TASC Mathematics - Statistics & Probability Content Emphases

Approximately 12% of the Math on the TASC is Statistics and Probability.

The following pages list the Statistics and Probability standards assessed on the TASC and a sample question for each standard[1]. Also noted is whether each standard is a high, medium or low emphasis topic on the TASC.

The statistics and probability standards are divided up into the following three sub-domains:

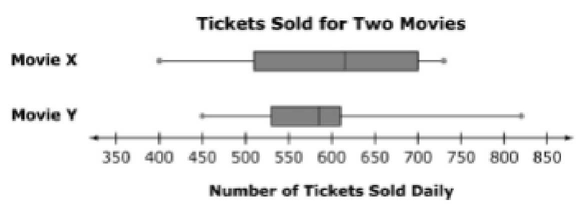
- Interpreting Categorical and Quantitative Data (6 standards) – 6%
- Making Inferences and Justifying Conclusions (1 standard) – 3%
- Conditional Probability and the Rules of Probability (3 standards)[2] – 3%

Interpreting Categorical and Quantitative Data – 6%

Represent data with plots on a real number line (dot plots, histograms, and box plots). (Medium Emphasis)

Sample Items

A movie theater recorded the number of tickets sold for two movies each day during one week. Box plots of the data are shown.



Based on the box plots, which of these statements is not true?

A. On at least one day, Movie X sold fewer tickets than Movie Y.
B. On at least one day, more tickets were sold for Movie Y than for Movie X.
C. The median number of tickets sold daily is greater for Movie X than for Movie Y.
D. There is a greater range in the number of tickets sold daily for Movie X than for Movie Y. (Correct response)

Having students write their own true and false statements and discussing each other's statements will help them evaluate graphs and answer questions like these.

As with the sample item shown above, problems will always be in a context and be accompanied by a diagram or graph. This sample item uses a box plot. Dot plots and histograms are also possible. Note that no calculations are required. Questions assessing this standard may also take the form of "Which dot plot/histogram/box plot represents this situation?" For these questions, students will have to choose from a selection of graphs. It will help if students have experience creating their own histograms/dot plots/box plots.

[1] The sample questions are taken from the TASC Item Specifications made available by DRC/CTB. http://www.acces.nysed.gov/common/acces/files/hse/tasc_2016_item_specifications_mathematics_may2016.pdf

[2] All three standards assessed in Conditional Probability and the Rules of Probability are low emphasis.

Interpret differences *in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).* (Medium Emphasis)

Sample Question Stems:

- Which pair of data sets have the same median/mean but a different range?
- Which data set has the greatest variance?

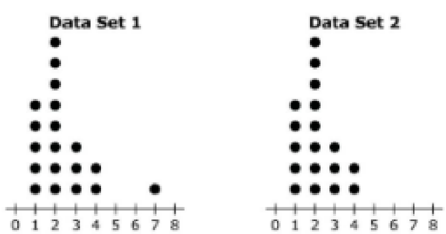
Sample Items:

1. A car dealership has 46 cars for sale. The least expensive car costs $10,959. The most expensive car costs $21,250. The mean sales price for the 46 cars is $17,450. Another car, priced at $32,675, is added to the dealership's inventory.

   Which two statistical measures will not necessarily increase? Select two responses.

   A. mean
   B. median (Correct response)
   C. mode (Correct response)
   D. range
   E. standard deviation

2. The frequency distributions of two data sets are shown in the dot plots.



   Which statement is true for these data sets?

   A. The mean of the data sets is equal, and the median of Set 1 is greater than Set 2.
   B. The mean of the data sets is equal, and the median of Set 2 is greater than Set 1.
   C. The median of the data sets is equal, and the mean of Set 1 is greater than Set 2. (Correct response)
   D. The median of the data sets is equal, and the mean of Set 2 is greater than Set 1.

Note again that students have to determine whether statements are "true" or "false" based on data in a graph.

Center refers to measures of central tendency like arithmetic mean, median, mode. Shape refers to what the data looks like in visual representations (a histogram, dot plot, or box plot). Spread refers to measures like range.

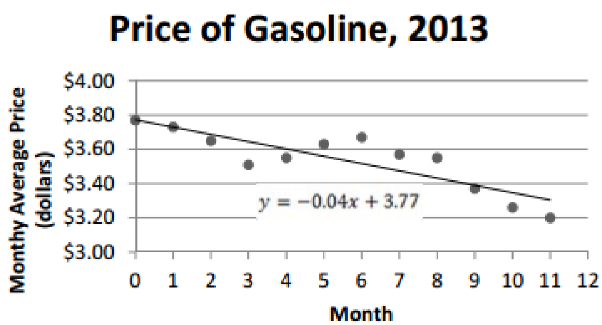
Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
(Medium Emphasis)

Students should be able to explain the meaning of slope and y-intercept in terms of the units stated in the data and the context of a given situation. Questions assessing this standard often take the form of "What is the slope/y-intercept of the trend line?" or "What does the slope/y-intercept of the trend line mean in the context of this situation?"

<u>Sample Item:</u>

As shown in the table, the trend line, $y = -0.04x + 3.77$, is a linear model of the price of gasoline for this time period.

- *x* is the month after January 2013.
- *y* is the monthly average price of a gallon of gasoline in dollars.



What does the value 3.77 mean in the context of this graph?

A. The price of gasoline averaged $3.77 in 2013.
B. The price of gasoline decreased about $3.77 during 2013.
C. The price of gasoline was about $3.77 at the beginning of 2013. (Correct response)
D. The price of gasoline was predicted to be about $3.77 at the end of 2013.

For the problem shown above, students need to understand the elements of a function (both written as a rule and shown as a graph) and how those elements connect to a real-life situation. To answer the question above, students need to know what the 3.77 means, both in terms of function notation and in terms of the price of gasoline. Also note, again no calculations are required.

Similar to the sample item shown above, questions assessing this standard will always be in a context and be accompanied by a scatter plot with a trend line. Please note, three other standards that relate to rate of change/slope can be found in the Function standards[3]. Questions assessing those standards will not necessarily contain a trend line or scatterplot.

[3] See CUNY's TASC Mathematics - Functions Content Emphases and Sample Items

Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. (Medium Emphasis)

Students should to read and interpret data displayed in a two-way table. They will need to be able to identify a summary of data displayed in a two-way frequency table. Students will need to describe patterns observed in the data.

Sample Item Stems:

- What is the relative frequency of…?
- What is the relationship between adults who liked the movie and children who liked the movie?

Sample Item:

The table shows the number of students in an area who use corrective eyewear.

Age	Uses only prescription glasses	Uses contact lenses
Less than 10	13	2
10–13	33	6
14–17	38	18

To the nearest hundredth, what is the relative frequency of students who use only prescription glasses?

(Correct response: 0.76)

A two-way table is a visual representation of relationships between two sets of categorical data. In the item above the table represents the relationship between the different ages of the students and the students who wear glasses versus those who wear contacts.
Relative frequency is the number of times a particular result comes up compared to the larger set of data. Relative frequency can found by calculating how often something happens and dividing it by the total number of possibilities. For the item above, 110 students of all ages use glasses or contacts. Eighty-four students wear only prescription glasses. 84 divided by 110 is .76.

Students can benefit from creating surveys in class, gathering data from each other, and determining the relative frequencies of various results of the data. For example:

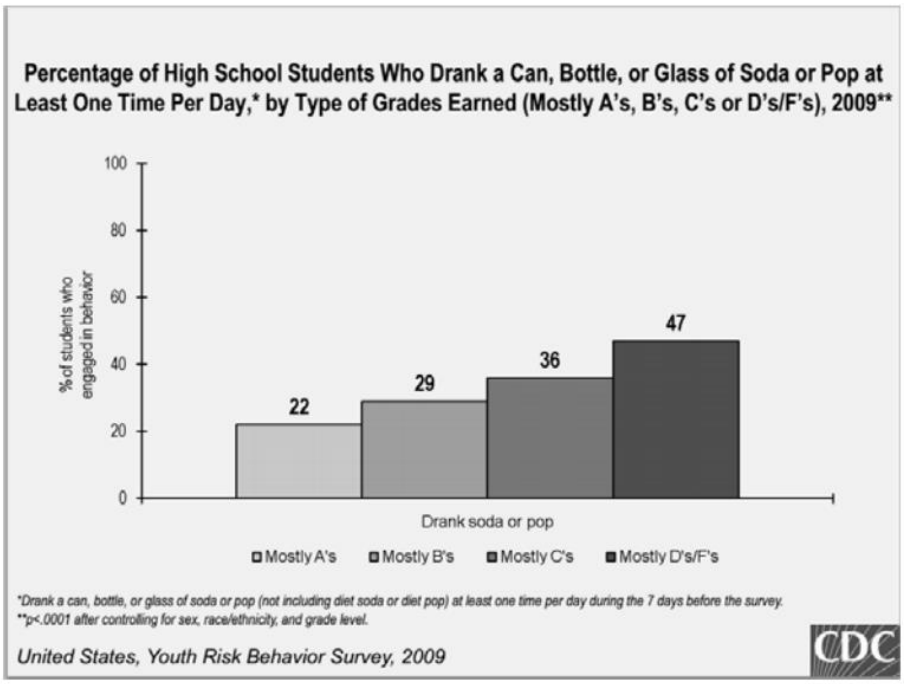
	Get to school by subway	Get to school by Bus	Walk to School	Other
Morning Students				
Evening Students				

Distinguish between correlation and causation. (Medium Emphasis)

Students may have to distinguish between correlation and causation in presented contexts. A common question stem assessing this standard may ask students, "Which conclusion can be drawn from this data?"

<u>Sample Item</u>:

The Centers for Disease Control and Prevention (CDC) has provided a graph that groups students by the grades they earned. It shows the percentage of high school students in each group who drank soda at least one time per day.



Which conclusion can be drawn about the relationship between drinking soda and getting poor grades?

A. Drinking soda causes students to earn poor grades.
B. Getting poor grades more likely causes students to drink soda.
C. There is a correlation between drinking soda and earning poor grades. (Correct response)
D. There is no relationship between drinking soda and earning poor grades.

In 1955 there was a movement to ban the sales of ice cream in the US[4]. At the height of the polio scare, people noticed that as the sales of ice cream increased, the number of cases of polio increased as well. They assumed it was a matter of causation (cause and effect), that the increase in cases of the disease were a result of the increase in ice cream sales. In reality, it was a matter of correlation – ice cream sales and cases of polio are related in that they both went up in the summer, but one did not cause the other. In the sample item above, there is some relationship between soda consumption and grades but this does not show causation.

[4] Here is a brief video on Youtube describing the polio/ice cream example: www.bit.ly/correlationvscausation

Making Inferences and Justifying Conclusions – 3%

Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. (Medium Emphasis)

Students may have to demonstrate an understanding that statistics involves conclusions about a population based on the results obtained from a random sample of the population. Questions assessing this standard often take the form of "Which sample will best represent the population?" or "Which conclusion can be drawn from this sample?"

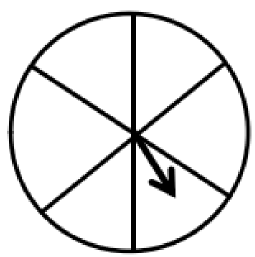
Sample Items:

1. From a group of 12 employees, 3 workers are to be randomly selected to serve on a safety advisory panel.

   Which sampling method is most likely to result in a random sample?

   A. Consult with the accounting office, and then select the first three names on the payroll.
   B. Send the employees home, and then select the first three who come to work in the morning.
   C. Place the names of the employees in a hat, mix them thoroughly, and select three names from the mix. (Correct response)
   D. Ask the group for volunteers, create a list, and alphabetically select the first three workers who volunteer.

2. The illustration shows a game in which a person spins the arrow and wins one of six prizes based on where the arrow stops. Each segment of the circle in the game is the same size.



   Which statement illustrates that winning any one of the prizes is the result of random selection?

   A. During the first six spins of the game, each prize will be awarded.
   B. Over time, one of the six prizes will be awarded more than the others.
   C. If one prize is awarded six times in a row, it will not be awarded on the next spin.
   D. As more people play the game, the same number of each prize will be awarded. (Correct response)

Sample Item #2 above resembles a question about probability, but note that the student analysis of the statements focuses on the concept of random selection.

3. A medical researcher is selecting participants for a study on the effects of a drug on memory. She is separating the participants into two groups. The first group will receive the drug and the second group will receive a placebo.

Which of these is a good method for ensuring a random selection of participants in each group?

A. The participants should be selected based on their age.
B. The group selections should be made by selecting names out of a hat. (Correct response)
C. The men should be in one group and the women should be in the other.
D. The participants should be allowed to choose which group they want to be in.

As with the sample items above, the TASC questions assessing this standard will likely:

- use possible data-generating processes including (but are not limited to) flipping coins, spinners, rolling dice (called number cubes) and using situation with random number generators.
- require students to be able to explain how randomization relates to sample surveys, experiments, and observational studies.
- be in a context familiar to adults.

<u>Conditional Probability and the Rules of Probability – 3%</u>

*Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), **identify the outcomes** in the sample space which compose the event.* (Low Emphasis)

Students may have to use probability and sample spaces to describe and interpret events. They should be able to determine whether two events are independent, and justify the conclusion.

Questions assessing this standard often take the form of "How many possible outcomes are there…? Or "Given the sample space listed, how many ways are there to get…?"

<u>Sample Item</u>:

How many possible outcomes are there if two six-sided number cubes are tossed?

(Correct response: 36)

*Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to **determine probabilities of events**. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* (Low Emphasis)

Students should be able to recognize and explain probabilities, using everyday language and situations.

<u>Sample Question Stems</u>[5]:

- There are 8 boys and 6 girls in a class. When a student is selected at random, what is the probability that the student is a girl?
- Based on the spinner shown, what is the probability of the spinner landing on blue?

If students see a problem assessing this standard, it will be in a real-world context and they will be given a table or a diagram. The two standards on this page

[5] No Sample Item is available beyond the two question stems provided without required stimulus (a table or diagram)

Understand that, just as with simple events, the probability of a ***compound event*** *is the fraction of outcomes in the sample space for which the compound event occurs.* (Low Emphasis)

Students may have to find compound probabilities and interpret their answers. The compound events may be two separate simple events (independent) or dependent events. If the compound events are related events ("no replacement"), the sample size will be limited to what students can solve the problem by creating lists or diagrams.

Sample Question Stems (these questions are models. Students would need a stimulus and/or more information to answer them):

- What is the probability of getting heads and rolling a five?
- When two students are selected at random, what is the probability that one is a man and that the other is a woman?

Sample Items:

Luke polled the students in his English class to see whether they read a book or watched TV the night before. He put the results in this table.

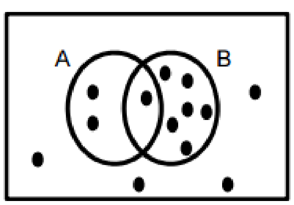
1.

	Read a book	Did not read a book
Watched TV	**12**	**8**
Did not watch TV	**7**	**3**

What is the probability that a student who read a book did <u>not</u> watch TV the night before?

(Correct response: 7/19)

2. Look at the Venn Diagram.



What is the probability of Event A or Event B occurring?

(Correct response: $\frac{9}{13}$)

Changes to Probability content on the TASC

Earlier versions of the TASC had six additional standards on probability. Reflecting that content, earlier versions of the TASC Math Reference sheet contained the set of formulas for probability seen below.

The TASC Math Reference Sheet for the current forms of the test (Forms G,H and I) contains no probability formulas. There are now only three standards for probability (as opposed to nine). The formulas below (and standards that they were connected to) were determined to be beyond the scope of what students need to do to earn their high school equivalency diplomas. TASC math problems will no longer assess students' ability to remember or use these formulas or to understand the mathematics behind them.

Probability

Permutations: ${}_nP_r = \frac{n!}{(n-r)!}$

Combinations: ${}_nC_r = \frac{n!}{(n-r)!r!}$

Multiplication rule (independent events): *P*(*A* and *B*) = *P*(*A*) · *P*(*B*)

Multiplication rule (general): *P*(*A* and *B*) = *P*(*A*) · *P*(*B*|*A*)

Addition rule: *P*(*A* or *B*) = *P*(*A*) + *P*(*B*) – *P*(*A* and *B*)

Conditional Probability: $P(B|A) = \frac{P(A \text{ and } B)}{P(A)}$

Arithmetic Sequence: $a_n = a_1 + (n-1)d$ where a_n is the nth term, a_1 is the first term, and d is the common difference.

Geometric Sequence: $a_n = a_1 r^{(n-1)}$ where a_n is the nth term, a_1 is the first term, and r is the common ratio.

Additional Useful Vocabulary for Students to Know in Statistics and Probability[6]

- Correlation
- Causation
- Relative Frequency
- Mean (average)
- Median
- Range
- Trend line/Line of best fit
- Random sample/Population
- Sampling bias
- Dependent/Independent
- Compound Event

[6] According to the Examinee Guide to the Test Assessing Secondary Completion TASC Test Math Subtest