NAEP Released Items Aligned to the Iowa Core

7.SP.1 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.

Benita and Jeff each surveyed some of the students in their eighth-grade homerooms to determine whether chicken or hamburgers should be served at the class picnic. The survey forms are shown below.

Benita's Survey
Homeroom: 8-A
Number of Students in Homeroom: 23

| Student Surveyed | Chicken | Hamburger |
|---|---|---|
| Adam | ✓ | |
| Carlene | ✓ | |
| Nancy | ✓ | |
| Hugh | ✓ | |

Jeff's Survey
Homeroom: 8-B
Number of Students in Homeroom: 20

| Student Surveyed | Chicken | Hamburger |
|---|---|---|
| Becky | | ✓ |
| Tanya | ✓ | |
| Joe | ✓ | |
| Ben | | ✓ |
| Abby | | ✓ |
| Linc | ✓ | |
| Marian | | ✓ |
| Han | | ✓ |
| Chris | | ✓ |
| Tina | | ✓ |
| Nate | | ✓ |
| Darrell | | ✓ |

Benita reported that 100 percent of those in her survey wanted chicken. Jeff reported that 75 percent of those in his survey wanted hamburger.

Which survey, Benita's or Jeff's, would probably be better to use when making the decision about what to serve?

Explain why that survey would be better.

2007-8-9-11

Source: National Assessment of Educational Progress, 2007, Grade 8 Mathematics Assessment.

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A survey is to be taken in a city to determine the most popular sport. Would sampling opinions at a baseball game be a good way to collect this data? Explain your answer.

2011-8-8-4
2003-8-7-15

Source: National Assessment of Educational Progress, 2011 and 2003, Grade 8 Mathematics Assessment.

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A poll is being taken at Baker Junior High School to determine whether to change the school mascot. Which of the following would be the best place to find a sample of students to interview that would be most representative of the entire student body?

A. An algebra class
B. The cafeteria
C. The guidance office
D. A French class
E. The faculty room

1996-8-3-6

Source: National Assessment of Educational Progress, 1996, Grade 8 Mathematics Assessment.

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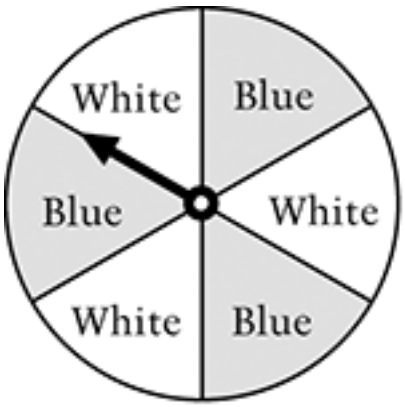
7.SP.2 Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.

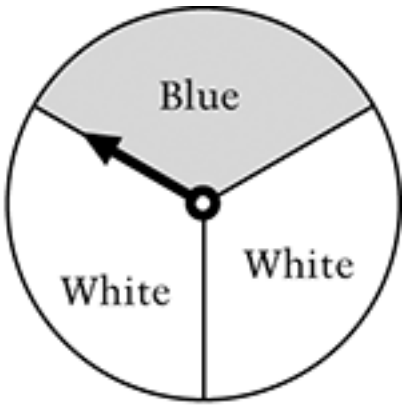
7.SP.3 Informally assess the degree of visual overlap of two numerical data distributions with similar variability's, measuring the difference between the centers by expressing it as a multiple of a measure of variability. For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.

7.SP.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.

7.SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.




Spinner A




Spinner B

Lori has a choice of two spinners. She wants the one that gives her a greater probability of landing on blue.

Which spinner should she choose?

○ Spinner A ○ Spinner B

Explain why the spinner you chose gives Lori the greater probability of landing on blue.

2011-4-9-15

Source: National Assessment of Educational Progress, 2011, Grade 4 Mathematics Assessment.

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Marty has 6 red pencils, 4 green pencils, and 5 blue pencils. If he picks out one pencil without looking, what is the probability that the pencil he picks will be green?

A. 1 out of 3
B. 1 out of 4
C. 1 out of 15
D. 4 out of 15

2011-4-5-10

Source: National Assessment of Educational Progress, 2011, Grade 4 Mathematics Assessment.

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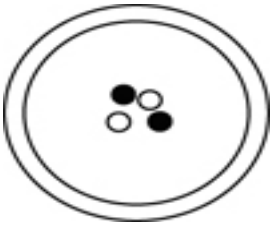
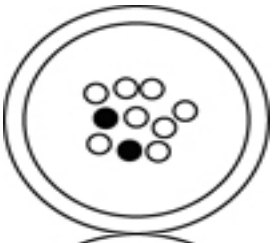
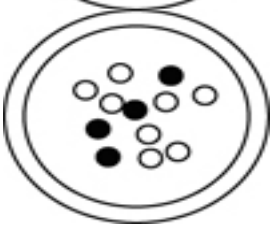
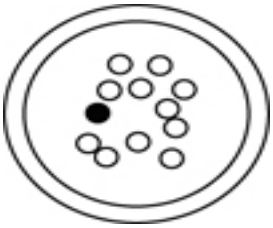
A person is going to pick one marble without looking. For which dish is there the greatest probability of picking a black marble?

A. 

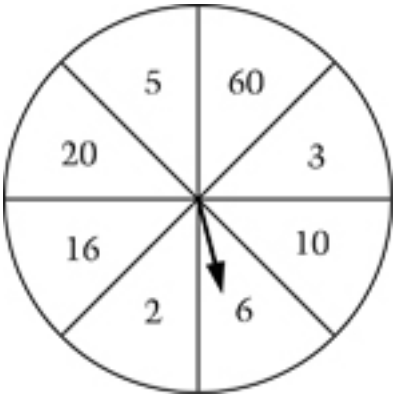
B. 

C. 

D. 

2007-4-7-7

Source: National Assessment of Educational Progress, 2007, Grade 4 Mathematics Assessment.




If the arrow is spun and stops in one of the 8 spaces, what is the probability that the arrow will stop in the space labeled 6?

A. 1 out of 6
B. 1 out of 8
C. 1 out of 10
D. 1 out of 60

2007-4-9-10

Source: National Assessment of Educational Progress, 2007, Grade 4 Mathematics Assessment.

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In a gumball machine there are 100 red, 75 blue, 50 green, and 125 yellow gumballs. These 350 gumballs are mixed up. Sam puts money in and one gumball comes out. Which color is most likely to come out?

A. Red
B. Blue
C. Green
D. Yellow

2005-4-12-10

Source: National Assessment of Educational Progress, 2005, Grade 4 Mathematics Assessment.

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The balls in this picture are placed in a box and a child picks one without looking. What is the probability that the ball picked will be the one with dots?

A. 1 out of 4
B. 1 out of 3
C. 1 out of 2
D. 3 out of 4

2003-4-7-10

Source: National Assessment of Educational Progress, 2003, Grade 4 Mathematics Assessment.

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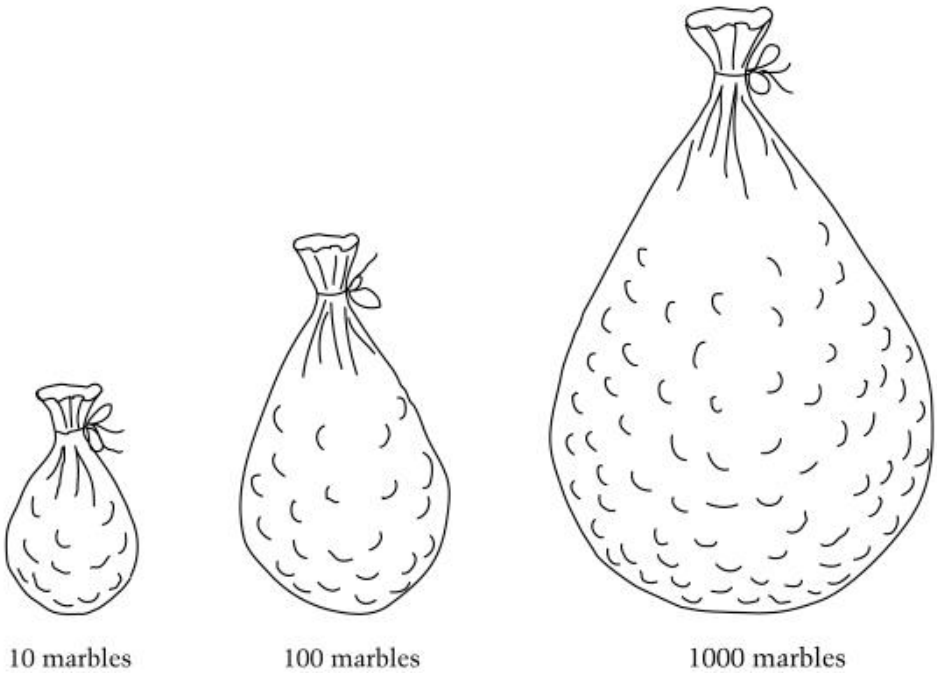
There is only one red marble in each of the bags shown below. Without looking, you are to pick a marble out of one of the bags. Which bag would give you the greatest chance of picking the red marble?




A. Bag with 10 marbles
B. Bag with 100 marbles
C. Bag with 1000 marbles
D. It makes no difference

2003-4-10-16

Source: National Assessment of Educational Progress, 2003, Grade 4 Mathematics Assessment.

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There are 3 fifth graders and 2 sixth graders on the swim team. Everyone's name is put in a hat and the captain is chosen by picking one name. What are the chances that the captain will be a fifth grader?

A. l out of 5
B. l out of 3
C. 3 out of 5
D. 2 out of 3

1996-4-9-9

Source: National Assessment of Educational Progress, 1996, Grade 4 Mathematics Assessment.

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| Stickers | Number |
|---|---|
| Red | \|\|\| |
| Blue | \|\|\|\| |
| Yellow | \|\| |
| Green | 𝍸 \|\| |

The 16 stickers listed above are placed in a box. If one sticker is drawn from the box, which color is it most likely to be?

A. Red
B. Blue
C. Yellow
D. Green

1990-4-7-4

Source: National Assessment of Educational Progress, 1990, Grade 4 Mathematics Assessment.

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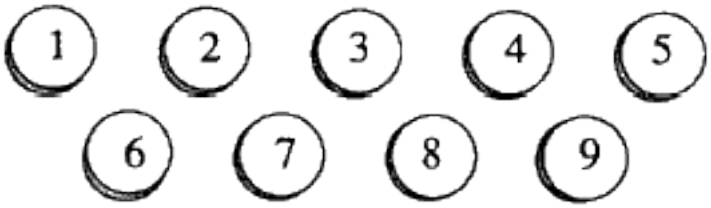


The nine chips shown above are placed in a sack and then mixed up. Madeline draws one chip from this sack. What is the probability that Madeline draws a chip with an even number?

A. $\frac{1}{9}$

B. $\frac{2}{9}$

C. $\frac{4}{9}$

D. $\frac{1}{2}$

E. $\frac{4}{5}$

1990-8-7-8
1990-12-7-8

Source: National Assessment of Educational Progress, 1990, Grade 8 Mathematics Assessment.

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There are 15 girls and 11 boys in a mathematics class. If a student is selected at random to run an errand, what is the probability that a boy will be selected?

A. $\frac{4}{26}$

B. $\frac{11}{26}$

C. $\frac{15}{26}$

D. $\frac{11}{15}$

E. $\frac{15}{11}$

1990-8-7-18

Source: National Assessment of Educational Progress, 1990, Grade 8 Mathematics Assessment.

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7.SP.6 Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.

A quarter is flipped 50 times. Which of the following is most likely to be the number of times heads comes up?

A. 2
B. 3
C. 11
D. 26
E. 50

2008-13-21-19
2008-17-21-19

Source: National Assessment of Educational Progress, 2008, age 13 and Age 17 Mathematics Assessments.

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RESULTS

| | |
|---|---|
| $G$ | 157 |
| $Y$ | 352 |
| $R$ | 491 |

2. Jerry spun one of the spinners below 1,000 times and obtained the results shown in the table above. Which spinner did Jerry probably use?

A.


B.


C.


D.

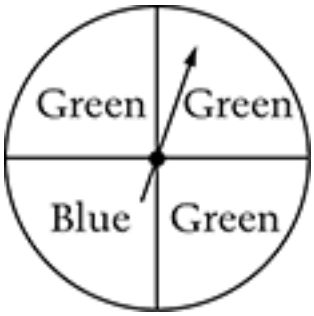

E.


2005-12-3-7

Source: National Assessment of Educational Progress, 2005, Grade 12 Mathematics Assessment.

7.SP.7 Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

a. 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.
b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?




Ms. Livingston's class spins the arrow on the spinner 92 times. Of the following, which is the most likely result?

A. 66 green, 26 blue
B. 46 green, 46 blue
C. 23 green, 69 blue
D. 2 green, 90 blue

2011-4-8-6

Source: National Assessment of Educational Progress, 2011, Grade 4 Mathematics Assessment.

| | | |
|---|---|---|
| 6 | 2 | 8 |

The three digits above can be used to make 6 different 3-digit numbers.
If one of the 3-digit numbers is picked at random, what are the chances that it will be an odd number?

A. Impossible
B. Possible but not very likely
C. Very likely but not certain
D. Certain

2011-4-12-5

Source: National Assessment of Educational Progress, 2011, Grade 4 Mathematics Assessment.

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| | | |
|---|---|---|
| Kara | Paula | Caitlyn |
| Pablo | Peter | Janet |
| Tanisha | Clara | Bill |
| | Matt | |

One student will be chosen at random from the list above. What is the probability that the student's name begins with the letter *P*?

A. 1 out of 3
B. 1 out of 10
C. 3 out of 7
D. 3 out of 10

2009-4-10-5

Source: National Assessment of Educational Progress, 2009, Grade 4 Mathematics Assessment.

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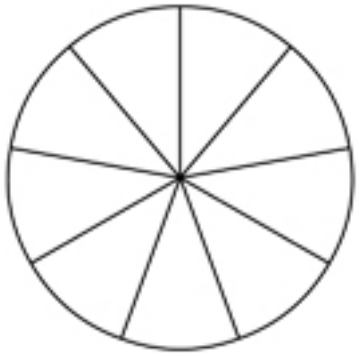
Luis wants to make a game spinner in which the chance of landing on blue will be twice the chance of landing on red. He is going to label each section either red (R) or blue (B).Show how he could label his spinner.



Number of blues: _____

Number of reds: _____

Explain how you found your answer.

2007-4-9-20

Source: National Assessment of Educational Progress, 2007, Grade 4 Mathematics Assessment.

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There are 6 cubes of the same size in a jar.

2 cubes are yellow.
3 cubes are red.
1 cube is blue.

Chuck is going to pick one cube without looking. Which color is he most likely to pick?

What is the probability of this color being picked?

2007-4-11-16

Source: National Assessment of Educational Progress, 2007, Grade 4 Mathematics Assessment.

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A pencil, 2 pens, and a marker are in a drawer. Leah picks one of these without looking. What are her chances of picking out the pencil?

A. 1 out of 1
B. 1 out of 2
C. 1 out of 3
D. 1 out of 4

2008-9-21-21

Source: National Assessment of Educational Progress, 2008, Age 9 Mathematics Assessment.

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Ken has a box that contains 12 marbles. The table below shows the number of marbles of each color that are in the box.

| Color | Number of Marbles |
|---|---|
| Yellow | 5 |
| Green | 3 |
| Orange | 2 |
| Blue | 2 |

Ken randomly selects 2 marbles from the box and keeps them. If Ken then randomly selects a third marble from the box, the probability that he will select a green marble is $\frac{2}{10}$. Which of the following statements could be true about the first 2 marbles Ken selected?

A. One was yellow and one was green.
B. One was orange and one was yellow.
C. One was orange and one was blue.
D. Both were green.
E. Both were yellow.

2011-8-8-4

Source: National Assessment of Educational Progress, 2011, Grade 8 Mathematics Assessment.

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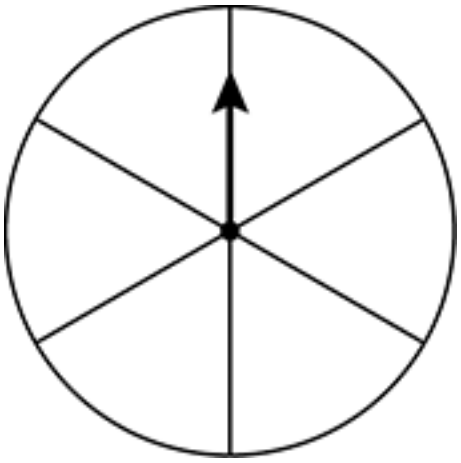
The circular spinner shown below is divided into 6 congruent sectors. The sectors are yellow or blue.



Label each of the sectors either yellow (Y) or blue (B) so that the probability of spinning the arrow once and landing on yellow is $\frac{1}{3}$.

2011-8-9-5

Source: National Assessment of Educational Progress, 2011, Grade 8 Mathematics Assessment.

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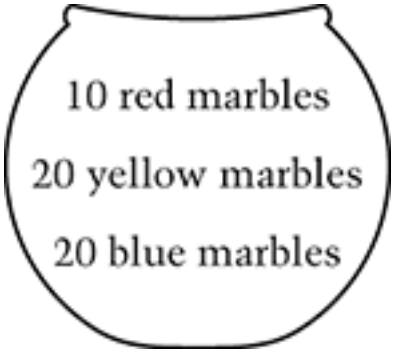


The bowl above contains the indicated number of marbles. The marbles are well mixed in this bowl. Juan will randomly pick a marble from the bowl. Juan believes that his chance of picking a blue marble is the same as his chance of picking a yellow marble. Is Juan correct?

Fill in the correct oval below.

◯ Yes ◯ No

Explain your answer.

2011-8-12-6

Source: National Assessment of Educational Progress, 2011, Grade 8 Mathematics Assessment.

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Each of the 6 faces of a fair cube is painted red, yellow, or blue. This cube is rolled 500 times. The table below shows the number of times each color landed faced up.

| Color | Red | Yellow | Blue |
|---|---|---|---|
| Total | 100 | 340 | 60 |

Based on these results, what is the most likely number of yellow faces on the cube?

A. One
B. Two
C. Three
D. Four
E. Six

2011-8-12-6

Source: National Assessment of Educational Progress, 2011, Grade 8 Mathematics Assessment.

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| | | |
|---|---|---|
| (1, 1) | (2, 1) | (3, 1) |
| (1, 2) | (2, 2) | (3, 2) |
| (1, 3) | (2, 3) | (3, 3) |

A pair of numbers will be chosen at random from the list above. What is the probability that the first number in the pair will be less than the second number in the pair?

2007-8-9-3

Source: National Assessment of Educational Progress, 2007, Grade 8 Mathematics Assessment.

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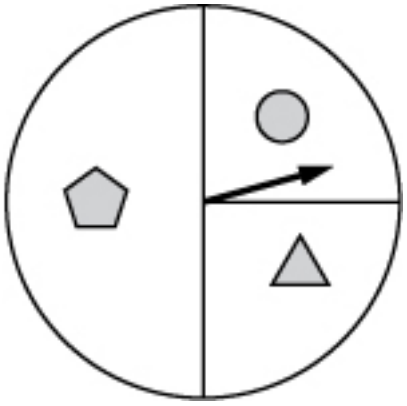

If Rose spins a spinner like the one above 300 times, about how many times should she expect it to land on the space with a circle?

F. 75
G. 90
H. 100
I. 120
J. 150

2007-8-11-14

Source: National Assessment of Educational Progress, 2007, Grade 8 Mathematics Assessment.

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Each of the 6 faces of a certain cube is labeled either R or S. When the cube is tossed,the probability of the cube landing with an R face up is $\frac{1}{3}$.

How many faces are labeled R?

A. Five
B. Four
C. Three
D. Two
E. One

2005-8-4-19

Source: National Assessment of Educational Progress, 2005, Grade 8 Mathematics Assessment.

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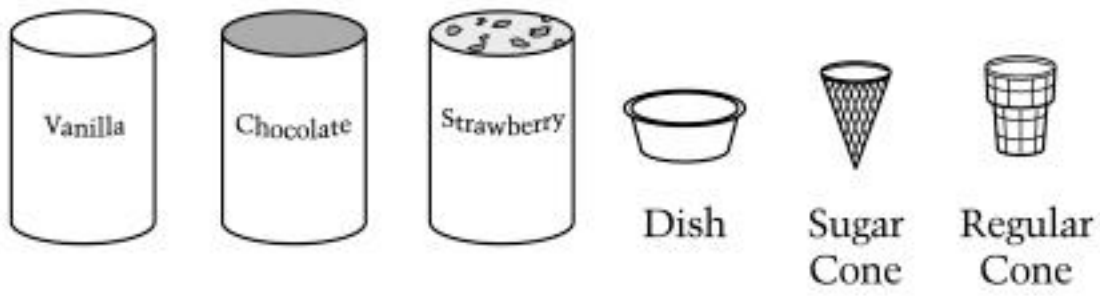
7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

a. 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.
b. 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.
c. Design and use a simulation to generate frequencies for compound events. For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?




Jan's Snack Shop has 3 flavors of ice cream—vanilla, chocolate, and strawberry.
The ice cream can be served in a dish, a sugar cone, or a regular cone.

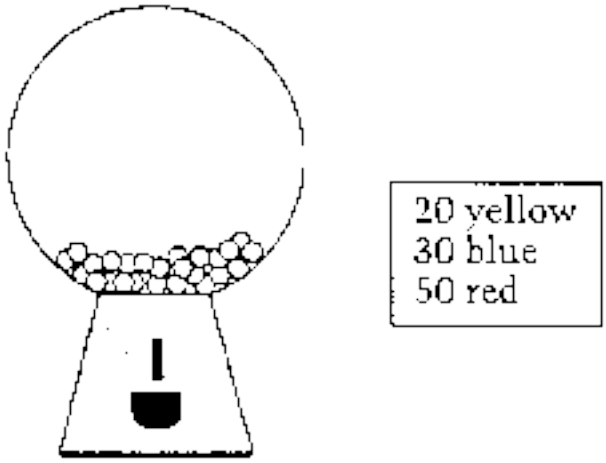
There are 9 people who choose 1 dip of ice cream in a dish, or in a sugar cone, or in a regular cone, and all of their choices are different. List or show the 9 different choices.

Could another person have a choice that is different from one of these 9 choices? Why or why not?

2003-4-10-17

Source: National Assessment of Educational Progress, 2003, Grade 4 Mathematics Assessment.

Think carefully about the following question. Write a complete answer. You may use drawings, words, and numbers to explain your answer. Be sure to show all of your work.




The gum ball machine has 100 gum balls; 20 are yellow, 30 are blue, and 50 are red. The gum balls are well mixed inside the machine. Jenny gets 10 gum balls from this machine.

What is your best prediction of the number that will be red? _____ gum balls

Explain why you chose this number.

1996-4-12-9

Source: National Assessment of Educational Progress, 1996, Grade 4 Mathematics Assessment.

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Steve was asked to pick two marbles from a bag of yellow marbles and blue marbles. One possible result was one yellow marble first and one blue marble second. He wrote this result in the table below. List all of the other possible results that Steve could get.

y stands for one yellow marble.
b stands for one blue marble.

| First Marble | Second Marble |
|---|---|
| y | b |

1992-4-7-9
1992-8-7-9

Source: National Assessment of Educational Progress, 1992, Grade 4 and Grade 8 Mathematics Assessments.

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This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it and understand your thinking. It is important that you show all your work.

Treena won a 7-day scholarship worth $1,000 to the Pro Shot Basketball Camp. Round-trip travel expenses to the camp are $335 by air or $125 by train. At the camp she must choose between a week of individual instruction at $60 per day or a week of group instruction at $40 per day. Treena's food and other expenses are fixed at $45 per day. If she does not plan to spend any money other than the scholarship, what are all choices of travel and instruction plans that she could afford to make? Explain your reasoning.

1992-8-14-9

Source: National Assessment of Educational Progress, 1992, Grade 8 Mathematics Assessment.

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How many different three-digit whole numbers can be written using each of the digits 4, 5, and 6 exactly once?

A. 3
B. 6
C. 9
D. 24
E. 27

2011-8-9-6

Source: National Assessment of Educational Progress, 2011, Grade 8 Mathematics Assessment.

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Leroy has one quarter, one dime, one nickel, and one penny. Two of the coins are in his left pocket and the other two coins are in his right pocket. The coins have been randomly placed in the two pockets.

What is the probability that Leroy will be able to purchase a 30-cent candy bar with the two coins in his left pocket?

Using the coins, explain your reasoning.

2011-8-5-18

Source: National Assessment of Educational Progress, 2011, Grade 8 Mathematics Assessment.

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Li's English book weighs 3 pounds, her math book weighs 5 pounds, her history book weighs 4 pounds, and her science book weighs 6 pounds. How many different combinations of one or more books can Li pack in her backpack so that the total weight of the books is 12 pounds or less?

A. 9
B. 10
C. 11
D. 12
E. 18

2007-8-11-16

Source: National Assessment of Educational Progress, 2007, Grade 8 Mathematics Assessment.

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A package of candies contained only 10 red candies, 10 blue candies, and 10 green candies. Bill shook up the package, opened it, and started taking out one candy at a time and eating it. The first 2 candies he took out and ate were blue. Bill thinks the probability of getting a blue candy on his third try is $\frac{10}{30}$ or $\frac{1}{3}$.

Is Bill correct or incorrect?

Explain your answer.

2005-8-12-7

Source: National Assessment of Educational Progress, 2005, Grade 8 Mathematics Assessment.

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A box contains 3 chips numbered 1 through 3. One chip will be taken at random from the box and then put back into the box. Then a second chip will be taken from the box.

In the space provided below, list all possible pairs of chips.

| Number on First Chip | Number on Second Chip |
|---|---|

2003-8-6-25

Source: National Assessment of Educational Progress, 2003, Grade 8 Mathematics Assessment.

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A bag contains two red candies and one yellow candy. Kim takes out one candy and eats it, and then Jeff takes out one candy. For each sentence below, fill in the oval to indicate whether it is possible or not possible.

| Possible | Not Possible | |
|---|---|---|
| (A) | (B) | Kim's candy is red and Jeff's candy is red. |
| (A) | (B) | Kim's candy is red and Jeff's candy is yellow. |
| (A) | (B) | Kim's candy is yellow and Jeff's candy is red. |
| (A) | (B) | Kim's candy is yellow and Jeff's candy is yellow. |

1996-8-3-4

Source: National Assessment of Educational Progress, 1996, Grade 8 Mathematics Assessment.

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Suppose that square lunchroom trays are assembled using 4 smaller square pieces. Each piece is a single color. If the smaller pieces are available in red and green only, how many different colored patterns of trays can be made?

(Patterns of colors that result from rotating the tray, such as

| | |
|---|---|
| R | G |
| G | G |

and

| | |
|---|---|
| G | G |
| G | R |

, are not considered different.)

Illustrate below the different patterns corresponding to your answers.

2005-12-4-18

Source: National Assessment of Educational Progress, 2005, Grade 12 Mathematics Assessment.

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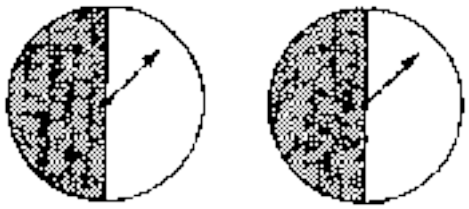

The two fair spinners shown above are part of a carnival game. A player wins a prize only when both arrows land on black after each spinner has been spun once.

James thinks he has a 50-50 chance of winning. Do you agree?

Ⓐ Yes Ⓑ No

Justify your answer.

1996-12-12-9

Source: National Assessment of Educational Progress, 1996, Grade 12 Mathematics Assessment.

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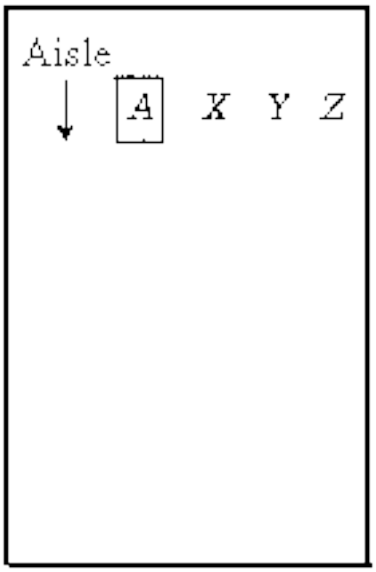
Four people - *A, X, Y,* and *Z* - go to a movie and sit in adjacent seats. If *A* sits in the aisle seat, list all possible arrangements of the other three people. One of the arrangements is shown below.




1996-12-13-6

Source: National Assessment of Educational Progress, 1996, Grade 12 Mathematics Assessment.

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A contractor is building 5 different model homes on 5 adjacent lots on one side of a street. If 1 house is to be built on each lot, how many different arrangements of the 5 houses are possible?

A. 120
B. 60
C. 25
D. 10
E. 5

1990-12-9-7

Source: National Assessment of Educational Progress, 1990, Grade 12 Mathematics Assessment.

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A fair coin is to be tossed three times. What is the probability that 2 heads and 1 tail in any order will come up?

1990-12-9-17

Source: National Assessment of Educational Progress, 1990, Grade 12 Mathematics Assessment.

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