

Normal Distribution

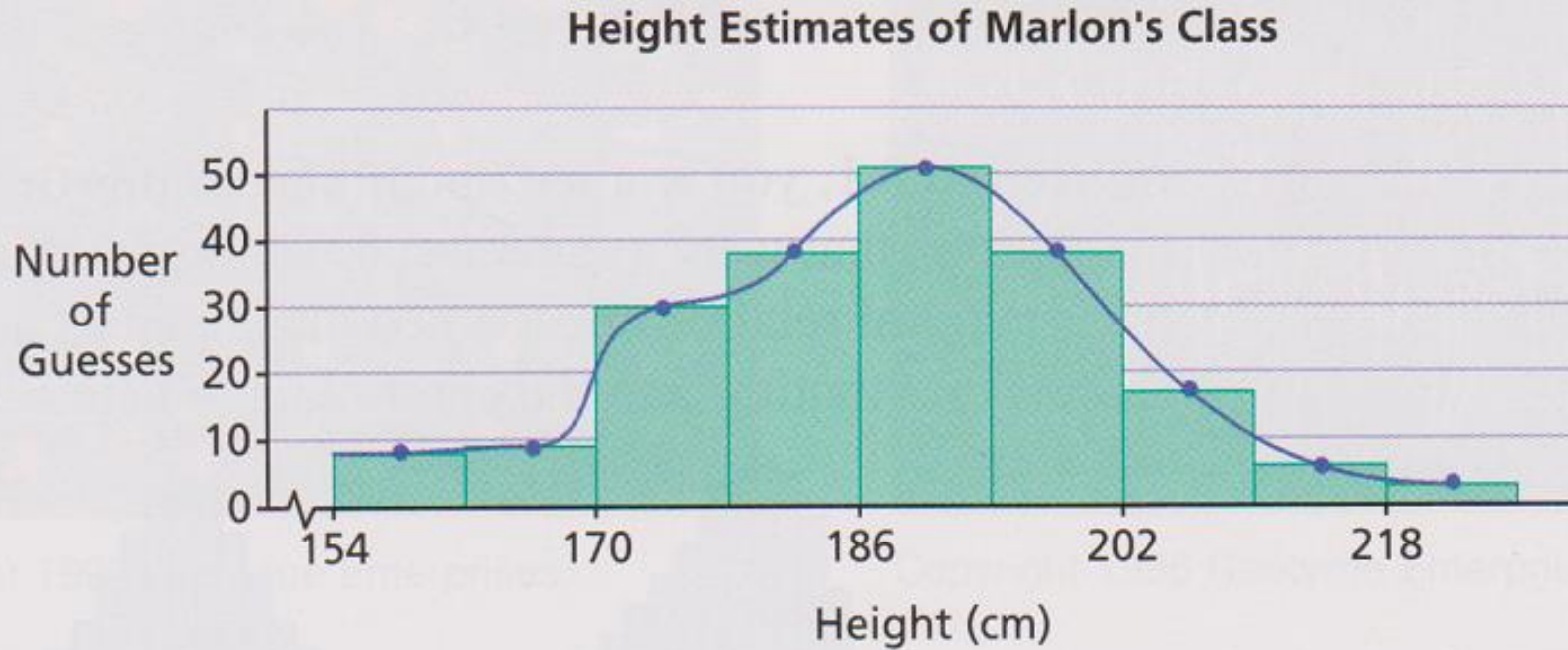


Normal Distribution

[ˈnɔːr-məl ˌdi-strə-ˈbyʊ-shən]

A probability distribution that is symmetric about the mean, showing that data near the mean are more frequent in occurrence than data far from the mean, and is also known as the Gaussian distribution.

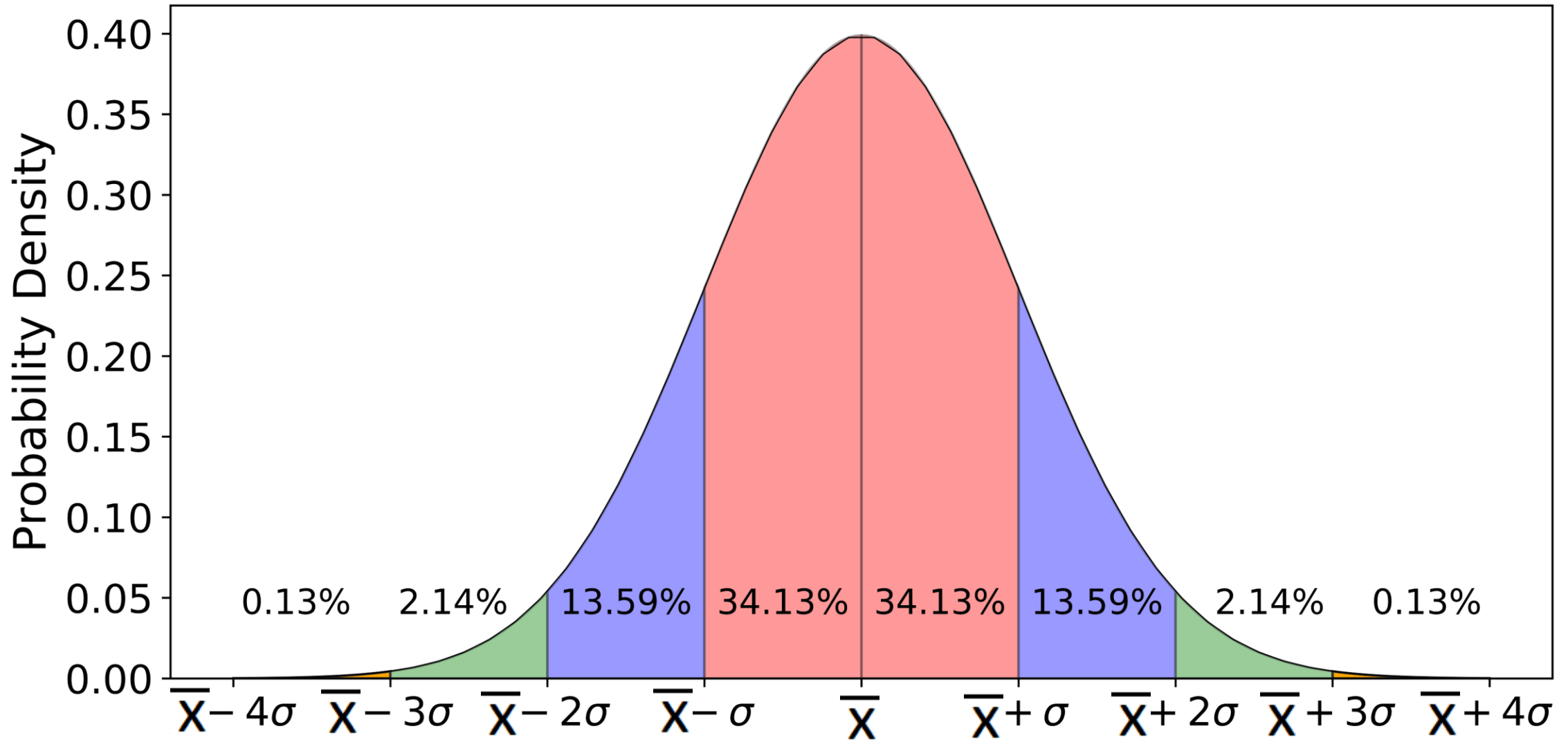
Marlon decides to collect 120 more samples and the histogram becomes the following:



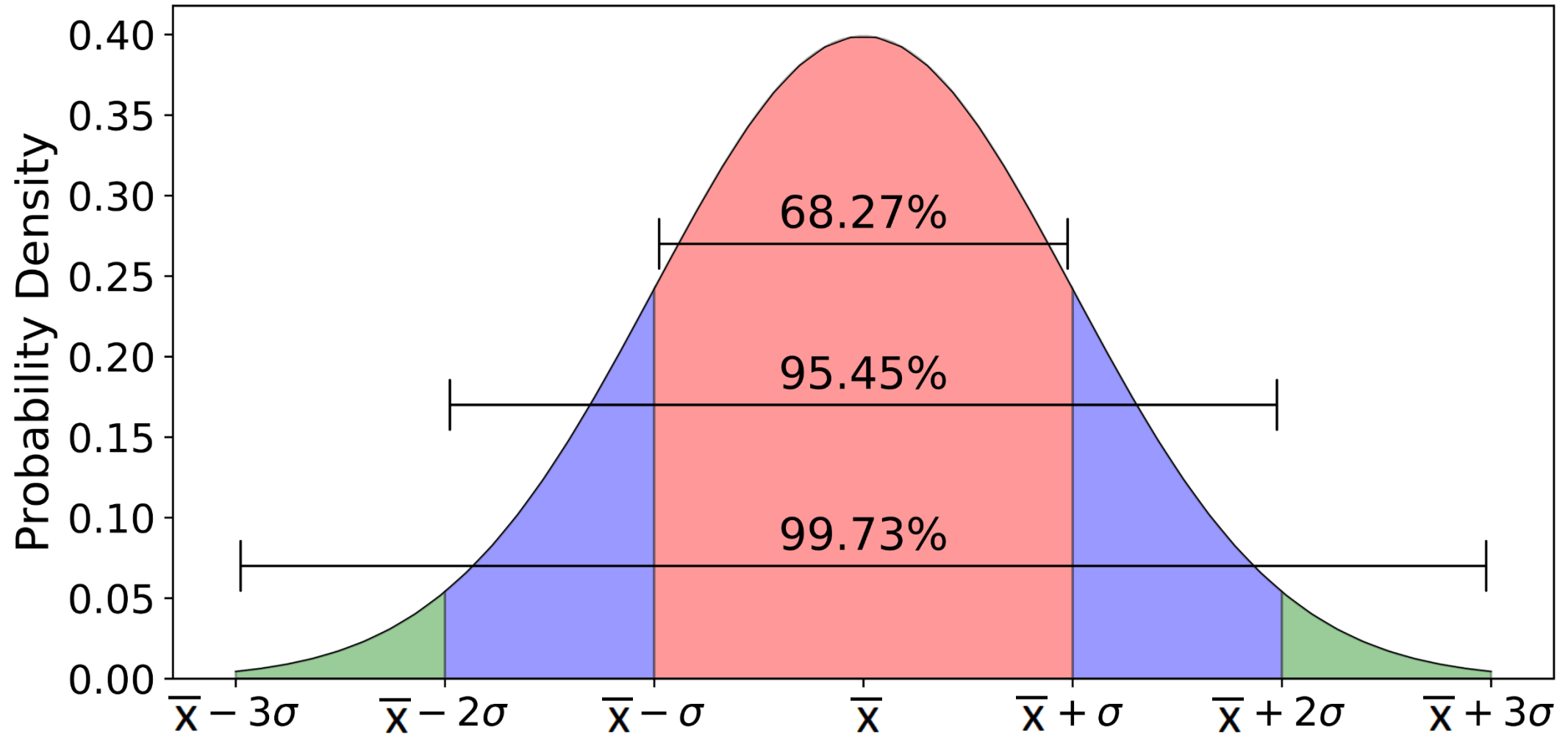
If you draw a smooth curve close to or through the tops of the rectangles in the histogram, you get a normal curve, like the one shown below.

Given enough data and small enough intervals, Marlon would eventually get a perfectly symmetrical bell-shaped curve. A distribution with a histogram that follows a normal curve is called a normal distribution.

Normal Distribution



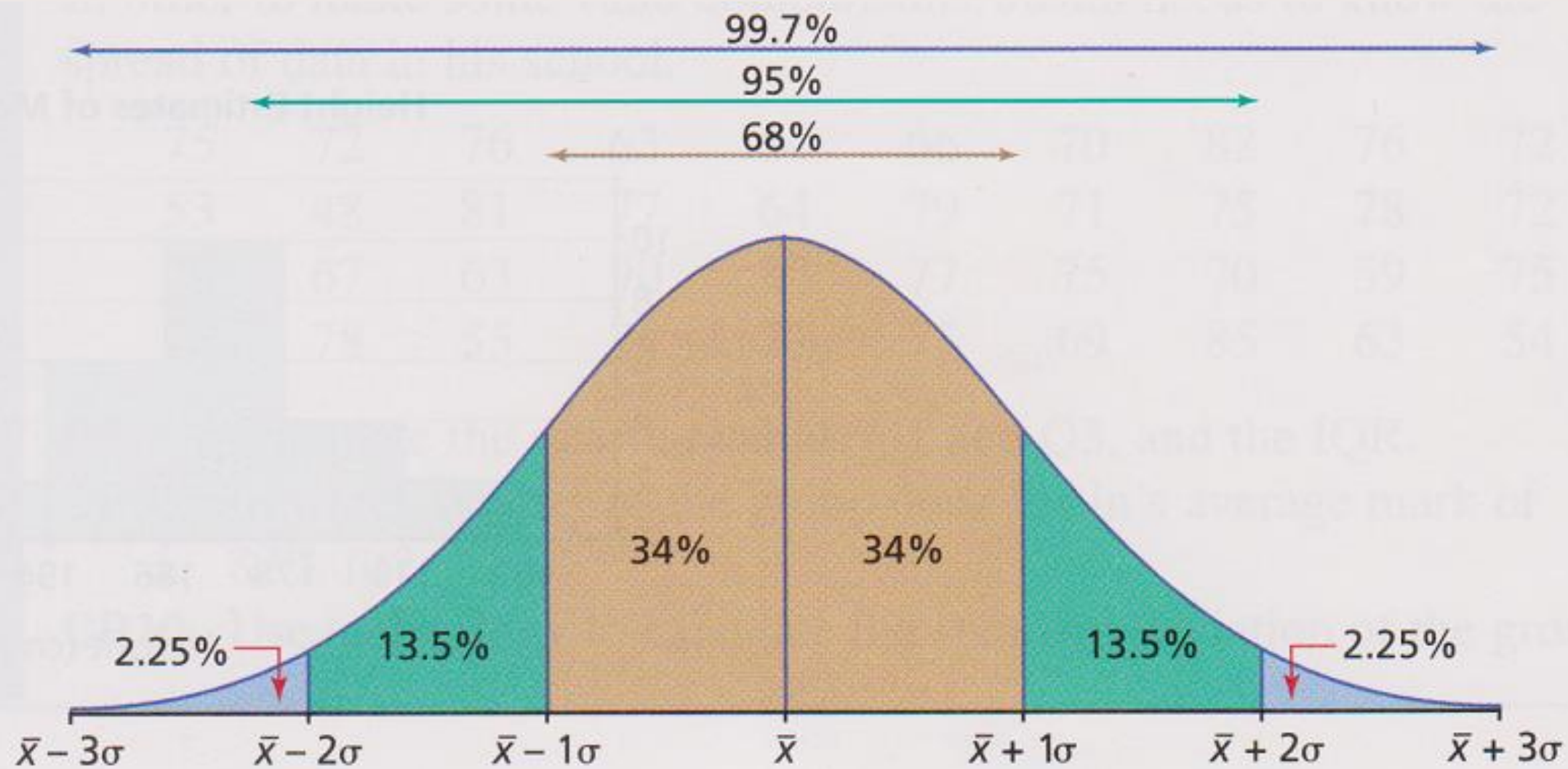
68-95-99.7 Rule



CHARACTERISTICS OF NORMAL DISTRIBUTION

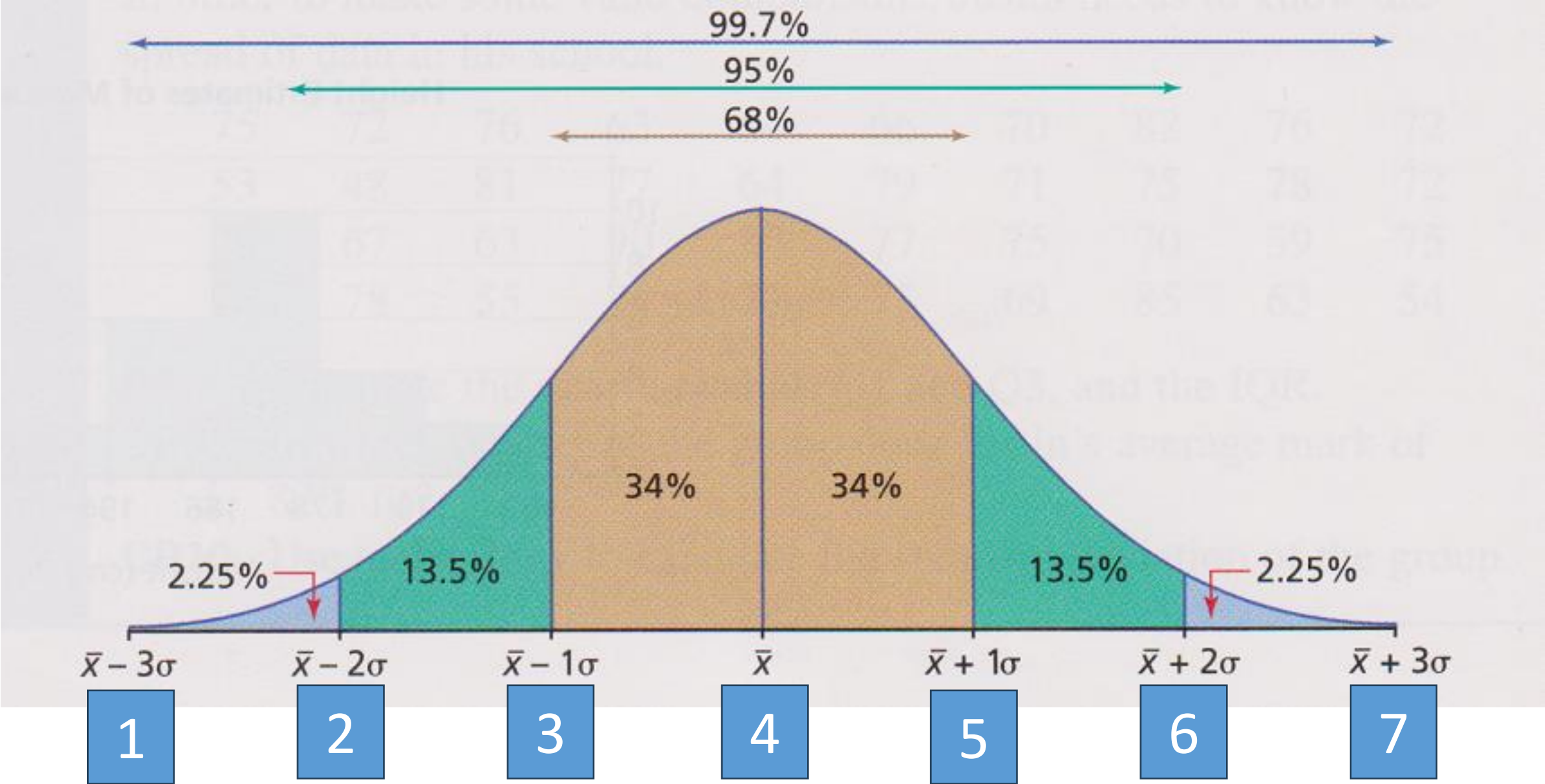
A normal distribution has the following properties:

- It is symmetrical; the mean, median, and mode are equal and fall at the line of symmetry for the curve.
- It is shaped like a bell, peaking in the middle and sloping down toward the sides.
- Approximately 68% of the data is within one standard deviation of the mean.
- Approximately 95% of the data is within two standard deviations of the mean.
- Approximately 99.7% of the data is within three standard deviations of the mean.
- The notation used to describe a normal distribution is $X \sim N(\bar{x}, \sigma^2)$, where \bar{x} is the mean and σ^2 is the variance (the square of the standard deviation).



The graph of the normal distribution $X \sim N(\bar{x}, \sigma^2)$

The weights of frogs are normally distributed around a mean of 25 g, with a standard deviation of 5. Draw the normal distribution for this situation.

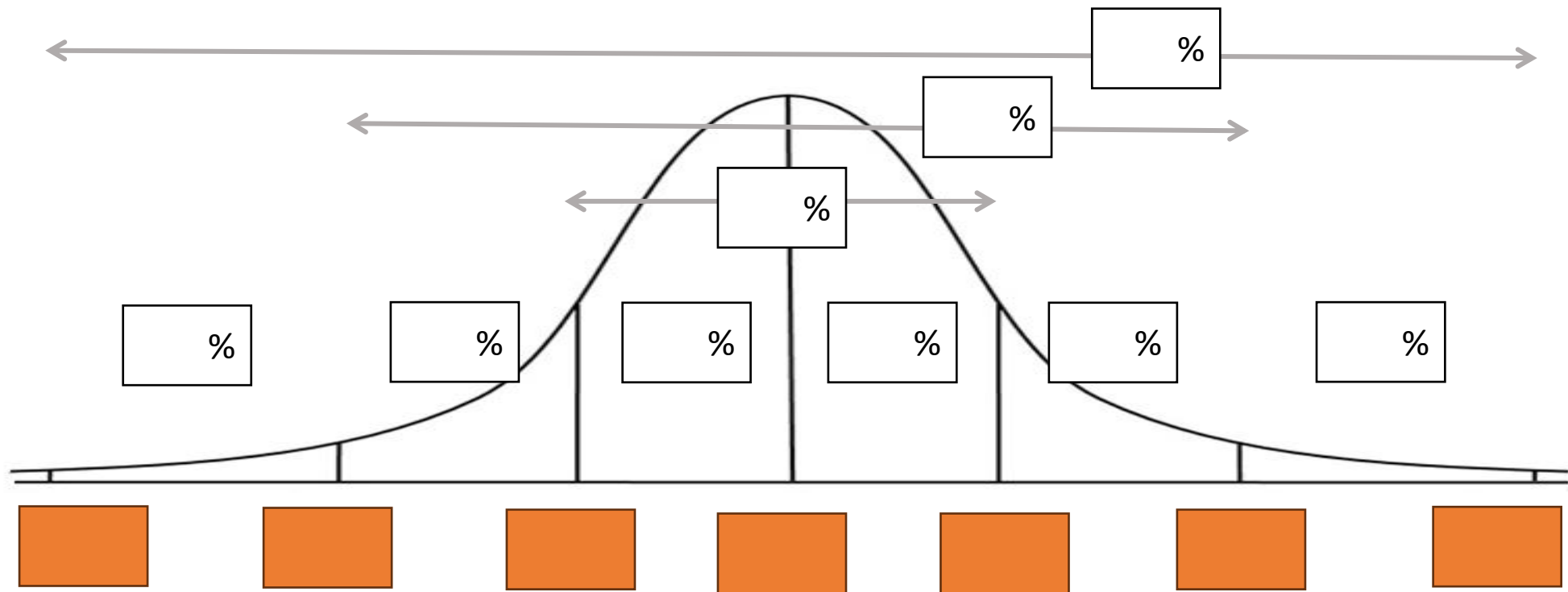


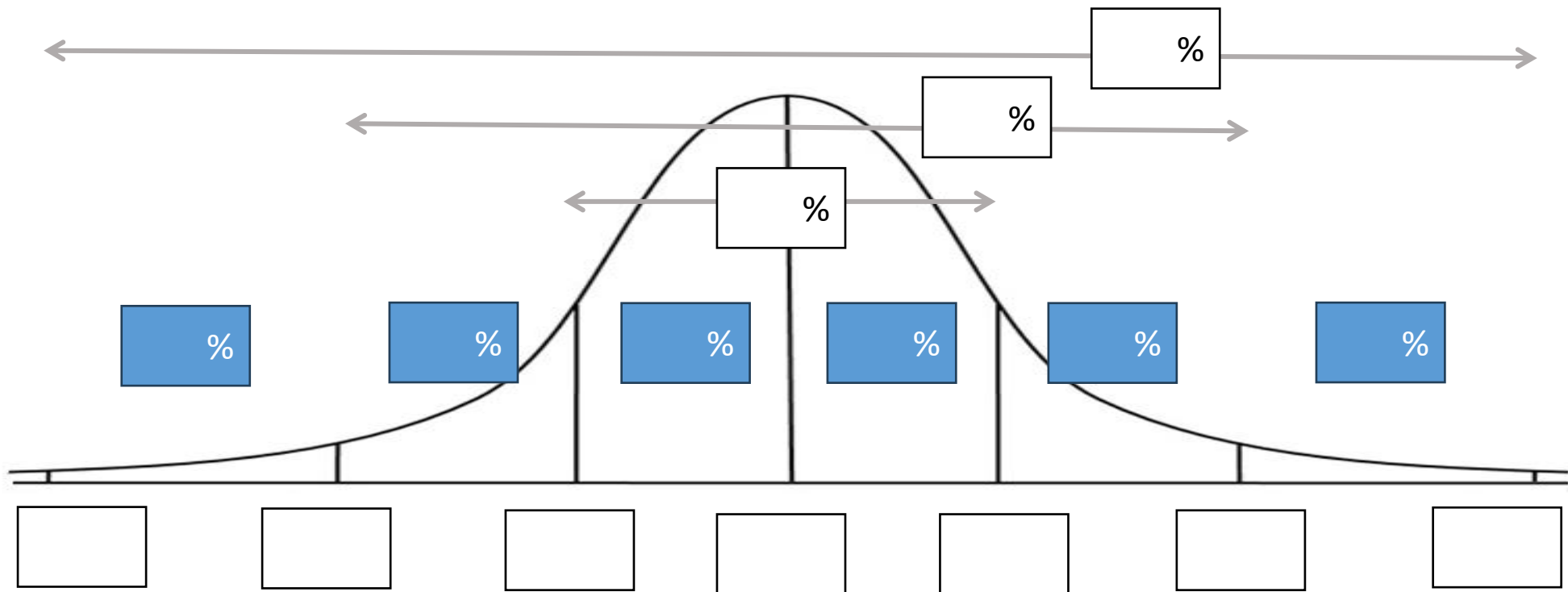
The “Equation of the Line” of a Normal Distribution looks like this:

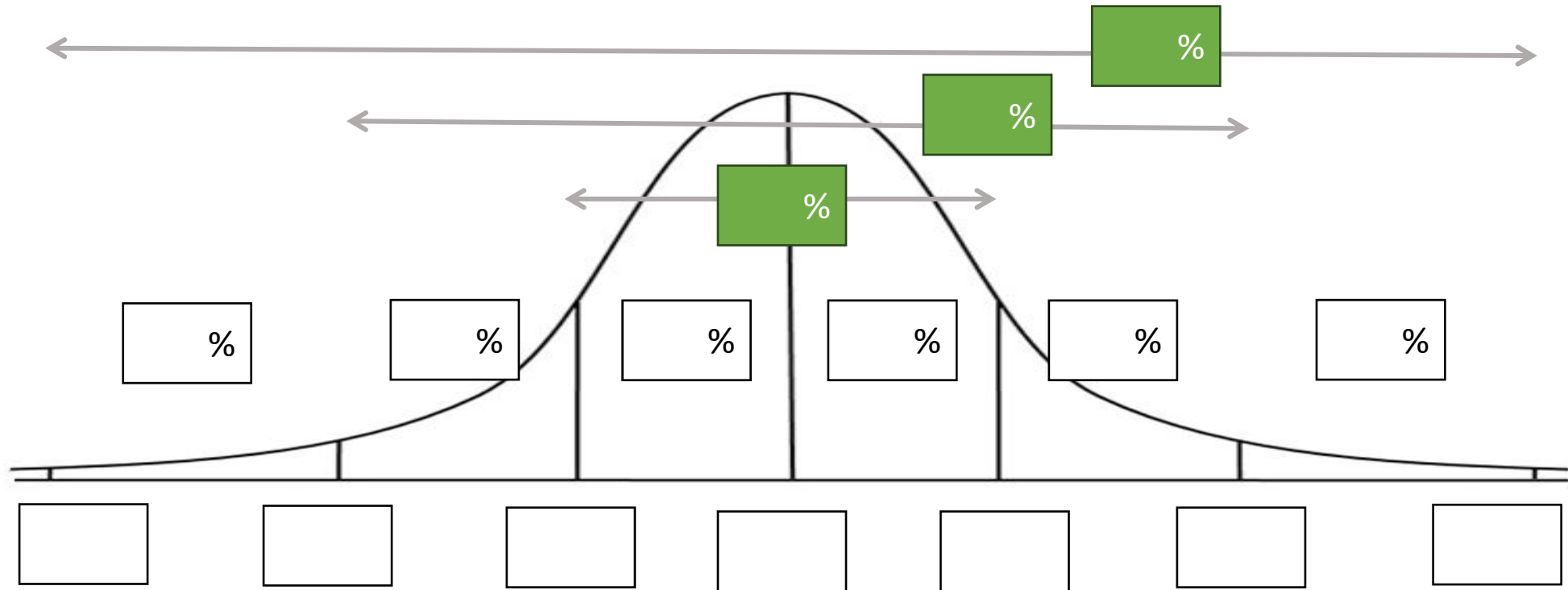
A photograph of a whiteboard with the equation $X \sim N(\bar{x}, \sigma^2)$ written in black marker. The mean \bar{x} has a horizontal line above it, and the standard deviation σ has a horizontal line above it. The equation is centered on the board.

X is Normally Distributed around a mean of \bar{x} with the standard deviation σ

The weights of frogs are normally distributed around a mean of 25 g, with a standard deviation of 5. Write the equation for this situation.



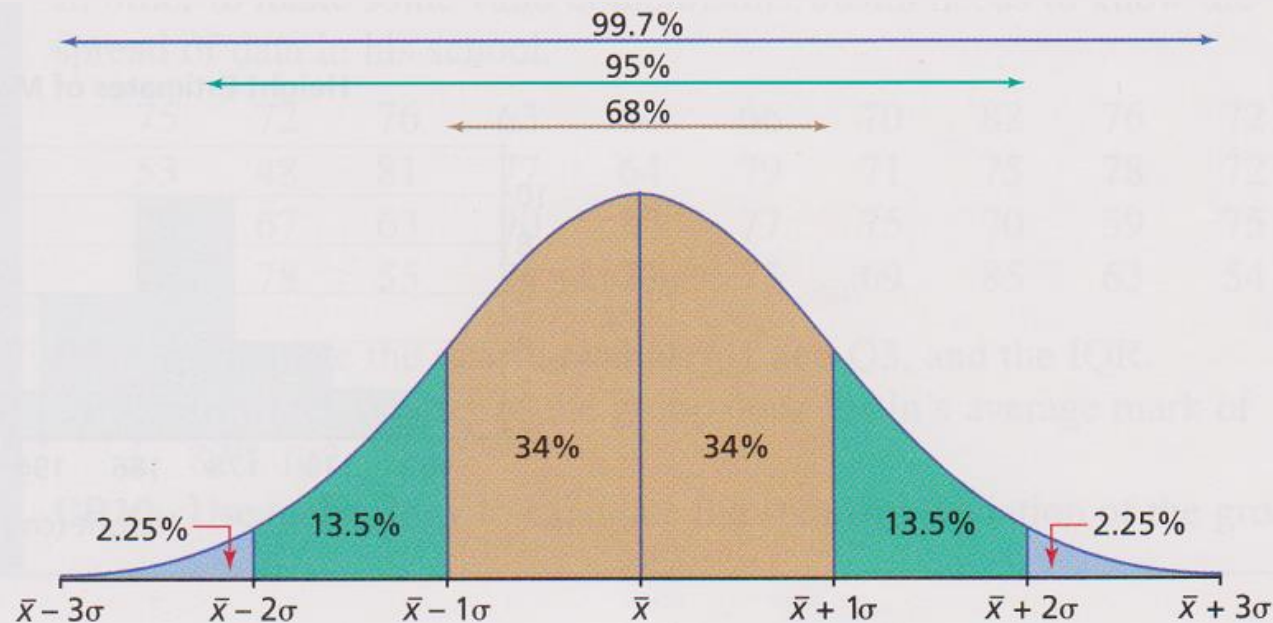




Example 2 Using Normal Distribution

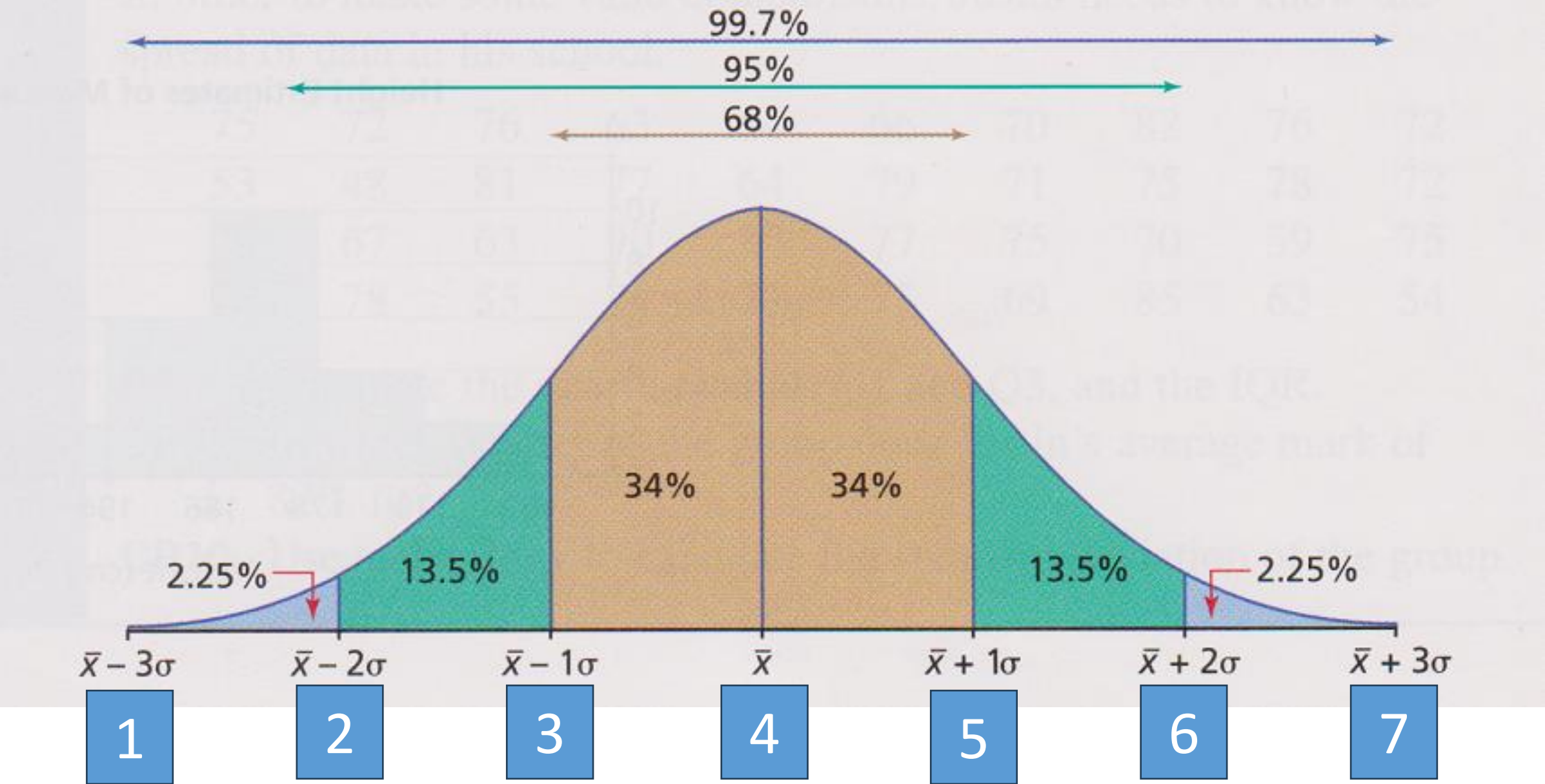
Julie is an engineer who designs roller coasters. She wants to develop a ride that 95% of the population can ride. The average adult in North America has a mass of 71.8 kg, with a standard deviation of 13.6 kg.

- (a) What range of masses should she be prepared to anticipate?
- (b) If she wanted to provide for 99.7% of the general population, what range of masses should she be prepared to anticipate?

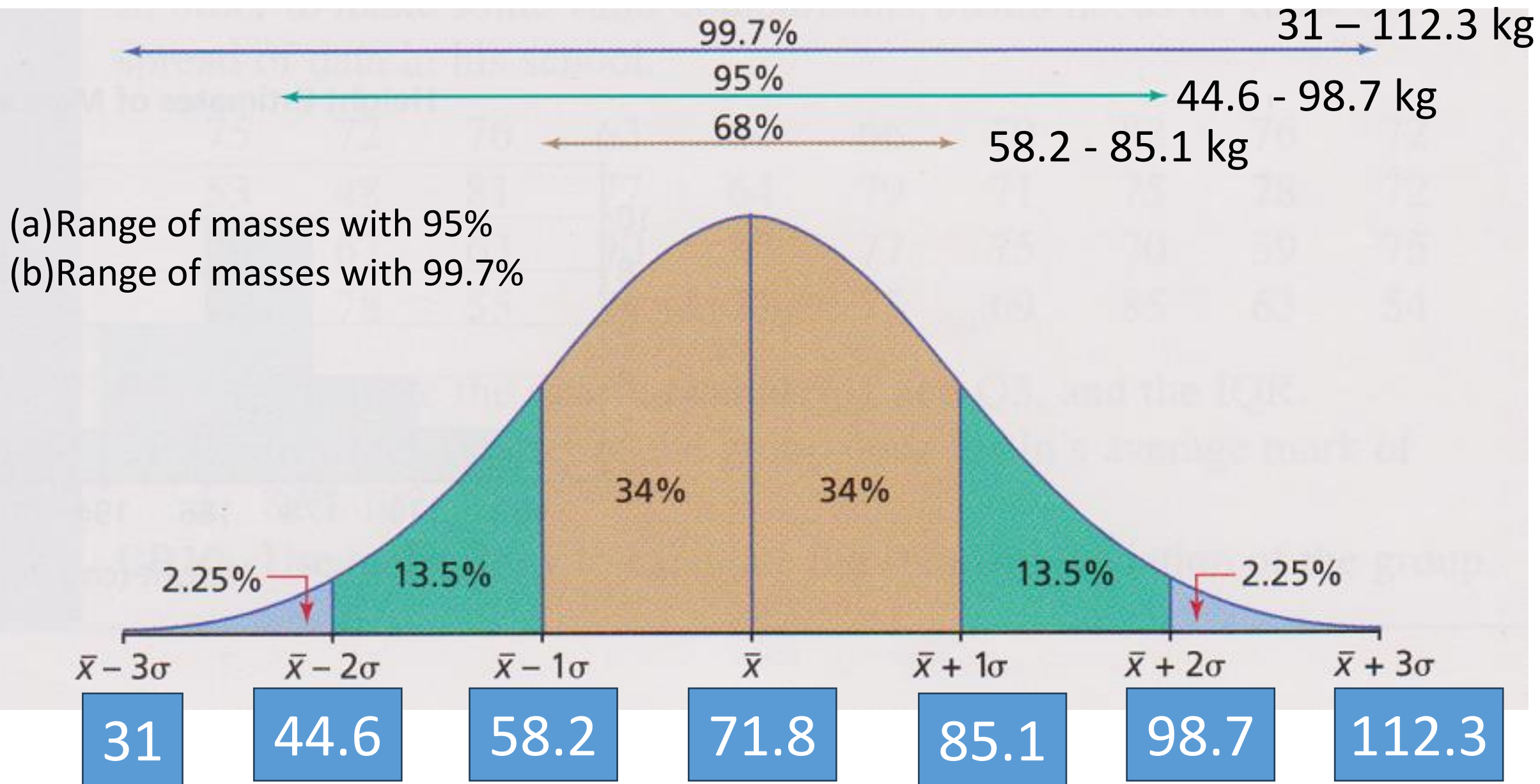


The graph of the normal distribution $X \sim N(\bar{x}, \sigma^2)$

$$X \sim N(71.8, 13.6^2)$$



$$X \sim N(71.8, 13.6^2)$$



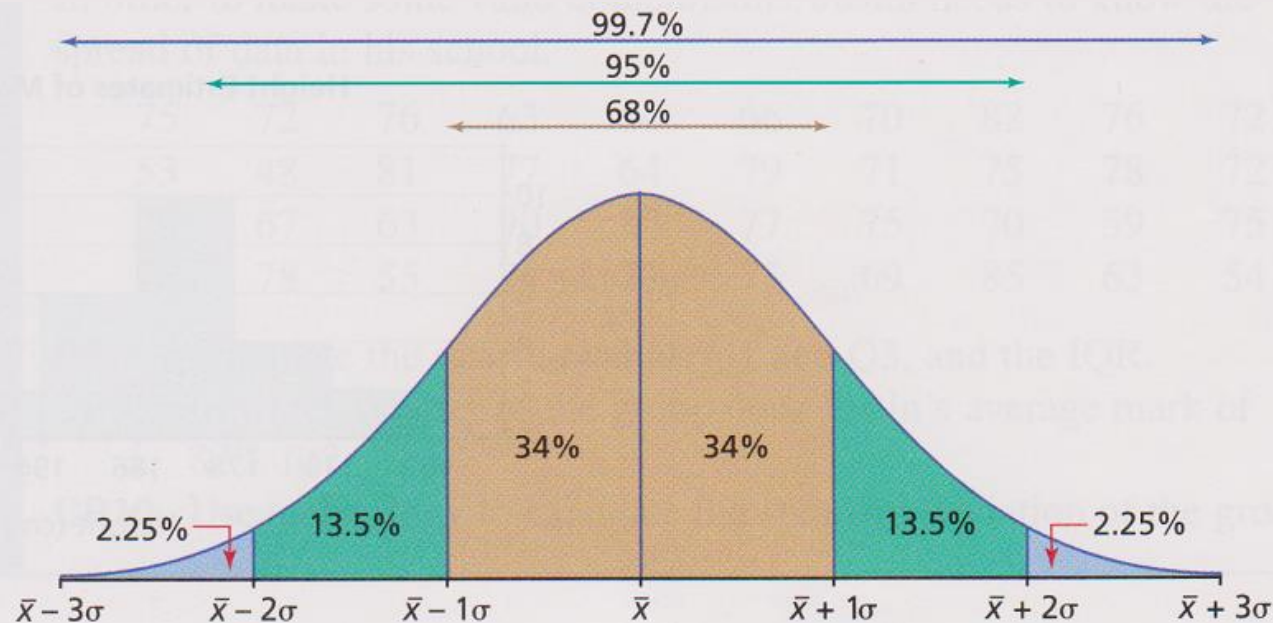
(a) Range of masses with 95%

(b) Range of masses with 99.7%

Example 2 Using Normal Distribution


Julie is an engineer who designs roller coasters. She wants to develop a ride that 95% of the population can ride. The average adult in North America has a mass of 71.8 kg, with a standard deviation of 13.6 kg.

- (a) What range of masses should she be prepared to anticipate?
- (b) If she wanted to provide for 99.7% of the general population, what range of masses should she be prepared to anticipate?



The graph of the normal distribution $X \sim N(\bar{x}, \sigma^2)$

- (a) In a normal distribution, 95% of the data is within two standard deviations of the mean. With a mean of 71.8 and a standard deviation of 13.6, that means that 95% of the data will likely be between $71.8 - 2(13.6)$, or 44.6 kg and $71.8 + 2(13.6)$, or 99 kg.
- (b) To get an interval into which 99.7% of the data fits, you need to widen it to three standard deviations from the mean (the interval 31 kg to 112.6 kg).

	Short Term Memory	Long Term Memory
Capacity	7 +/- 2 items of information	Limitless
Duration	18 - 30 seconds	Up to a lifetime
Encoding	Mainly acoustically	Mainly semantically

4 digits

1

2

3

4

4

8

1

2

What's the
number?



6 digits

1

2

3

4

5

6

6

5

2

9

7

1

What's the
number?



8 digits

1

2

3

4

5

6

7

8

3

9

2

1

8

5

4

1

What's the
number?



10 digits

1

2

3

4

5

6

7

8

9

10

9

6

2

1

4

3

6

5

7

0

What's the
number?



10 digits

1

2

3

4

5

6

7

8

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10

11

12

13

14

15

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5

1

2

4

7

1

9

0

6

4

1

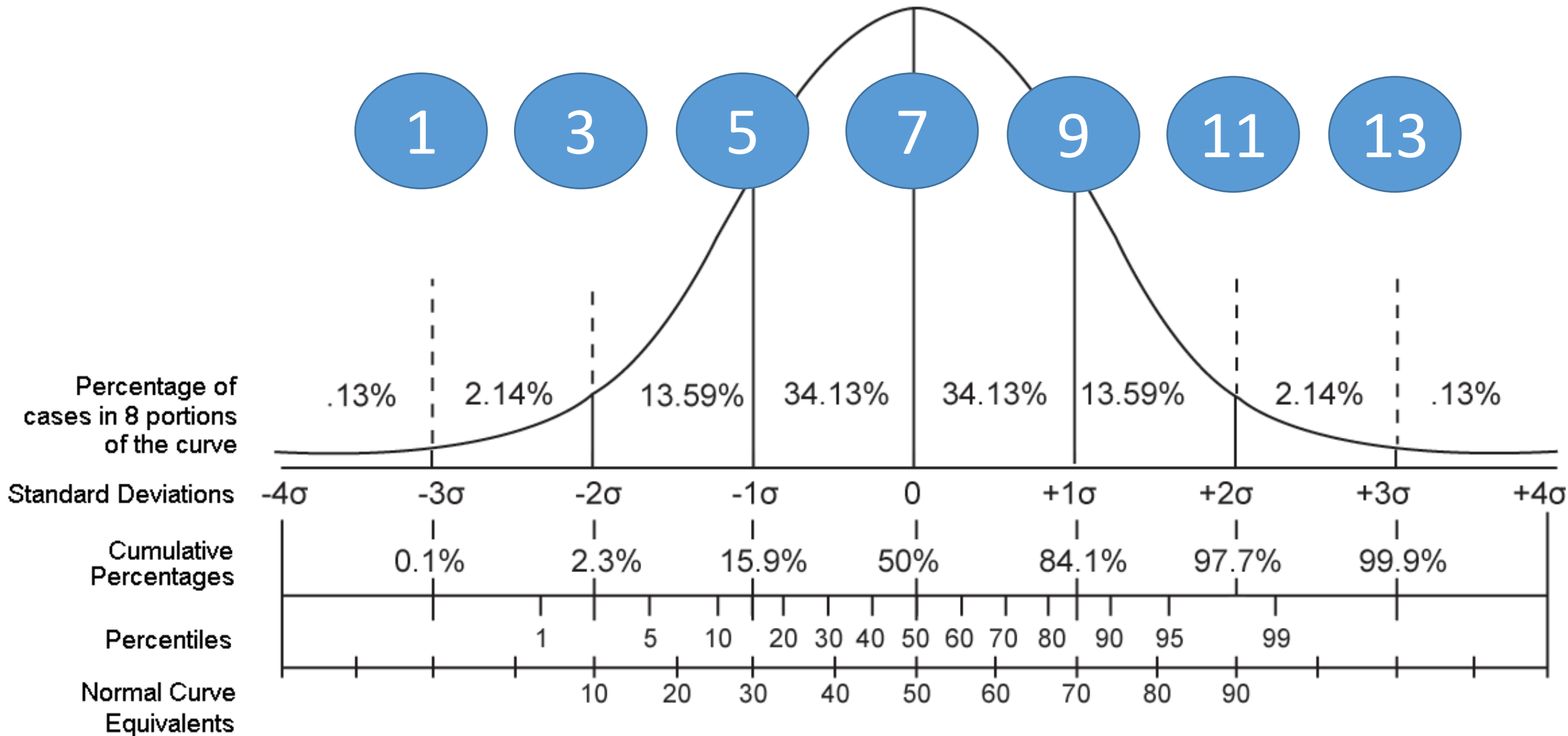
3

5

What's the
number?



Age (years)	DS forward						DS backward					
	Men			Women			Men			Women		
	0-3	4-9	≥10	0-3	4-9	≥10	0-3	4-9	≥10	0-3	4-9	≥10
60-74												
N	9	60	109	101	167	116	9	60	109	101	167	116
Mean	3.89	5.52	7.58	3.66	4.93	6.86	3.56	4.47	5.42	2.86	4.12	5.05
SD	2.15	2.48	2.49	1.73	2.02	2.02	0.88	1.56	1.55	1.43	1.46	1.54
5th percentile	1.00	2.00	3.00	2.00	2.00	4.00	2.00	2.00	3.00	0.00	2.00	2.85
Median	4.00	5.00	8.00	3.00	5.00	7.00	4.00	4.00	6.00	3.00	4.00	5.00
75-90												
N	8	41	39	53	53	28	8	41	39	53	53	28
Mean	4.13	5.2	6.28	3.04	4.58	6.25	3.13	4.27	5.23	2.55	3.94	4.96
SD	1.13	2.1	1.96	1.21	2.17	2.84	1.46	1.38	1.75	1.15	1.46	1.88
5th percentile	3.00	2.00	4.00	2.00	1.70	2.00	0.00	2.10	3.00	0.70	1.70	2.00
Median	4.00	5.00	6.00	3.00	4.00	6.00	4.00	4.00	5.00	2.00	4.00	5.00



<https://www.youtube.com/watch?v=orC1SMZRFWM>

<https://www.youtube.com/watch?v=mI96Ph-yHcA>