



Holyoke Public Schools

Grade 8

Samples and Populations

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Samples and Populations

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Curriculum Maps Outline

Map Goals:

1. To ensure that students are exposed to a rigorous curriculum in every school and every grade.
2. To have consistent instruction and assessment district wide.
3. To prepare students for the MCAS test.
4. To explain what is expected to be covered in each CMP or Investigations Unit.

Expectations:

The district's expectation is for students to successfully meet the Massachusetts Mathematics Standards. In order to help facilitate this, teachers are required to follow the curriculum maps. The successful implementation of these maps requires teachers to thoroughly read each lesson in the TE and work through the project and problems in the map and the text prior to planning their lessons. Work should be kept in the binder with the curriculum map. Working through the math is an essential part of lesson planning, as it helps the teacher to better understand the concept being taught and the students' possible misunderstandings.

Feedback To Students:

Feedback needs to happen daily in the classroom. There are many ways to give feedback. Conferencing, observations, questions asked during your opening, work time and closing are all forms of feedback.

Map Components:

1. GENERAL PROBING QUESTIONS
2. UNIT SPECIFIC PROBING QUESTIONS
3. GOALS OF UNIT, CONTENT STANDARDS, & PERFORMANCE STANDARDS
4. PROJECT- to be done at end of unit and kept in the portfolio.
5. STUDENT MASTER – for project
6. INVESTIGATIONS
7. NOTEBOOK - includes: 3 Ring Binder, Bound Notebook, Portfolio
8. ACCOUNTABLE TALK – using probing questions
9. ON DEMAND ASSESSMENTS - to be done during teaching of unit.
10. STUDENT MASTERS- for on-demand assessments.

Mathematics Evidence of Learning Artifacts

Artifact	K - 1	2 - 5	6 - 8
3 Ring Binder (3R)*	<ul style="list-style-type: none"> ○ Student Work¹ 	<ul style="list-style-type: none"> ○ Vocabulary ○ Student sheets¹ <p style="text-align: center;"><u>All work should be dated and listed by investigation</u></p>	<ul style="list-style-type: none"> ○ Math books ○ Vocabulary ○ Core Problems¹ ○ Lab sheets <p style="text-align: center;"><u>All work should be dated and listed by investigation</u></p>
Marble Notebook (MNB)	<ul style="list-style-type: none"> ○ Journal entries² 	<ul style="list-style-type: none"> ○ Table of Contents ○ Problem of the day ○ Journal entries ○ Class work <p style="text-align: center;"><u>All work should be dated and listed by investigation in the Table of Contents</u></p>	<ul style="list-style-type: none"> ○ Table of Contents ○ Work time ○ Journal entries <p style="text-align: center;"><u>All work should be dated and listed by investigation in the Table of Contents</u></p>
Portfolio³ (P)	<ul style="list-style-type: none"> ○ On-demand tasks ○ Projects ○ Teacher anecdotal notes 	<ul style="list-style-type: none"> ○ On-demand tasks ○ Reflections ○ Projects <p style="text-align: center;"><u>All work should be dated and listed by investigation</u></p>	<ul style="list-style-type: none"> ○ On-demand tasks ○ Reflections ○ Projects <p style="text-align: center;"><u>All work should be dated and listed by investigation</u></p>

* Folders may be used in place of binders for these grade levels

¹ Send home at the end of each unit

² Use grade level math journals

³ All documents should be kept for the entire year

Accountable Talk

Probing Assessment Questions

As students progress through this unit, they should be asked the following questions to assess their specific knowledge of the unit.

- *What is the population? about*
- *What is the sample?*
- *What kinds of comparisons or relationships can I explore using data from the sample?*
- *Can I use my results to make predictions or generalizations the populations?*

Probing Questions – Teacher’s Role

The teacher’s role in probing for understanding is to ask questions that will:

- *Clarify student understanding*
- *Get at the objective of the lesson*
- *Go deeper into the mathematics*
- *Uncover misconceptions and misunderstandings*
- *Compare and contrast*

Probing Questions – Student’s Role

The students’ role is to be an active participant by:

- *Explaining their strategies*
- *Asking clarifying questions to teacher and other students*
- *Being active listeners*
- *Using the language of mathematics*

Probing Questions - Suggestions

When probing for understanding the teacher and students can use one or more of these suggested questions:

- *Why are you using $<$ $>$?*
- *What are the ways you could $<$ $>$?*
- *What else do you know?*
- *How do you know that?*
- *Can you show that?*
- *What convention did you use here?*
- *What can you do if you do not know?*
- *What standard does this work apply to?*
- *Is this always true?*
- *How does this connect to other mathematics we have learned?*
- *What is the same and what are the differences between $<$ $>$?*
- *Can you back that up?*
- *Where is the math in your sketch?*
- *What does the answer mean?*
- *Does the answer make sense?*
- *Could you have used another operation to solve this task?*
- *Can you give examples?*
- *Can you say it another way?*

- *What's the math?*
- *Tell me about the task in your own words?*
- *What are you trying to find?*
- *How did you make your estimate?*
- *Will your answer be an over-estimate or an under-estimate? Why?*
- *I noticed that you used <...> to help you understand the task. Can you show us what you did and tell us how it helped you?*
- *Where do you see < > in your <model, diagram, number line, chart, etc.>?*
- *How can we see < > in your <model, diagram, number line, chart, etc.>?*
- *You have used a representation that is different from others that I've seen. Can you show us your <model, diagram, number line, chart, etc.>, and tell us how it helped you?*
- *How did you decide to solve the task? Why did you choose that method?*
- *Did you try any method that didn't work?*
- *Tell us what you tried.*
- *Why didn't it work?*
- *Would it ever work?*

Goals, Content Standards, & Performance Standards

Unit Goals:

- *Why are you using $<$ $>$?*
- *What are the ways you could $<$ $>$?*
- *What else do you know?*
- *How do you know that?*
- *Can you show that?*
- *What convention did you use here?*
- *What can you do if you do not know?*
- *What standard does this work apply to?*
- *Is this always true?*
- *How does this connect to other mathematics we have learned?*
- *What is the same and what are the differences between $<$ $>$?*
- *Can you back that up?*
- *Where is the math in your sketch?*
- *What does the answer mean?*
- *Does the answer make sense?*
- *Could you have used another operation to solve this task?*
- *Can you give examples?*
- *Can you say it another way?*
- *What's the math?*
- *Tell me about the task in your own words?*
- *What are you trying to find?*
- *How did you make your estimate?*

- *Will your answer be an over-estimate or an under-estimate? Why?*
- *I noticed that you used <....> to help you understand the task. Can you show us what you did and tell us how it helped you?*
- *Where do you see < > in your <model, diagram, number line, chart, etc.>?*
- *How can we see < > in your <model, diagram, number line, chart, etc.>?*
- *You have used a representation that is different from others that I've seen. Can you show us your <model, diagram, number line, chart, etc.>, and tell us how it helped you?*
- *How did you decide to solve the task? Why did you choose that method?*
- *Did you try any method that didn't work?*
- *Tell us what you tried.*
- *Why didn't it work?*
- *Would it ever work?*

Math Content Standards:

- *(8.D.1) Describe the characteristics and limitations of a data sample. Identify different ways of selecting a sample, e.g., convenience sampling, responses to a survey, random sampling.*
- *(8.D.2) Select, create, interpret, and utilize various tabular and graphical representations of data, e.g., circle graphs, Venn diagrams, scatterplots, stem-and-leaf plots, box-and-whisker plots, histograms, tables, and charts. Differentiate between continuous and discrete data and ways to represent them.*
- *(8.D.3) Find, describe, and interpret appropriate measures of central tendency (mean, median, and mode) and spread (range) that represent a set of data. Use these notions to compare different sets of data.s*

Performance Standards:

- *(M4a) Collects data, organizes data, and displays data with tables, charts, graphs that are appropriate, ie, consistent with the nature of the data*
- *(M4b) Analyzes data with respect to characteristics of frequency and distribution, including mode and range*
- *(M4c) Analyzes appropriately central tendencies of data by considering mean and median.*
- *(M4d) Makes conclusions and recommendations based on data analysis*
- *(M4e) Critiques the conclusions and recommendations of others' statistics.*

- *(M4f) Considers the effects of missing or incorrect information*
- *(M4g) Formulates hypotheses to answer a question and uses data to test hypotheses*

NOTE: See ADDITIONAL PRACTICE sheets to address portions of the standards not covered in the unit.

Investigation 1: Comparing Data Sets

<p><u>Objectives</u> Investigations 1.1 – 1.4</p>	<p><u>Pacing:</u> 5 days</p>
<p style="text-align: center;"><i>Evidence of Learning Artifacts</i></p> <p>Journal and Reflection questions should be posted and referred to at the beginning of the appropriate <i>Investigation</i>.</p> <p>Journal and Reflection entries need to be done in class as part of the closure and assessment</p>	<p><u>Vocabulary</u>²: Appendix 2, Investigation 1</p>
	<p><u>Core Problems</u>²: Samples and Populations, Investigation 1 ACE Problems: #1,2-6, 29,7-17, 31, 19-26</p>
	<p><u>Work Time</u>¹: Samples and Populations, Problems 1.1 – 1.4</p>
	<p><u>Journal Entries</u>¹: Appendix 3, Inv 1.1 – 1.4</p>
	<p><u>On Demand Tasks</u>³: Appendix 5, Investigation 1</p>
<p><u>Mathematical Reflection</u>³ Appendix 4, MMR1:</p>	
<p style="text-align: center;"><i>Accountable Talk</i></p> <p>To promote learning, explore solutions, and justify reasoning, conversations between students and students or students and teacher must be accountable – accountable to the learning community, to the mathematics discipline, and to rigorous thinking.</p>	<p>As a result of this Investigation, students should be able to talk and manipulate the vocabulary of the Investigation in response to this type of question:</p> <ul style="list-style-type: none"> ○ How did you know that....? ○ What can you tell about _____ from the graph? ○ How do the respective graphs relate to one another? <p>These are some recommended questions that you might use. Others can be found at the beginning of the map and on the probing question sheet in the district mathematics guide.</p>

1. *Marble Note Book*
2. *3 Ring Binder*
3. *Portfolio*

Investigation 2: Choosing a Sample From a Population

Objectives Investigations 2.1 – 2.4	Pacing: 5 days
<p style="text-align: center;"><i>Evidence of Learning Artifacts</i></p> <p>Journal and Reflection questions should be posted and referred to at the beginning of the appropriate <i>Investigation</i>.</p> <p>Journal and Reflection entries need to be done in class as part of the closure and assessment</p>	<p><u>Vocabulary</u>²: Appendix 2, Investigation 2</p>
	<p><u>Core Problems</u>²: Samples and Populations , Investigation 2 ACE Problems: #1-4, 5-9, 25, 10,11, 26, 16,17</p>
	<p><u>Work Time</u>¹: Samples and Populations, Problems 2.1 – 2.4</p>
	<p><u>Journal Entries</u>¹: Appendix 3, Inv 2.1 – 2.4</p>
	<p><u>On Demand Tasks</u>³: Appendix 5, Investigation 2</p>
	<p><u>Mathematical Reflection</u>³ Appendix 4, MMR2:</p>
<p style="text-align: center;"><i>Accountable Talk</i></p> <p>To promote learning, explore solutions, and justify reasoning, conversations between students and students or students and teacher must be accountable – accountable to the learning community, to the mathematics discipline, and to rigorous thinking.</p>	<p>As a result of this Investigation, students should be able to talk and manipulate the vocabulary of the Investigation in response to this type of question:</p> <ul style="list-style-type: none"> ○ How did you know that? ○ How can you use ...? ○ Can you show another way? ○ What convention did you use? <p>These are some recommended questions that you might use. Others can be found at the beginning of the map and on the probing question sheet in the district mathematics guide.</p>

1. Marble Note Book
2.3 Ring Binder
3. Portfolio

Investigation 4: Relating Two Variables

<p><u>Objectives</u> Investigation 4.1 – 4.2</p>	<p><u>Pacing:</u> 5 day</p>
<p style="text-align: center;"><i>Evidence of Learning Artifacts</i></p> <p>Journal and Reflection questions should be posted and referred to at the beginning of the appropriate <i>Investigation</i>.</p> <p>Journal and Reflection entries need to be done in class as part of the closure and assessment</p>	<p><u>Vocabulary</u>²: Appendix 2, Investigation 4</p> <p><u>Core Problems</u>²: Samples and Populations, Investigation 4 ACE Problems: # 7, 8, 2, 10-13</p> <p><u>Work Time</u>¹: Samples and Populations, Problem 4.1 – 4.2</p> <p><u>Journal Entries</u>¹: Appendix 3, Inv 4.1 – 4.2</p> <p><u>On Demand Tasks</u>³: Appendix 5, Investigation 4</p> <p><u>Mathematical Reflection</u>³ Appendix 4, MMR4:</p>
<p style="text-align: center;"><i>Accountable Talk</i></p> <p>To promote learning, explore solutions, and justify reasoning, conversations between students and students or students and teacher must be accountable – accountable to the learning community, to the mathematics discipline, and to rigorous thinking.</p>	<p>As a result of this Investigation, students should be able to talk and manipulate the vocabulary of the Investigation in response to this type of question:</p> <ul style="list-style-type: none"> ○ How can this data help you answer questions about.....? ○ What data in this representation is unusual? What does it tell you? ○ What comparisons can you make from this data? <p>These are some recommended questions that you might use. Others can be found at the beginning of the map and on the probing question sheet in the district mathematics guide.</p>

1. Marble Note Book
2.3 Ring Binder
3. Portfolio

Appendix 1 Unit Project

<p style="text-align: center;"><i>Project</i>¹</p> <p>Student work should be placed in portfolio</p>	<p>The project is the culminating assessment, which will allow students to apply what they learned about the use of data and statistics. It is written in MCAS form to give students the experience of answering an open-response question.</p> <p>The unit project is called ‘Television Survey’ and the student handout for the project can be found in Appendix 1</p>
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1. portfolio

Unit Project Scoring Guide

Score	Description
<u>4</u>	The student response demonstrates an exemplary understanding of the Data Analysis, Statistics, and Probability concepts involved in interpreting tabular representations of sets of data and using appropriate statistics to communicate information about the data.
<u>3</u>	The student response demonstrates a good understanding of the Data Analysis, Statistics, and Probability concepts involved in interpreting tabular representations of sets of data and using appropriate statistics to communicate information about the data. Although there is significant evidence that the student was able to recognize and apply the concepts involved, some aspect of the response is flawed. As a result the response merits 3 points.
<u>2</u>	The student response demonstrates a fair understanding of the Data Analysis, Statistics, and Probability concepts involved in interpreting tabular representations of sets of data and using appropriate statistics to communicate information about the data. While some aspects of the task are completed correctly, others are not. The mixed evidence provided by the student merits 2 points.
<u>1</u>	The student response demonstrates a minimal understanding of the Data Analysis, Statistics, and Probability concepts involved in interpreting tabular representations of sets of data and using appropriate statistics to communicate information about the data.
<u>0</u>	The student response contains insufficient evidence of an understanding of the Data Analysis, Statistics, and Probability concepts involved in interpreting tabular representations of sets of data and using appropriate statistics to communicate information about the data to merit any points.

NAME: _____

DATE: _____

Television Survey

- BE SURE TO ANSWER AND LABEL ALL PARTS OF EACH QUESTION.
- Show all work (diagrams, tables, and computations) on your answer sheet.
- If you do the work in your head, explain in writing how you did the work.

In an experiment, Sue and Helise asked each of 30 students in a random sample of the juniors at their school to record the number of minutes they watched television on a Saturday and Sunday in April. The results, rounded to the nearest 30 minutes, are shown in the table.

Minutes of Television Watching	
Total Number of Minutes of Television Watched on Saturday and Sunday	Number of Junior Students
0	1
60	3
90	6
120	5
180	5
240	2
300	5
420	1
540	2

-
- What number of minutes spent watching television should the girls report as the mode for this group of students? Justify your answer.
-
- Helise said that the median number of minutes for this group of students is 180, but Sue disagreed. Do you agree with Sue or Helise? Justify your answer.
-
- Suppose that Sue and Helise had used the entire class of 185 juniors as their sample. Based on the results from their smaller sample, what total number of the 185 juniors would probably have reported watching 300 minutes of television on that weekend? Show or explain how you obtained your answer.

2004 MCAS Grade 10 Mathematics

Student Work: Question #31 - Score Point 4

- a) The mode for the number of minutes watching tv in the data set should be 90. This is because it occurs the most (6 times)
- b) I agree with Sue. This is because there are 30 pieces of data. Therefore the median is the average of the middle two, 15th (120), 16th (180). $(120 + 180) / 2 = 150$
Therefore 150 is the correct median, not 180
- c) The way to find this answer is to use proportions so the ratio of total old size : total new size should be about equal to old group size : new group size
- $$\frac{30}{185} = \frac{5}{x} \quad \text{where } x \text{ is new group total size}$$
- $30x = 925$
 $x = 30.833$
- so there would most likely be 31 juniors now watching tv for 300 minutes on that weekend.

2004 MCAS Grade 10 Mathematics

Student Work: Question #31 - Score Point 2

A. The mode is the largest number + the smallest divided by 2. $0 + 540 = \frac{540}{2} = 270$.
So the mode is 270 minutes spent watching tv

B I do not agree with Helise, 150 is the middle number. There are two middle numbers. So you have to take $120 + 180 = \frac{300}{2} = 150$.
150 is the median

C. 6% watch 300 hours. So about 31 students would watch 300 minutes of television.

2004 MCAS Grade 10 Mathematics

Student Work: Question #31 - Score Point 1

a) 90 mins. is the mode because it is the most occurring result.

b) I Disagree, 300 is the answer, because it is the median.

c) No. 90 mins. is the highest number of students, Therefore the larger scale would have reflected 90 mins as well.

Appendix 2 Vocabulary

Investigation 1:

- *attribute, distribution, frequency, histogram, relative frequency histogram, box-and-whisker plot, five-number summary, minimum, maximum, upper quartile, lower quartile, measures of center*

Investigation 2:

- *convenience sampling, systematic sampling, voluntary-response, random sampling, bias, stem-and-leaf plot*

Investigation 4:

- *scatter plot*

Appendix 3 Journal Entries

Investigation 1:

Investigation 1.1:

.How is the interval stacked line plot developed from the Using shaded-intervals line plot?

Investigation 1.2:

Describe the information you can read from a histogram.

Investigation 1.3:

Describe the information you can read from a box-and-whisker plot.

***Note: Teachers may find it helpful to have students organize data using a Stem-and-Leaf Plot to make the Box-and-Whisker Plot

Investigation 1.4:

Select a peanut butter from the data studied and explain why you would recommend it.

Investigation 2:

Investigation 2.1

What makes a sample a good predictor of a population?

Investigation 2.2

Select one sampling strategy and discuss its advantages and disadvantages.

Investigation 2.3

Why is random sampling preferable to convenience, self-selected, or systematic sampling?

Investigation 2.4

What factors need to be considered in choosing sample size?

Investigation 4

Investigation 4.1

In the scatter plot (4.1), do any (quality rating, price) pairs appear to be unusual? Explain.

Investigation 4.2

Using your equation from 4.2C, describe the relationship between body length and wingspan.

Investigation 4.3 (OPTIONAL)

(Human Development Index and Life Expectancies)

Appendix 4 Reflections

MMR1

In what ways are histograms and box-plots alike? In what ways are they different?

MMR2

Describe several methods for selecting a sample from a population. Discuss the advantages and disadvantages of each method. [pg. 46 #2]

MMR4

– Describe some situations you explored in which the values of two variables are related in a predictable way. For example, you saw that you can estimate a person's arm span if you know his or her height.[pg 80 #1]

Appendix 5 On Demand Tasks

CMP2: Samples and Populations

On-Demand Tasks

Additional Practice & Skills Workbook

Assessment Resources

In class individualized On-Demand tasks assess knowledge of mathematical facts, operations, concepts, and skills, and their efficient application to problem solving. The results of these different forms of assessment provide rich profiles of students' achievements in mathematics and serve as the basis for identifying curricula and instructional approaches to best develop their talents.

After Inv. 1

Additional Practice and Skills Workbook pg 173

After Inv. 2

Additional Practice and Skills Workbook pg. 182

After Inv. 4

ACE Question pg69 #53

HPS Mathematics Scoring Rubric

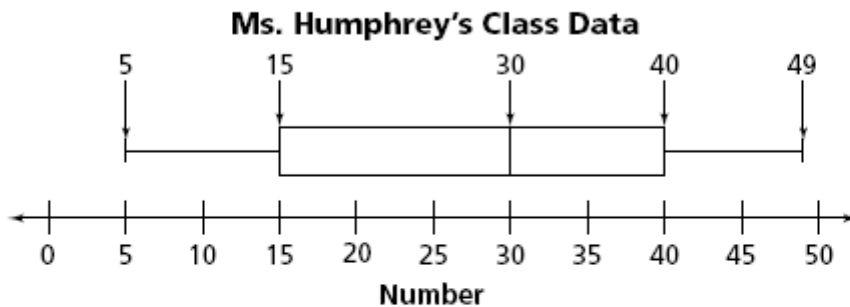
Score	Description
<u>4</u>	The response shows a <u>comprehensive</u> understanding of the mathematical concept(s) and/or procedures embodied in the task(s). It indicates that the student has <u>completed the task(s)</u> correctly, using mathematically sound procedures. It contains <u>clear, complete explanations</u> and/or <u>adequate work required</u> .
<u>3</u>	The response shows a <u>general</u> understanding of the mathematical concept(s) and/or procedures embodied in the task(s). It indicates that the student has <u>completed the task(s)</u> , using mathematically sound procedures. It contains <u>complete explanations</u> and/or <u>adequate work required</u> .
<u>2</u>	The response shows a <u>basic</u> understanding of the mathematical concept(s) and/or procedures embodied in the task(s). It addresses <u>most aspects of the task(s)</u> , using mathematically sound procedures. It may contain a correct solution but provides <u>incomplete procedures, reasoning and/or explanations</u> . It may reflect <u>some misunderstandings</u> of the underlying mathematical concepts and/or procedures.
<u>1</u>	The response shows a <u>minimal</u> understanding of the mathematical concepts and/or procedures embodied in the task(s). It addresses <u>some elements of the task(s)</u> correctly but reaches an <u>inadequate solution and/or provides reasoning that is faulty or incomplete</u> . It exhibits <u>multiple flaws related to a misunderstanding of important aspects</u> of the task(s), misuse of mathematical procedures, or faulty mathematical reasoning. It reflects a <u>lack of essential understanding</u> of the underlying mathematical concepts. It may contain a correct numerical answer but <u>the required work is not provided</u> .
<u>0</u>	The response is <u>completely incorrect, irrelevant, or incoherent</u> , or contains a correct response arrived at using an <u>obviously incorrect procedure</u> .

NAME: _____

DATE: _____

Investigation 1

Ms. Humphrey asked each of the 21 students in her class to choose a number between 1 and 50. Ms. Humphrey recorded the data and made this box plot:



3. What is the median number that was chosen?
4. What percent of students in Ms. Humphrey's class chose numbers above 15? Explain your reasoning.
5. About how many students chose numbers between 30 and 40? Explain.
6. What were the least and the greatest numbers chosen?
7. Is it possible to determine from the box plot whether one of the students chose the number 27? Explain.
8. Is it possible to determine from the box plot whether one of the students chose the number 4? Explain.

NAME:

DATE:

Investigation 2

Additional Practice and Skills Workbook pg. 182

- *BE SURE TO ANSWER AND LABEL ALL PARTS OF EACH QUESTION.*
- *Show all work (diagrams, tables, and computations) on your answer sheet.*
- *If you do the work in your head, explain in writing how you did the work.*

You want to survey students in your school about their exercise habits. Tell whether Exercises 1–2 are likely to give a random sample of the population. Explain.

1. You select every tenth student on an alphabetical list of the students in your school. You survey the selected students in their first-period classes.

2. At lunchtime you stand by a vending machine. You survey every student who buys something from the vending machine.

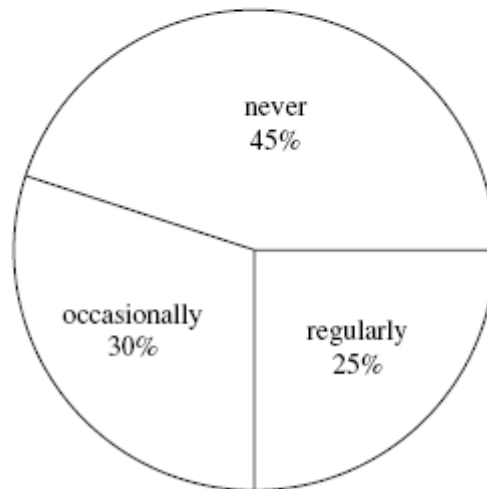
In a mall, 2,146 shoppers (age 16 and older) were asked, “How often do you eat at a restaurant in the mall?” Here is how they responded.

3. What population does the sample represent?

4. How many people responded in each of the categories?

5. What is the sample size?

6. Can you tell if the sample is random?



NAME: _____

DATE: _____

Investigation 4

ACE Question #53 pg.69

a. Find the sum for each row.

Row 1: $\frac{1}{3}$

Row 2: $\frac{1}{3} + \left(\frac{1}{3}\right)^2$

Row 3: $\frac{1}{3} + \left(\frac{1}{3}\right)^2 + \left(\frac{1}{3}\right)^3$

Row 4: $\frac{1}{3} + \left(\frac{1}{3}\right)^2 + \left(\frac{1}{3}\right)^3 + \left(\frac{1}{3}\right)^4$

b. Study the pattern. Suppose the pattern continues. Write the expression that would be in row 5, and find its sum.

c. What would be the sum of the expression in row 10? What would be the sum for row 20?

d. Describe the pattern of sums in words and with an equation.

e. As the row number increases, the sum gets closer and closer to what number?

NOTES