ZEARN Math

MISSION OVERVIEW

GRADE 7

M8 Probability and Sampling

Introduction

In this Mission, students understand and use the terms “event,” “sample space,” “outcome,” “chance experiment,” “probability,” “simulation,” “random,” “sample,” “random sample,” “representative sample,” “overrepresented,” “underrepresented,” “population,” and “proportion.”

Overview of Topics and Lesson Objectives

Each mission is broken down into topics. A topic is a group of lessons that teach the same concept. There is a balance of Independent Digital Lessons and Concept Explorations in each topic of a mission to ensure every student learns with a mix of modalities, feedback, and support while engaging in grade-level content. Throughout each mission, students work on grade-level content with embedded remediation to address unfinished learnings.

	Objective	INDEPENDENT DIGITAL LESSON	CONCEPT EXPLORATION
Topic A	**Probabilities of Single Step Events**		
Lesson 1	Determine the likelihood of an event by using results from previous experiments.	✓	✓
Lesson 2	Describe the likelihood of events and order events from least likely to most likely.	✓	✓
Lesson 3	List the sample space of a chance experiment and calculate the probability of an event when all outcomes are equally likely.	✓	✓
Lesson 4	Generalize that the cumulative relative frequency approaches the probability of the event as an experiment is repeated many times.	✓	✓
Lesson 5	Use the results from a repeated experiment to estimate the probability of an event.	✓	✓
Lesson 6	Simulate real-world situations with simple experiments that reflect the probability of the actual event.	✓	✓
Topic B	**Probabilities of Multi-step Events**		
Lesson 7	Use a simulation to estimate the probability of a multi-step event.	✓	✓
Lesson 8	Find the sample space for multi-step experiments using tables, trees, and organized lists, and determine the total number of possible outcomes for a compound event.	✓	✓
Lesson 9	Use the sample space to calculate the probability of an event in a multi-step experiment.	✓	✓
Lesson 10	Design a multi-step experiment that could be used to simulate a compound event, and perform a simulation to estimate the probability of a compound event.	✓	✓
Mid-Mission Assessment: Topics A-B			

	Objective	INDEPENDENT DIGITAL LESSON	CONCEPT EXPLORATION
Topic C	**Sampling**		
Lesson 11	Justify whether two populations are “very different” based on the difference in their means expressed as a multiple of the mean absolute deviation.	✓	✓
Lesson 12	Understand what a population is, what a sample is, and why a sample might be used. Describe a sample for a given population.	✓	✓
Lesson 13	Given dot plots, determine whether a sample is representative of the population and explain the reasoning.	✓	✓
Lesson 14	Recognize that random sampling tends to produce representative samples and support valid inferences.	✓	✓
Topic D	**Using Samples**		
Lesson 15	Use the mean and MAD of a sample to make inferences about the population, and explain the reasoning.	✓	✓
Lesson 16	Use proportions from a random sample to make inferences about the population.	✓	✓
Lesson 17	Compare different distributions of sample means from the same population using dot plots.	X	OPTIONAL
Lesson 18	Apply reasoning about center and spread to determine whether two populations are likely to be meaningfully different.	✓	✓
Lesson 19	Compare two populations using samples from each, and apply reasoning about center and variability to determine if the populations are meaningfully different.	X	✓
Topic E	**Let’s Put it to Work**		
Lesson 20	Generate a random sample and use it to make inferences about the population.	X	OPTIONAL
End-of-Mission Assessment: Topics C-E			

Foundational Missions

For each mission, Zearn Math highlights the foundational missions, the earlier content where concepts are introduced and developed. Teachers can access foundational missions directly from the mission page of their Teacher Account to address any unfinished learnings. Zearn recommends that teachers assign foundational missions during Flex Day or during additional non-core instruction time. It is important to use a foundational mission to support students who are struggling, rather than an unaligned mission, because the content students learn in each foundational mission supports their Core Day learning.

Foundational Mission(s) for G7M8: G6M8 TopicsC-D

Mission Overview

In this mission, students understand and use the terms “event,” “sample space,” “outcome,” “chance experiment,” “probability,” “simulation,” “random,” “sample,” “random sample,” “representative sample,” “overrepresented,” “underrepresented,” “population,” and “proportion.” They design and use simulations to estimate probabilities of outcomes of chance experiments and understand the probability of an outcome as its long-run relative frequency. They represent sample spaces (that is, all possible outcomes of a chance experiment) in tables and tree diagrams and as lists. They calculate the number of outcomes in a given sample space to find the probability of a given event. They consider the strengths and weaknesses of different methods for obtaining a representative sample from a given population. They generate samples from a given population, e.g., by drawing numbered papers from a bag and recording the numbers, and examine the distributions of the samples, comparing these to the distribution of the population. They compare two populations by comparing samples from each population.

Progression of Disciplinary Language

In this mission, teachers can anticipate students using language for mathematical purposes such as describing, explaining, justifying, and comparing. Throughout the mission students will benefit from routines designed to grow robust disciplinary language, both for their own sense-making and for building shared understanding with peers. Teachers can formatively assess how students are using language in these ways, particularly when students are using language to:

Describe

- observations and predictions during a game (Lesson 1)
- patterns observed in repeated experiments (Lesson 4)
- chance experiments to model situations (Lessons 6 and 7)
- a simulation used to model a situation (Lesson 10)
- observations about data sets (Lessons 11 and 17)

Explain

- predictions (Lesson 2)
- how to determine which events are more likely (Lesson 3)
- possible differences in experimental and theoretical probability (Lesson 5)
- how to use simulations to estimate probability (Lesson 7)
- how to use a simulation to answer questions about the situation (Lesson 10)

Justify

- whether situations are surprising and possible (Lesson 4)
- which samples are or are not representative of a larger population (Lesson 13)
- which samples correspond with each show, which show is most appropriate for a commercial, and whether a movie is eligible for an award (Lesson 15)
- reasoning about samples and populations (Lesson 16)
- whether or not differences between samples are meaningful (Lesson 18, 19, and 20)

Compare

- sample spaces and probably of outcomes for different spinners (Lesson 5)
- methods for writing sample spaces (Lesson 8)
- heights of two groups (Lesson 11)
- measures of center with samples (Lesson 13)
- sampling methods (Lesson 14)
- populations based on samples (Lessons 18 and 20)

In addition, students are expected to critique predictions about the mean of random samples, and generalize about samples spaces, predictions, sampling, and fairness. Students also have opportunities to use language to represent data from repeated experiments, represent probabilities and sample spaces, and interpret situations involving sample spaces, probability, and populations.

The table shows lessons where new terminology is first introduced, including when students are expected to understand the word or phrase receptively and when students are expected to produce the word or phrase in their own speaking or writing. Terms from the glossary appear bolded. Teachers should continue to support students' use of a new term in the lessons that follow where it was first introduced.

New Terminology		
Lesson	**Receptive**	**Productive**
1		more likely less likely
2	**event** **chance experiment** **outcome** equally likely as not	likely unlikely impossible certain
3	**probability** **random** **sample space**	**outcome**
5	simulation	**probability** **random**
7		**event** simulation
8	tree (diagram)	**sample space**
9		tree (diagram)
11	**mean absolute deviation (MAD)** distribution very different overlap	**mean** **median**
12	**population** **sample** survey	**mean absolute deviation (MAD)**
13	measure of center **representative sample**	distribution center (of a distribution) spread
14	random sample	
15	**interquartile range (IQR)** measure of variability	**population** **sample** random sample symmetric
16	**proportion**	**representative sample**

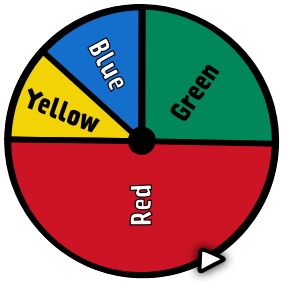
New Terminology		
Lesson	**Receptive**	**Productive**
17		**interquartile range (IQR)** measure of variability
18	meaningful difference	overlap measure of center
20		meaningful difference

Terminology

Chance experiment

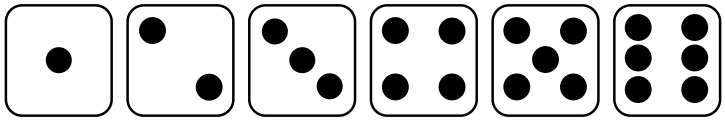
A chance experiment is something you can do over and over again, and you don't know what will happen each time.

For example, each time you spin the spinner, it could land on red, yellow, blue, or green.



Event

An event is a set of one or more outcomes in a chance experiment. For example, if we roll a number cube, there are six possible outcomes.



Examples of events are "rolling a number less than 3," "rolling an even number," or "rolling a 5."

Interquartile range

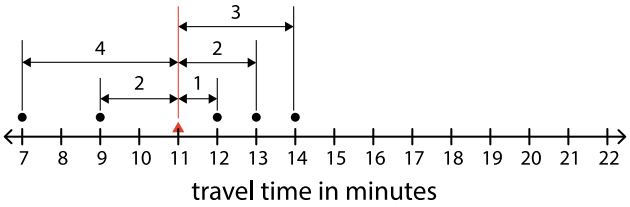
The interquartile range is one way to measure how spread out a data set is. We sometimes call this the IQR. To find the interquartile range we subtract the first quartile from the third quartile.

22	29	30	31	32	43	44	45	50	50	59
		Q1			Q2			Q3		

For example, the IQR of this data set is 20 because 50 − 30 = 20.

Mean

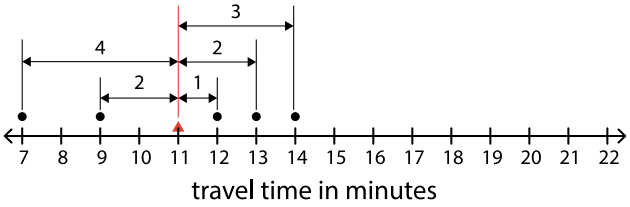
The mean is one way to measure the center of a data set. We can think of it as a balance point. For example, for the data set 7, 9, 12, 13, 14, the mean is 11.



To find the mean, add up all the numbers in the data set. Then, divide by how many numbers there are. 7 + 9 + 12 + 13 +14 = 55 and 55 ÷ 5 = 11.

Mean absolute deviation (MAD)

The mean absolute deviation is one way to measure how spread out a data set is. Sometimes we call this the MAD. For example, for the data set 7, 9, 12, 13, 14, the MAD is 2.4. This tells us that these travel times are typically 2.4 minutes away from the mean, which is 11.



To find the MAD, add up the distance between each data point and the mean. Then, divide by how many numbers there are. 4 + 2 + 1 + 2 + 3 = 12 and 12 ÷ 5 = 2.4.

Median

The median is one way to measure the center of a data set. It is the middle number when the data set is listed in order.

For the data set 7, 9, 12, 13, 14, the median is 12.

For the data set 3, 5, 6, 8, 11, 12, there are two numbers in the middle. The median is the average of these two numbers.

6 + 8 = 14 and 14 ÷ 2 = 7.

Outcome

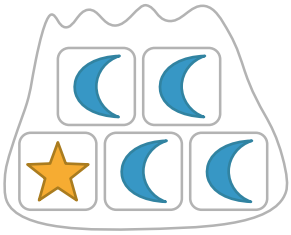
An outcome of a chance experiment is one of the things that can happen when you do the experiment. For example, the possible outcomes of tossing a coin are heads and tails.

Population

A population is a set of people or things that we want to study.

For example, if we want to study the heights of people on different sports teams, the population would be all the people on the teams.

Probability



The probability of an event is a number that tells how likely it is to happen. A probability of 1 means the event will always happen. A probability of 0 means the event will never happen.

For example, the probability of selecting a moon block at random from this bag is $\frac{4}{5}$.

Proportion

A proportion of a data set is the fraction of the data in a given category.

For example, a class has 18 students. There are 2 left-handed students and 16 right-handed students in the class. The proportion of students who are left-handed is $\frac{2}{20}$, or 0.1.

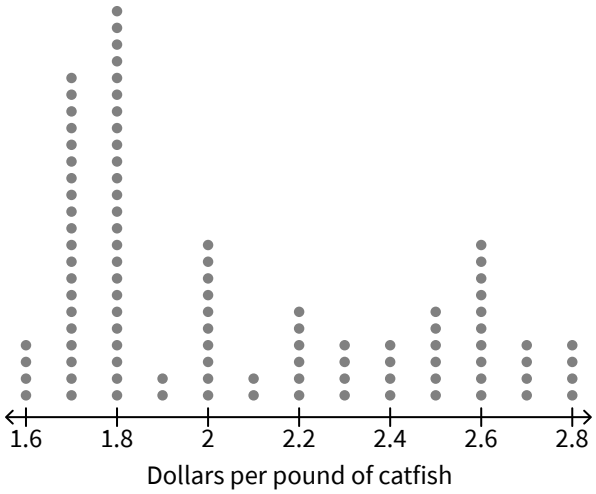
Random

Outcomes of a chance experiment are random if they are all equally likely to happen.

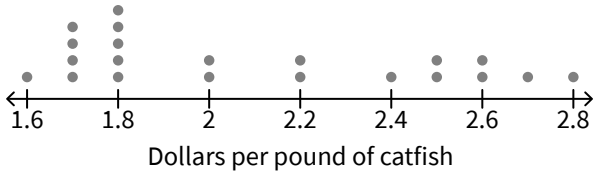
Representative

A sample is representative of a population if its distribution resembles the population's distribution in center, shape, and spread.

For example, this dot plot represents a population.



This dot plot shows a sample that is representative of the population.



Sample

A sample is part of a population. For example, a population could be all the seventh grade students at one school. One sample of that population is all the seventh grade students who are in band.

Sample Space

The sample space is the list of every possible outcome for a chance experiment.

For example, the sample space for tossing two coins is:

heads-heads	tails-heads
heads-tails	tails-tails

Required Materials

Coins

Compasses

Four-function calculators

Graph paper

Paper bags

Paper clips

Protractors

Number cubes

Rulers marked with inches

Scissors

Snap cubes

Sticky notes

Straightedges

Straws

Templates

Pre-printed slips, cut from copies of the template

Lesson 2 Activity 3

Lesson 3 Activity 2

Lesson 5 Activity 1

Lesson 6 Activity 1

Lesson 7 Activity 1

Lesson 10 Activity 2

Lesson 16 Activity 1

Lesson 19 Activity 1

Lesson 20 Warm-Up