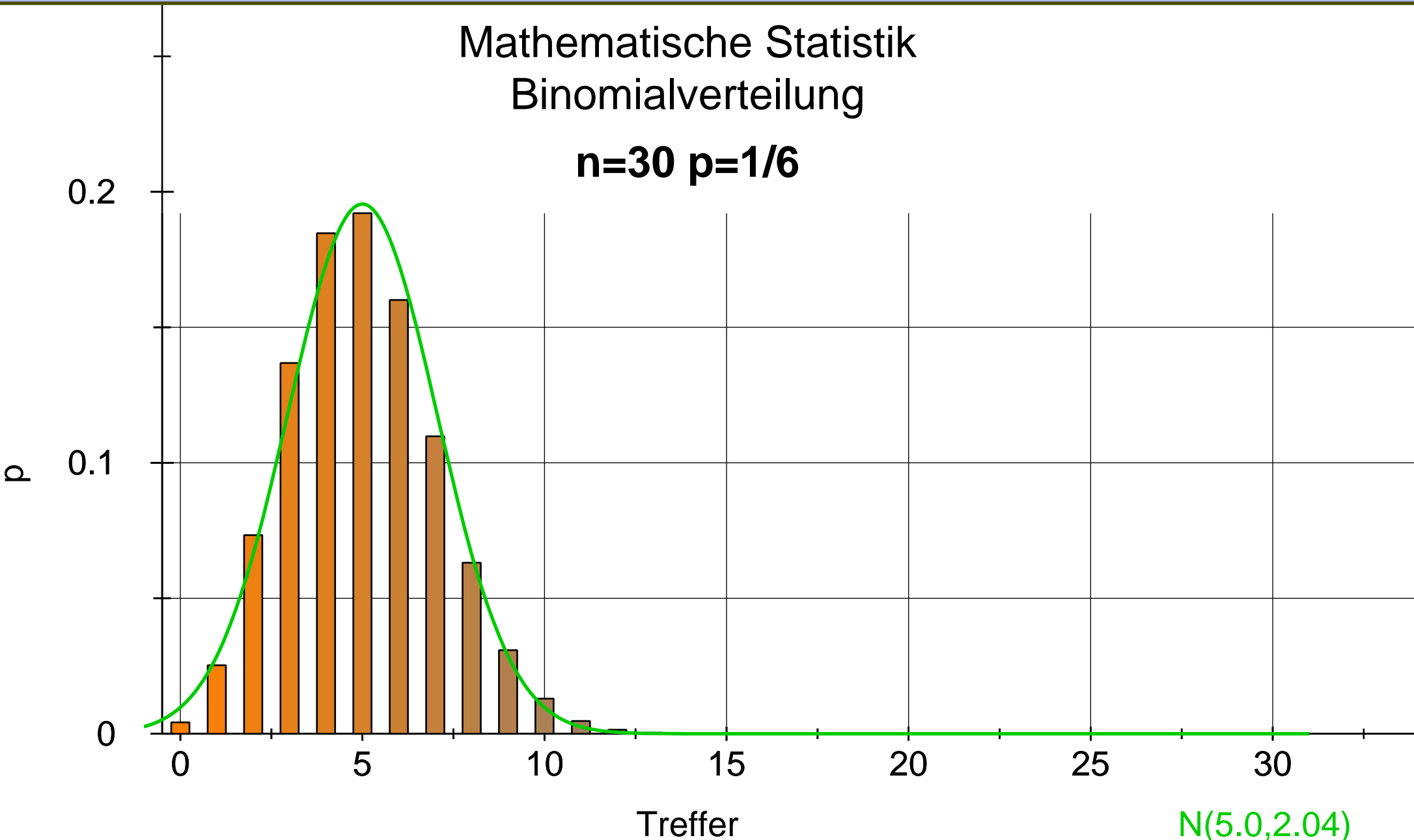
$N(4.8, 2.01)$



# Mathematische Statistik

## Binomialverteilung

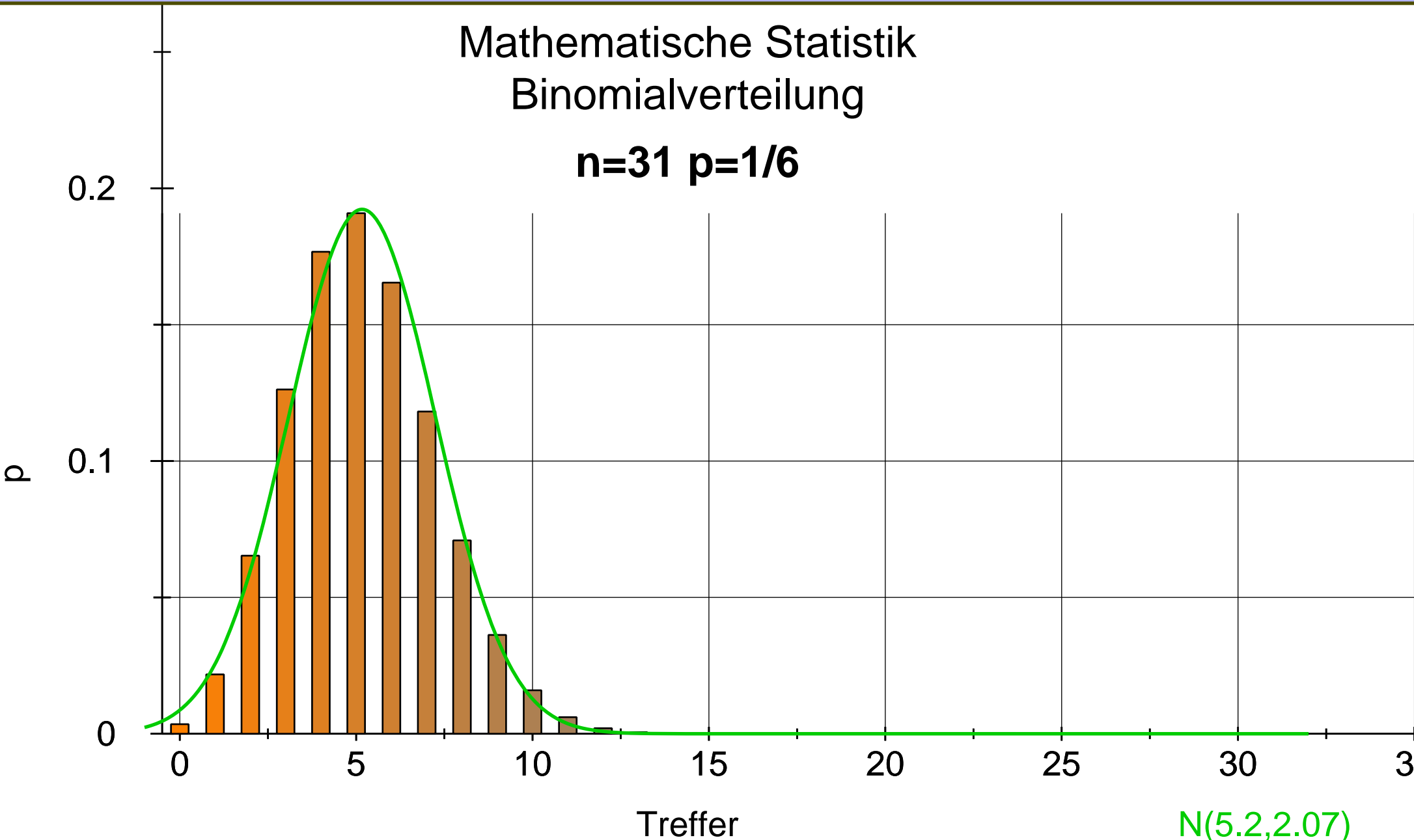
**n=30 p=1/6**



$N(5.0, 2.04)$

Mathematische Statistik  
Binomialverteilung

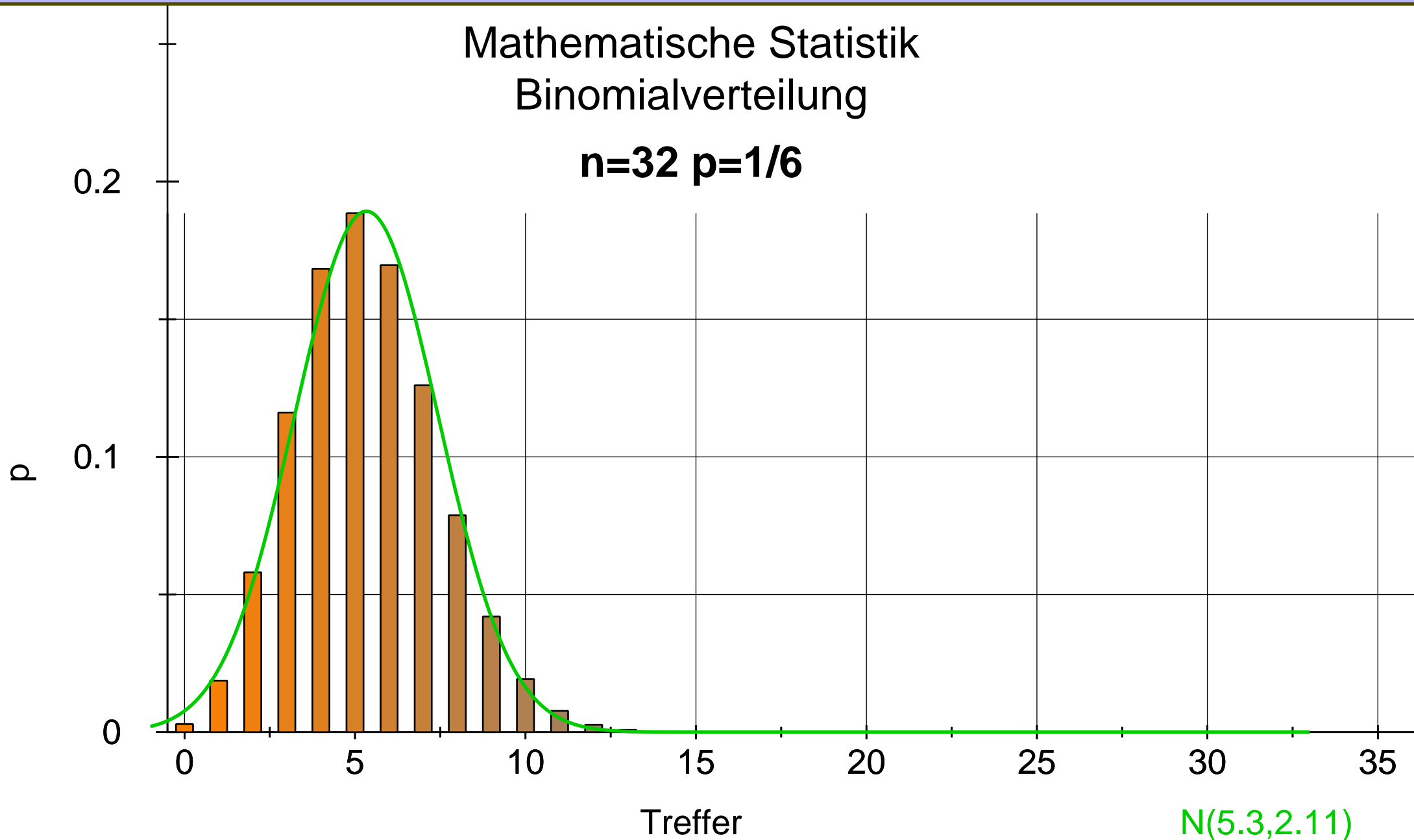
**n=31 p=1/6**



$N(5.2, 2.07)$

# Mathematische Statistik Binomialverteilung

**$n=32$   $p=1/6$**

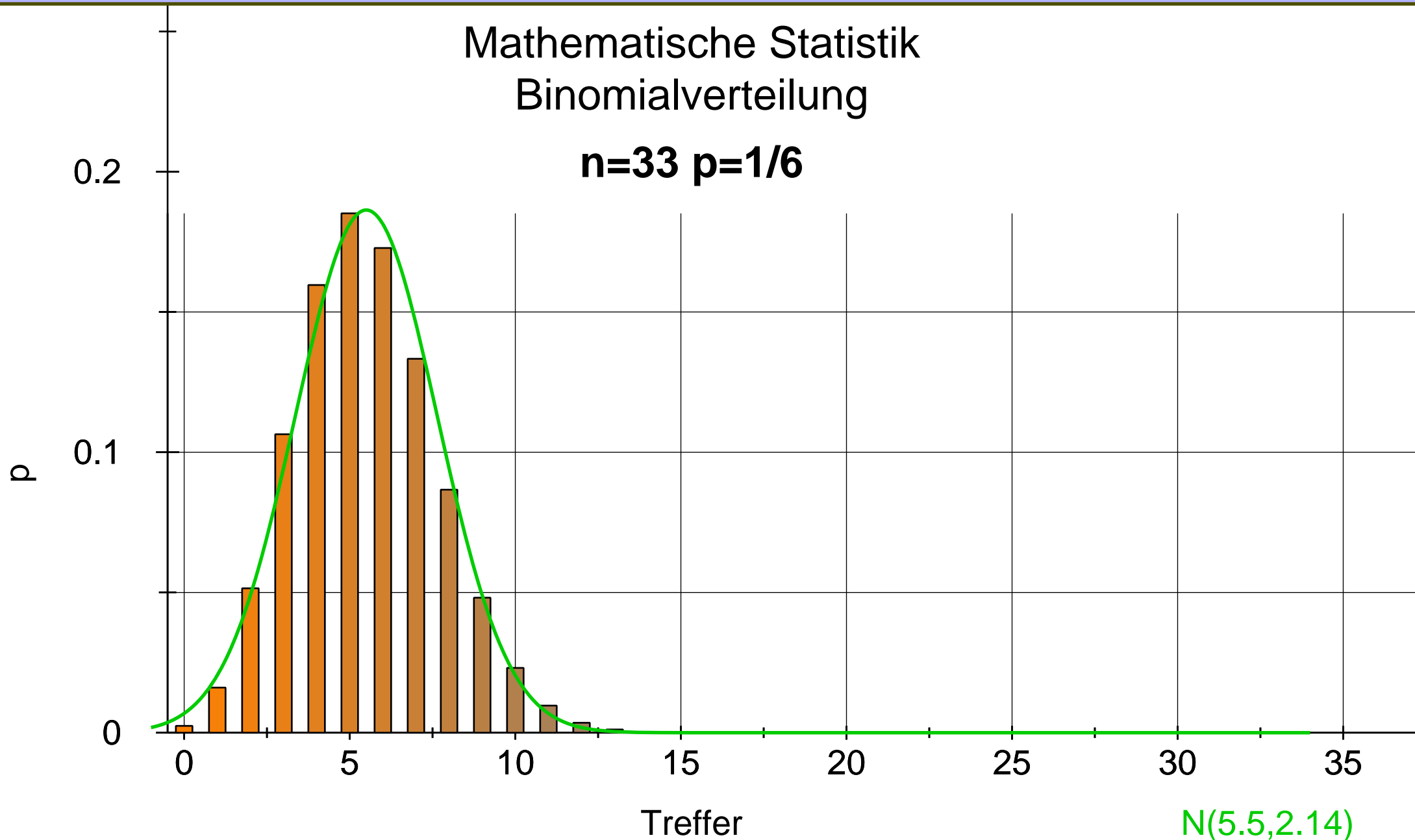


$N(5.3, 2.11)$

# Mathematische Statistik

## Binomialverteilung

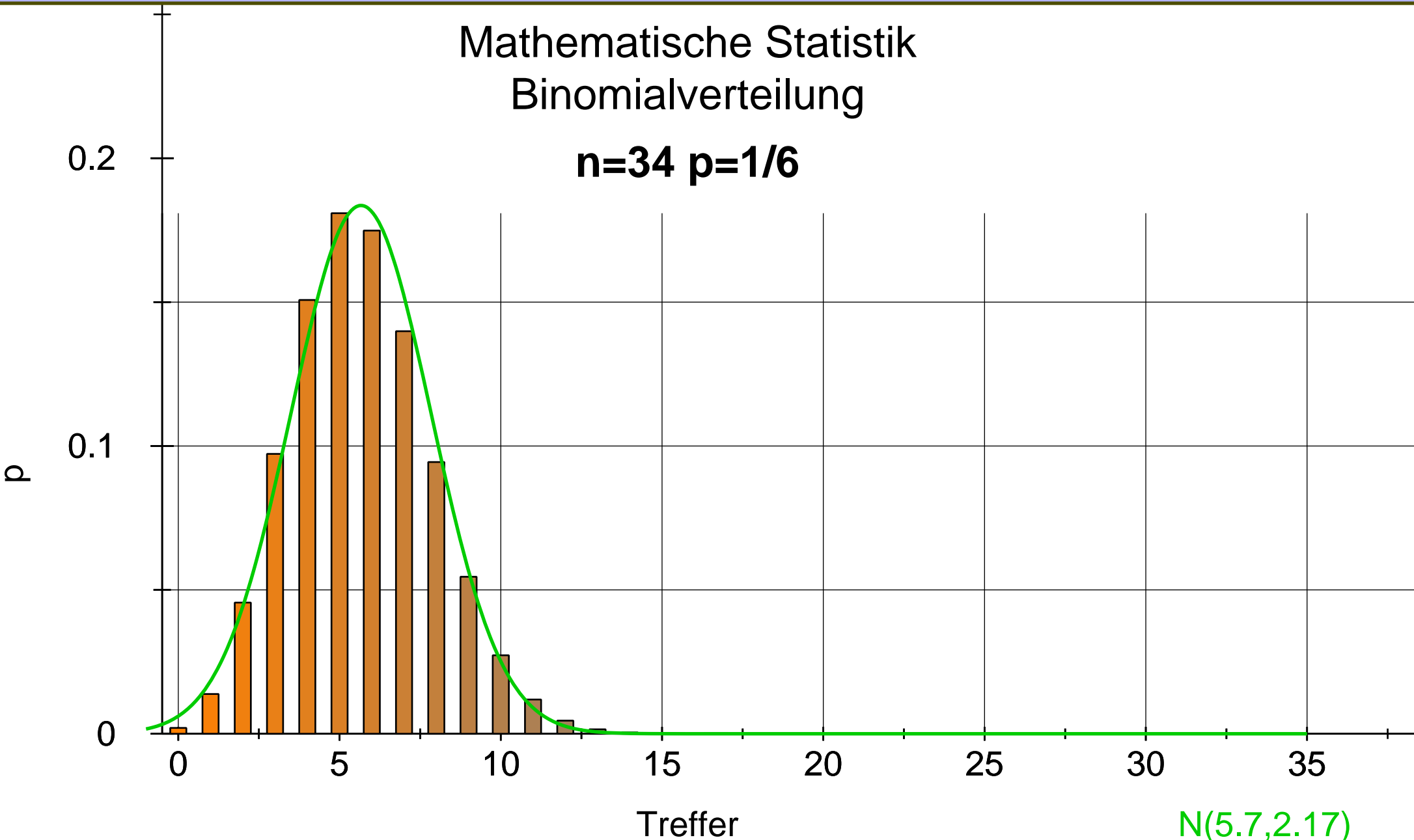
**$n=33$   $p=1/6$**



$N(5.5, 2.14)$

Mathematische Statistik  
Binomialverteilung

**n=34 p=1/6**

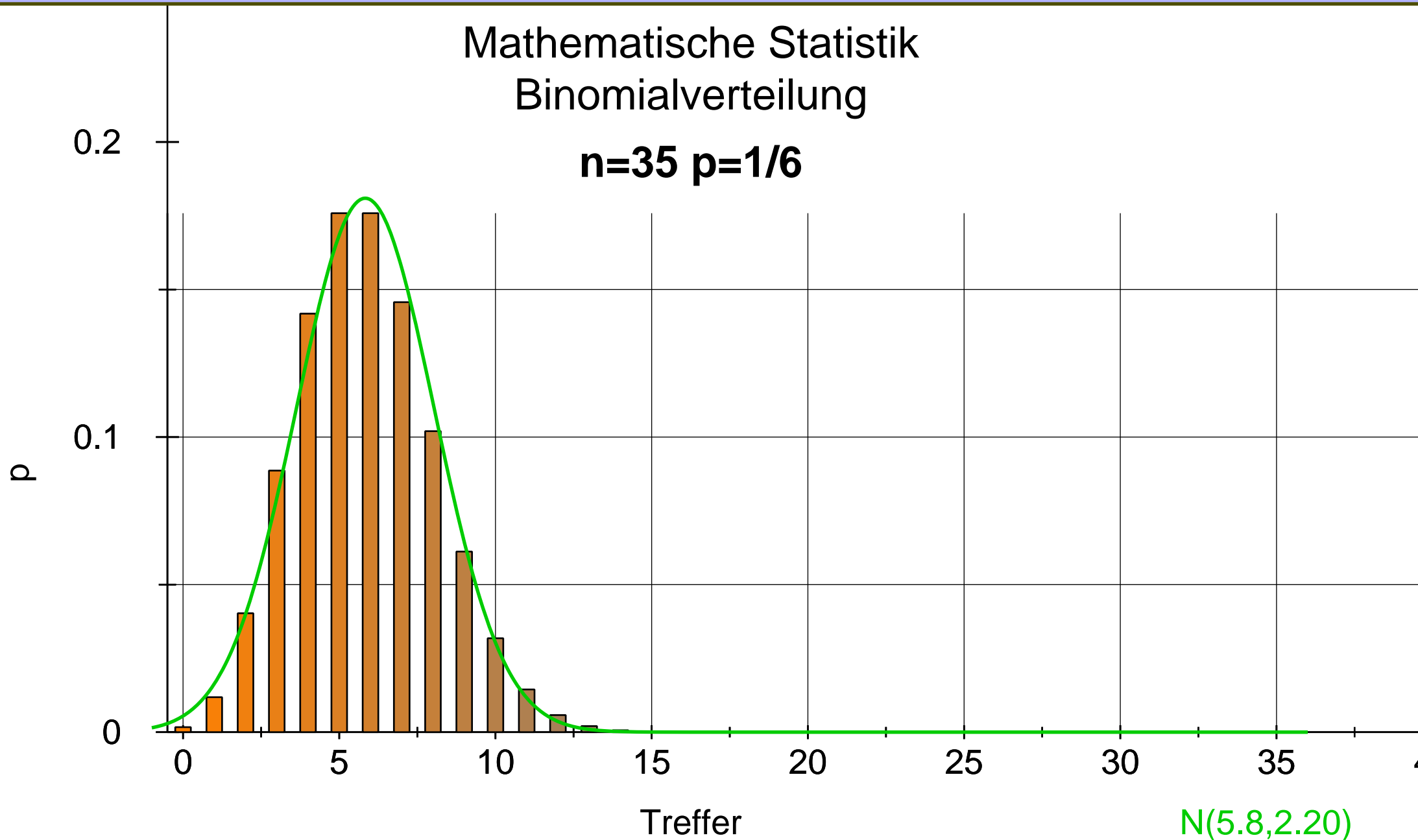


$N(5.7, 2.17)$

# Mathematische Statistik

## Binomialverteilung

**$n=35$   $p=1/6$**

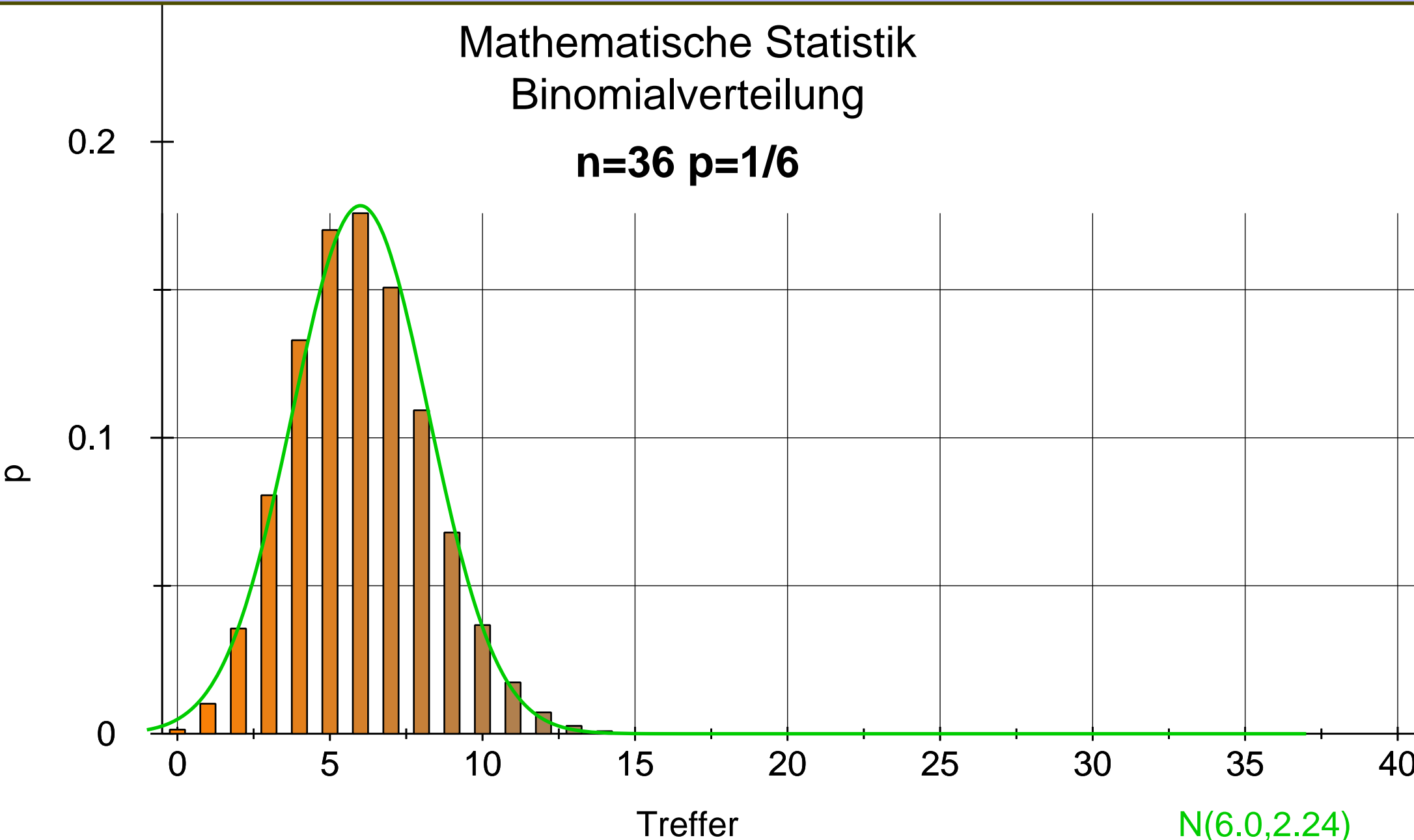


$N(5.8, 2.20)$

# Mathematische Statistik

## Binomialverteilung

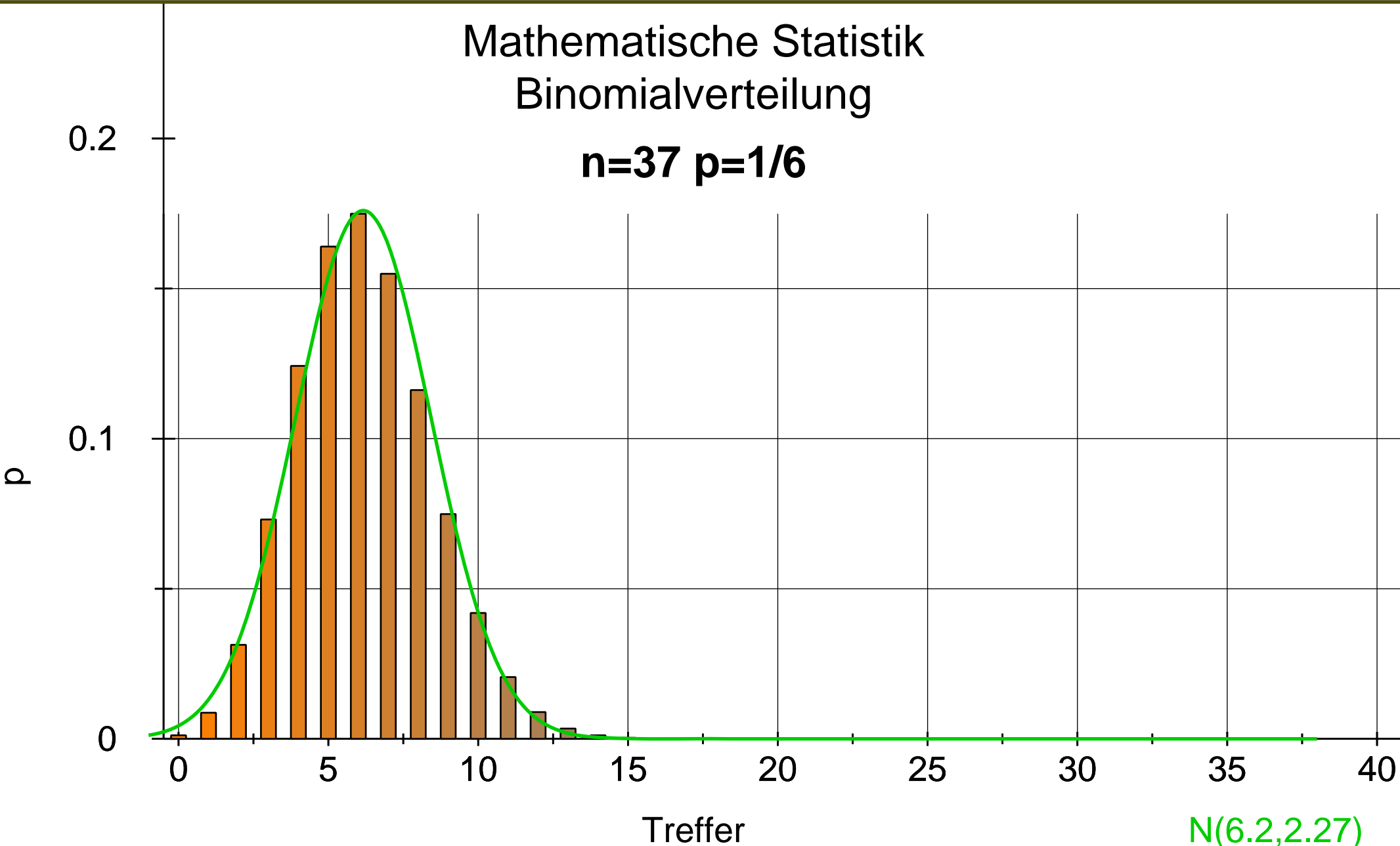
**n=36 p=1/6**



# Mathematische Statistik

## Binomialverteilung

**n=37 p=1/6**



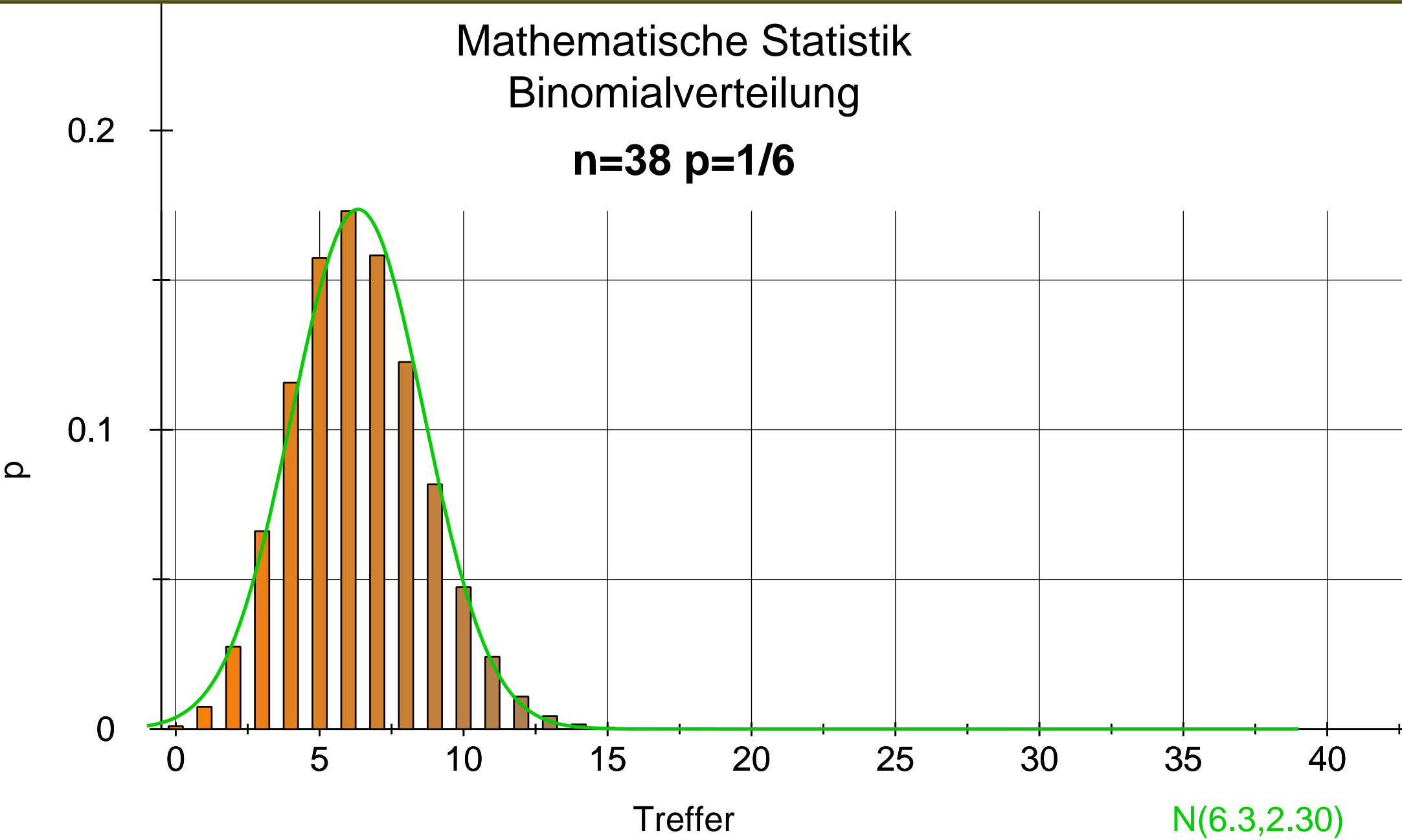
$N(6.2, 2.27)$



# Mathematische Statistik

## Binomialverteilung

**n=38 p=1/6**

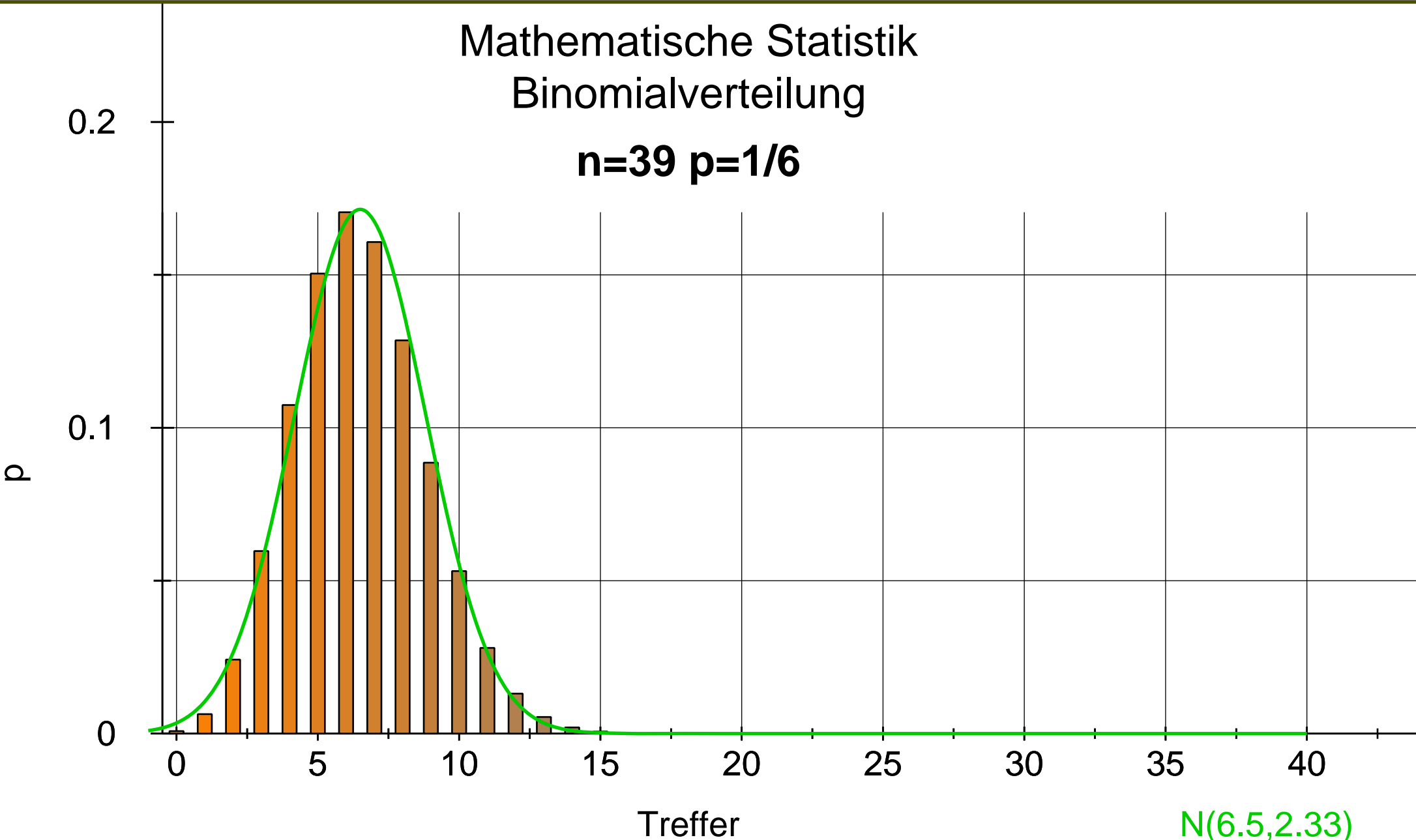


$N(6.3, 2.30)$

# Mathematische Statistik

## Binomialverteilung

**n=39 p=1/6**

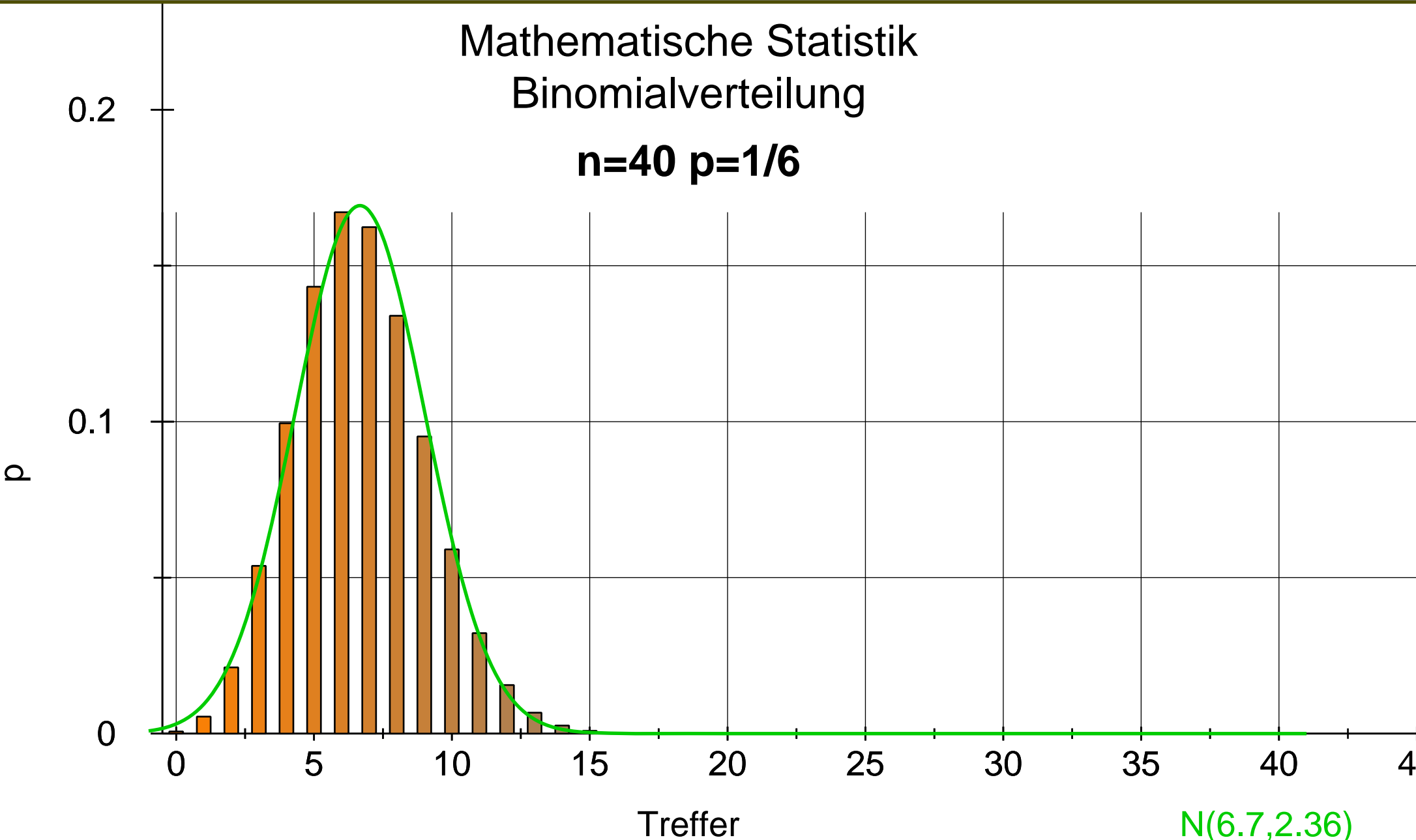


$N(6.5, 2.33)$

# Mathematische Statistik

## Binomialverteilung

**n=40 p=1/6**

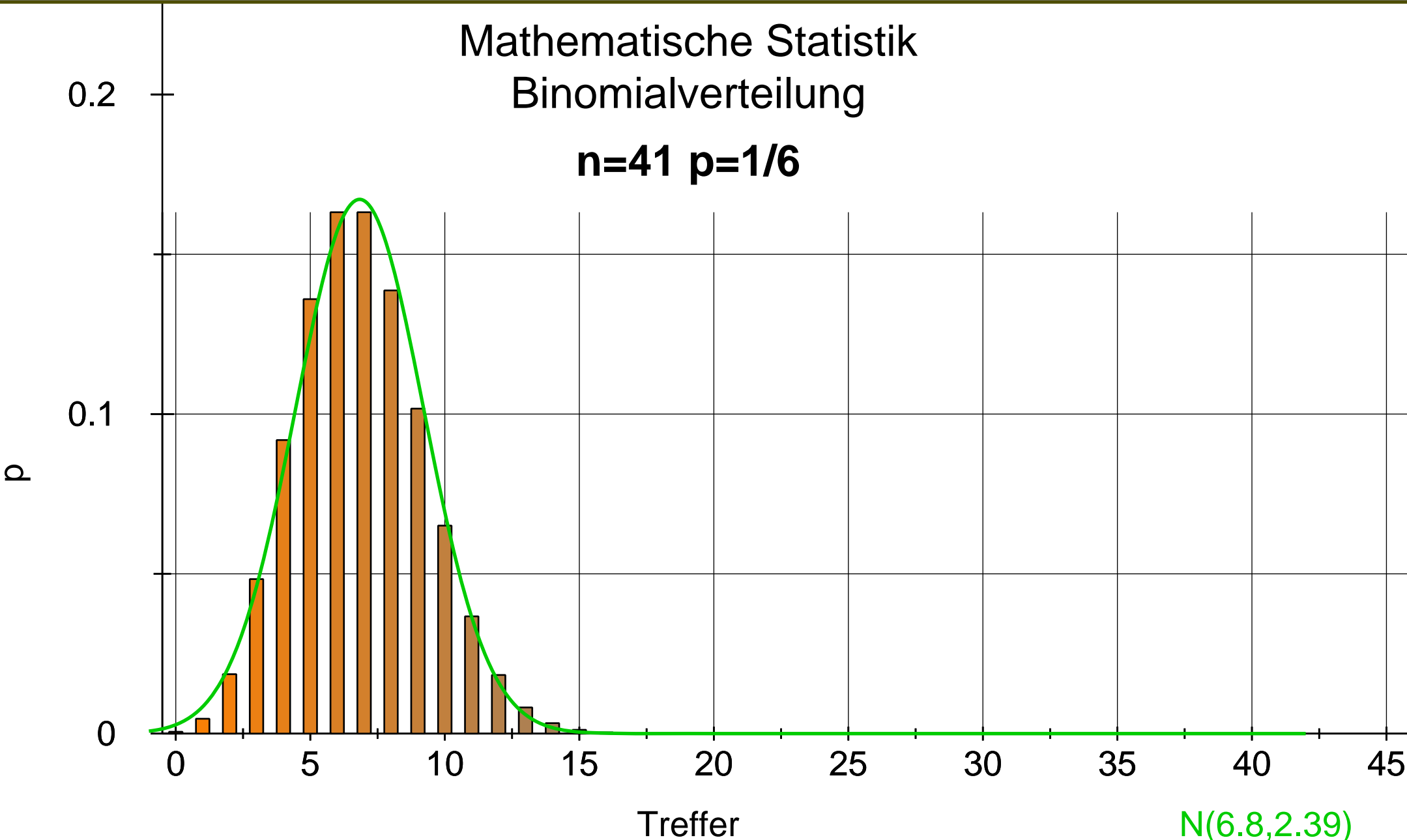


$N(6.7, 2.36)$

# Mathematische Statistik

## Binomialverteilung

**n=41 p=1/6**

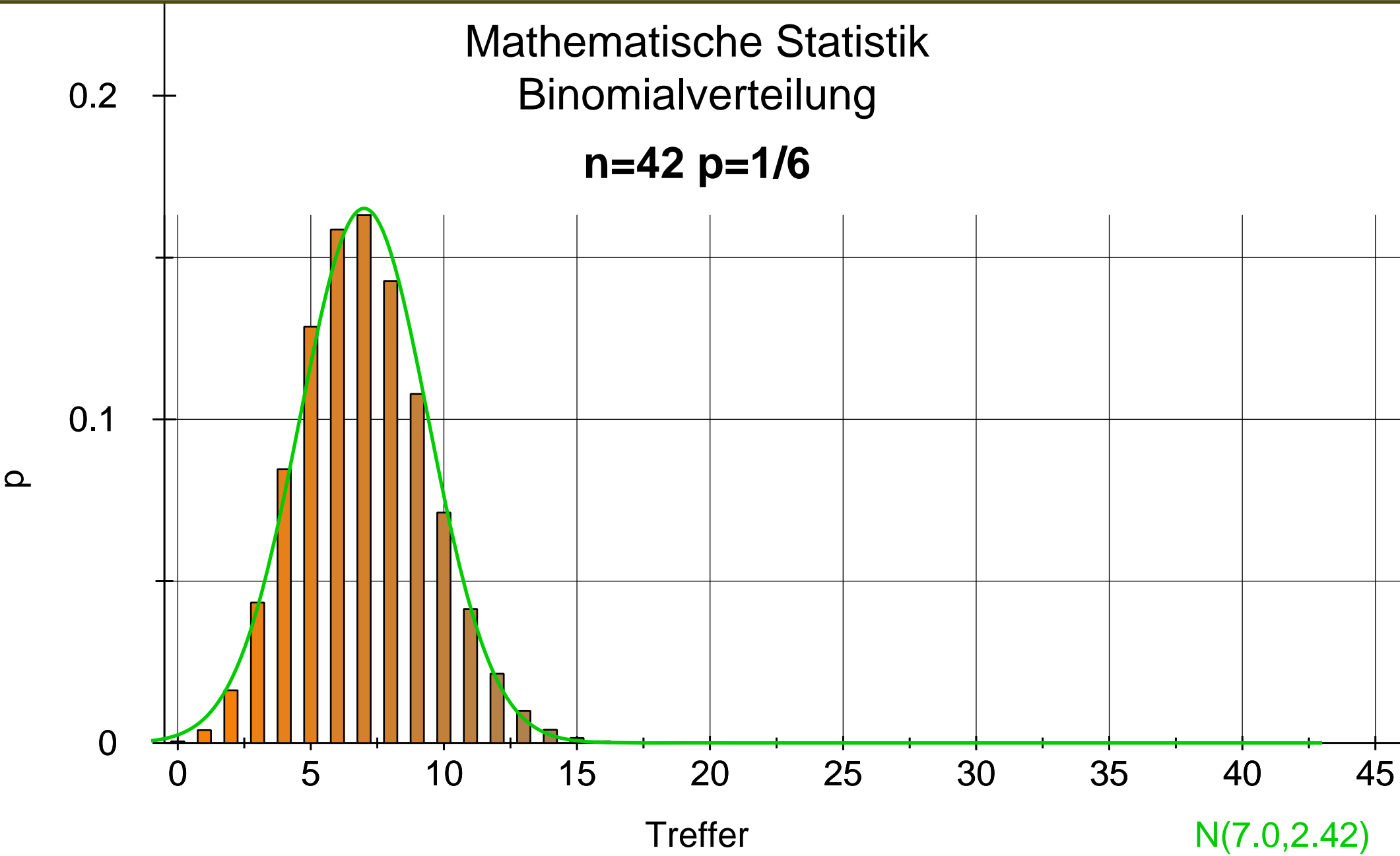


$N(6.8, 2.39)$

# Mathematische Statistik

## Binomialverteilung

**n=42 p=1/6**

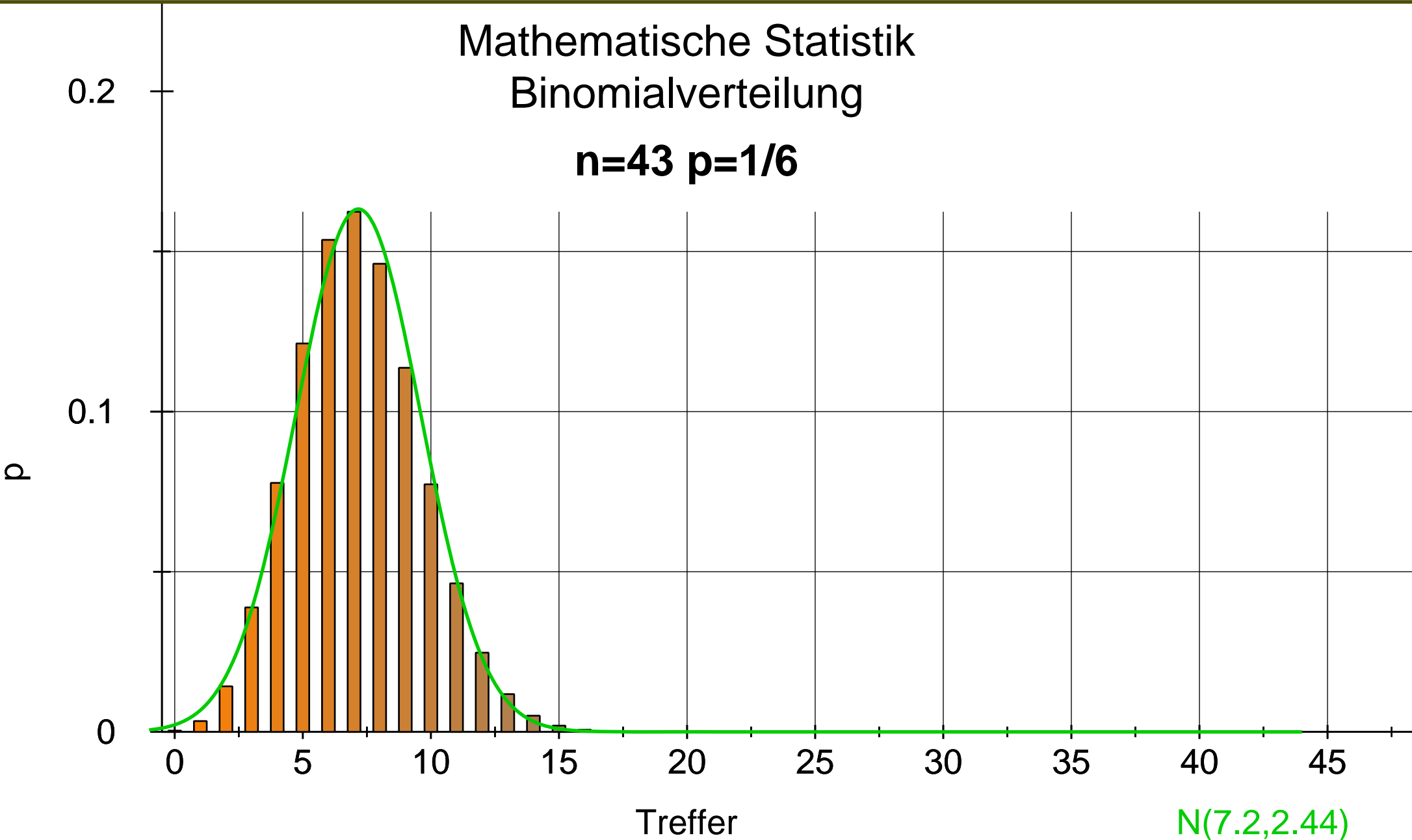


$N(7.0, 2.42)$

# Mathematische Statistik

## Binomialverteilung

**n=43 p=1/6**

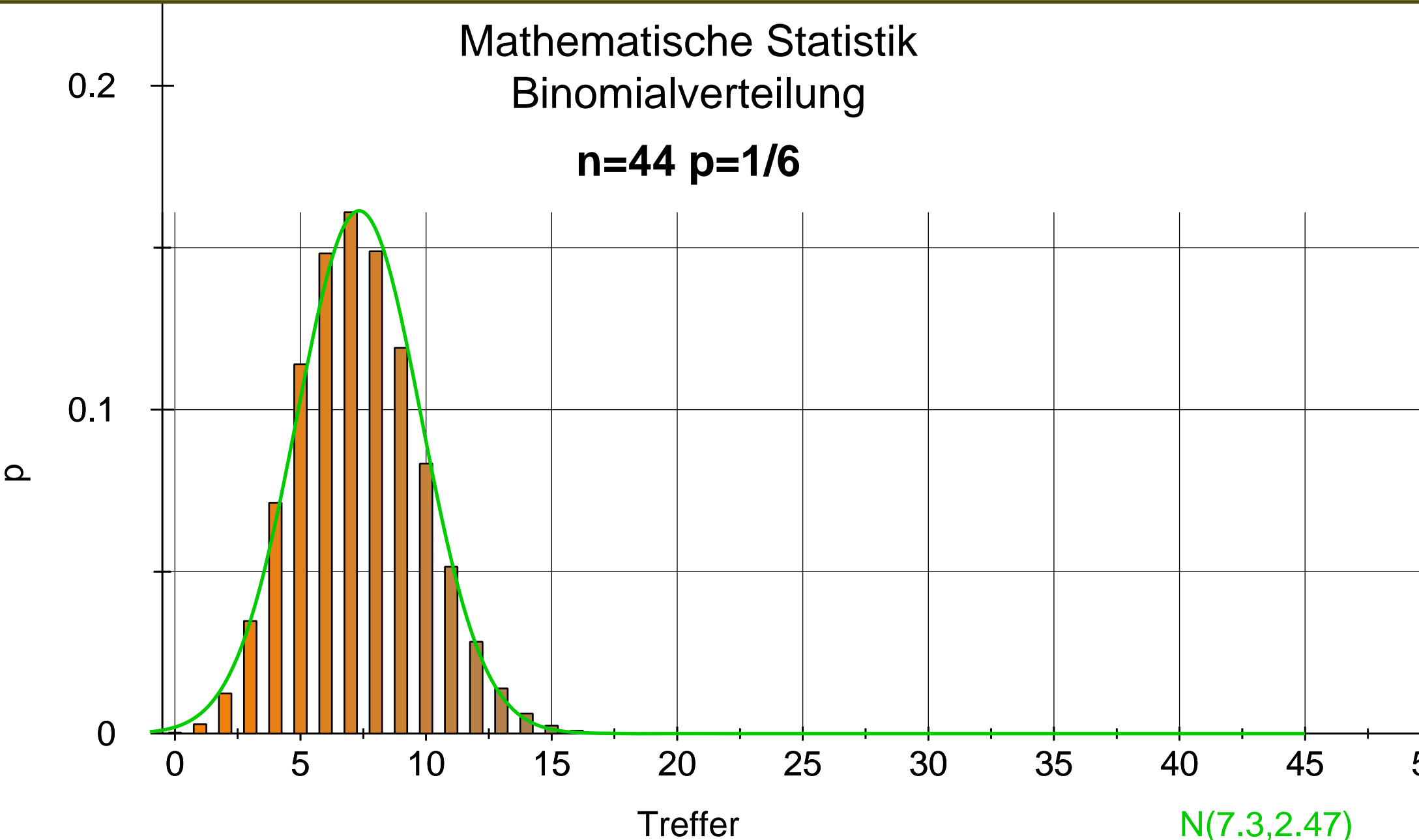


$N(7.2, 2.44)$

# Mathematische Statistik

## Binomialverteilung

**n=44 p=1/6**

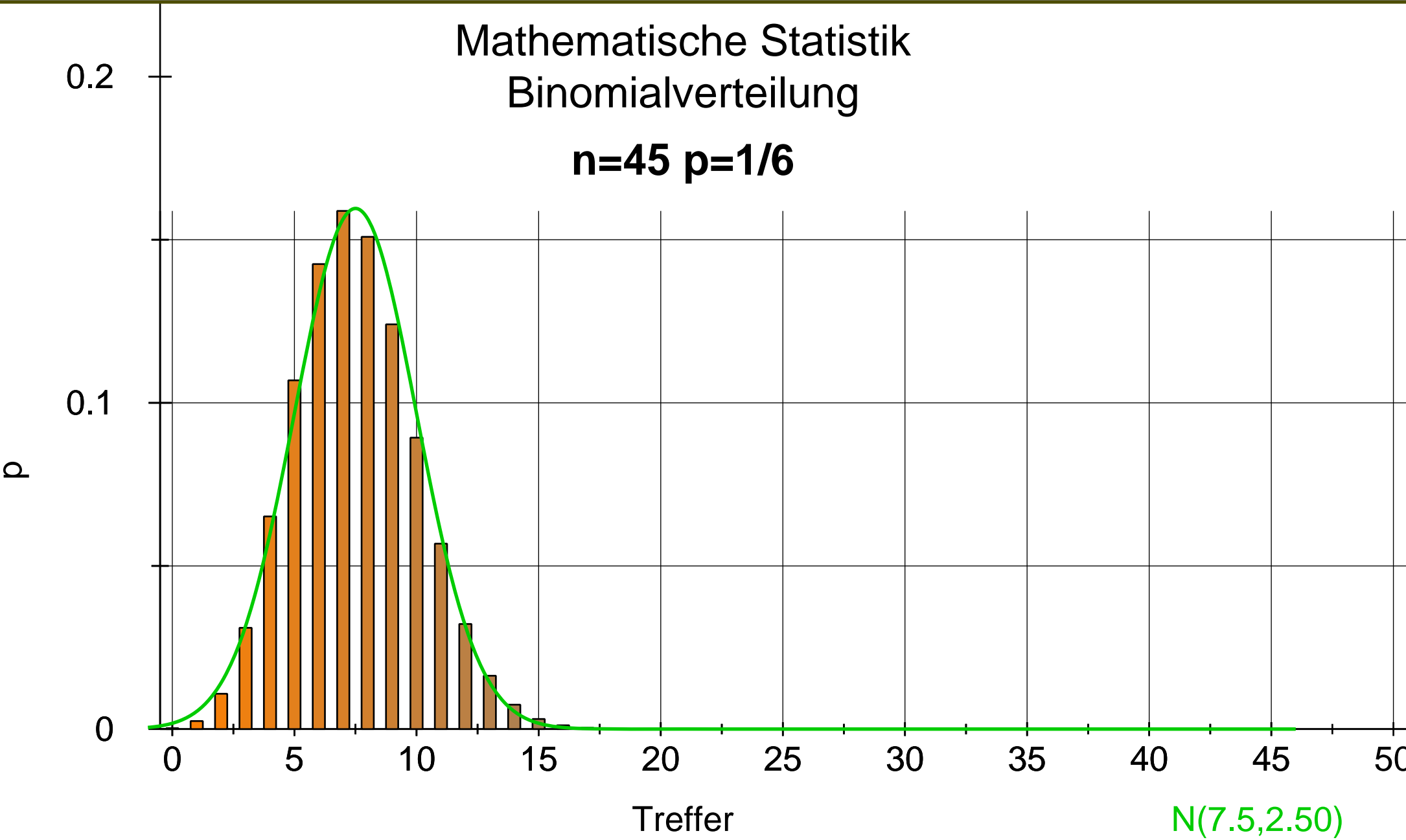


$N(7.3, 2.47)$

# Mathematische Statistik

## Binomialverteilung

**n=45 p=1/6**

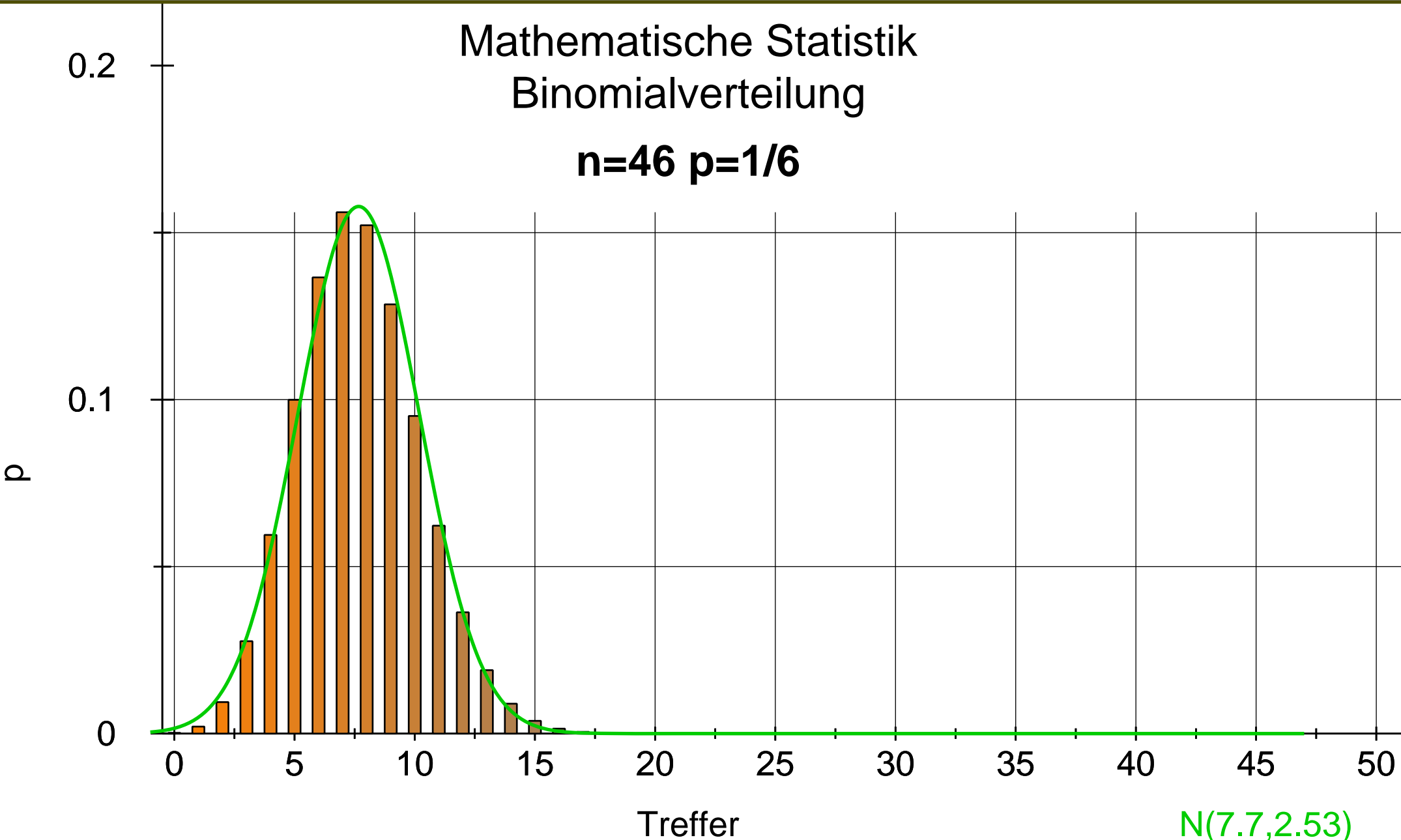


$N(7.5, 2.50)$



Mathematische Statistik  
Binomialverteilung

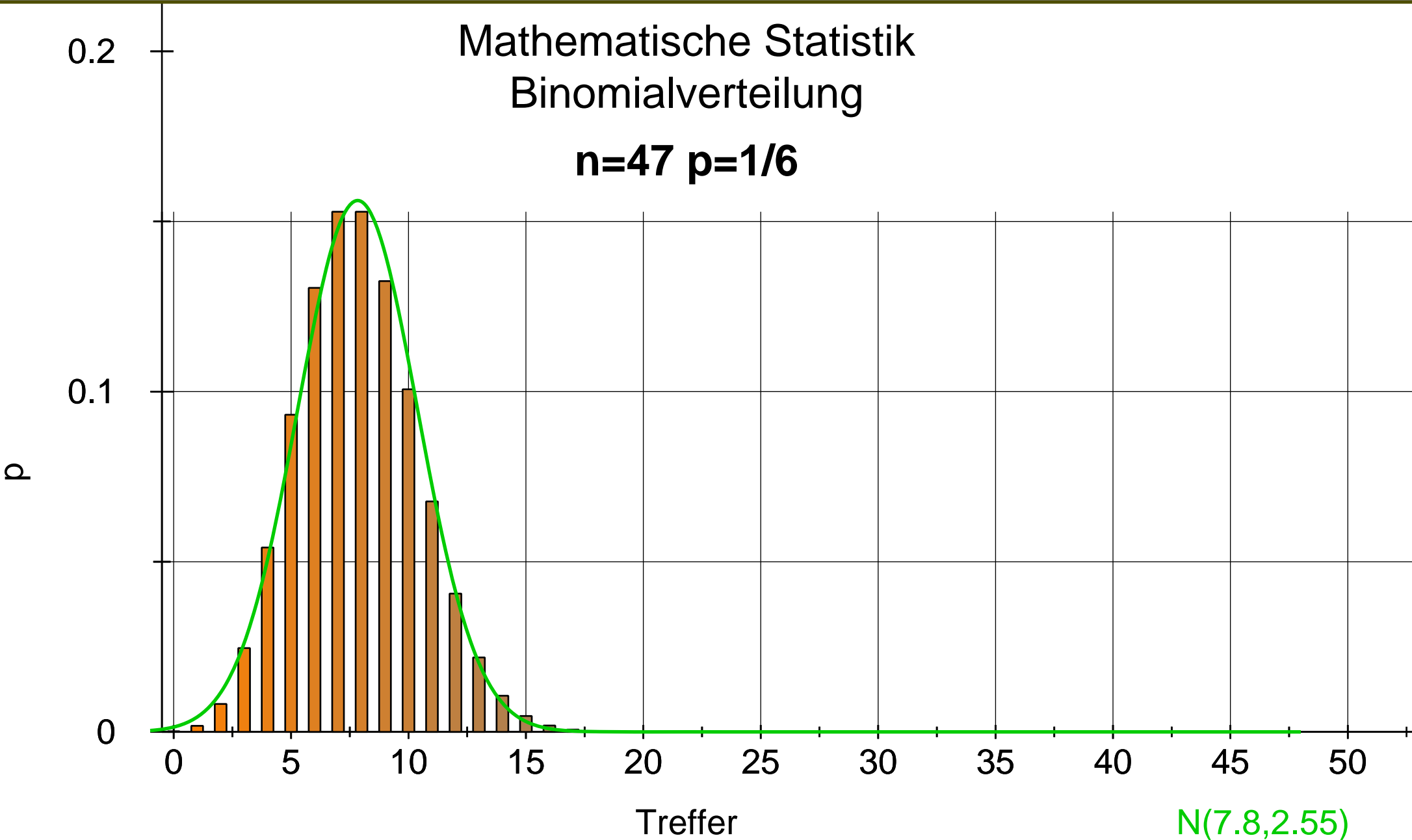
**n=46 p=1/6**



$N(7.7, 2.53)$

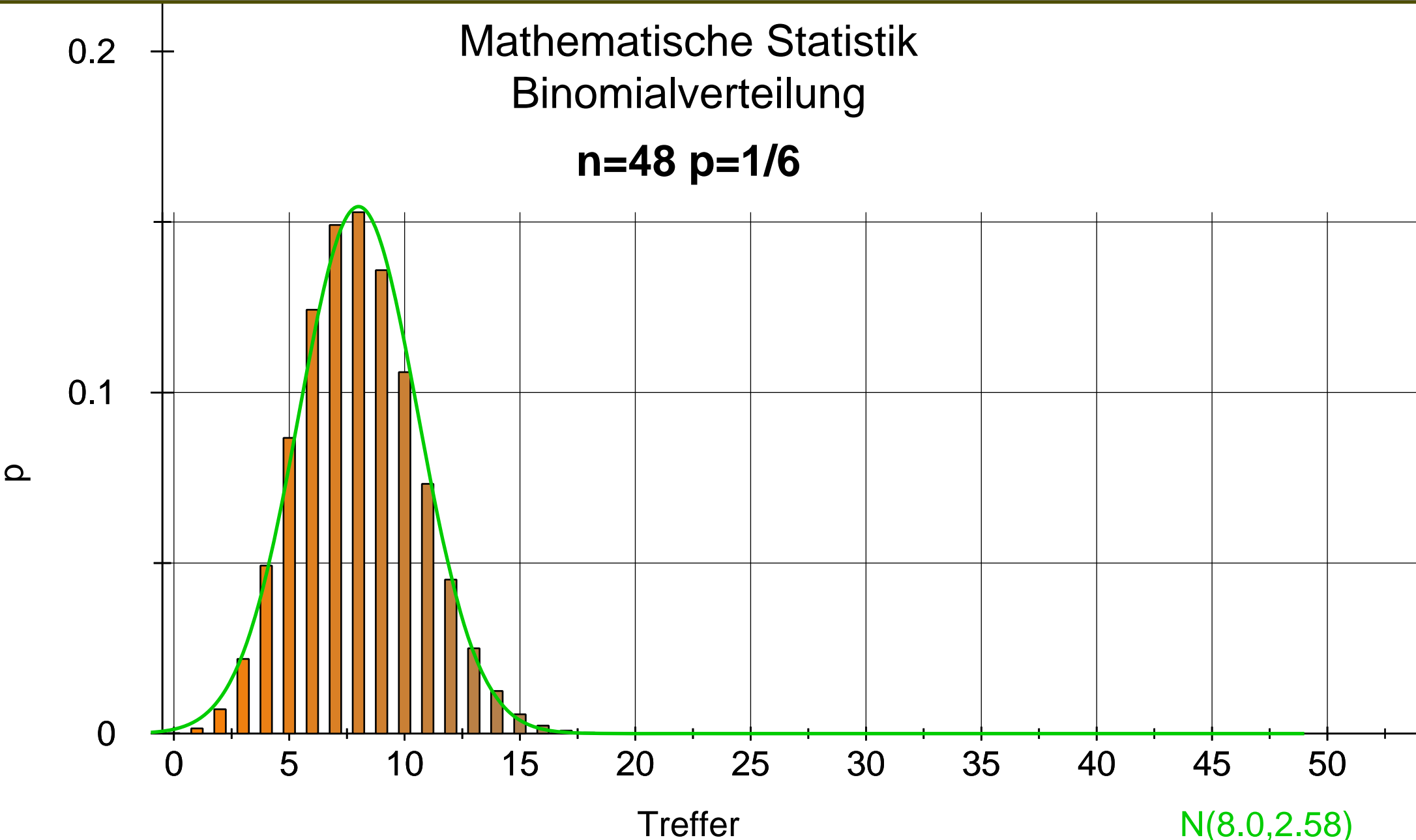
# Mathematische Statistik Binomialverteilung

**n=47 p=1/6**



Mathematische Statistik  
Binomialverteilung

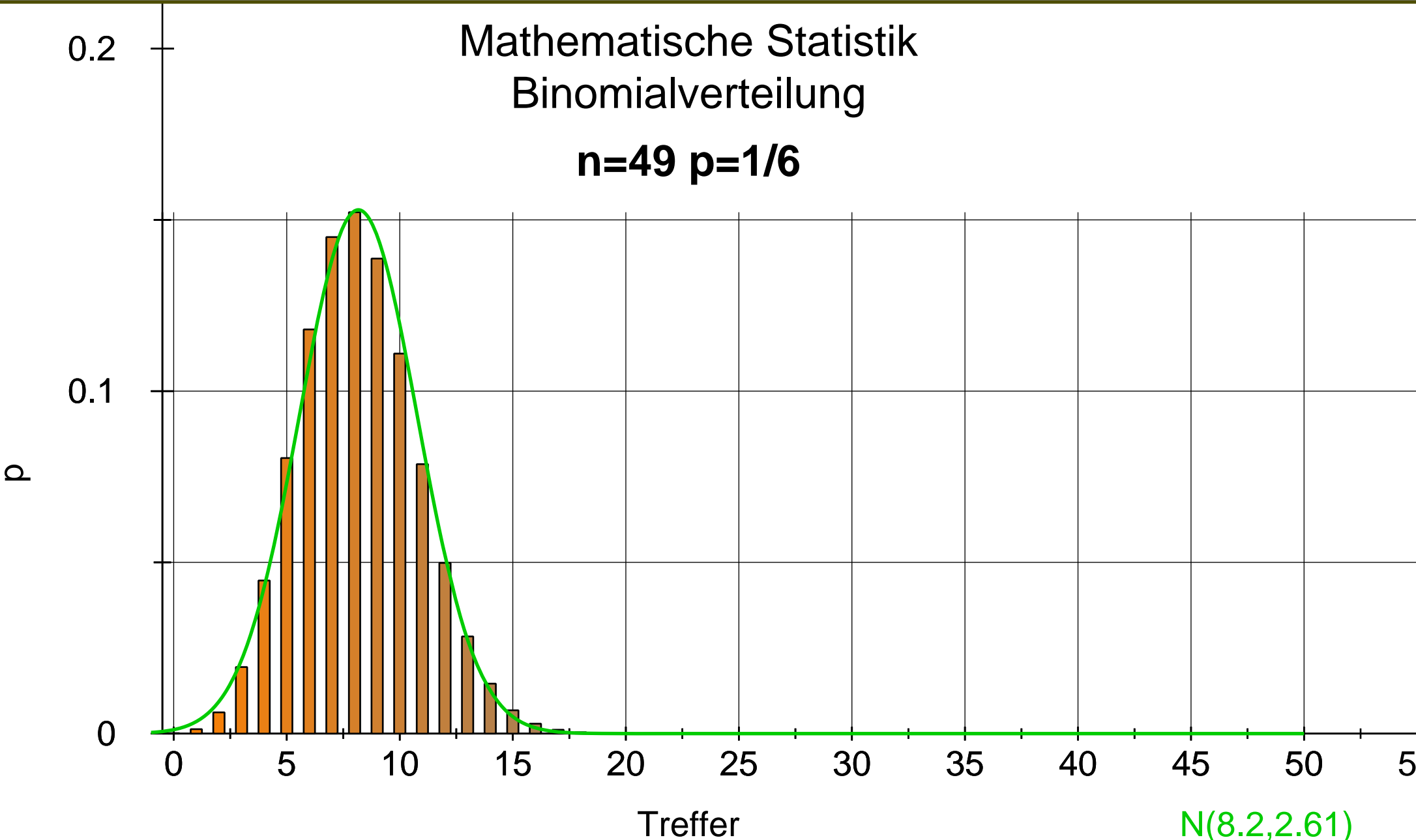
**n=48 p=1/6**



$N(8.0, 2.58)$

Mathematische Statistik  
Binomialverteilung

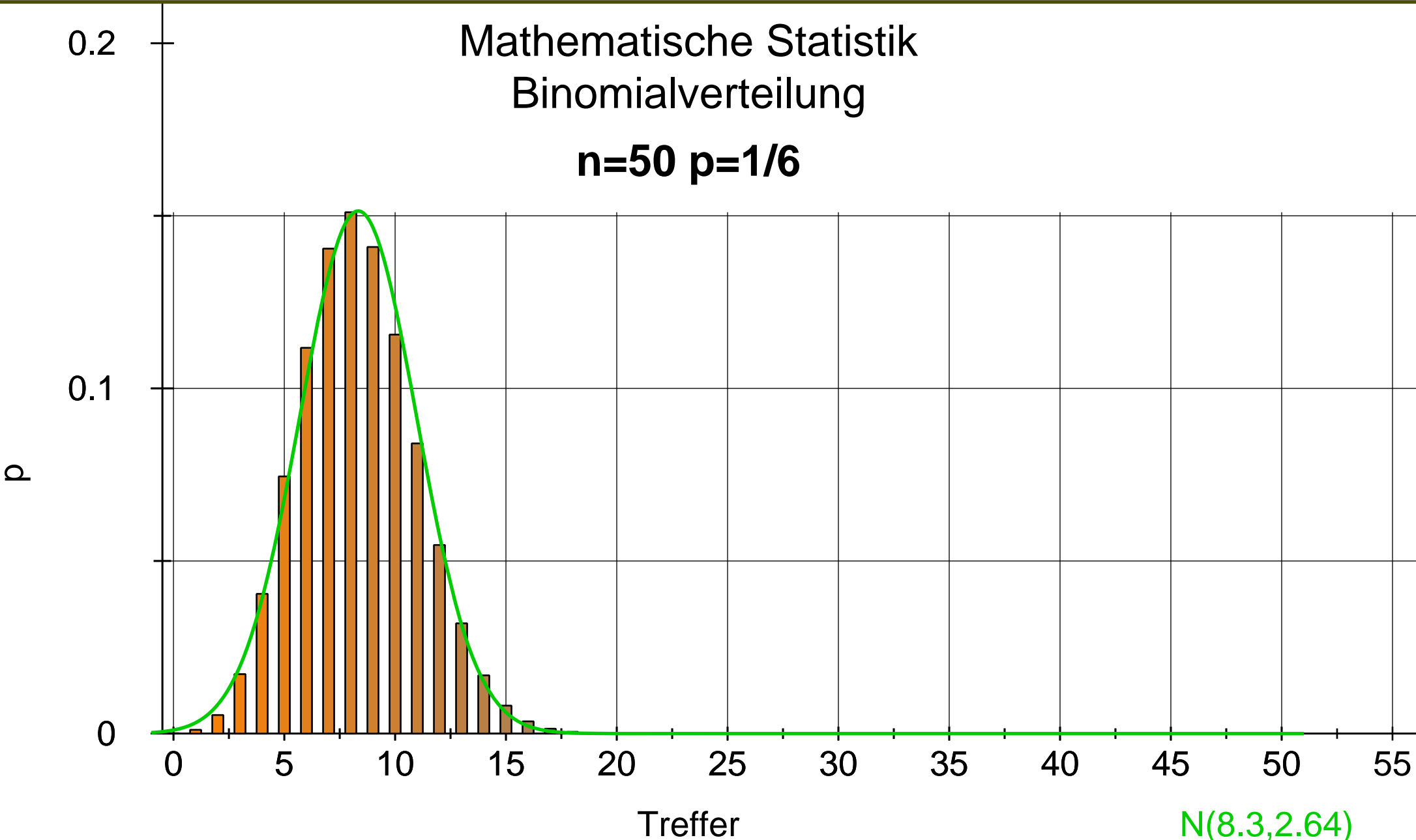
**n=49 p=1/6**



$N(8.2, 2.61)$

Mathematische Statistik  
Binomialverteilung

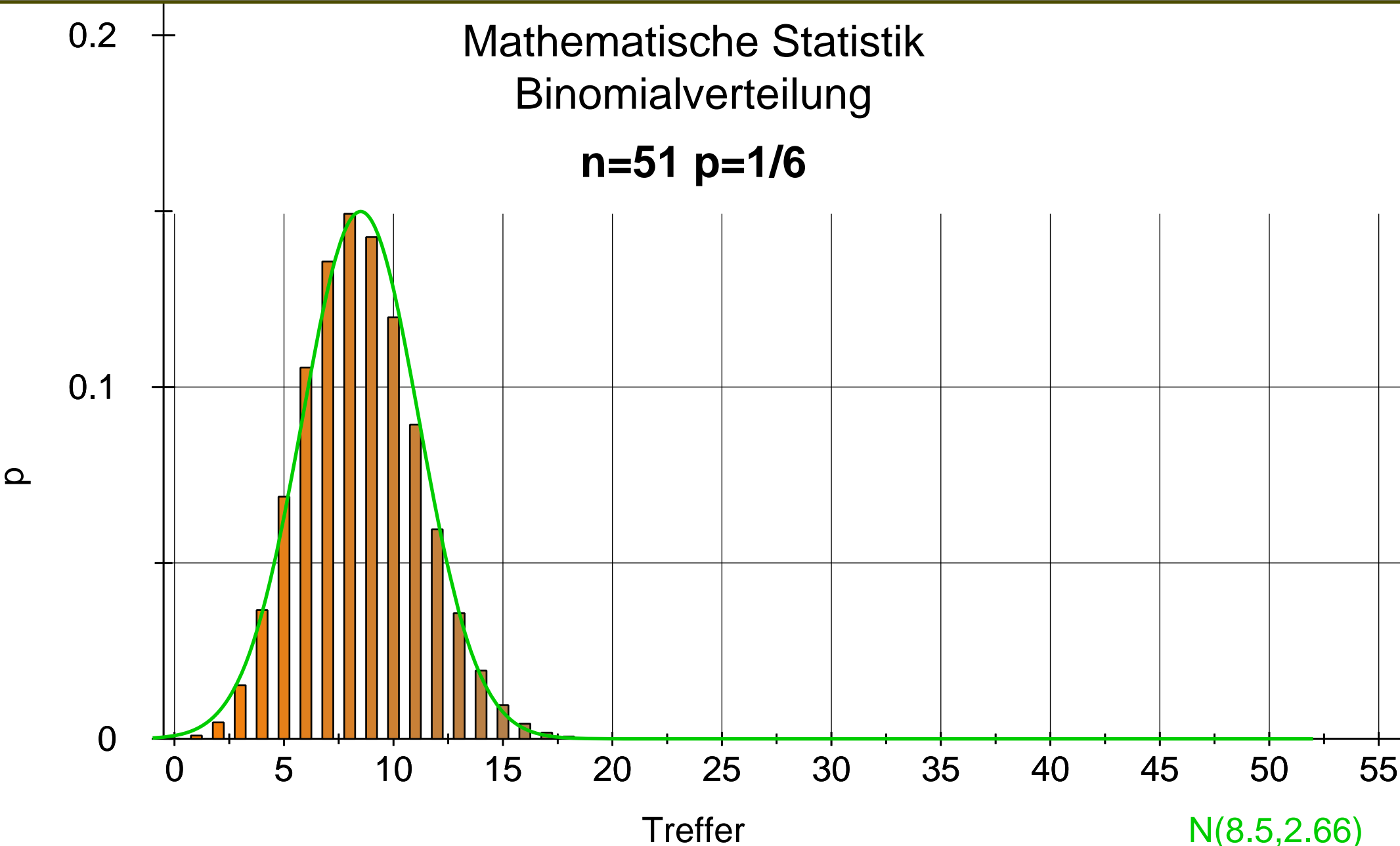
**n=50 p=1/6**



$N(8.3, 2.64)$

Mathematische Statistik  
Binomialverteilung

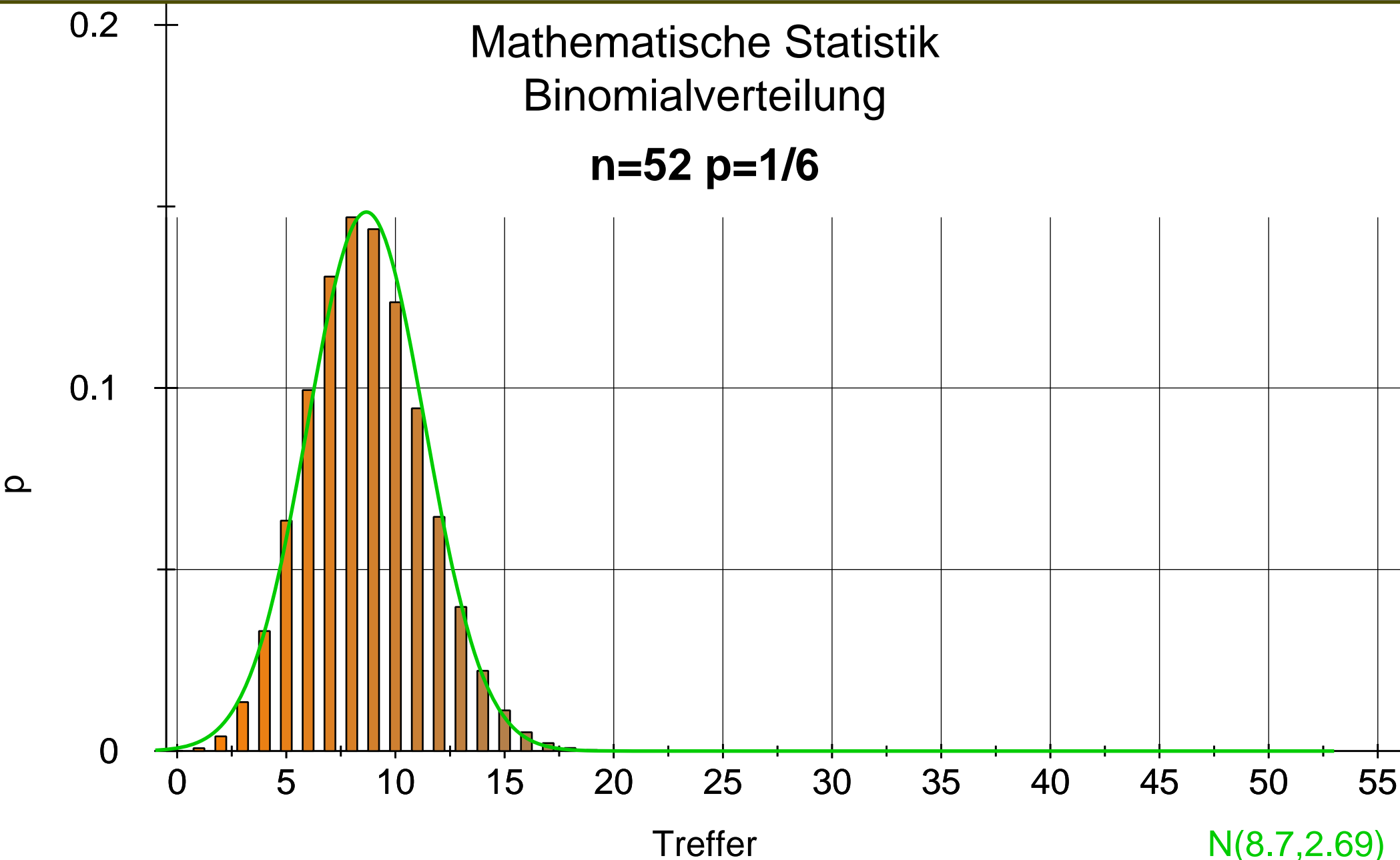
**n=51 p=1/6**



$N(8.5, 2.66)$

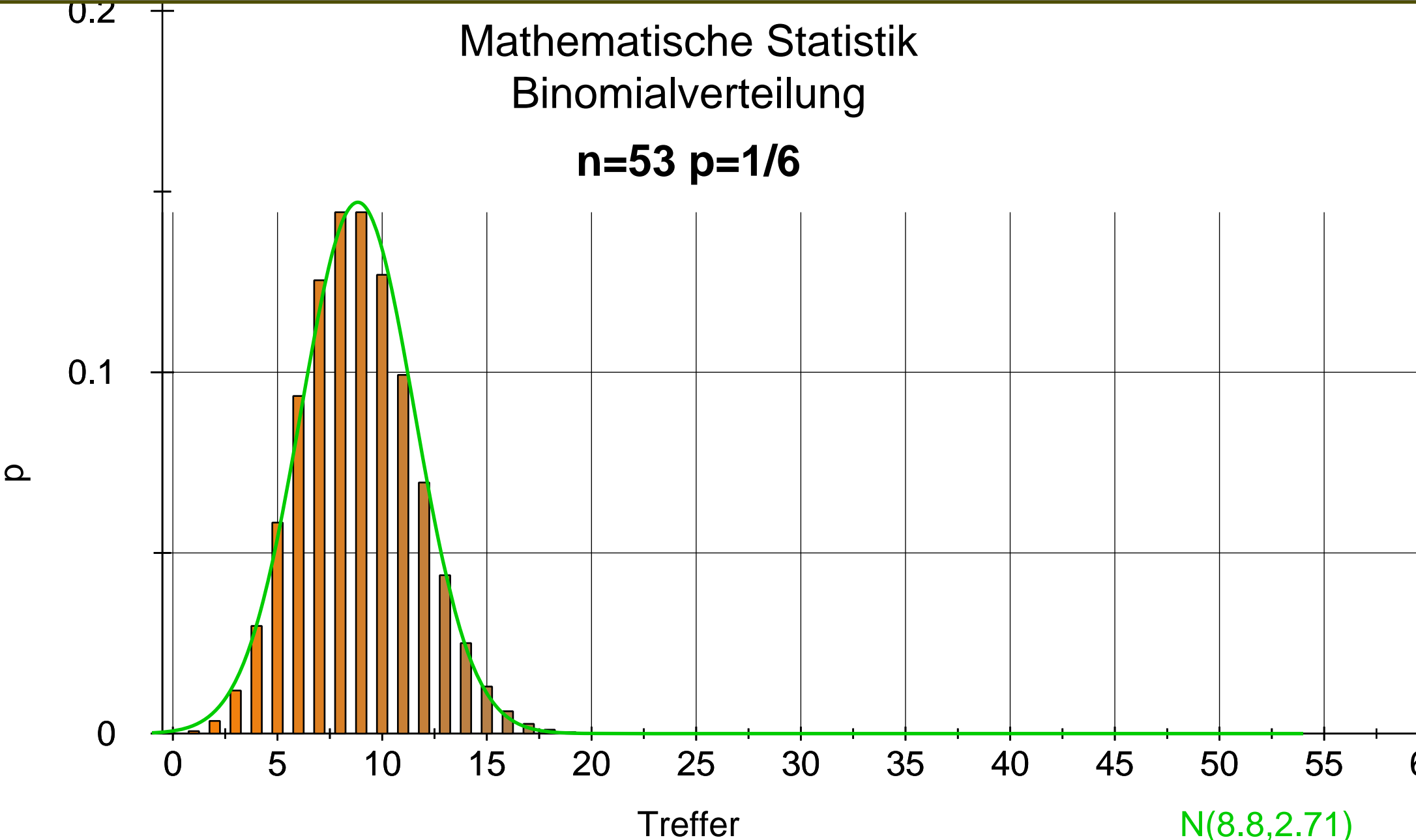
# Mathematische Statistik Binomialverteilung

**n=52 p=1/6**



Mathematische Statistik  
Binomialverteilung

**n=53 p=1/6**

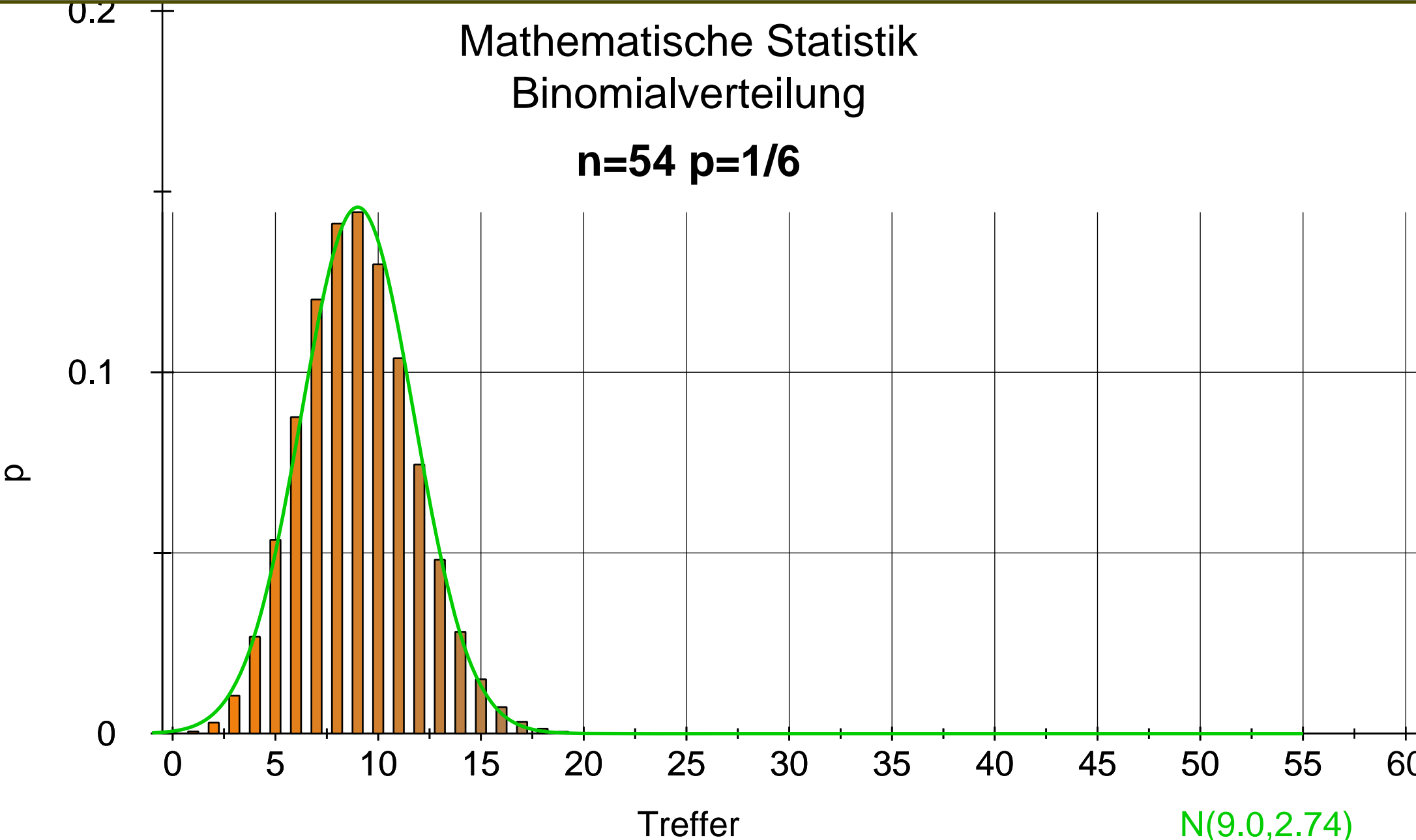


$N(8.8, 2.71)$



Mathematische Statistik  
Binomialverteilung

**n=54 p=1/6**

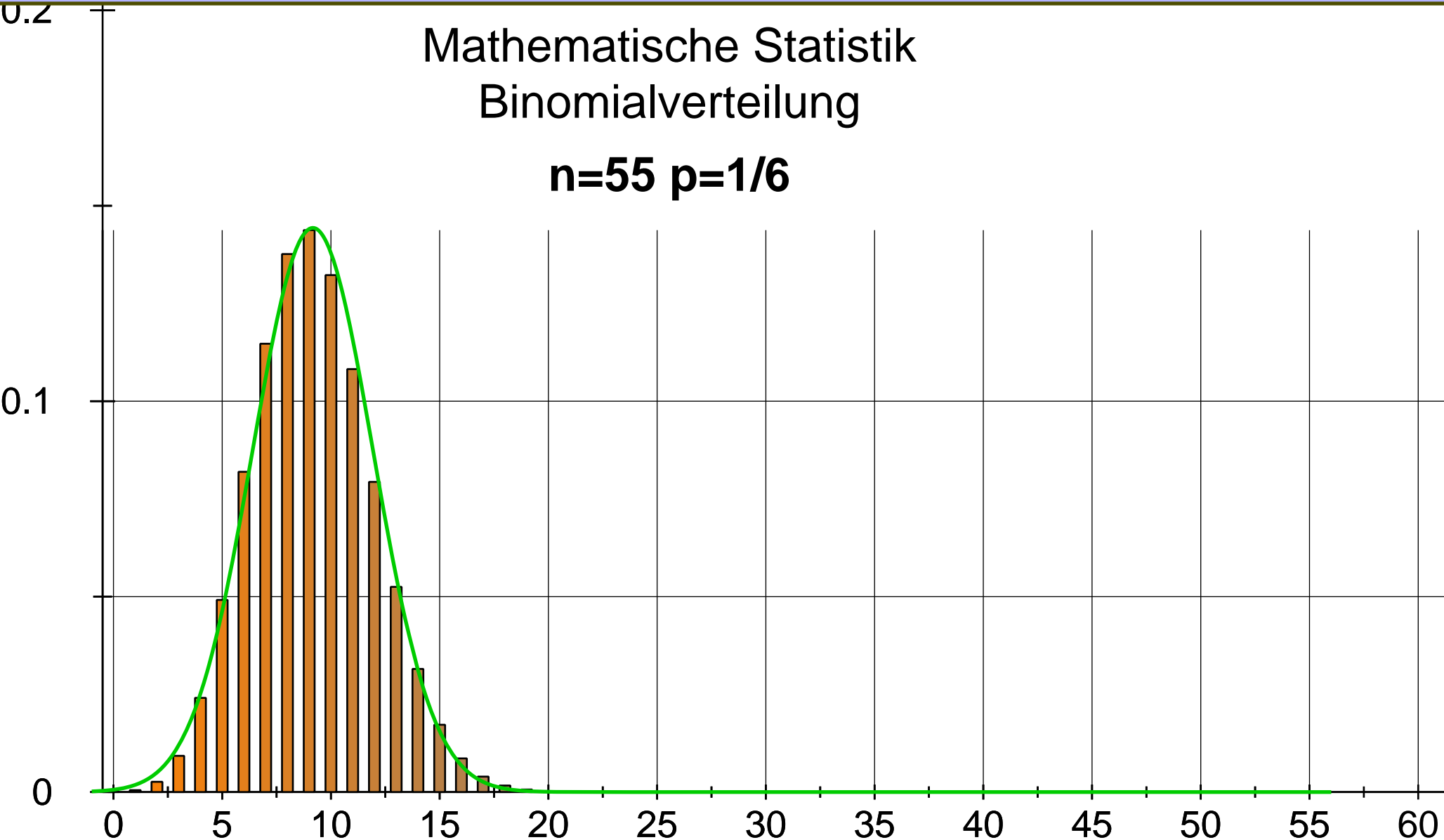


$N(9.0, 2.74)$

Mathematische Statistik  
Binomialverteilung

**n=55 p=1/6**

p

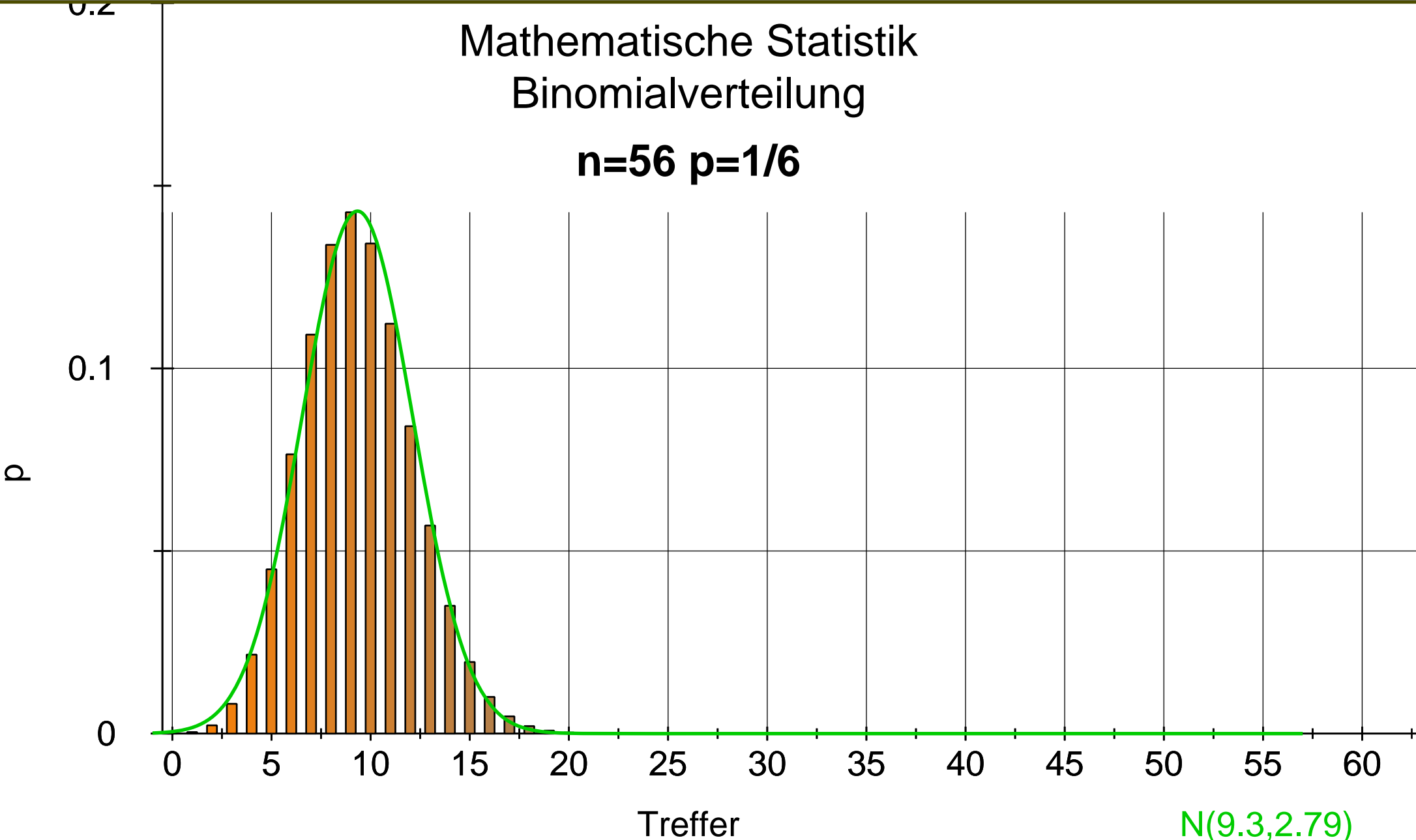


Treffer

$N(9.2, 2.76)$

Mathematische Statistik  
Binomialverteilung

**n=56 p=1/6**



N(9.3, 2.79)

# Mathematische Statistik

## Binomialverteilung

**n=57 p=1/6**

p

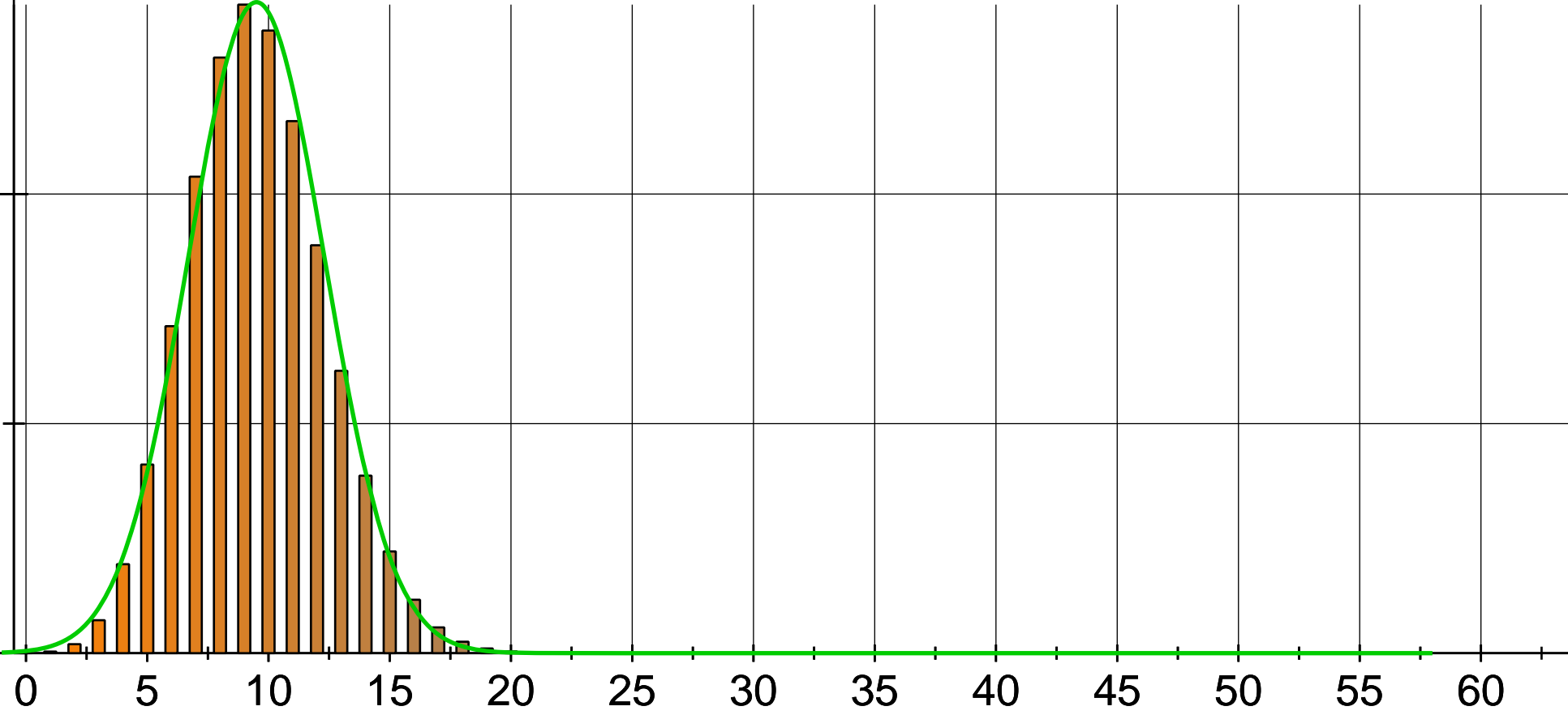
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0

0 5 10 15 20 25 30 35 40 45 50 55 60

Treffer

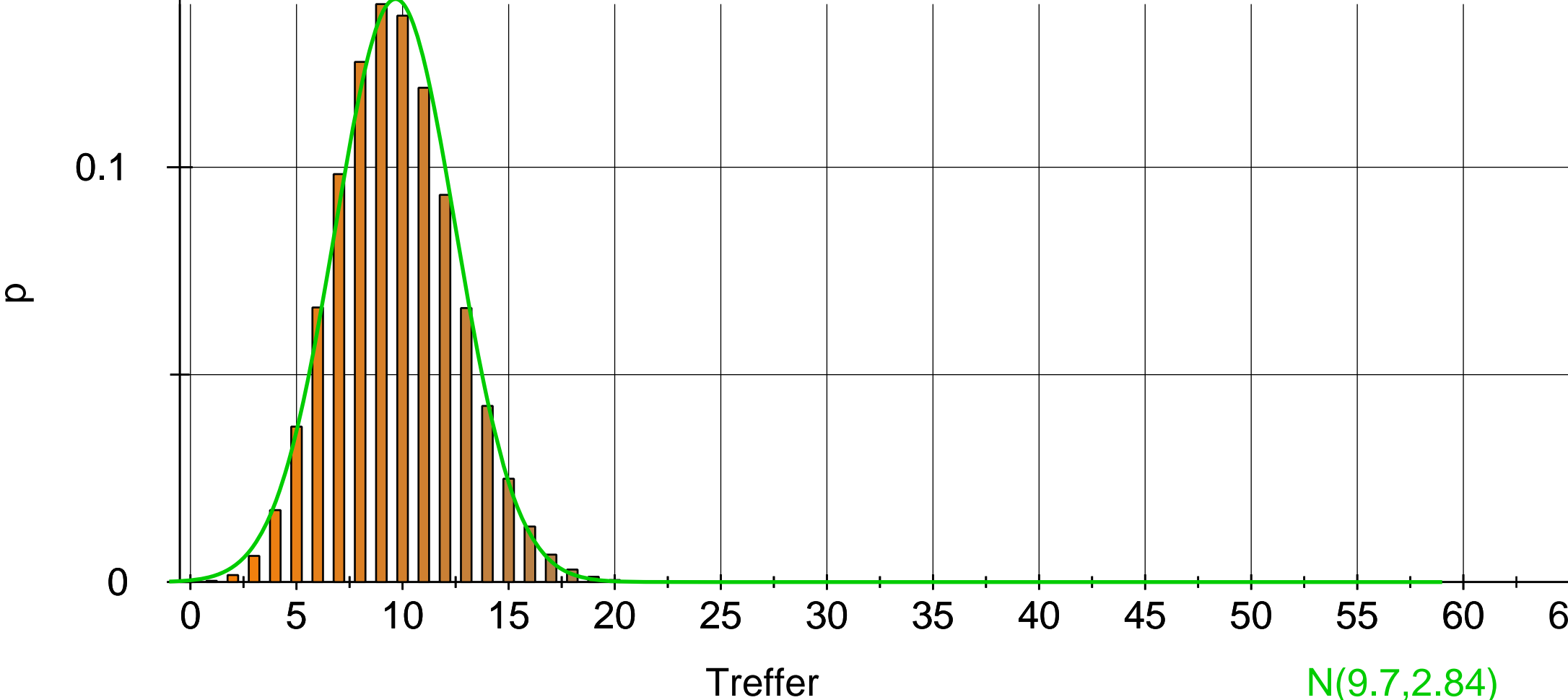
$N(9.5, 2.81)$



# Mathematische Statistik

## Binomialverteilung

**n=58 p=1/6**



$N(9.7, 2.84)$

# Mathematische Statistik

## Binomialverteilung

**n=59 p=1/6**

p

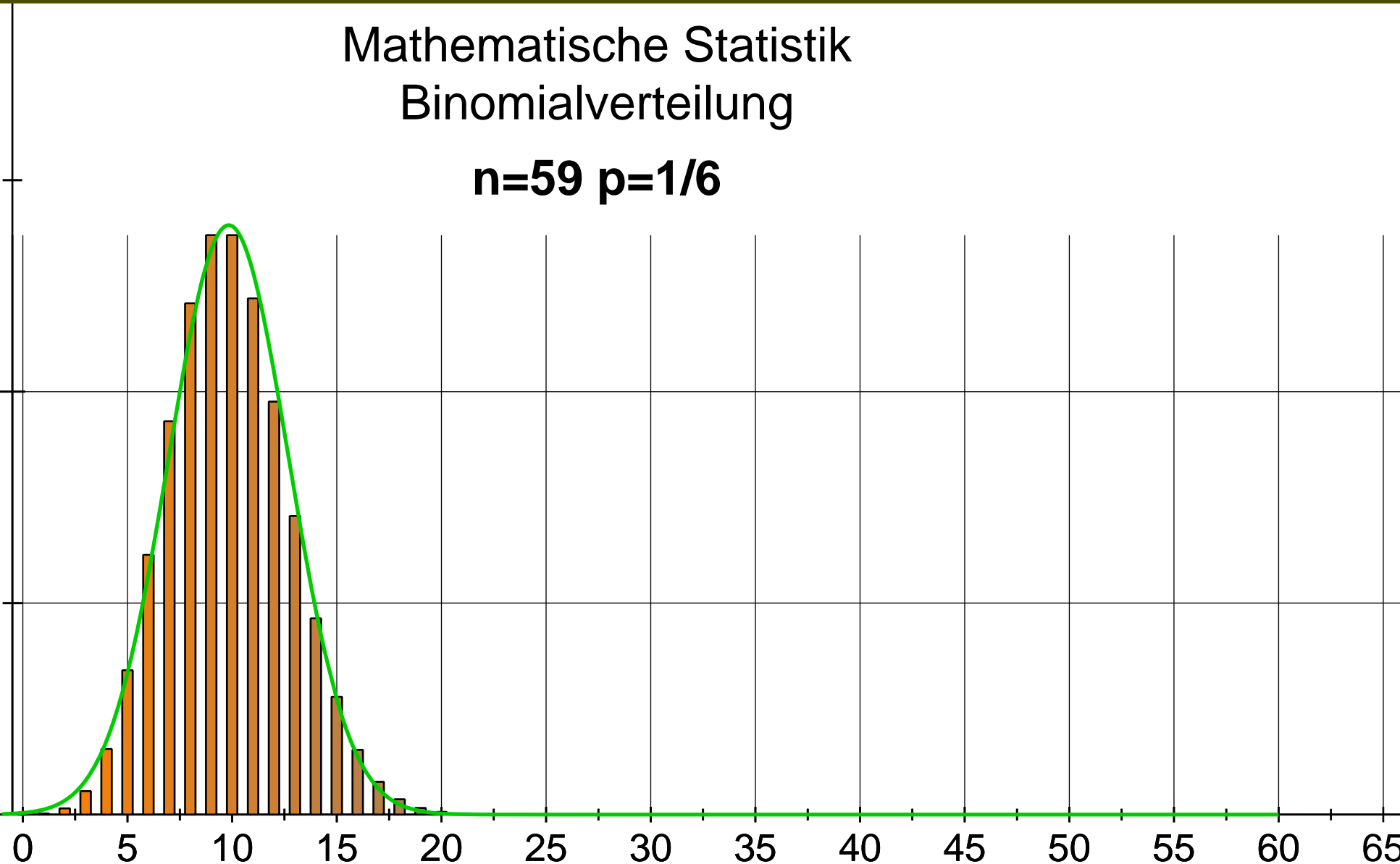
0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65

Treffer

$N(9.8, 2.86)$



# Mathematische Statistik

## Binomialverteilung

**n=60 p=1/6**

p

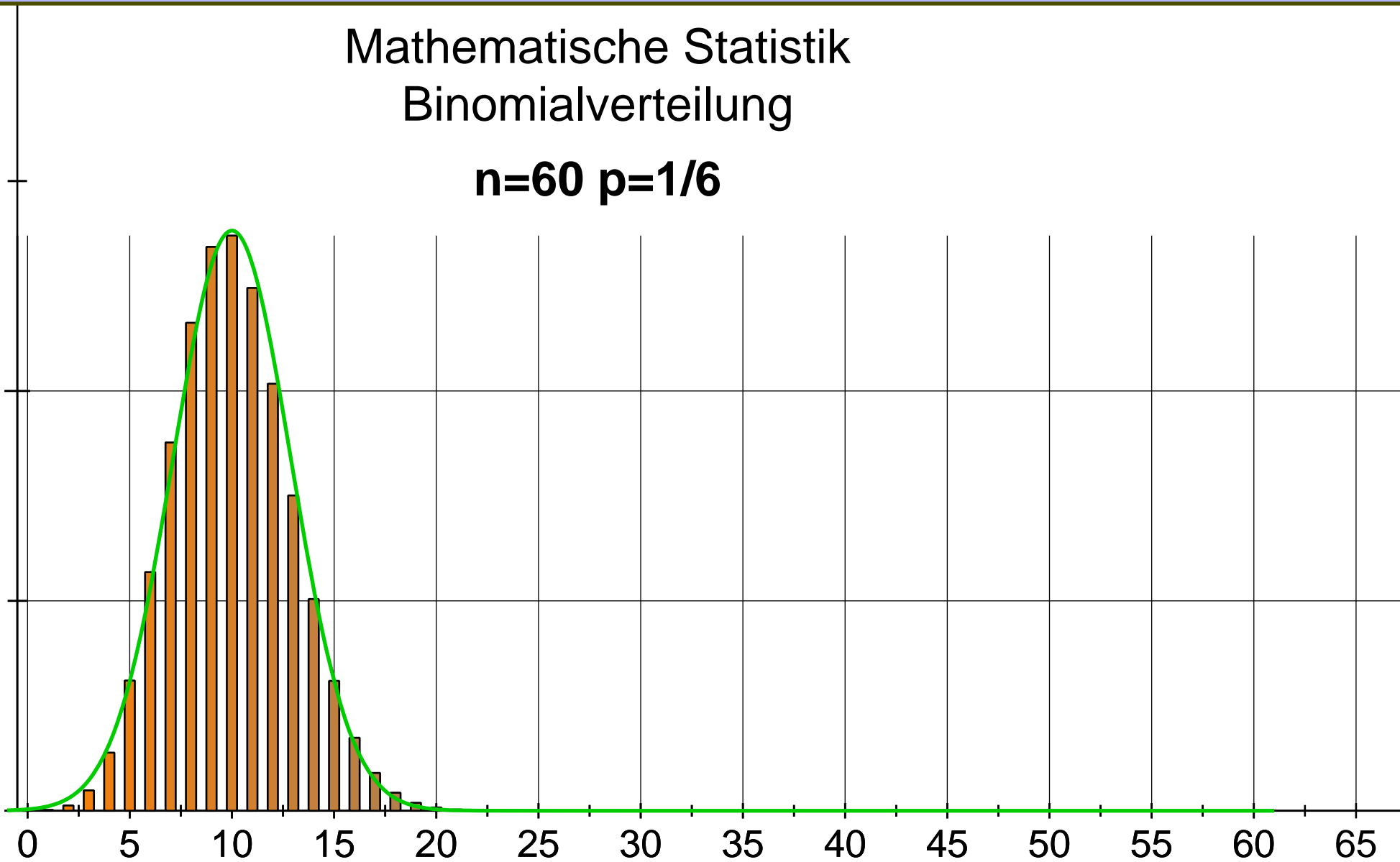
0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65

Treffer

$N(10.0, 2.89)$



# Mathematische Statistik

## Binomialverteilung

**$n=61$   $p=1/6$**

$p$

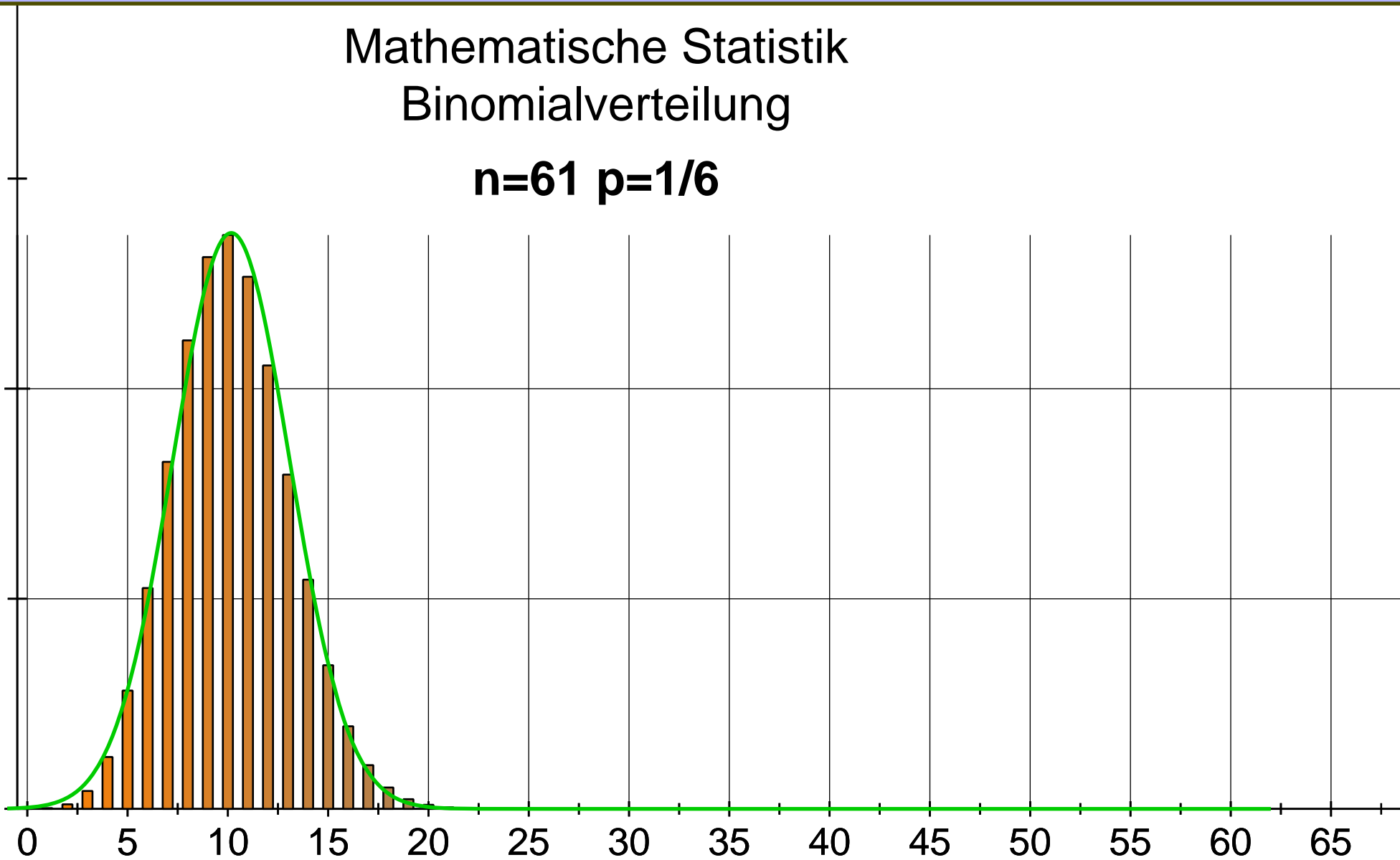
0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65

Treffer

$N(10.2, 2.91)$





# Mathematische Statistik

## Binomialverteilung

**n=62 p=1/6**

p

0.1

0

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

Treffer

$N(10.3, 2.93)$

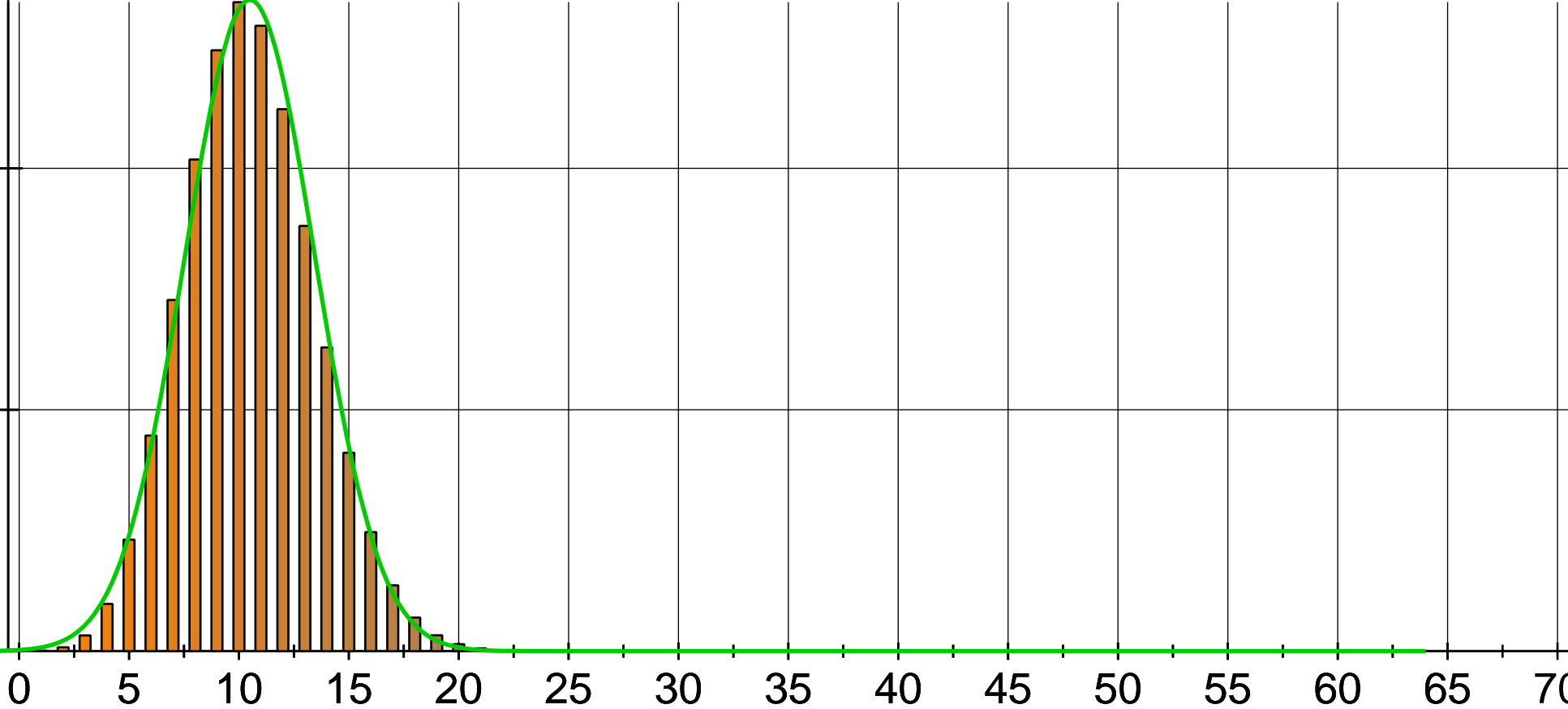
Mathematische Statistik  
Binomialverteilung

**n=63 p=1/6**

p

0.1

0



Treffer

N(10.5, 2.96)

Mathematische Statistik  
Binomialverteilung

**n=64 p=1/6**

p

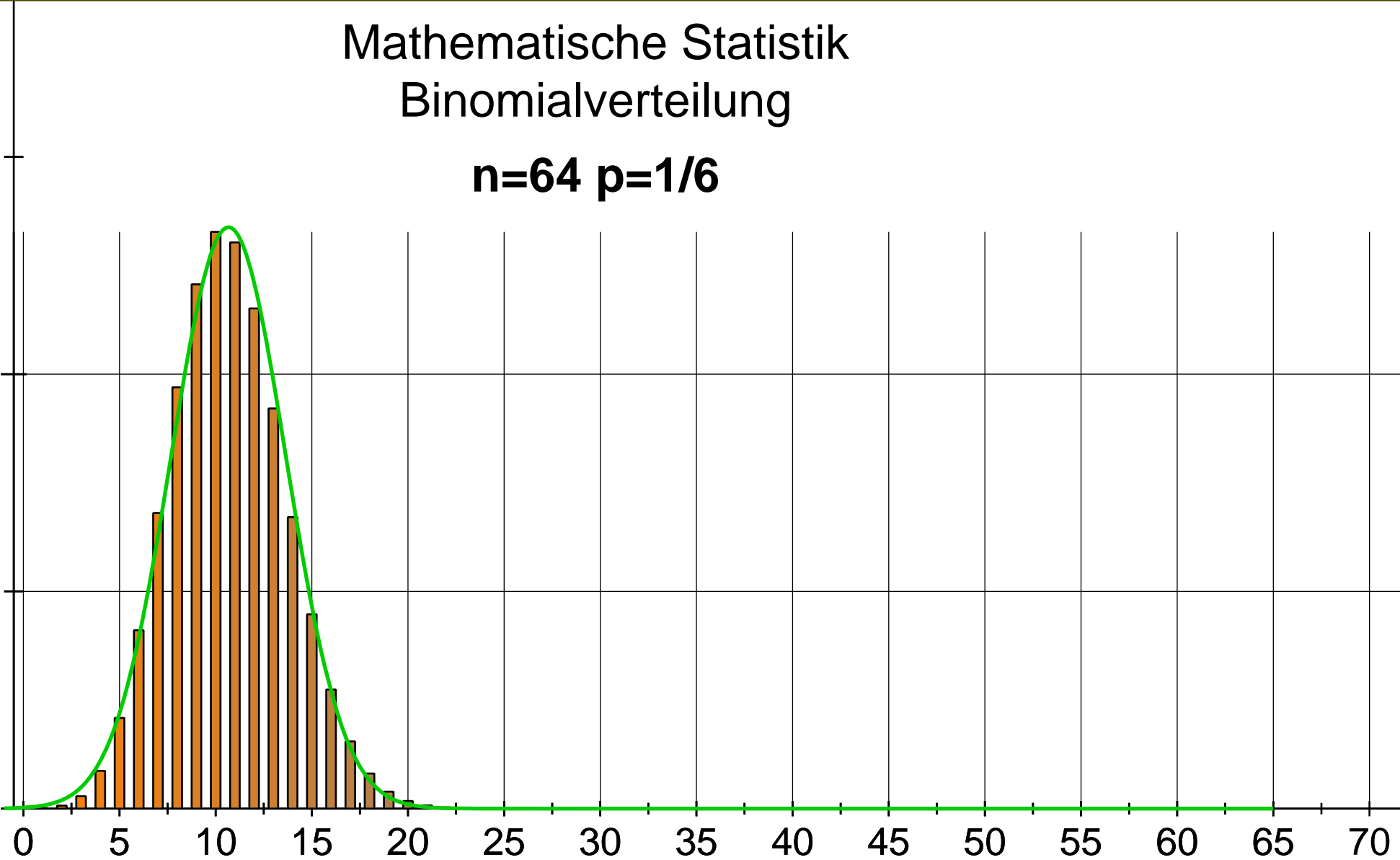
0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70

Treffer

$N(10.7, 2.98)$



# Mathematische Statistik

## Binomialverteilung

**n=65 p=1/6**

p

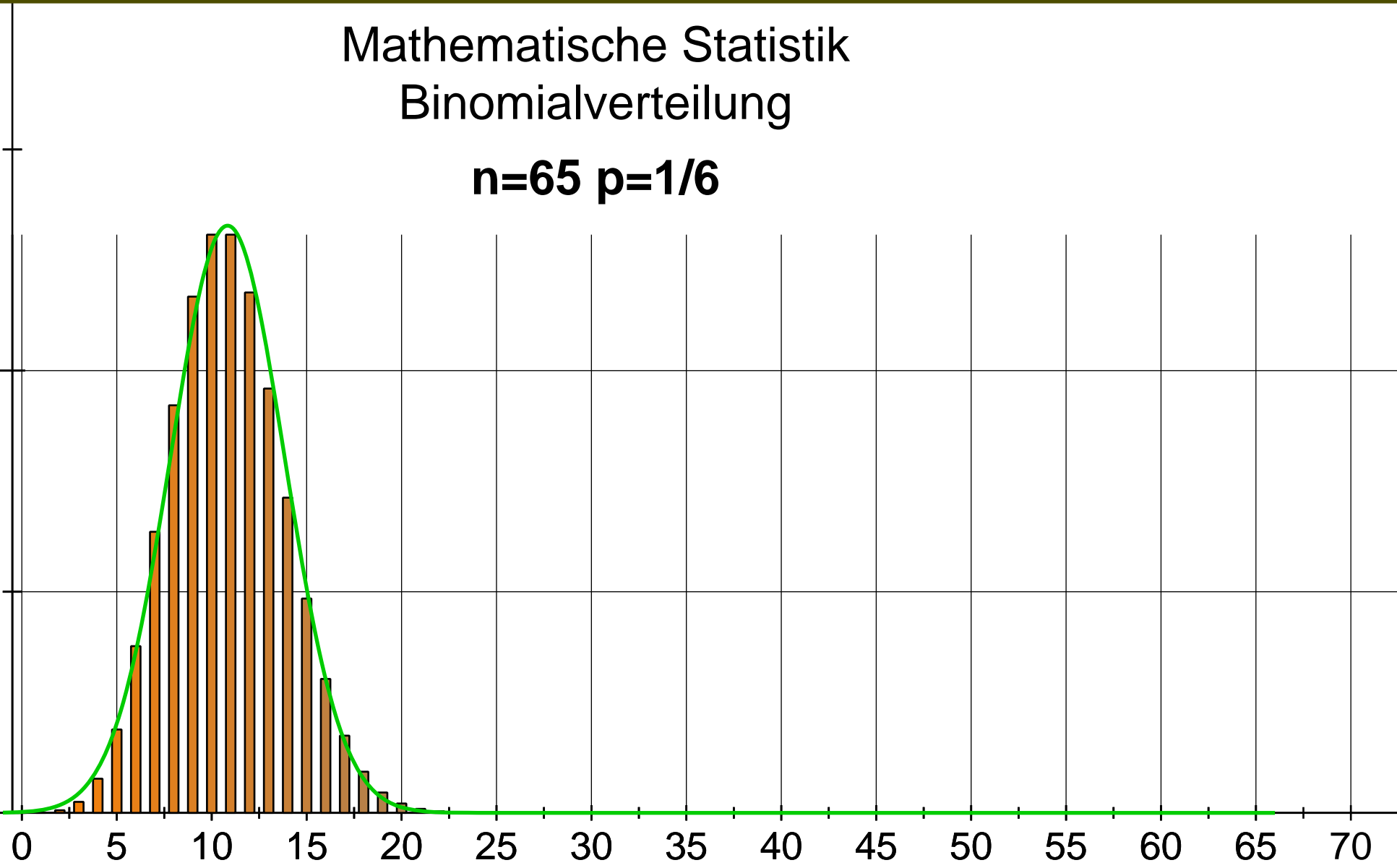
0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70

Treffer

$N(10.8, 3.00)$



# Mathematische Statistik

## Binomialverteilung

**n=66 p=1/6**

p

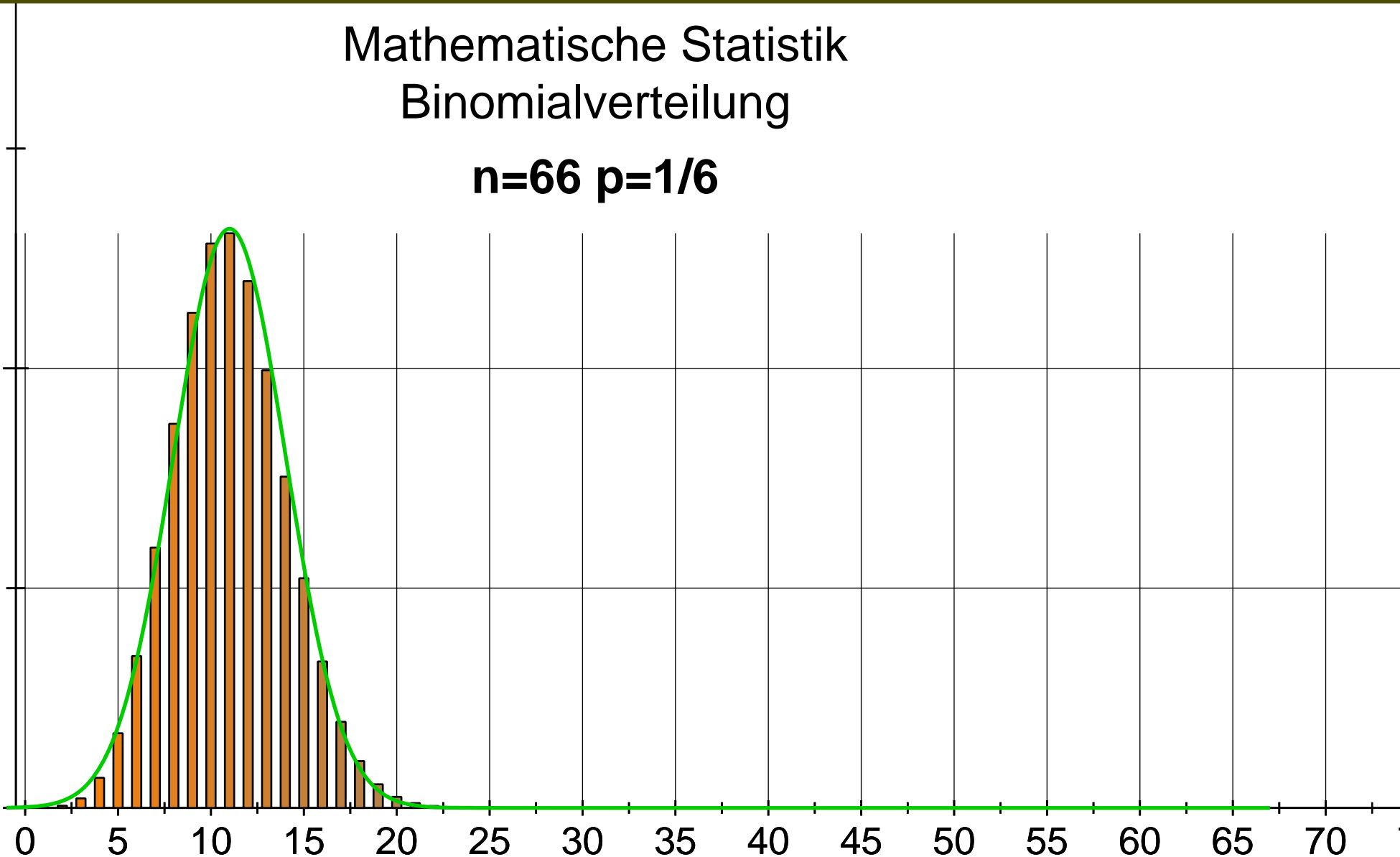
0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70

Treffer

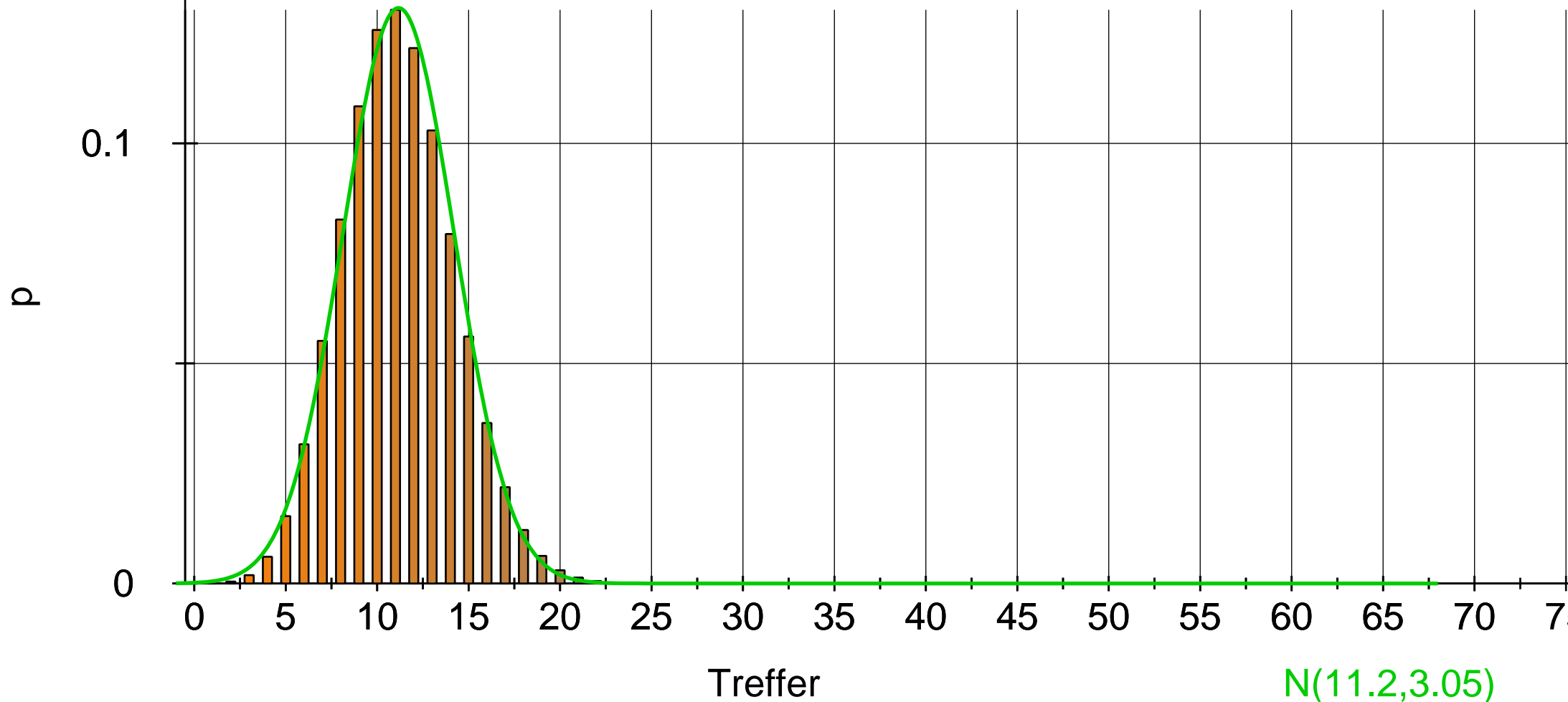
$N(11.0, 3.03)$



# Mathematische Statistik

## Binomialverteilung

**$n=67$   $p=1/6$**



$N(11.2, 3.05)$

# Mathematische Statistik

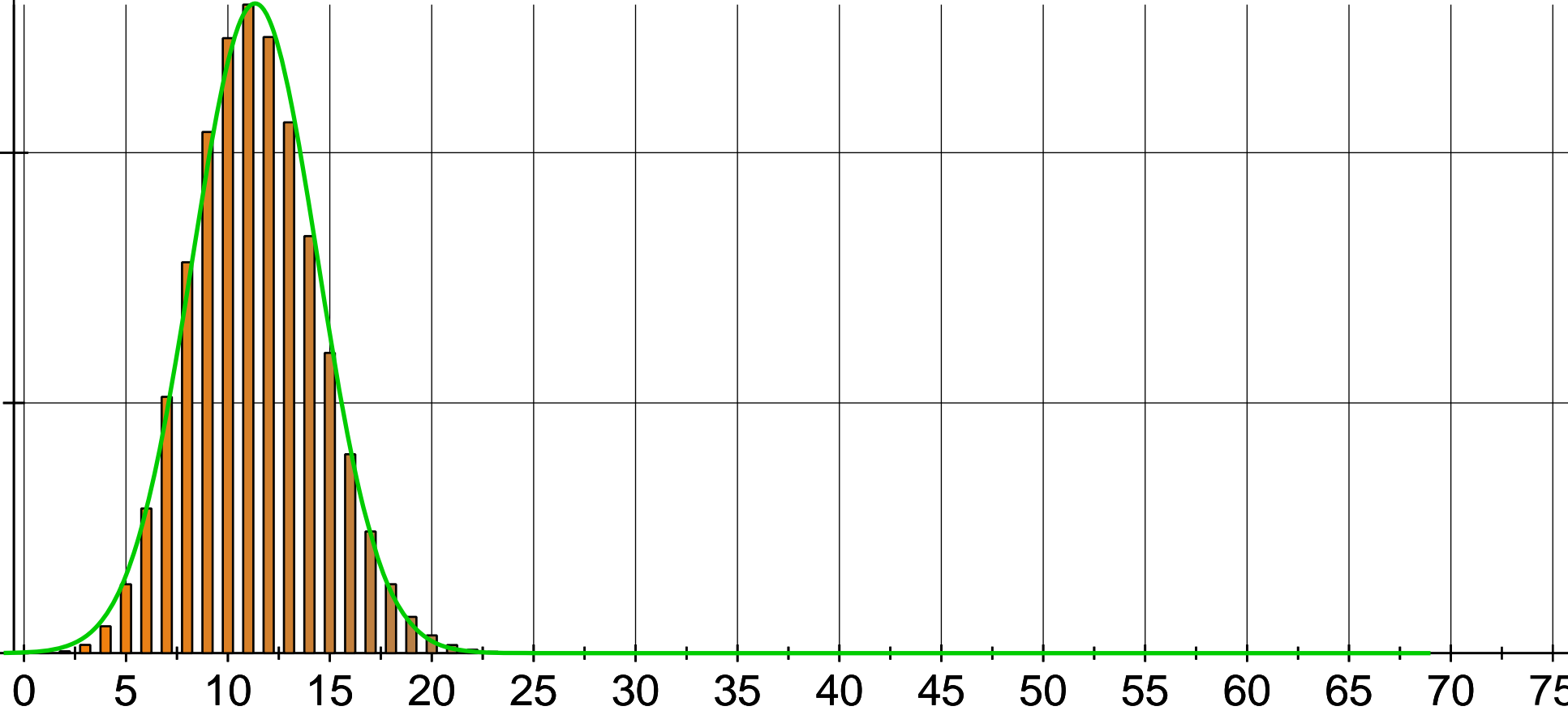
## Binomialverteilung

**n=68 p=1/6**

p

0.1

0



Treffer

$N(11.3, 3.07)$

# Mathematische Statistik

## Binomialverteilung

**n=69 p=1/6**

p

0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

Treffer

$N(11.5, 3.10)$



# Mathematische Statistik

## Binomialverteilung

**$n=70$   $p=1/6$**

$p$

0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

Treffer

$N(11.7, 3.12)$

# Mathematische Statistik

## Binomialverteilung

**$n=71$   $p=1/6$**

$p$

0.1

0

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

80

Treffer

$N(11.8, 3.14)$

# Mathematische Statistik

## Binomialverteilung

**n=72 p=1/6**

p

0.1

0

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

80

Treffer

$N(12.0, 3.16)$

# Mathematische Statistik

## Binomialverteilung

**$n=73$   $p=1/6$**

$p$

0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80

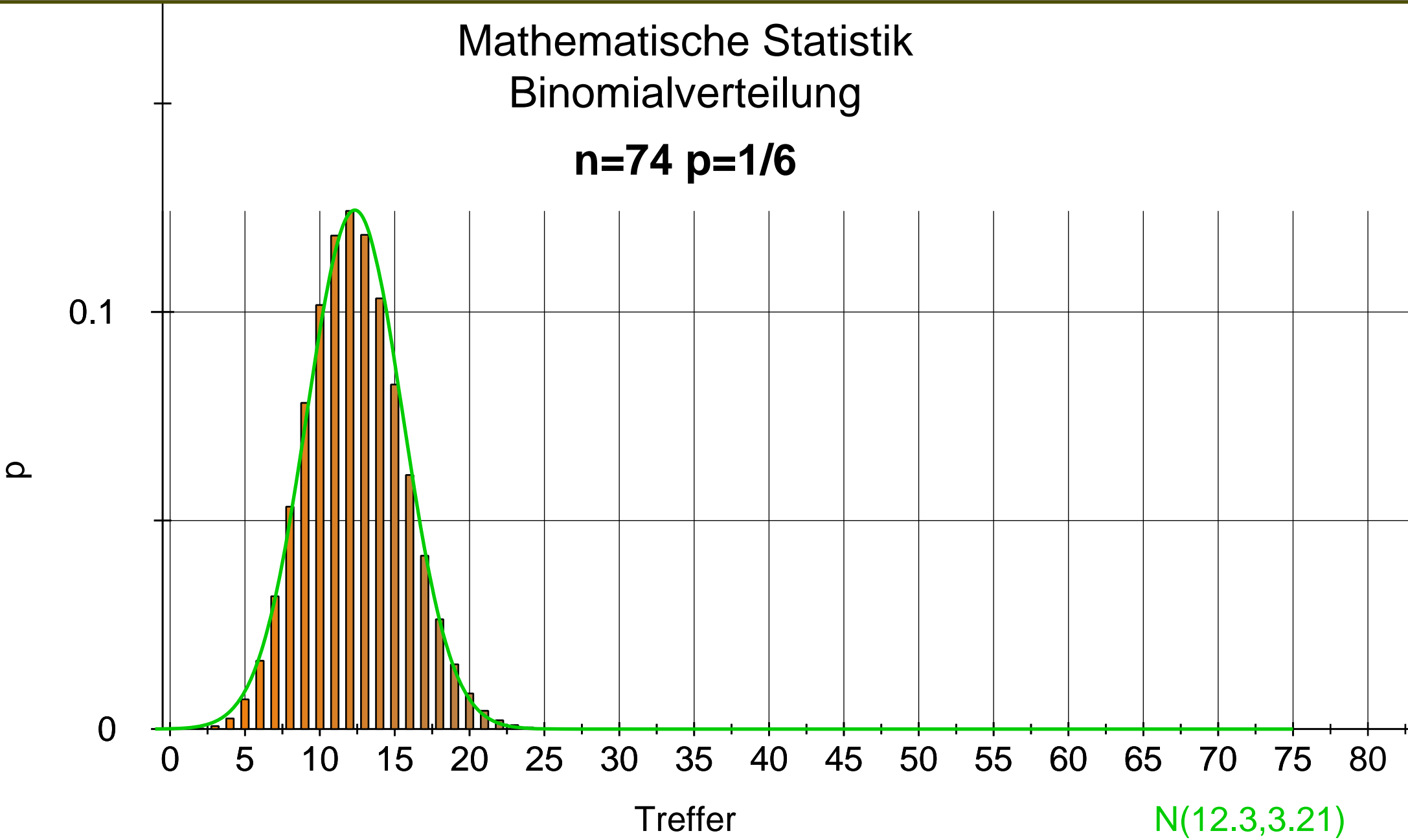
Treffer

$N(12.2, 3.18)$

# Mathematische Statistik

## Binomialverteilung

**n=74 p=1/6**



$N(12.3, 3.21)$

Mathematische Statistik  
Binomialverteilung

**n=75 p=1/6**

p

0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80

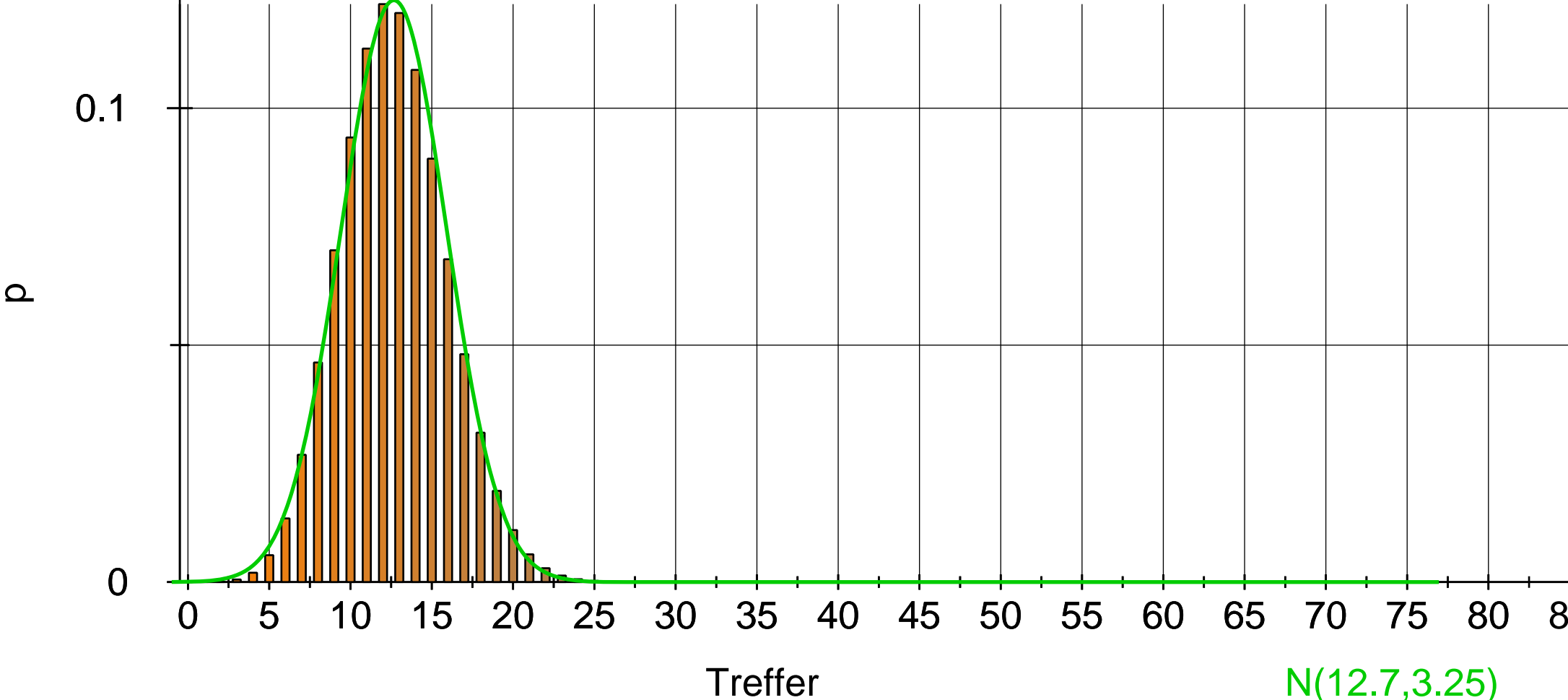
Treffer

$N(12.5, 3.23)$

# Mathematische Statistik

## Binomialverteilung

**n=76 p=1/6**



$N(12.7, 3.25)$

# Mathematische Statistik

## Binomialverteilung

**$n=77$   $p=1/6$**

$p$

0.1

0

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

80

85

Treffer

$N(12.8, 3.27)$



# Mathematische Statistik

## Binomialverteilung

**n=78 p=1/6**

p

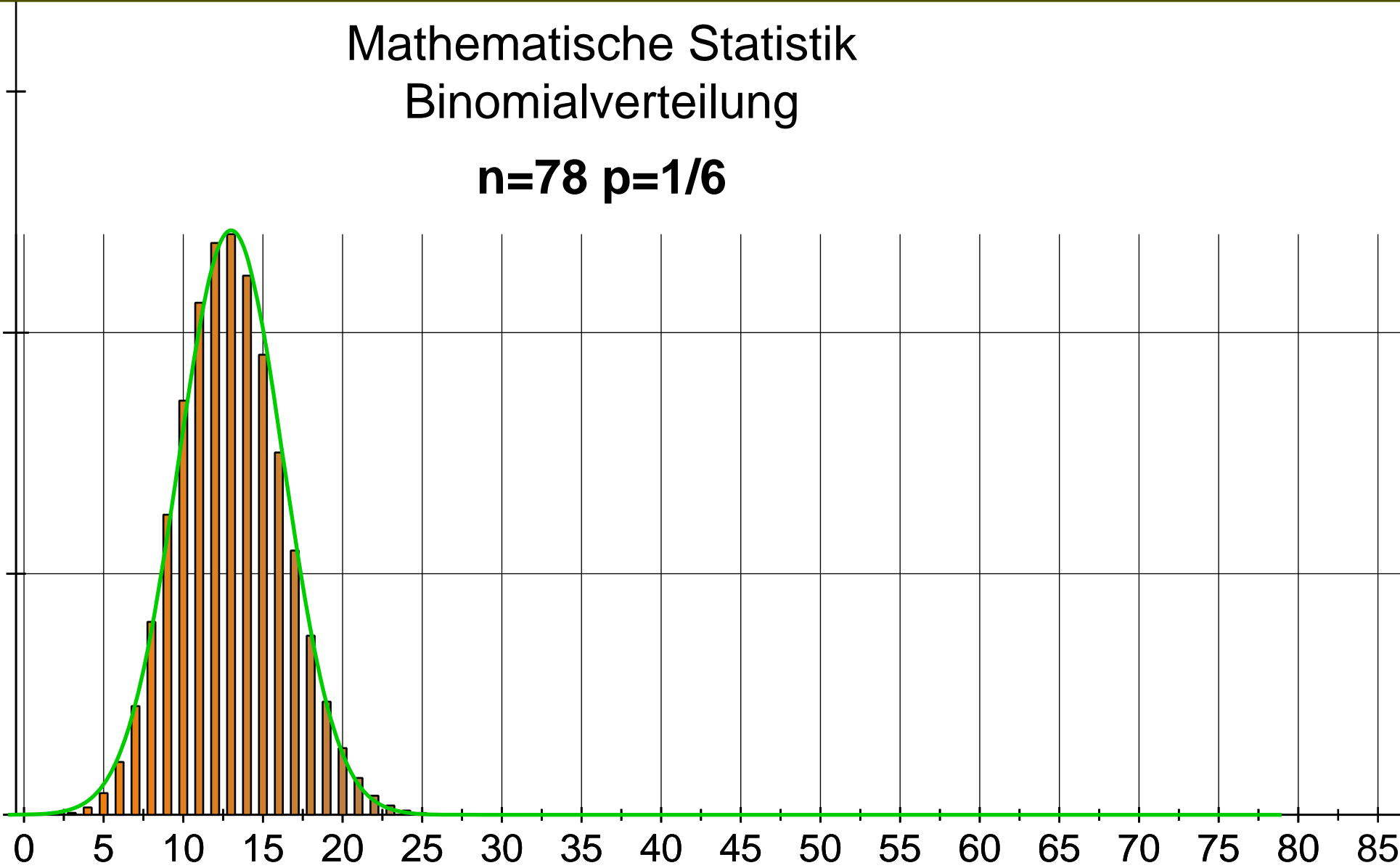
0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85

Treffer

$N(13.0, 3.29)$



Mathematische Statistik  
Binomialverteilung

**n=79 p=1/6**

p

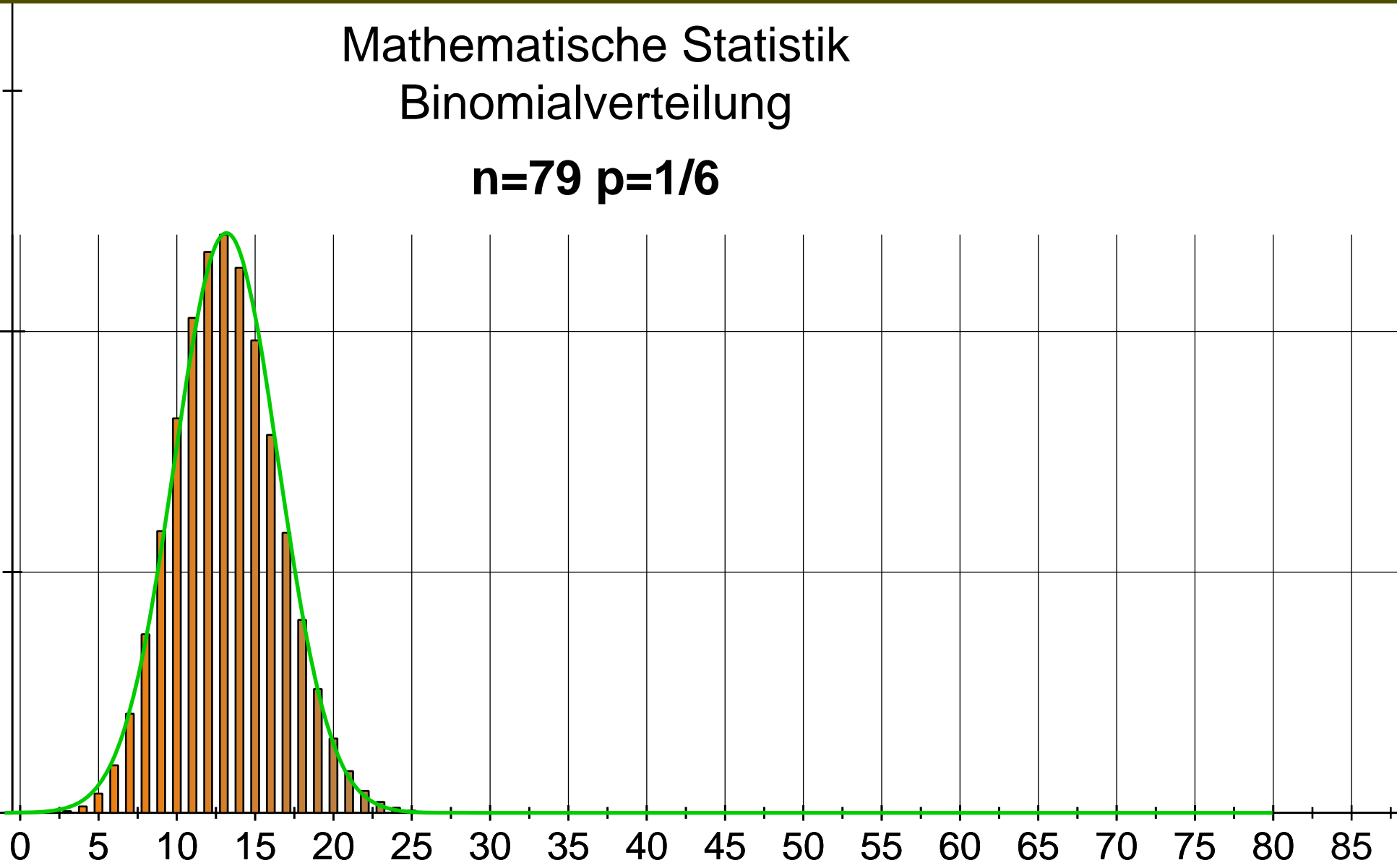
0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85

Treffer

$N(13.2, 3.31)$



# Mathematische Statistik

## Binomialverteilung

**$n=80$   $p=1/6$**

$p$

0.1

0

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

80

85

9

Treffer

$N(13.3, 3.33)$

# Mathematische Statistik

## Binomialverteilung

**n=81 p=1/6**

p

0.1

0

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

80

85

90

Treffer

$N(13.5, 3.35)$

# Mathematische Statistik

## Binomialverteilung

**n=82 p=1/6**

p

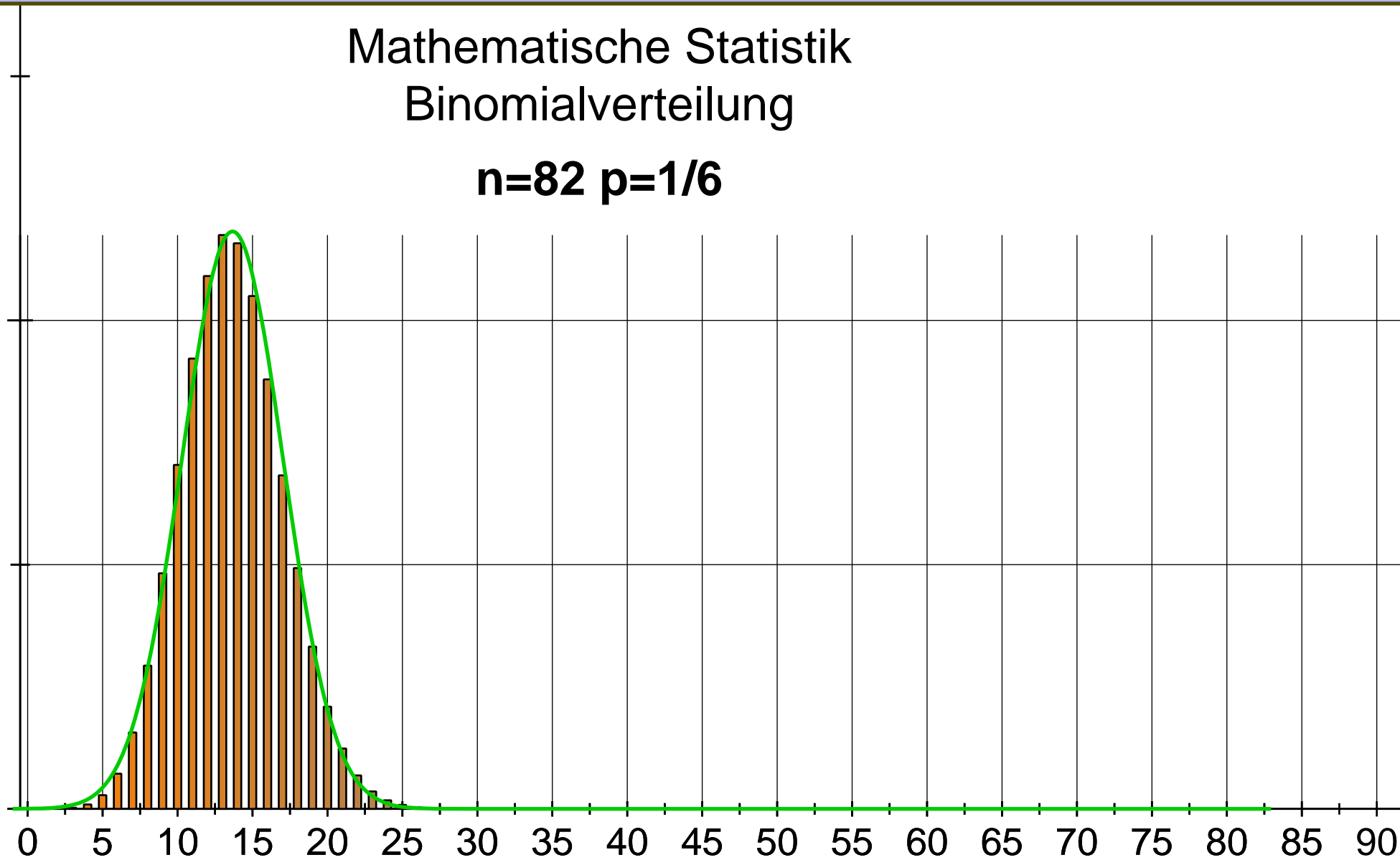
0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90

Treffer

$N(13.7, 3.37)$



# Mathematische Statistik

## Binomialverteilung

**n=83 p=1/6**

p

0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90

Treffer

$N(13.8, 3.40)$

# Mathematische Statistik

## Binomialverteilung

**n=84 p=1/6**

p

0.1

0

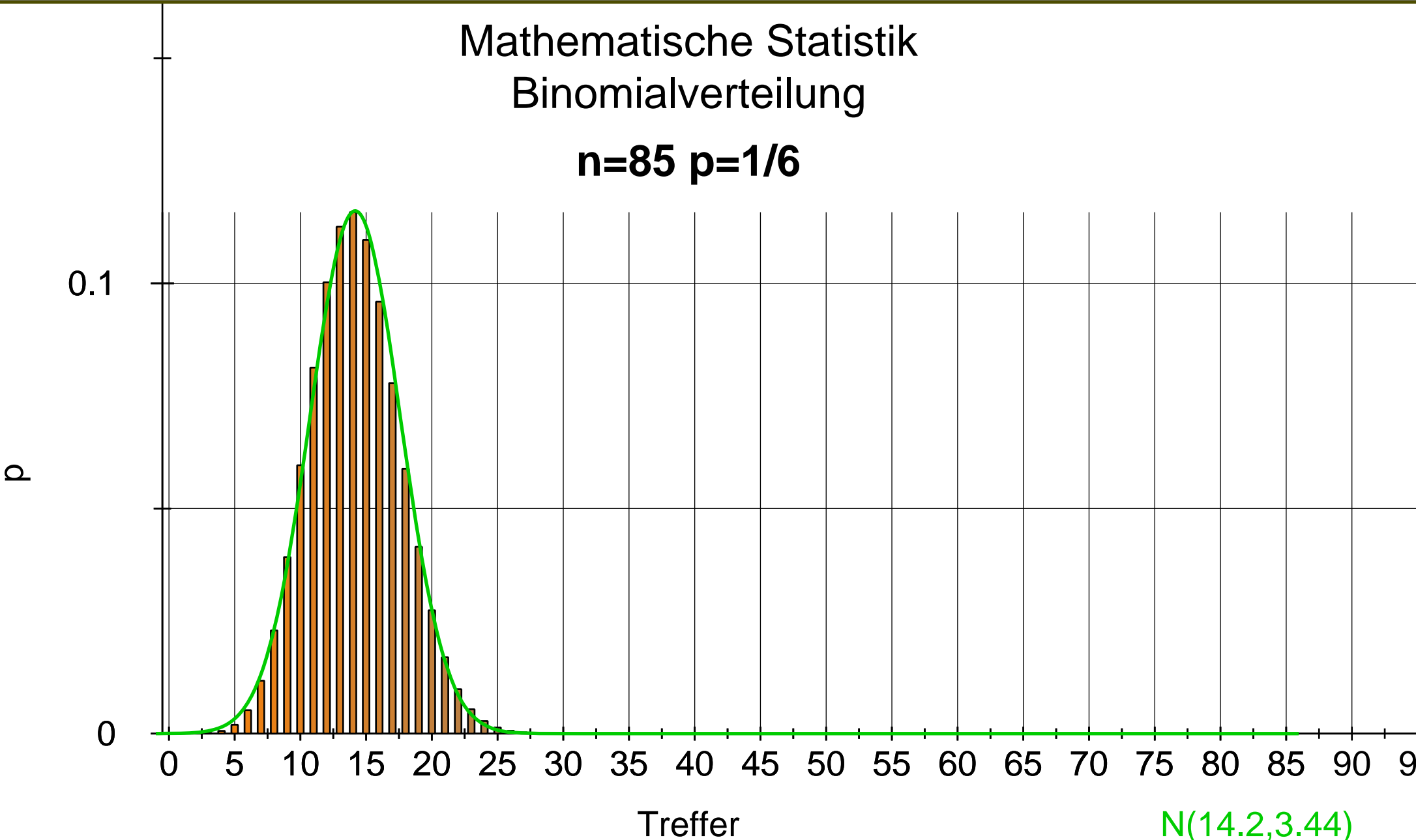
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95

Treffer

$N(14.0, 3.42)$

Mathematische Statistik  
Binomialverteilung

**n=85 p=1/6**



$N(14.2, 3.44)$



# Mathematische Statistik Binomialverteilung

**n=86 p=1/6**

p

0.1

0

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

80

85

90

95

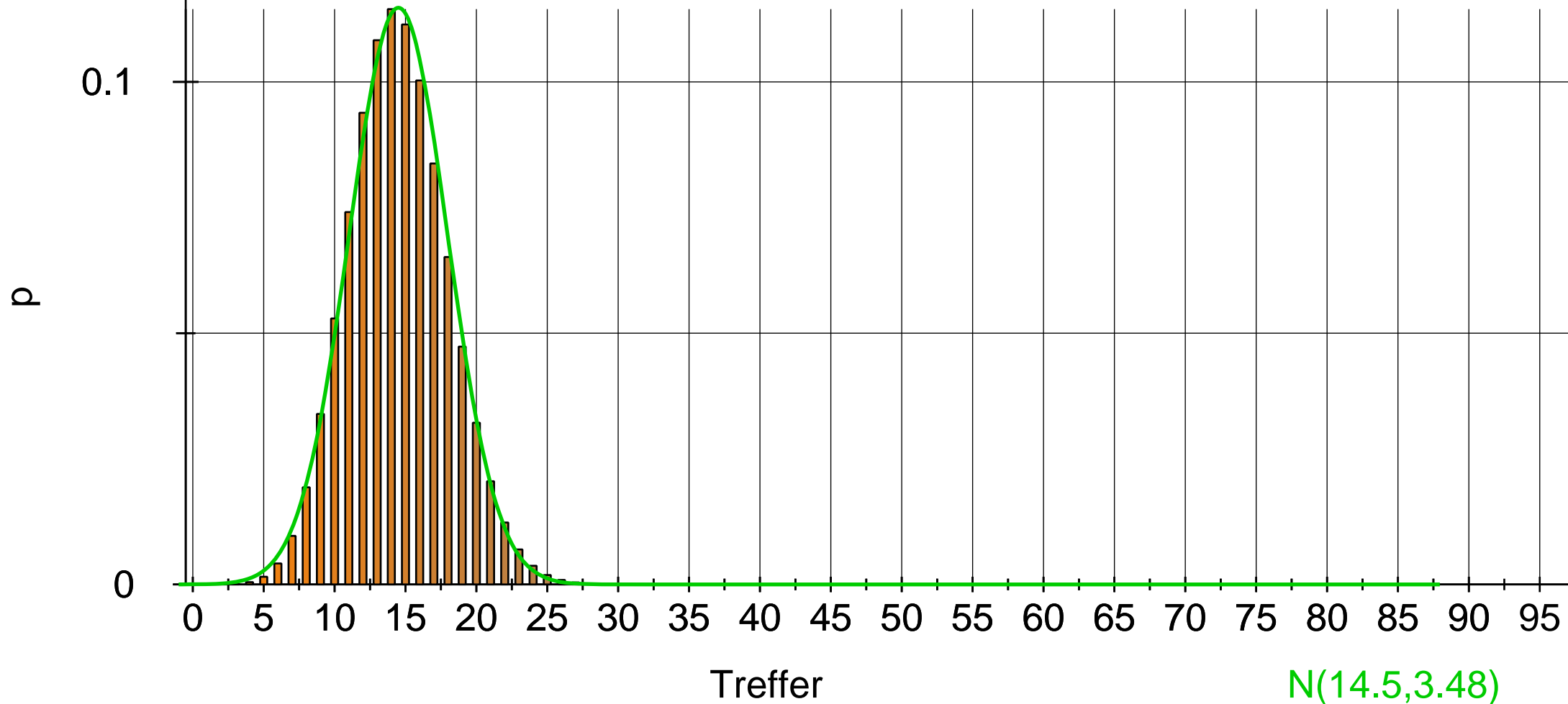
Treffer

$N(14.3, 3.46)$

# Mathematische Statistik

## Binomialverteilung

**$n=87$   $p=1/6$**



$N(14.5, 3.48)$

# Mathematische Statistik Binomialverteilung

**n=88 p=1/6**

p

0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Treffer

$N(14.7, 3.50)$

# Mathematische Statistik

## Binomialverteilung

**n=89 p=1/6**

p

0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Treffer

$N(14.8, 3.52)$

# Mathematische Statistik

## Binomialverteilung

**n=90 p=1/6**

p

0.1

0

0

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

80

85

90

95

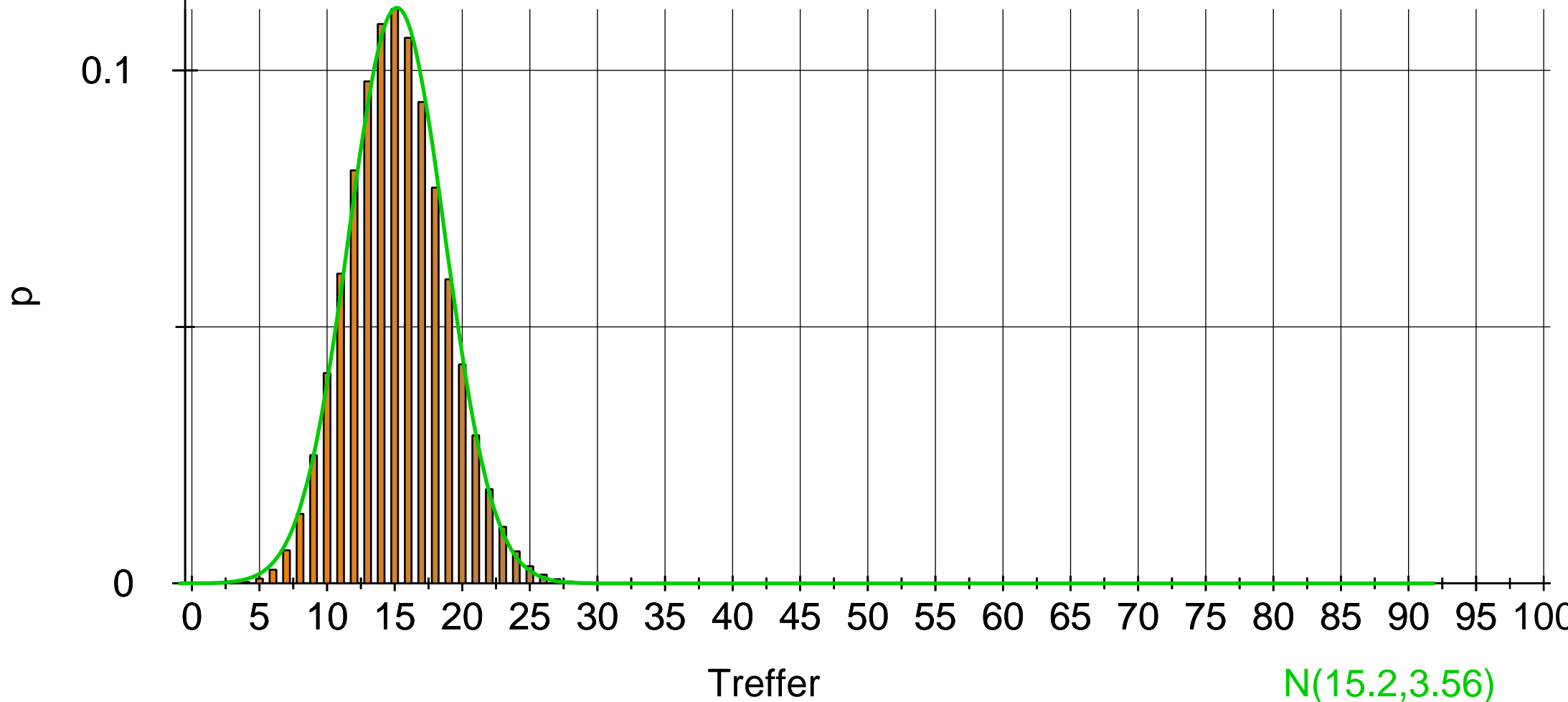
100

Treffer

$N(15.0, 3.54)$

# Mathematische Statistik Binomialverteilung

**n=91 p=1/6**



$N(15.2, 3.56)$

# Mathematische Statistik

## Binomialverteilung

**n=92 p=1/6**

p

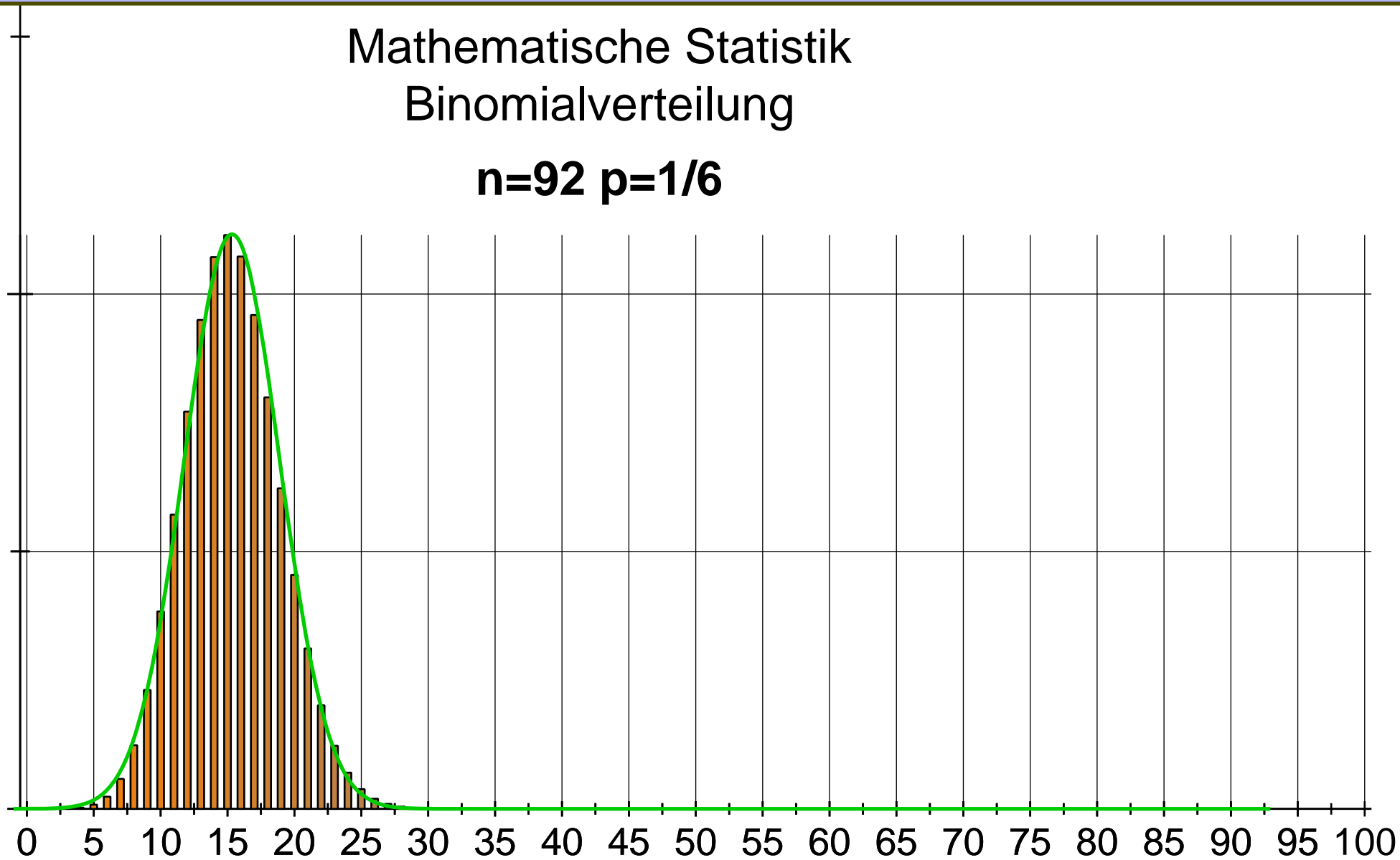
0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

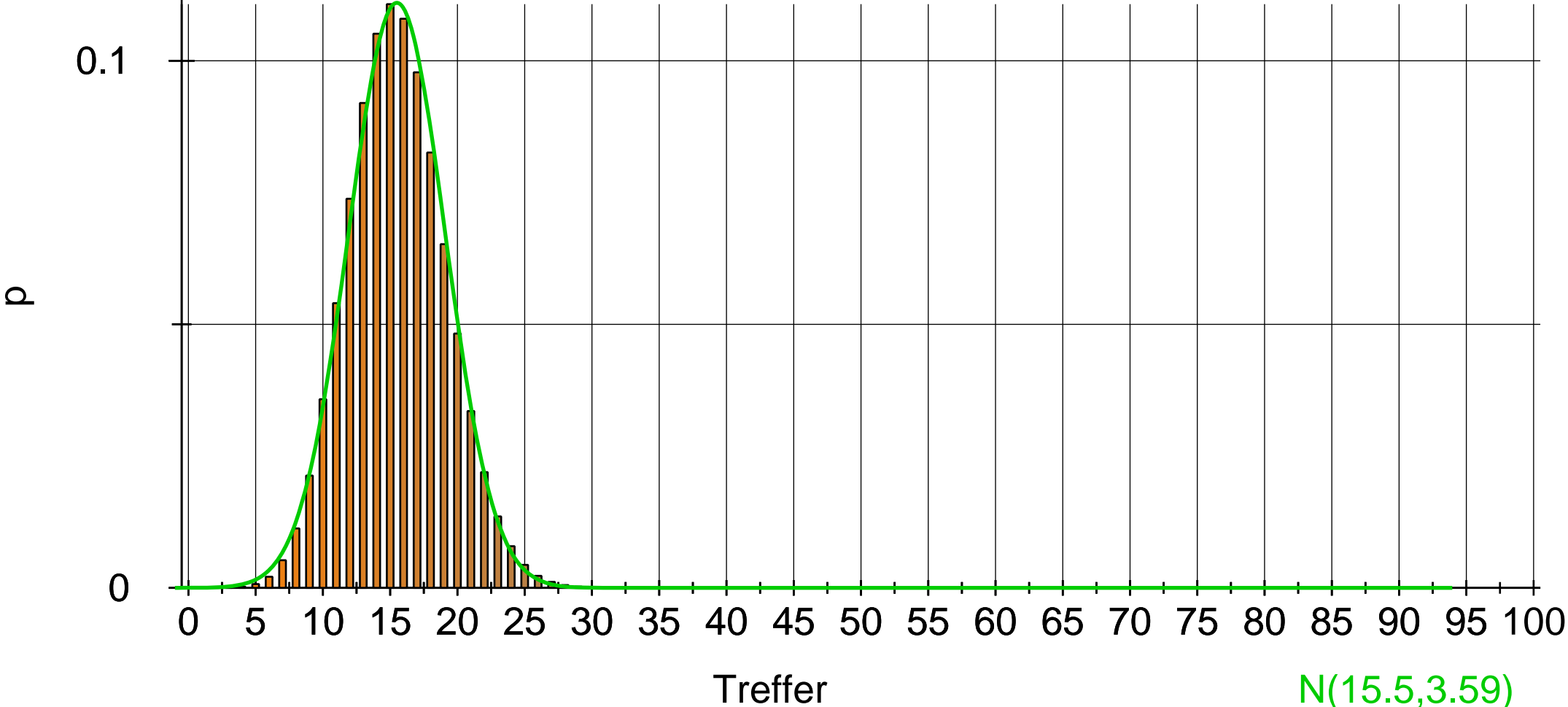
Treffer

$N(15.3, 3.57)$



Mathematische Statistik  
Binomialverteilung

**n=93 p=1/6**



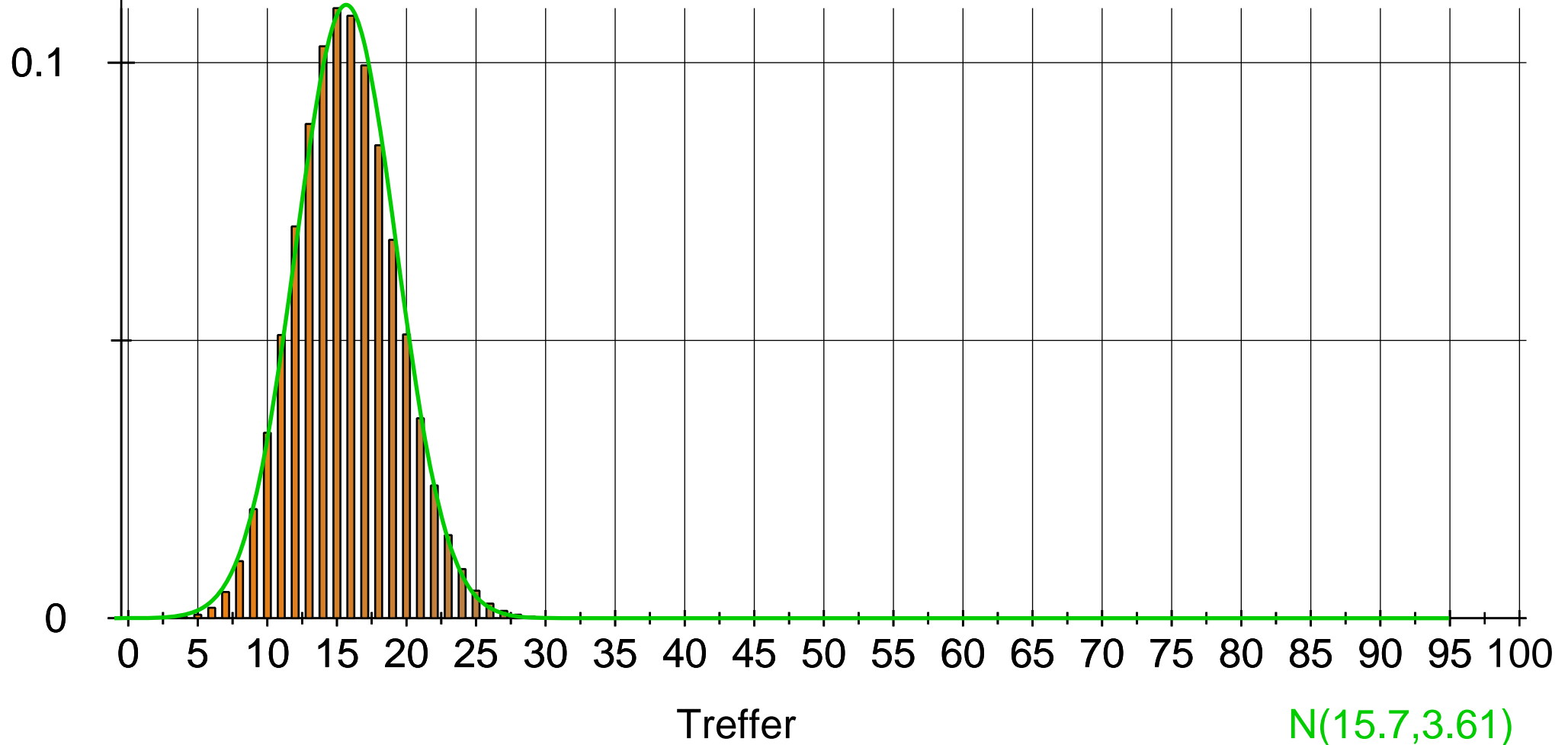


# Mathematische Statistik

## Binomialverteilung

**n=94 p=1/6**

p



$N(15.7, 3.61)$

# Mathematische Statistik

## Binomialverteilung

**$n=95$   $p=1/6$**

$p$

0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Treffer

$N(15.8, 3.63)$

# Mathematische Statistik

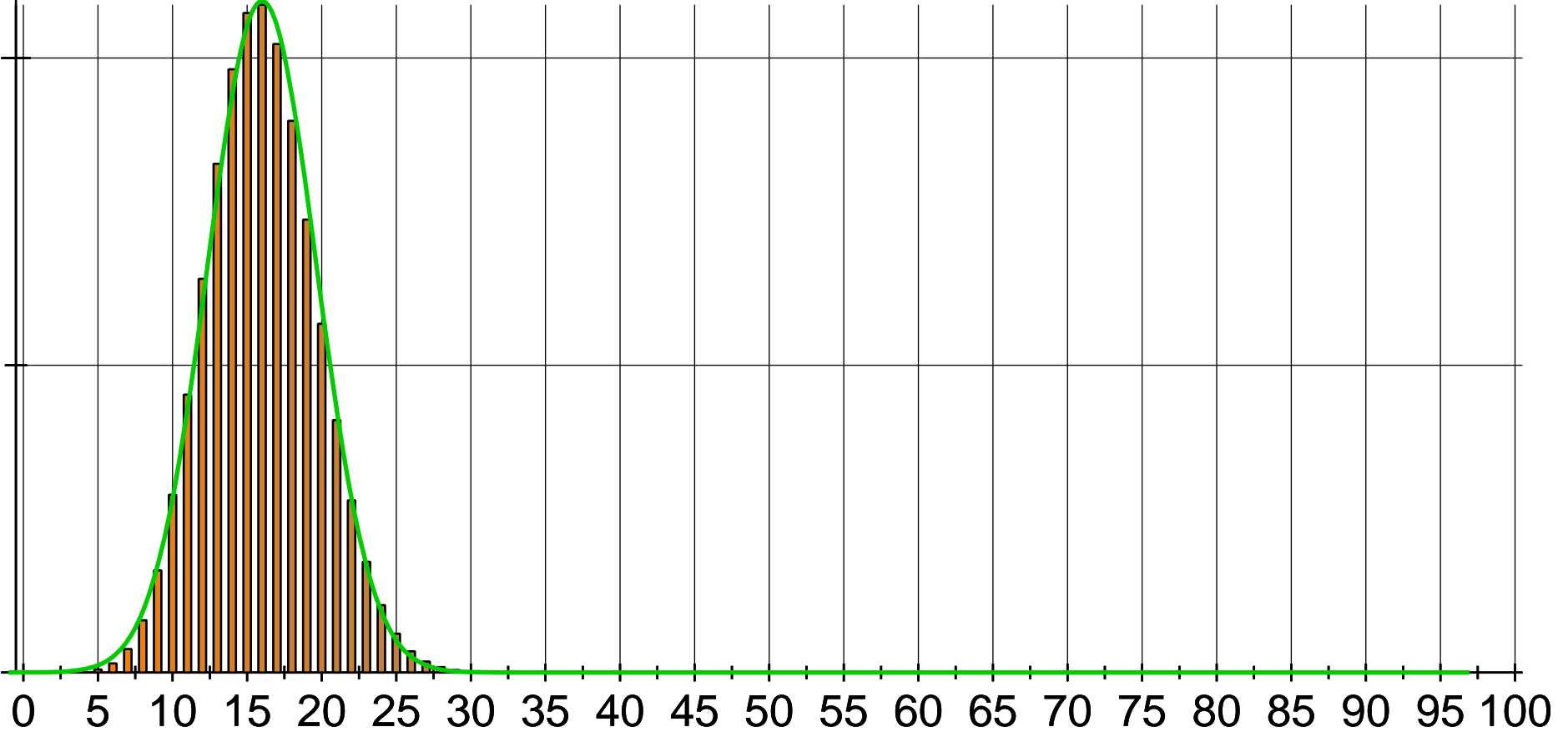
## Binomialverteilung

**n=96 p=1/6**

p

0.1

0



Treffer

$N(16.0, 3.65)$

# Mathematische Statistik

## Binomialverteilung

**$n=97$   $p=1/6$**

$p$

0.1

0

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

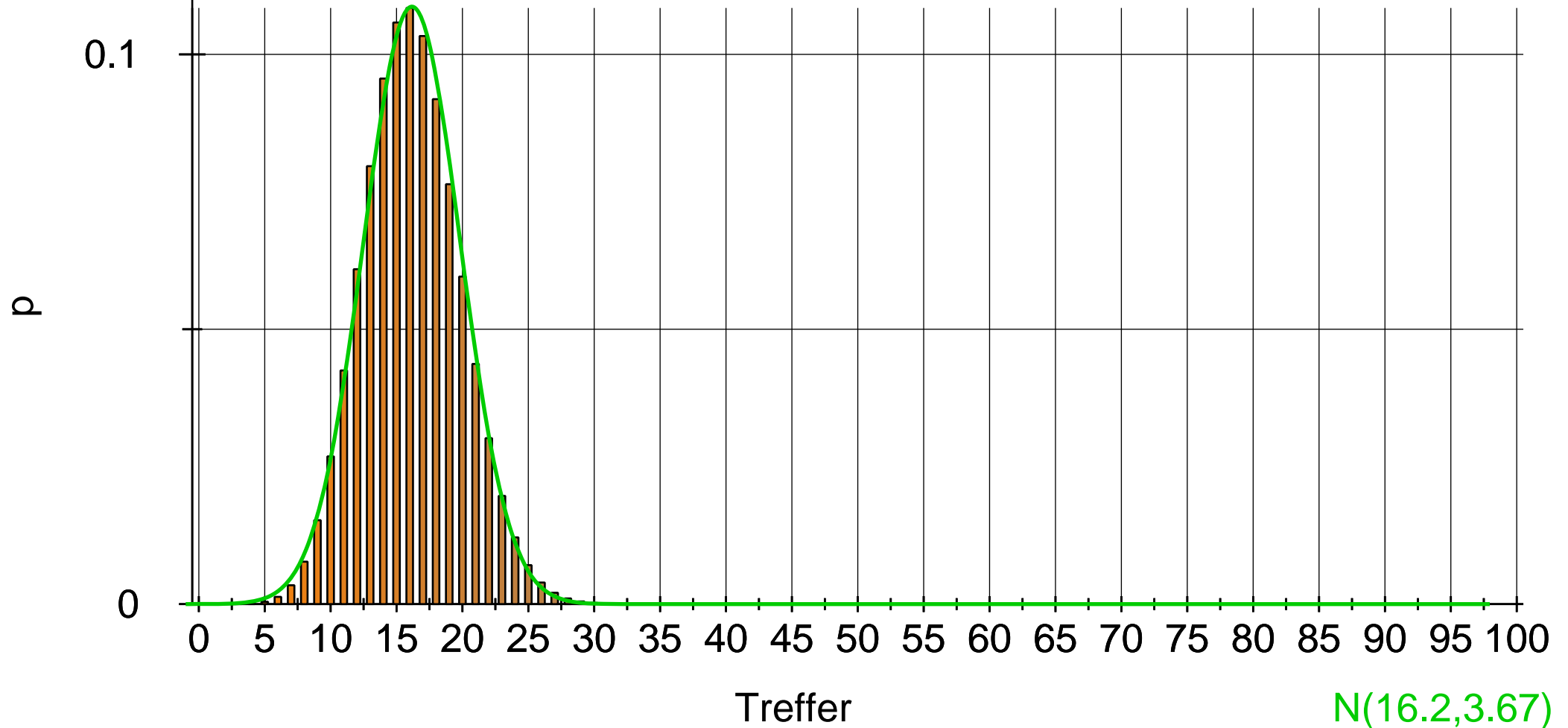
Treffer

$N(16.2, 3.67)$

# Mathematische Statistik

## Binomialverteilung

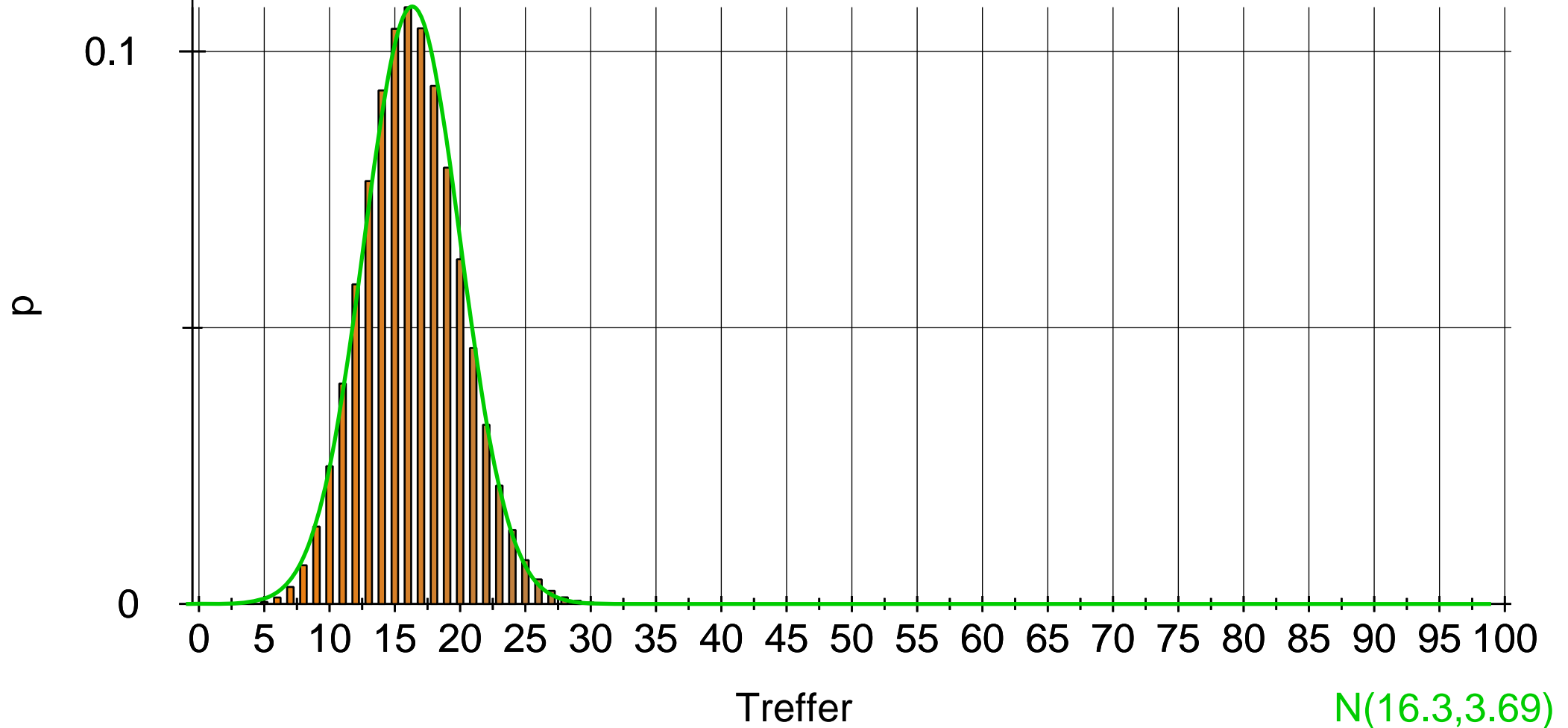
**$n=97$   $p=1/6$**



# Mathematische Statistik

## Binomialverteilung

**n=98 p=1/6**

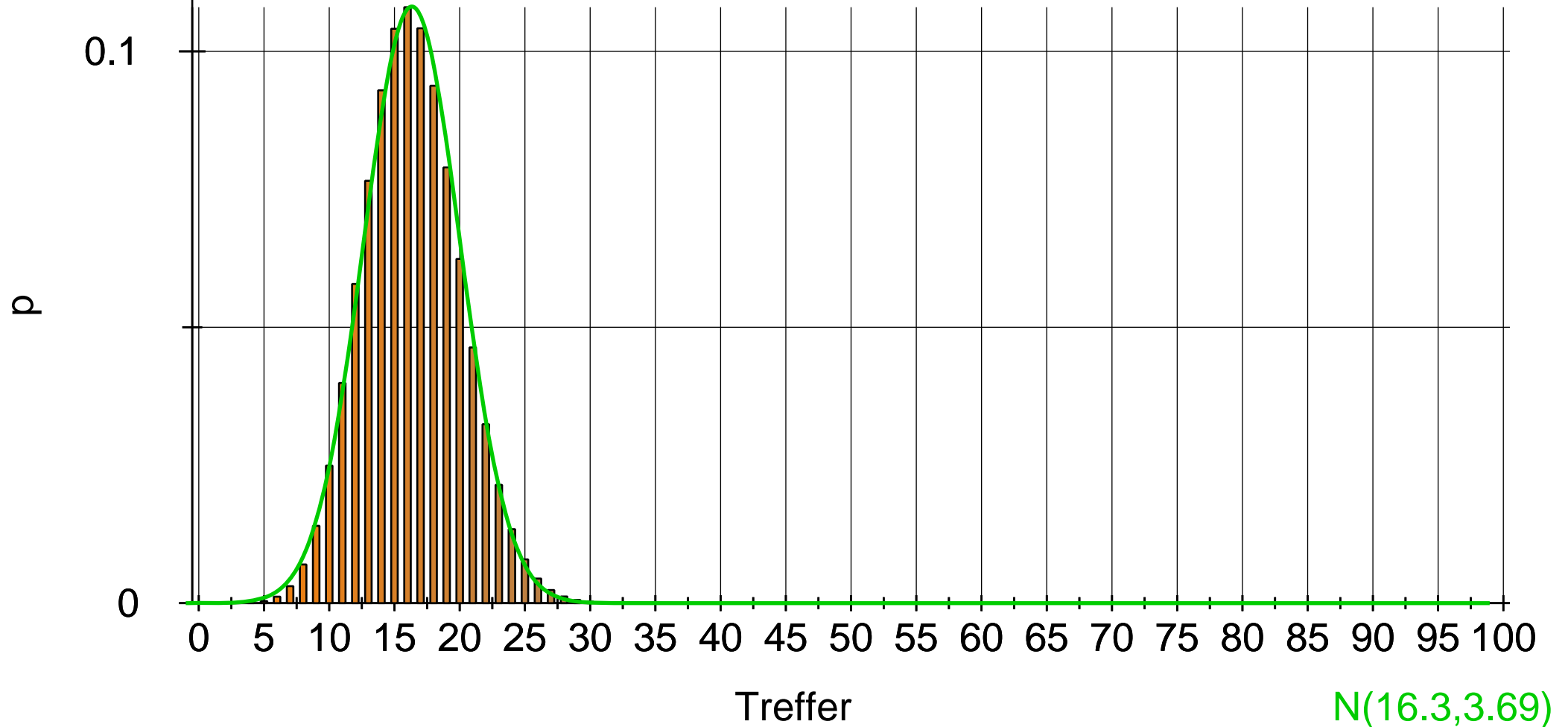


$N(16.3, 3.69)$

# Mathematische Statistik

## Binomialverteilung

**n=98 p=1/6**

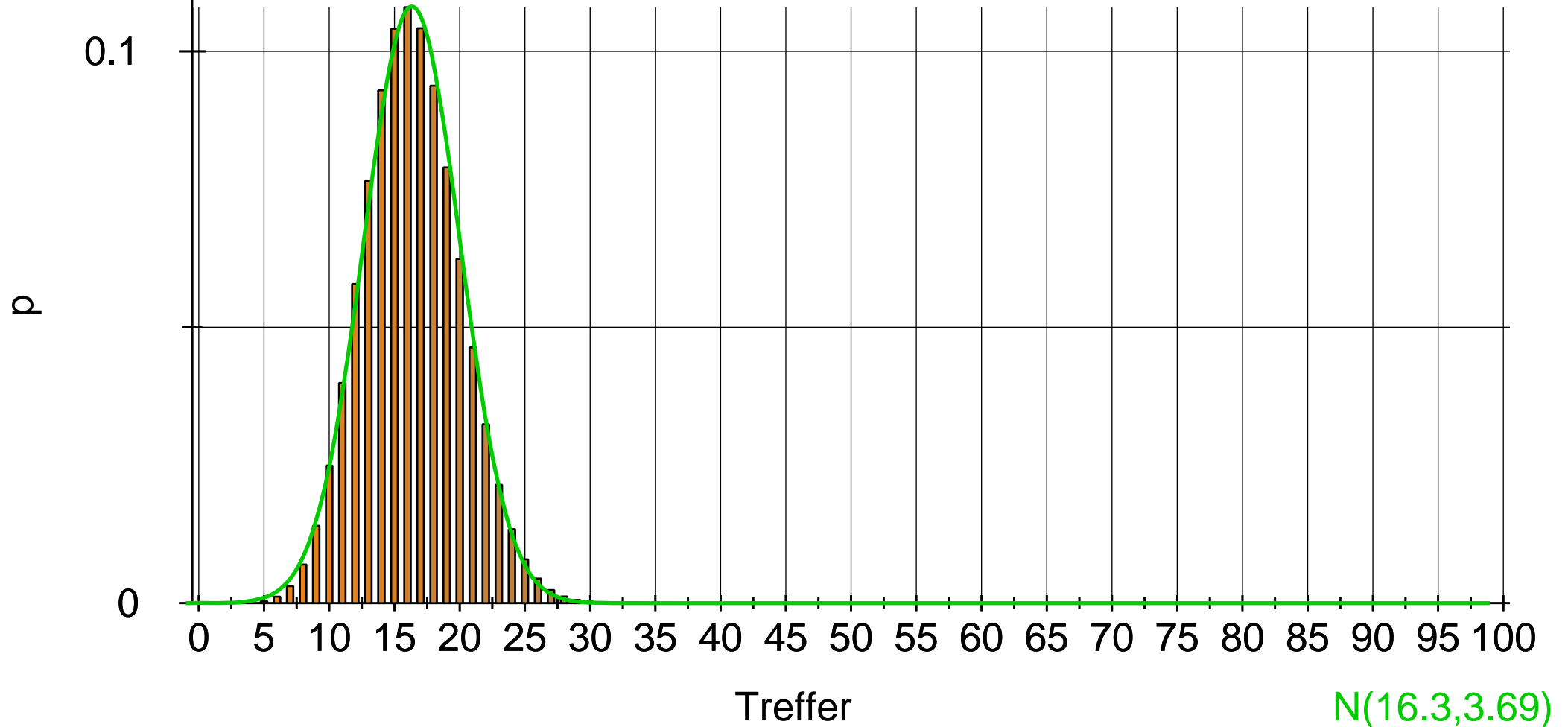


$N(16.3, 3.69)$

# Mathematische Statistik

## Binomialverteilung

**n=98 p=1/6**



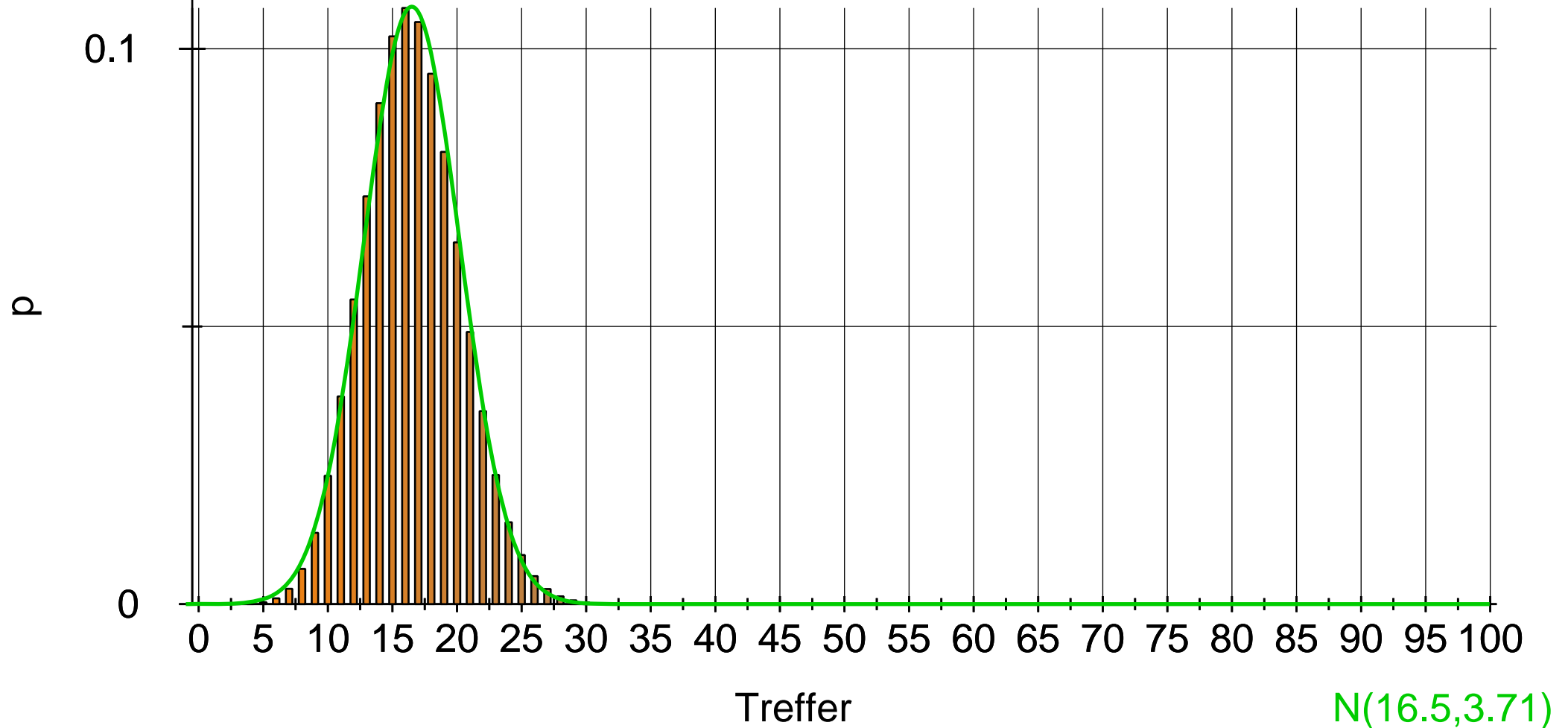
$N(16.3, 3.69)$



# Mathematische Statistik

## Binomialverteilung

**$n=99$   $p=1/6$**

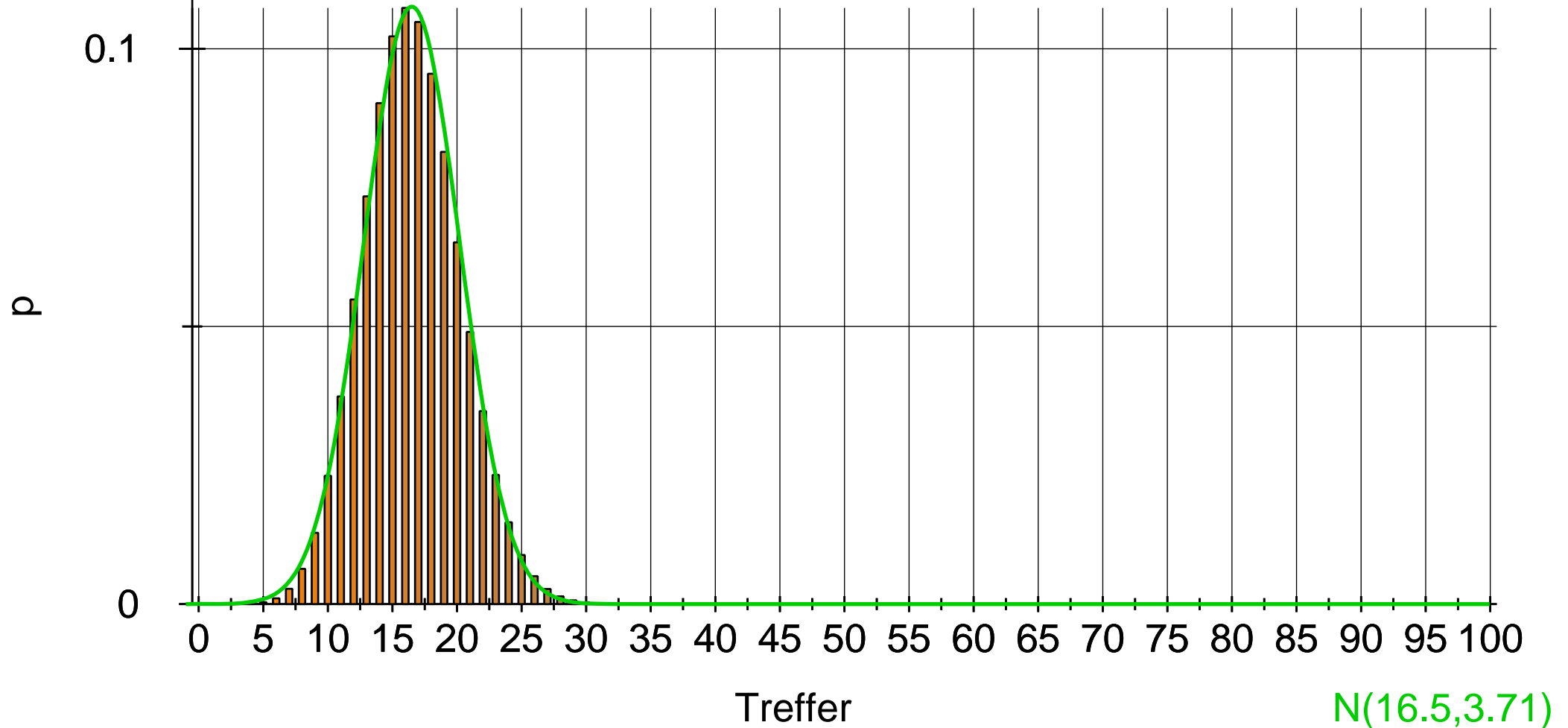


$N(16.5, 3.71)$

# Mathematische Statistik

## Binomialverteilung

**n=99 p=1/6**

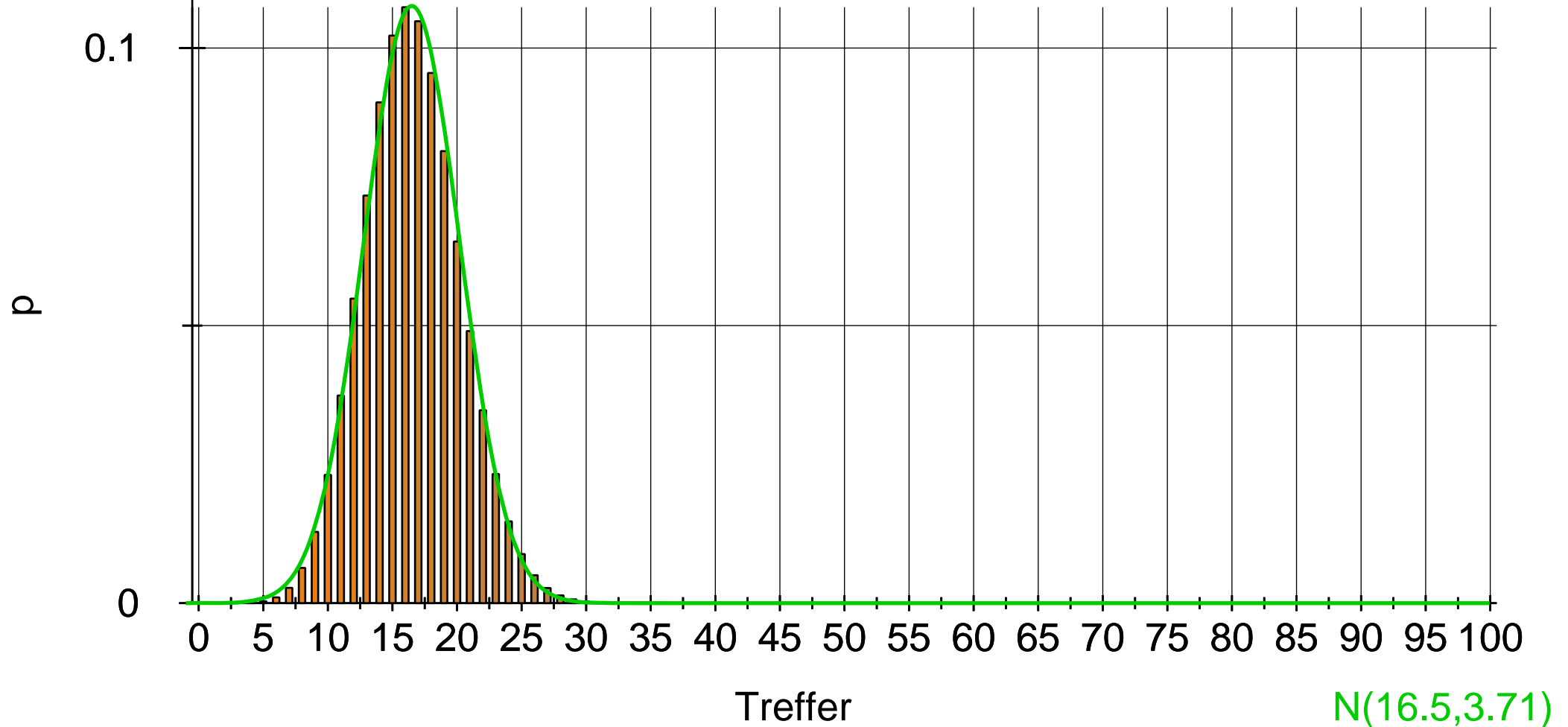


$N(16.5, 3.71)$

# Mathematische Statistik

## Binomialverteilung

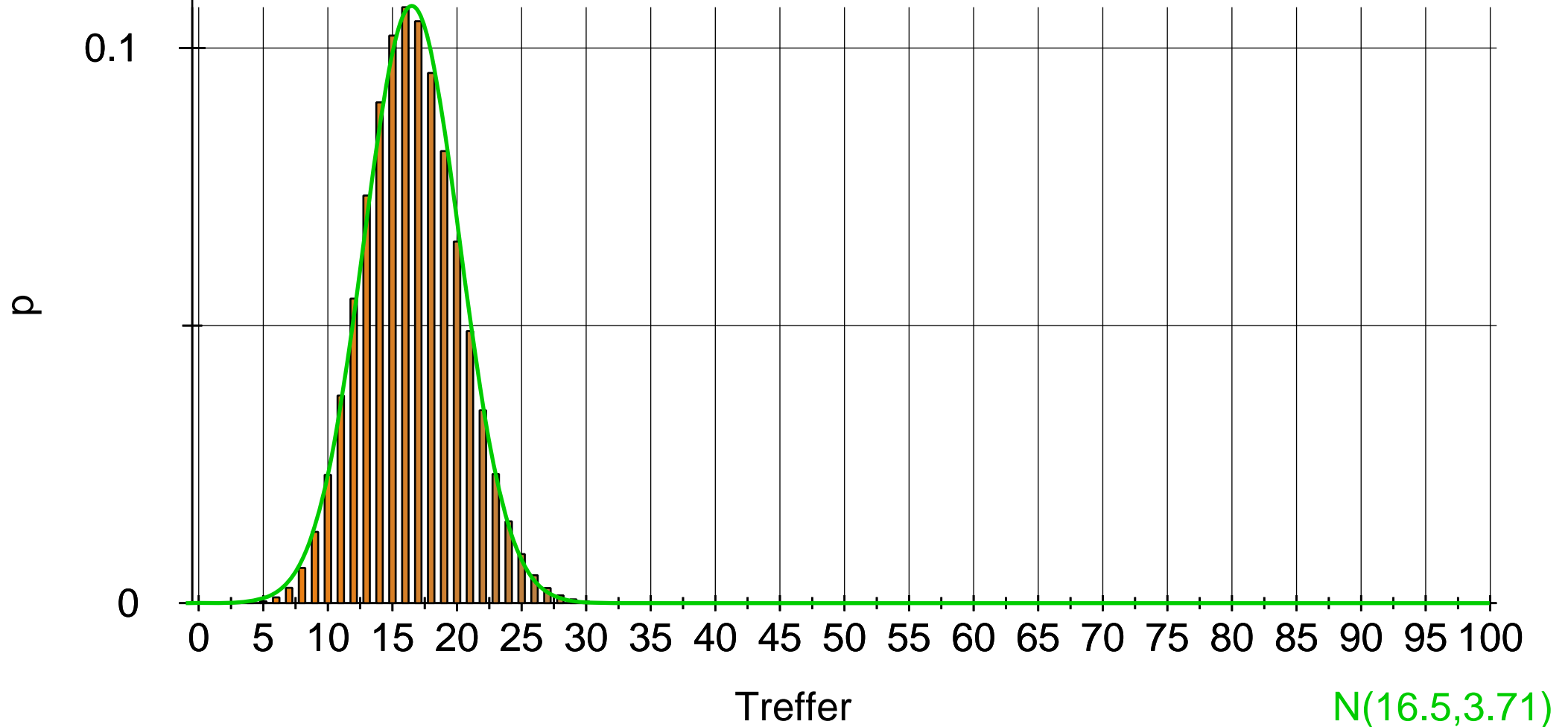
**n=99 p=1/6**



# Mathematische Statistik

## Binomialverteilung

**n=99 p=1/6**

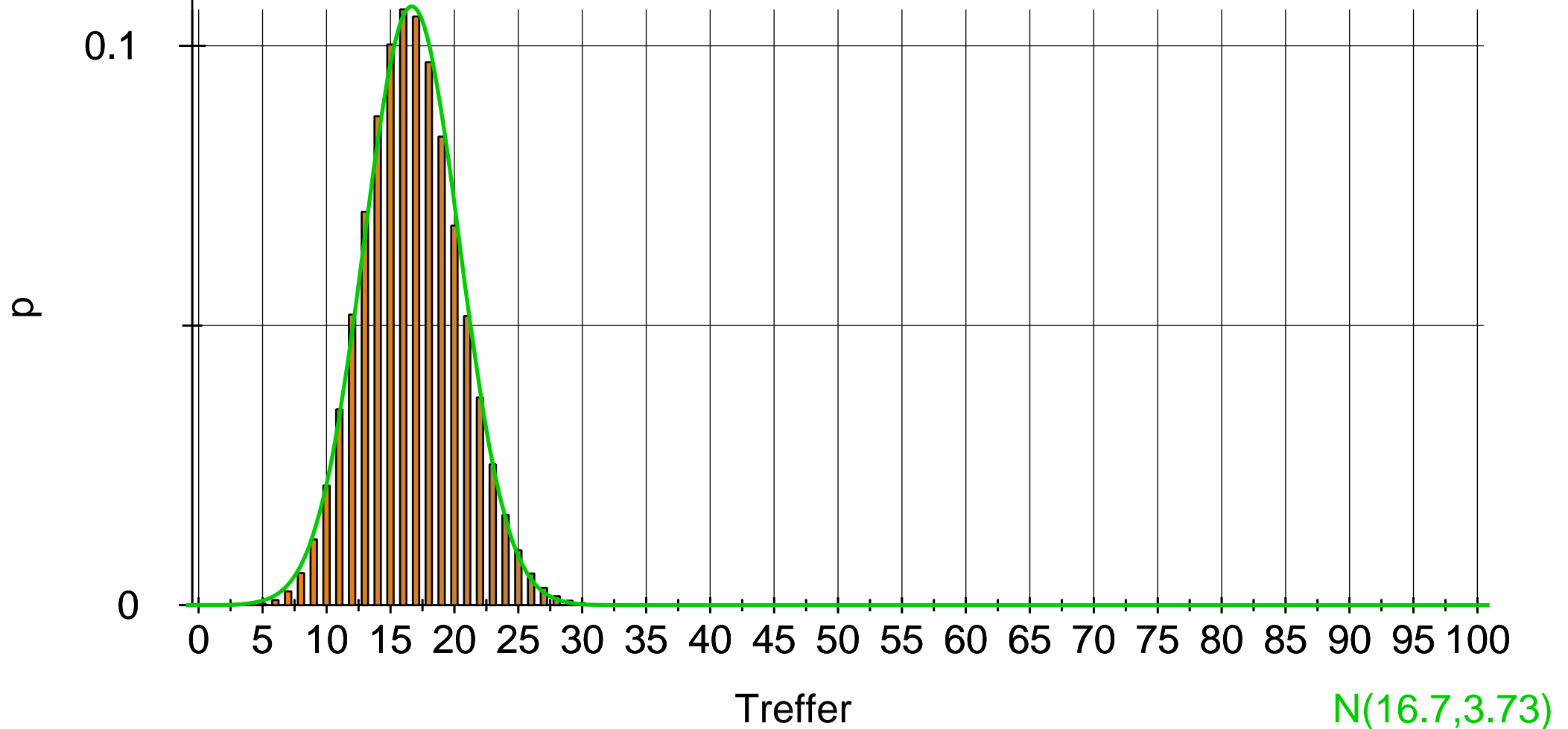


$N(16.5, 3.71)$

# Mathematische Statistik

## Binomialverteilung

**$n=100$   $p=1/6$**

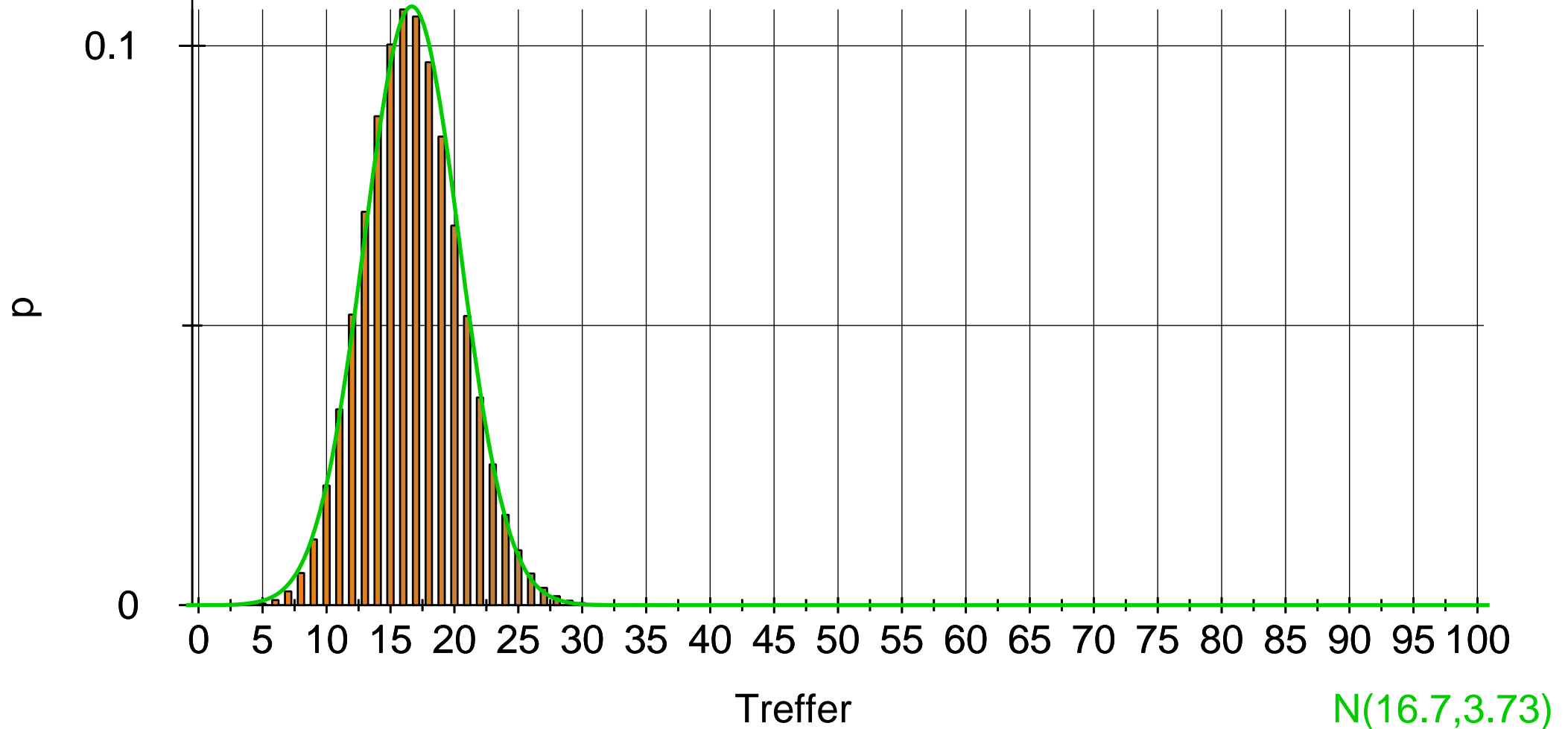


$N(16.7, 3.73)$

# Mathematische Statistik

## Binomialverteilung

**$n=100$   $p=1/6$**

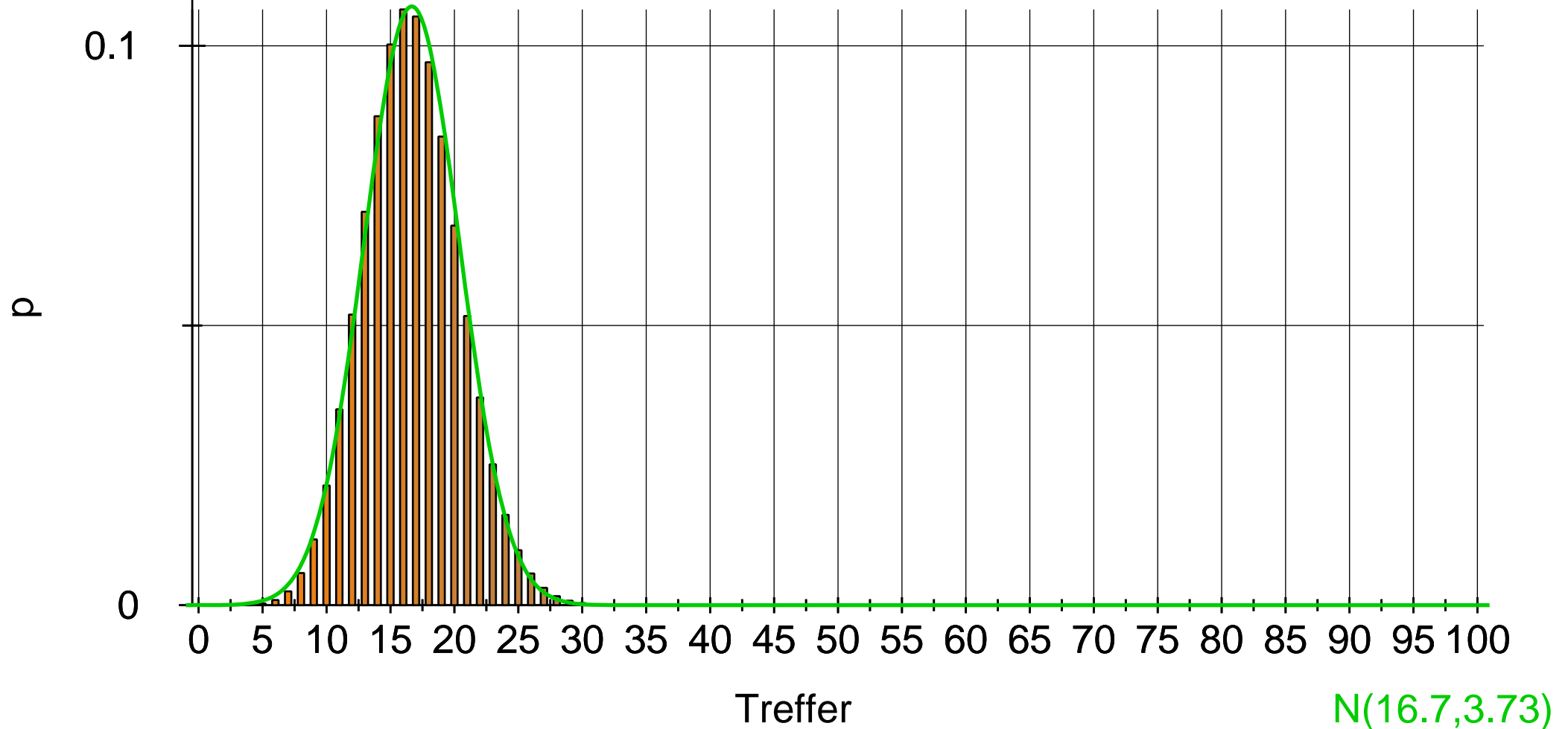


$N(16.7, 3.73)$

# Mathematische Statistik

## Binomialverteilung

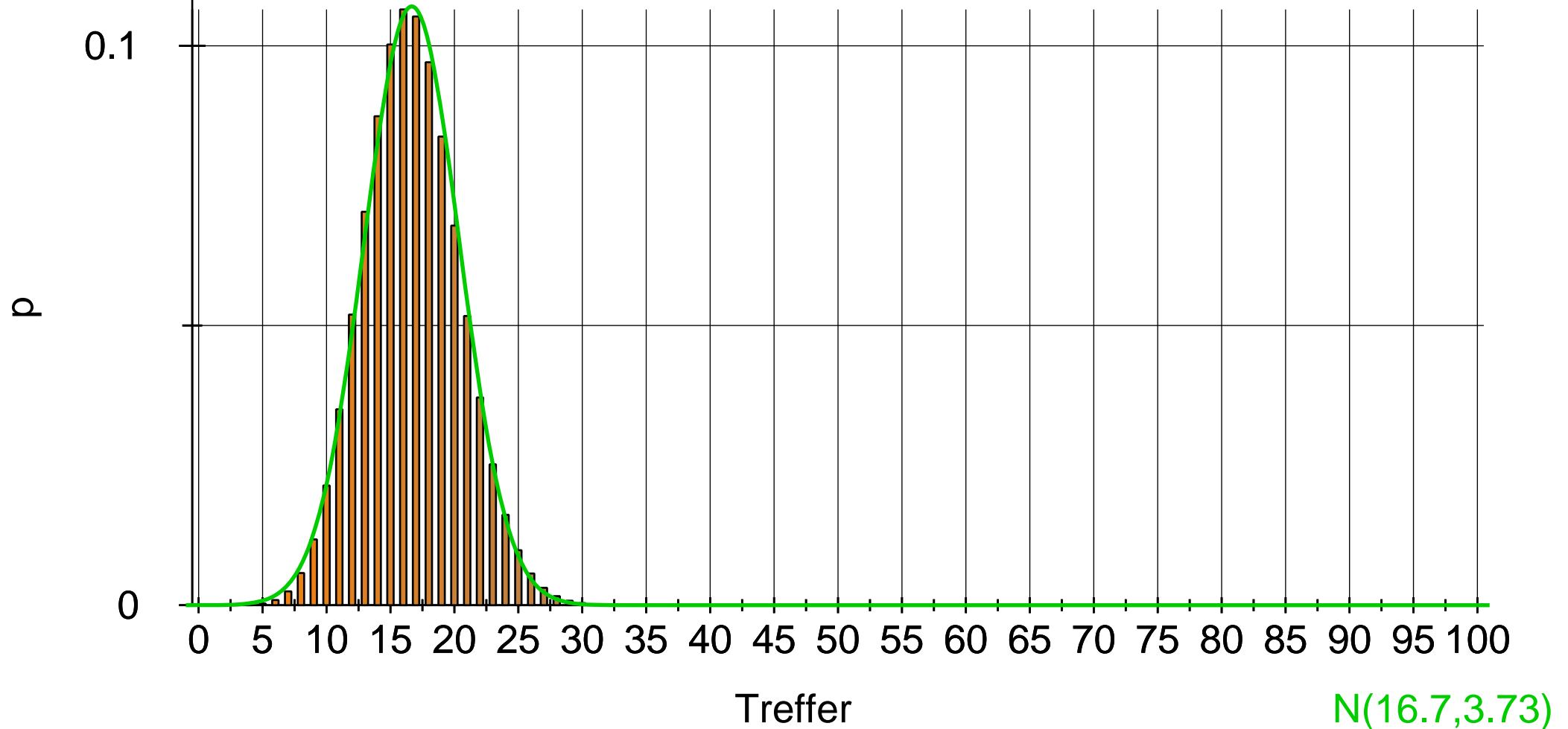
**$n=100$   $p=1/6$**



$N(16.7, 3.73)$

# Mathematische Statistik Binomialverteilung

**$n=100$   $p=1/6$**

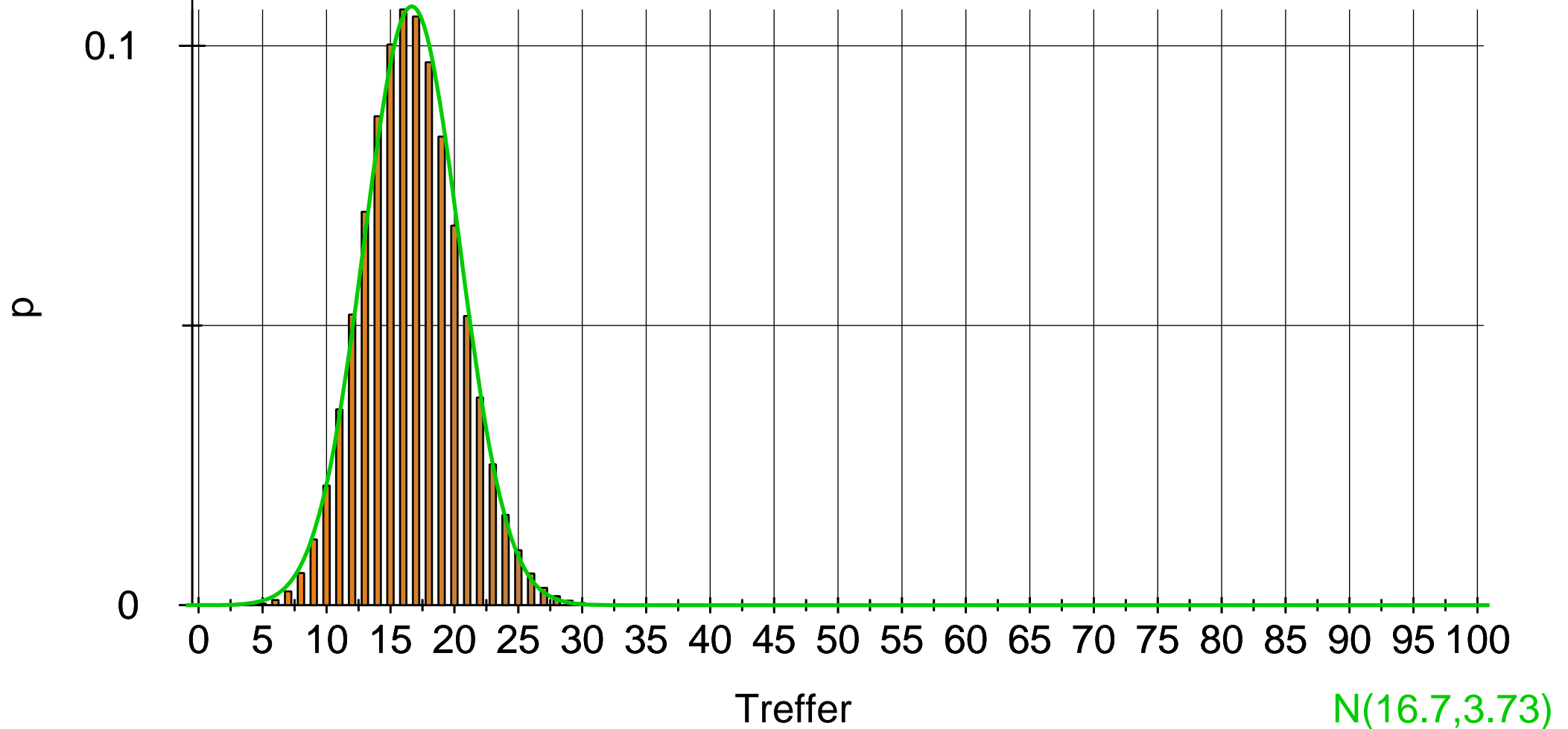


$N(16.7, 3.73)$



# Mathematische Statistik Binomialverteilung

**$n=100$   $p=1/6$**



$N(16.7, 3.73)$