

Focus Questions

Background

The student book is organized around three to five investigations, each of which contain three to five problems and a Mathematical Reflection that students explore during class.

In the Teacher Guide the Goals for each unit include two to four big concepts with an elaboration of the essential understandings for each.

In the Teacher Guide, a Focus Question is provided for each problem in an investigation. The Focus Question collapses the mathematical understandings and strategies embedded in the problem into one overarching question. The teacher can use the Focus Question to guide his/her instructional decisions throughout his/her planning, teaching, and reflections on student understanding.

Description

The Goals of the unit describe the mathematics content developed in the unit. The Focus Questions provide a story line for the mathematical development of an investigation. The set of Mathematical Reflections in the student book provide a story line for the mathematical development of the unit. The following contain all of the Goals, Focus Questions and Mathematical Reflections for each unit in CMP3.

Purpose

These stories can serve as an overview of the unit and as a guide for planning, teaching and assessing.

The Goals, Mathematical Reflections, and Focus Questions can be laminated and used a bookmark for the Teacher.

8-1: Thinking with Mathematical Models

Unit Goals, Focus Questions, and Mathematical Reflections

Unit Goals

Recognize and model linear and nonlinear relationships in bivariate data

- Represent data patterns using graphs, tables, word descriptions and algebraic expressions
- Use mathematical models to answer questions about linear relationships
- Investigate the nature of linear variation in contexts
- Write linear functions from verbal, numerical, or graphical information
- Analyze, approximate, and solve linear equations
- Model situations with inequalities expressed as “at most” and “at least” situations
- Investigate the nature of inverse variation in contexts
- Use mathematical models to answer questions about inverse variation relationships

Compare inverse variation relationships with linear relationships

Characterize the Strength and Variability of Mathematical Models

- Use data patterns to make predictions
- Fit a line to data that show a linear trend and measure goodness of fit
- Analyze scatter plots of bivariate data to determine the strength of the linear relationship between the two variables.
- Use correlation coefficients informally to describe the strength of the linear relationship illustrated by scatter plots.
- Distinguish between categorical and numerical variables.
- Use 2-way tables and analysis of cell frequencies and relative frequencies to help in deciding whether two categorical variables are related.
- Use standard deviation to measure variability in data distributions

Focus Questions and Mathematical Reflections

Exploring Data Patterns	Linear Models and Equations	Inverse Variation	Variability and Associations in Numerical Data	Variability and Associations in Categorical Data
<p>1.1 Bridge Thickness and Strength</p> <p>Focus Question: How would you describe the relationship between bridge strength and bridge thickness revealed by your experiment?</p>	<p>2.1 Modeling Linear Data Patterns</p> <p>Focus Question: How can you find a linear function that is a good model for a set of data and then measure the accuracy of that model with residuals?</p>	<p>3.1 Rectangles with Fixed Area</p> <p>Focus Question: When the product of two variables is some fixed number, what is the pattern of change and how is that pattern of change reflected in tables and graphs of the relationship?</p>	<p>4.1 Vitruvian Man: Relating Body Measurements</p> <p>Focus Question: If you have data relating two variables, how can you check to see whether a linear model is a good fit?</p>	<p>5.1 Wood or Steel? That's the Question</p> <p>Focus Question: What does a two-way table show you about preferences among groups?</p>
<p>1.2 Bridge Length and Strength</p> <p>Focus Question: How would you describe the pattern relating bridge strength to bridge length shown in your experimental data?</p>	<p>2.2 Up and Down the Staircase: Exploring Slope</p> <p>Focus Question: How do you write an equation for a linear function if you are given a graph, a table, or two points?</p>	<p>3.2 Distance, Speed and Time</p> <p>Focus Question: What examples using distance, rate, and time show one variable inversely related to another?</p>	<p>4.2 Older and Faster: Negative Correlations</p> <p>Focus Question: From the scatter plot, how do you know if a linear model fits the data? How do you know if there are outliers? How do you know if the relationship is negative or positive?</p>	<p>5.2 Politics of Girls and Boys: Analyzing Data in Two-Way Tables</p> <p>Focus Question: Suppose you have recorded the counts of different preferences by group in a two-way table. How can you use those counts, or percents from the</p>

				counts, to decide if two groups have the same preferences or not?
1.3 Custom Construction Parts: Finding Patterns Focus Question: How can you predict if a pattern between variables will be linear or nonlinear?	2.3 Tree Top Fun: Equations for Linear Functions Focus Question: What strategies do you use in writing equations for linear functions?	3.3 Planning a Field Trip: Finding Individual Cost Focus Question: How does the cost per person change if a fixed total cost is split among an increasing number of individual payers?	4.3 Correlation Coefficients and Outliers Focus Question: What does a correlation coefficient of 1, 0, or -1 suggest to you about the relationship between two variables?	5.3 After-School Jobs and Homework: Working Backward: Setting up a Two-Way Table Focus Question: Suppose you have data about the same trait in two groups. How can you organize the data to compare and decide if the groups are the same or not relative to the trait?
	2.4 Boat Rental Business: Solving Linear Equations Focus Question: What strategies do you find useful to find solutions for linear equations?	3.4 Modeling Data Patterns Focus Question: What pattern in a table or graph of data suggests an inverse variation model and what strategies can you use to find an equation model for that kind of function?	4.4 Measuring Variability: Standard Deviation Focus Question: How do you calculate the standard deviation for a data distribution and what does that statistic tell about the distribution?	
	2.5 Amusement Park or Movies: Intersecting			

	<p>Linear Models</p> <p>Focus Question: When the graphs of two linear functions intersect, what do the coordinates of that intersection point tell you?</p>			
<p>Mathematical Reflection:</p> <p>1. You can represent a relationship between variables with a table, a graph, a description in words, or an equation.</p> <p>a. How can you decide whether a relationship is linear by studying the pattern in a data table?</p> <p>b. How can you decide whether a relationship is linear by studying the pattern in a graph?</p> <p>c. How can you decide whether a relationship is linear by studying the words used to describe the variables?</p>	<p>Mathematical Reflection:</p> <p>1. Why is it helpful to use a linear model for a set of data?</p> <p>2. When does it make sense to choose a linear function to model a set of data?</p> <p>3. How would you find the equation for a linear function in the following situations?</p> <p>a. You are given a description of the variables in words.</p> <p>b. You are given a table of values for the variables</p>	<p>Mathematical Reflection:</p> <p>1. Suppose the relationship between variables x and y is an inverse variation.</p> <p>a. How do the values of y change as the values of x increase?</p> <p>b. Describe the trend in a graph of (x, y) values.</p> <p>c. Describe the equation that relates the values of x and y.</p> <p>2. How is an inverse variation similar to a linear relationship? How is it different?</p>	<p>Mathematical Reflection:</p> <p>1. Think about the pattern of points you see in a scatter plot.</p> <p>a. What pattern would you expect when two variables are related by a linear model with positive slope?</p> <p>b. What pattern would you expect when two variables are related by a linear model with negative slope?</p> <p>c. What would you expect to see in a scatter plot when two variables are unrelated?</p>	<p>Mathematical Reflection:</p> <p>1. What are categorical variables and what do they measure?</p> <p>2. Suppose a survey asked teenagers and adults whether or not they use text messaging.</p> <p>a. How could you arrange the data to compare the groups?</p> <p>b. How would you decide that the two groups - teenagers and adults - were different in their use of text messaging?</p> <p>c. Suppose that one analysis compared only</p>

<p>d. How can you decide whether a relationship is linear by studying the equation that expresses the relationship in symbolic form?</p> <p>2. What are the advantages and disadvantages in finding patterns and making predictions?</p>	<p>c. You are given a graph of sample data points</p> <p>4. What strategies can you use to solve a linear equation such as $500 = 245 + 5x$?</p> <p>5. What kind of mathematical sentences express “at least” and “at most” questions about linear functions?</p>		<p>2. You assessed the accuracy of linear models.</p> <p>a. What do outliers on a scatter plot indicate?</p> <p>b. What can you learn from the errors of prediction or residuals?</p> <p>c. What do you know about a linear model from the correlation coefficient?</p> <p>3. What does the standard deviation tell you about a set of data?</p>	<p>the numbers in each group - teenage text messenger, teenage non-text messenger, adult text messenger, and adult non-text messenger. How might the analysis result in misleading conclusions?</p>
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