MA207
The Normal Distribution
(Diez et. al. Ch. 3)

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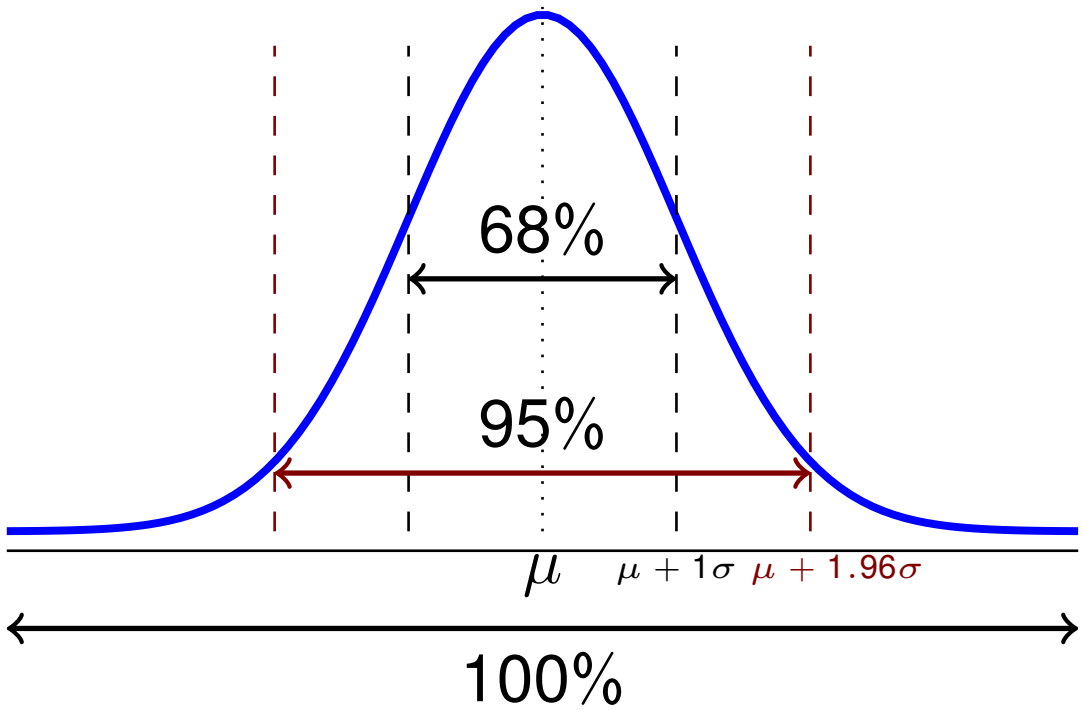
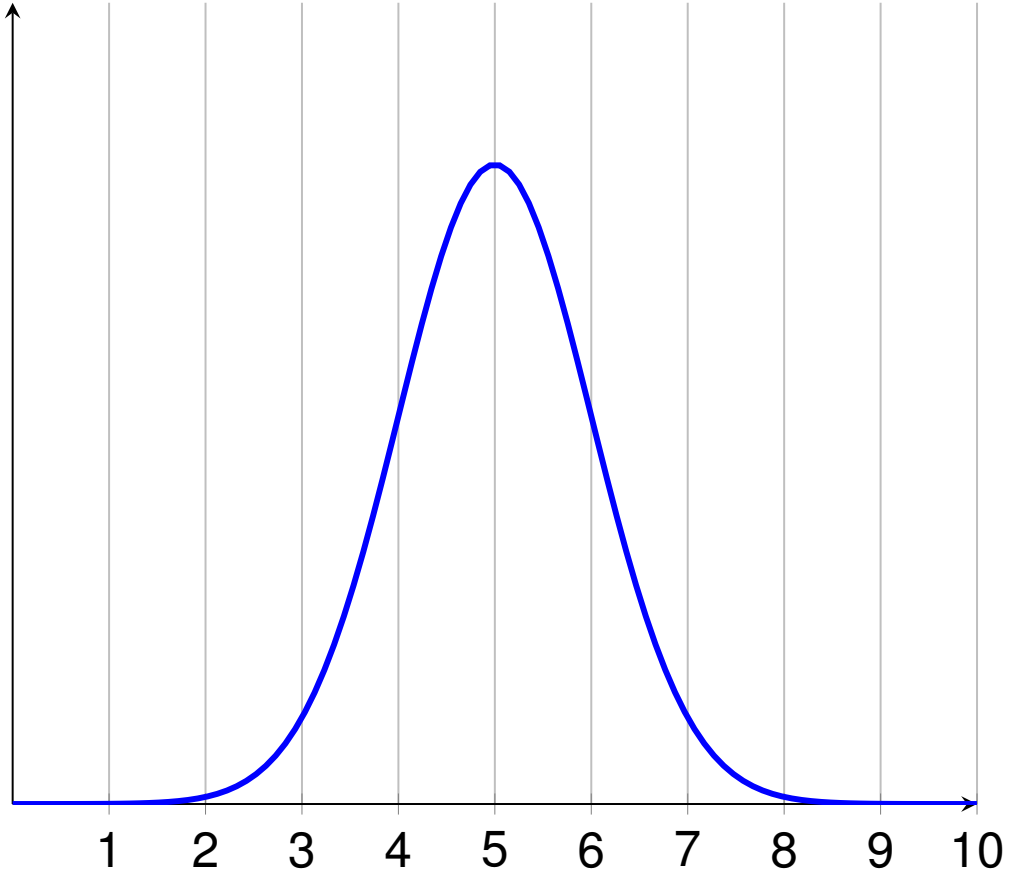
Features of normal distributions:

1. Normal distributions are symmetric around their mean. (where are the median and mode?)
2. Defined by the mean (μ) and the standard deviation (σ).
3. The area under the normal curve is equal to 1.0.
4. 68% of the area is within one standard deviation of the mean.
5. Approximately 95% of the area is within 1.96 standard deviations of the mean.



Approximate the standard deviation on the blue normal distribution.



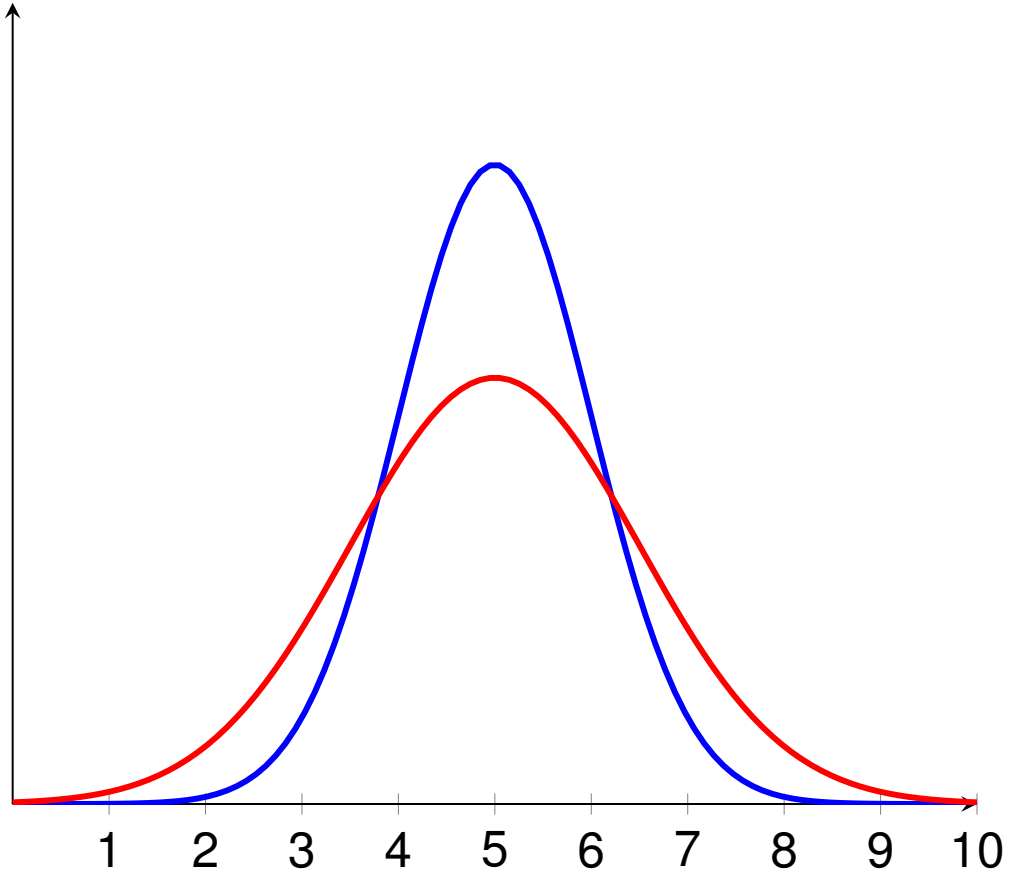
(A) $\mu = 5$ and $\sigma = 1$

(B) $\mu = 5$ and $\sigma = 2$

(C) $\mu = 5$ and $\sigma = 3$

(D) $\mu = 5$ and $\sigma = 4$

Pick the correct comparison



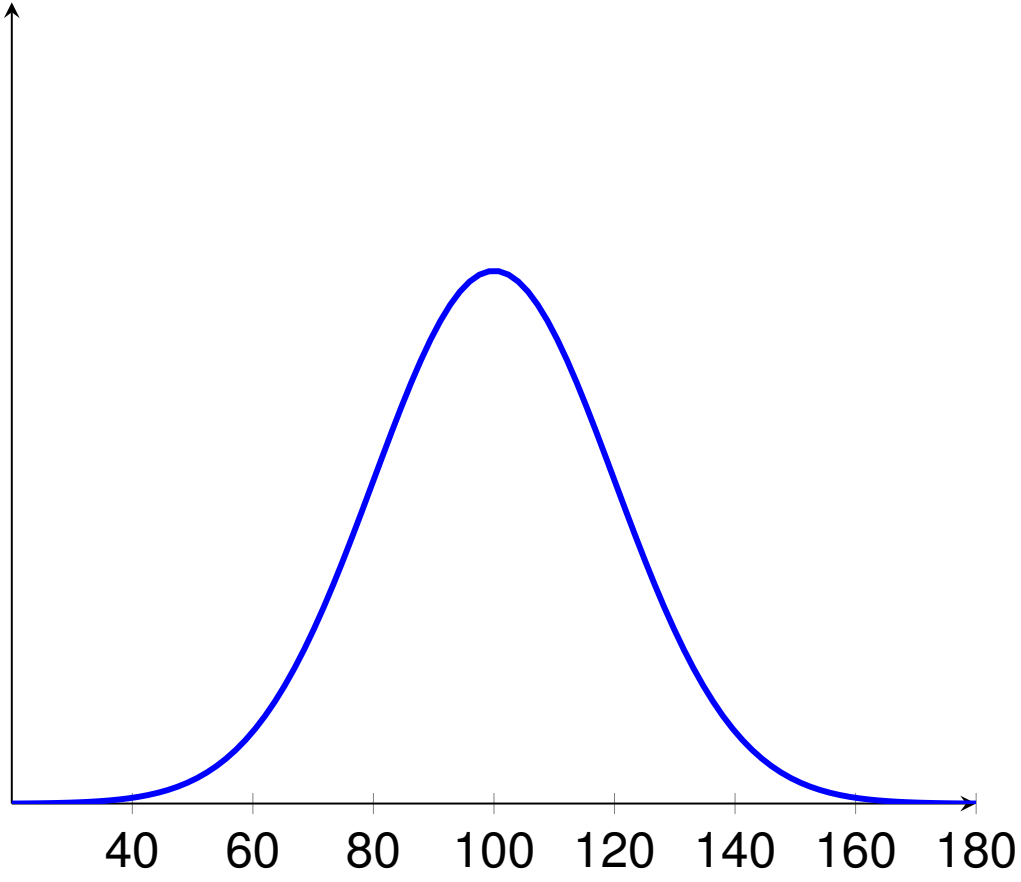
(A) $\sigma_{red} = \sigma_{blue}$

(B) $\sigma_{red} > \sigma_{blue}$

(C) $\sigma_{red} < \sigma_{blue}$

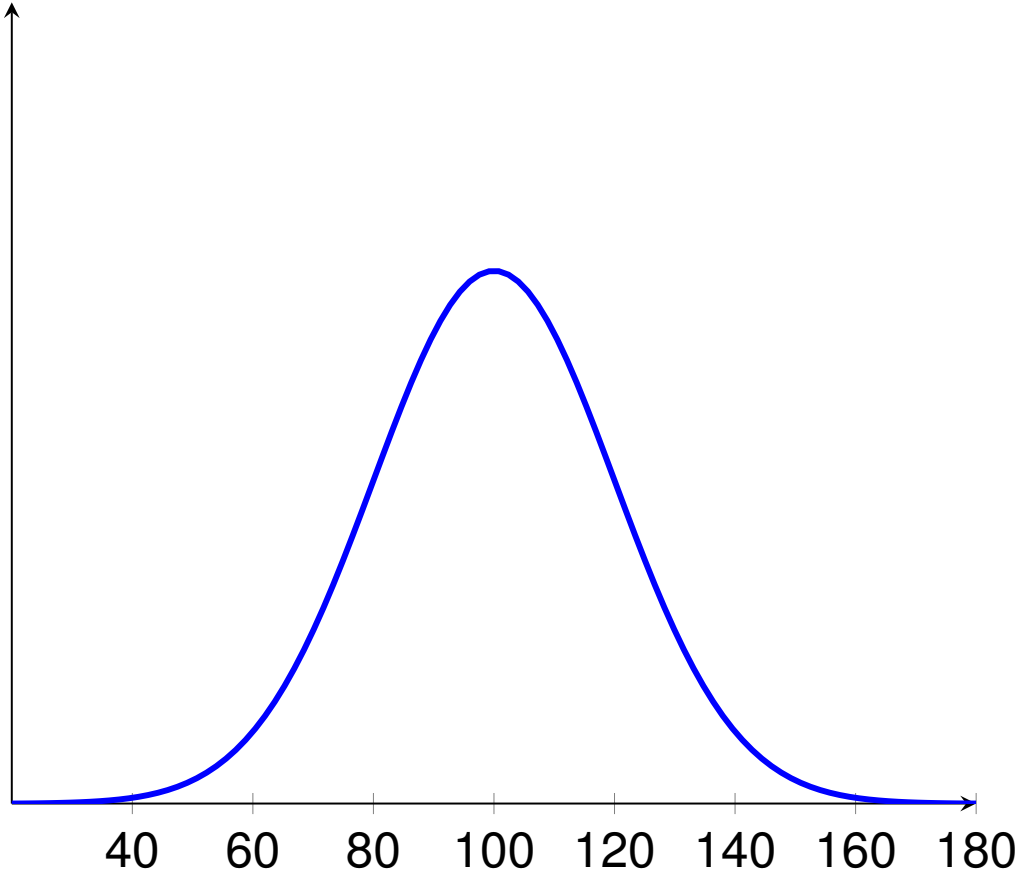
(D) Not enough information

In the following normal distribution we have $\mu = 100$ and $\sigma = 20$.
Question: 68% of the data described by this distribution is between which two values?



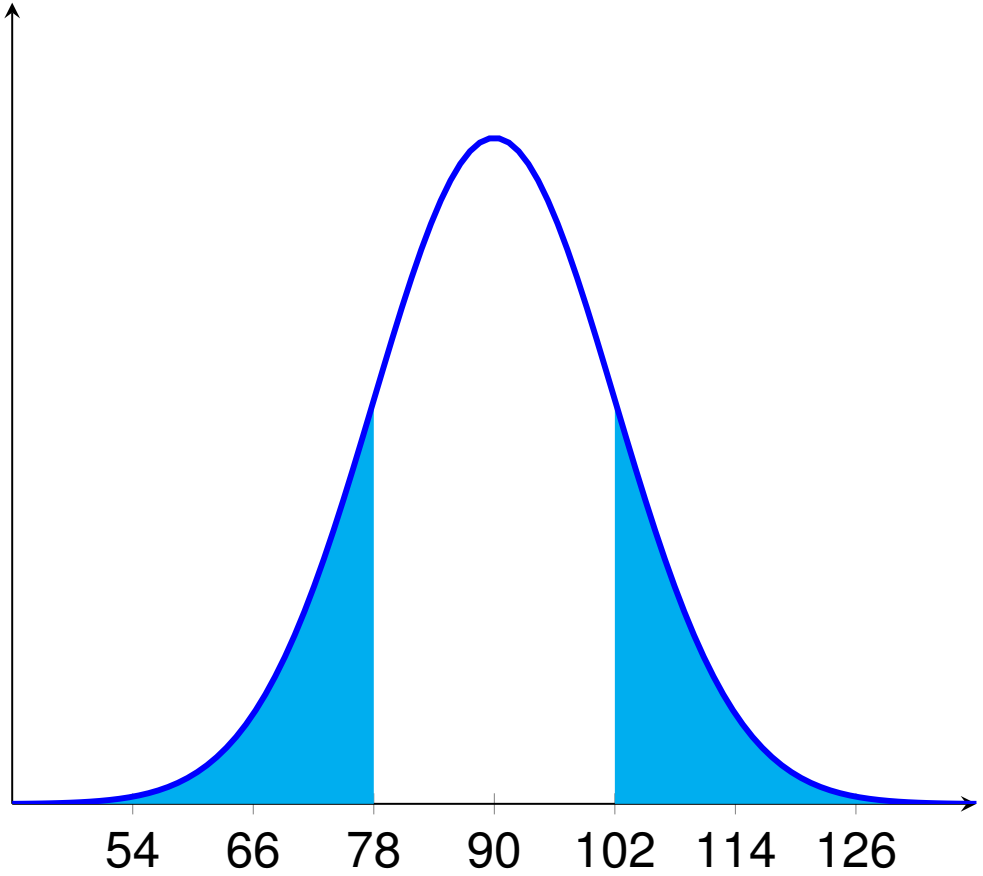
(A) 99 and 101
(B) -80 and 120
(C) 80 and 120
(D) 60 and 140

In the following normal distribution we have $\mu = 100$ and $\sigma = 20$.
Question: 95% of the data described by this distribution is between which two values?



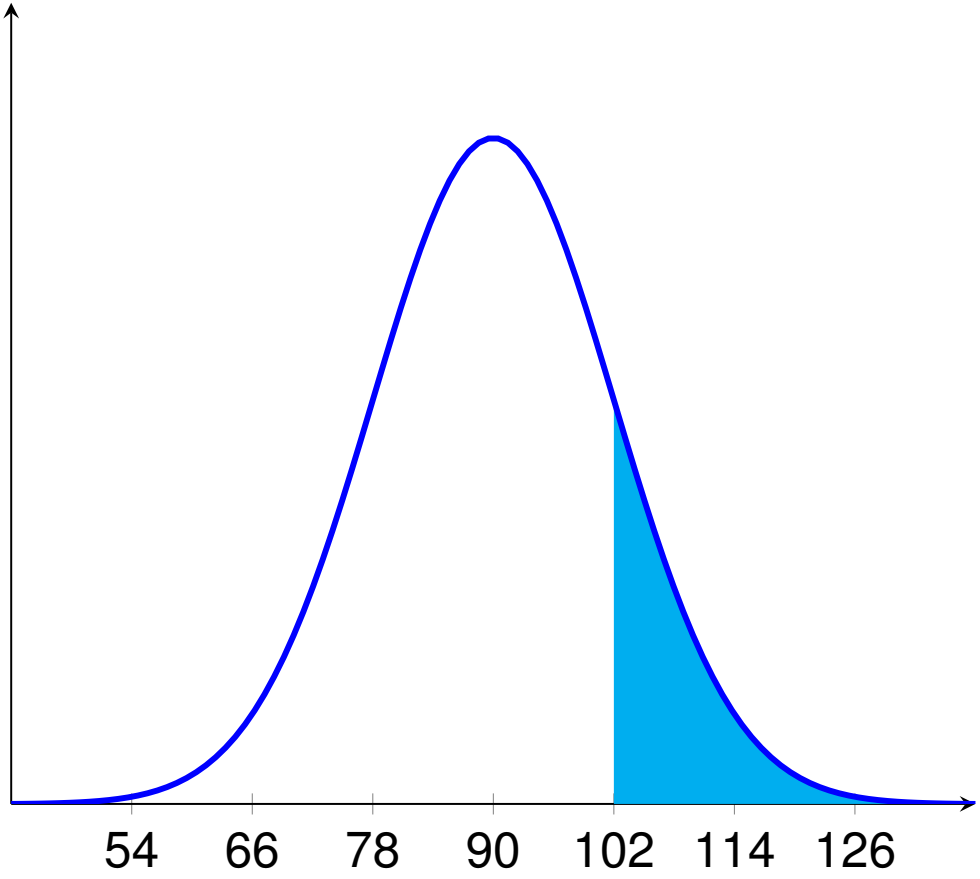
(A) 99 and 101
(B) -80 and 120
(C) 80 and 120
(D) 60 and 140

In the following normal distribution we have $\mu = 90$ and $\sigma = 12$.
What is the approximate percent of the data that is either greater than 102 or less than 78?



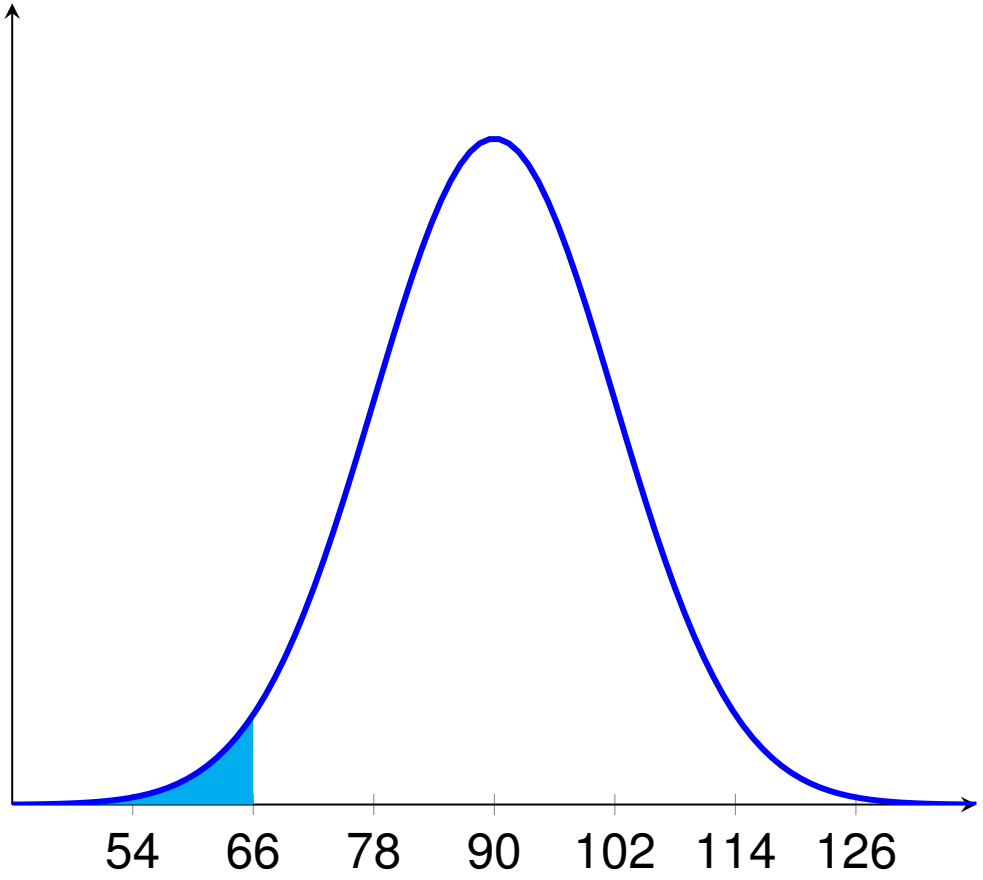
(A) 68%
(B) 95%
(C) 32%
(D) 5%
(E) Not enough information

In the following normal distribution we have $\mu = 90$ and $\sigma = 12$.
What is the approximate percent of the data that is greater than 102?



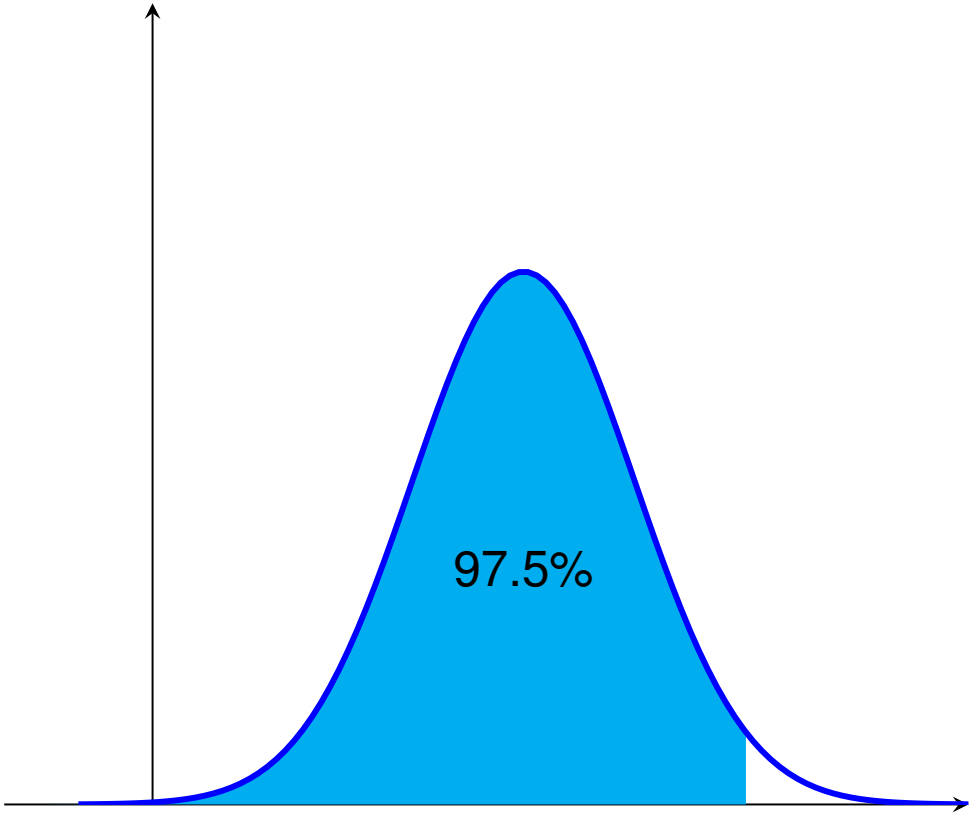
(A) 32%
(B) 68%
(C) 16%
(D) 5%
(E) Not enough information

In the following normal distribution we have $\mu = 90$ and $\sigma = 12$.
What is the approximate percent of the data that is less than 66?



(A) 95%
(B) 5%
(C) 2.5%
(D) 10%
(E) Not enough information

In the following normal distribution we have $\mu = 5$ and $\sigma =$??.
If 97.5% of the data falls below 8 then what is the approximate standard deviation for the distribution?



(A) $\sigma \approx 1$
(B) $\sigma \approx 1.5$
(C) $\sigma \approx 2$
(D) $\sigma \approx 2.5$
(E) $\sigma \approx 3$

Definition: z Score

The z **score** for a value from a normal distribution is the number of standard deviations the value is away from the mean. Mathematically,

$$z = \frac{x - \mu}{\sigma}.$$

In a normal distribution with mean $\mu = 6$ and standard deviation $\sigma = 2$, what is the z score for $x = 5.5$?

(A) $z = -0.5$

(B) $z = -0.25$

(C) $z = 0.5$

(D) $z = 0.25$

Discussion: What does the sign of the z score mean about the data point?
Draw the associated normal distribution plot.

A number 1.5 standard deviations below the mean has a z score of

(A) 1.5

(B) -1.5

(C) 3

(D) -3

(E) not enough information

Draw the associated normal distribution plot.

Excel With Normal Distributions: Given Score Find Area

Mathematical Question	Excel Command
Prob. getting less than x	`=NORM.DIST(`x`,mean,stdev,1)`
Prob. getting greater than x	`=1-NORM.DIST(`x`,mean,stdev,1)`
Prob. getting exactly x	not possible

The distribution of heights of American women aged 18 to 24 is approximately normally distributed with a mean of 65.5 inches and a standard deviation of 2.5 inches. What percent of these women is less than 5'8" (68 inches)?

(A) $P(x < 68) \approx 0.841$

(B) $P(x < 68) \approx 0.159$

(C) $P(x < 68) \approx 0.097$

(D) $P(x < 68) \approx 0.903$

Draw the associated normal distribution plot.

Excel With Normal Distributions: Given Score Find Area

Mathematical Question	Excel Command
Prob. getting less than x	`=NORM.DIST(`x`,mean,stdev,1)`
Prob. getting greater than x	`=1-NORM.DIST(`x`,mean,stdev,1)`
Prob. getting exactly x	not possible

The distribution of heights of American women aged 18 to 24 is approximately normally distributed with a mean of 65.5 inches and a standard deviation of 2.5 inches. What percent of these women is greater than 5'8" (68 inches)?

(A) $P(x > 68) \approx 0.841$

(B) $P(x > 68) \approx 0.159$

(C) $P(x > 68) \approx 0.097$

(D) $P(x > 68) \approx 0.903$

Draw the associated normal distribution plot.

Excel With Normal Distributions: Given Area Find Score

Mathematical Question	Excel Command
Prob. getting less than x is P. Find x	`=NORM.INV(P,mean,stdev)`
Prob. getting greater than x is P. Find x	`=NORM.INV(1-P,mean,stdev)`

A group of students at Carroll takes a statistics quiz. The distribution is normal with a mean of 25 and a standard deviation of 4. Everyone who scores in the top 30% of the distribution gets a certificate. What is the lowest score someone can get and still earn a certificate?

(A) 29

(B) 25

(C) 27

(D) 23

Draw the associated normal distribution plot.

Excel With Normal Distributions: Given Area Find Score

Mathematical Question	Excel Command
Prob. getting less than x is P. Find x	`=NORM.INV(P,mean,stdev)`
Prob. getting greater than x is P. Find x	`=NORM.INV(1-P,mean,stdev)`

A group of students at Carroll takes a statistics quiz. The distribution is normal with a mean of 25 and a standard deviation of 4. The top 5% of the scores get to compete in a statewide statistics contest. What is the lowest score someone can get and still go on to compete with the rest of the state?

(A) 31

(B) 32

(C) 18

(D) 19

Draw the associated normal distribution plot.

Assume a normal distribution with a mean of 70 and a standard deviation of 12. What limits would include the middle 65% of the cases?

(A) Bottom Score = `norm.inv(58,70,12)`,
Top Score = `norm.inv(82,70,12)`

(B) Bottom Score = `norm.inv(5,70,12)`,
Top Score = `norm.inv(135,70,12)`

(C) Bottom Score = `norm.inv(.175,70,12)`,
Top Score = `norm.inv(.825,70,12)`

(D) Bottom Score = `norm.inv(.475,70,12)`,
Top Score = `norm.inv(.975,70,12)`

(E) not enough information

Draw the associated normal distribution plot.