Name ______________________ Date ______________________

Analyzing Data Trends

SETTING THE STAGE
OPENING ACTIVITY

Martin is a member of the Comet Club, a group of people who enjoy amusement park rides. Martin plans to write an article in the club's newsletter, so he is doing research on a number of amusement parks that are located within a few hours' drive of where he lives. Martin finds the height of the tallest roller coaster in each amusement park. Then, he polls his club members to find out how many tickets they bought at each of the amusement parks in the past year. He organizes the information into a table, shown below.

Amusement Park	Height of Tallest Roller Coaster (in feet)	Tickets Sold to Members of the Comet Club in the Past Year
Ashmont Hills	340	230
Berkshire Adventure	413	954
Kingdom Fun	398	585
Scream Land	456	1129
Wild Ride World	298	104

What factor seems to determine how many members of the Comet Club visit a particular park?

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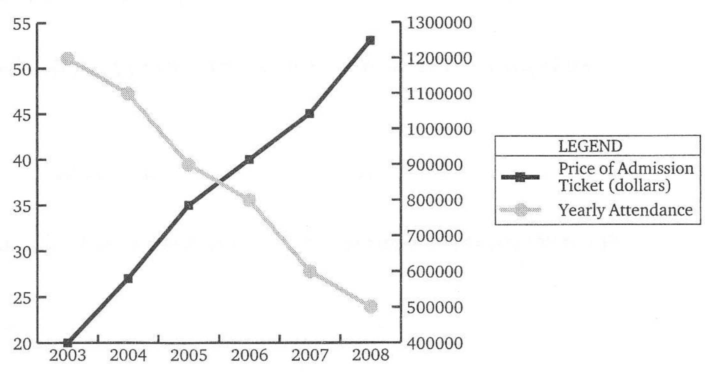
Martin then does more detailed research on Ashmont Hills. He knows that the owners of the park have been raising the price of admission tickets in an attempt to increase revenue. To research the effectiveness of this approach, Martin examines the park's attendance records. On the graph shown at right, he plots the total park attendance and the price of an admission ticket for each of the past six years.

Over the time period this graph displays, what happened to the cost of admission tickets? What happened to the number of people who attended the park?

Yearly Attendance and Ticket Price at Ashmont Hills Amusement Park, 2003-2008



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The owners of Ashmont Hills are frustrated that they ended up making less money in 2008 than they did in 2003. Why might their strategy have been unsuccessful?

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Name ______________________ Date ______________________

DRESS REHEARSAL
INSTRUCTION & GUIDED PRACTICE

VOCABULARY TERMS

Direct relationship: A relationship in which two trends move in the same direction

Inverse relationship: A relationship in which two trends move in opposite directions

Relationship: Describes how two or more data trends affect one another

Trend: A pattern that describes how data changes

INTRODUCTION

Data often follows particular patterns. For example, tides come and go at specific times, and gift buying tends to be highest during the holiday season. Such patterns are called **trends**. Trends can move in different directions and occasionally influence one another. For example, as the price of gas increases, fewer people drive cars.

A **relationship** describes how data trends affect each other, and there are a number of ways that this can happen. Martin's data suggested that the higher an amusement park's roller coaster is, the more members of the Comet Club visit it. This is an example of a **direct relationship**, in which two trends (the height of a roller coaster and the number of visitors) move in the same direction. On the other hand, relationships can also be **inverse relationships** when they describe trends that move in opposite directions. At Ashmont Hills, it appears that the number of people attending decreased as the price of admission increased.

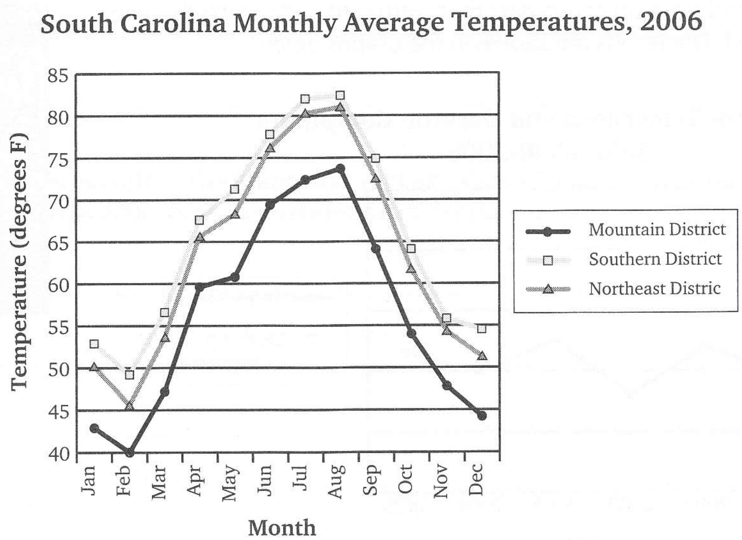
Understanding relationships between certain trends can help in estimating the directions and amounts of changes. For example, the price of gas and the number of people who drive share an inverse relationship, so it can be assumed that the number of people who drive will increase as gasoline becomes less expensive, and vice versa.

Name ______________________ Date ______________

DRESS REHEARSAL
(continued)

Use the scenario below to answer questions 1–4.

Scientists at a national climatology research center collect monthly average temperature data for each state each year. The graph below shows this data for three different geographical districts within South Carolina in 2006.



1) There are three lines plotted on the graph. What do they represent?

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2) Based on this data, in which month and in which part of the state would the weather most likely be the warmest?

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3) What sort of relationship exists between the data for the Southern District and the Mountain District?

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4) Describe the overall trend in temperature data for all three regions throughout the year.

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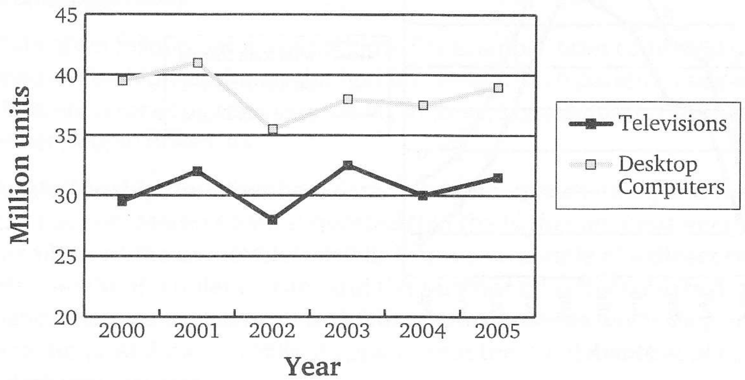
DRESS REHEARSAL
(continued)

Use the scenario below to answer questions 5–8.

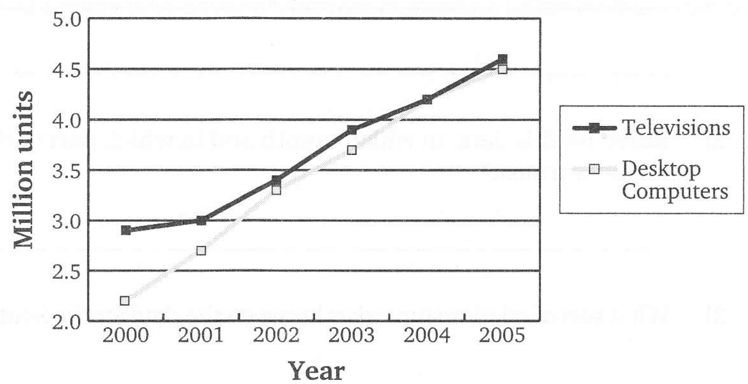
When electronic devices such as cell phones, televisions, and computers reach the end of their useful lives, the devices are typically disposed of.

A consumer-electronics association used industry data to chart the number of televisions and desktop computers that were sold and recycled over a five-year period. The results are shown in the graphs below.

Number of Televisions and Desktop Computers Sold, 2000-2005



Number of Televisions and Desktop Computers Recycled, 2000-2005



5) In which year were the greatest number of desktop computers sold? In which year were the greatest number of televisions sold?

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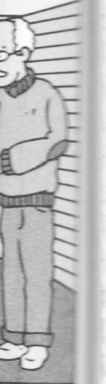

DRESS REHEARSAL
(continued)

6) Describe the relationship between time and the number of televisions and desktop computers recycled. How do you know?

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7) One of your friends examines the graph and suggests that 4.5 million desktop computers would have been recycled in 2006. Is this consistent with the data trends?

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8) Based on the current trends, how much growth do you expect to see in the near future in the number of televisions and desktop computers that are sold?

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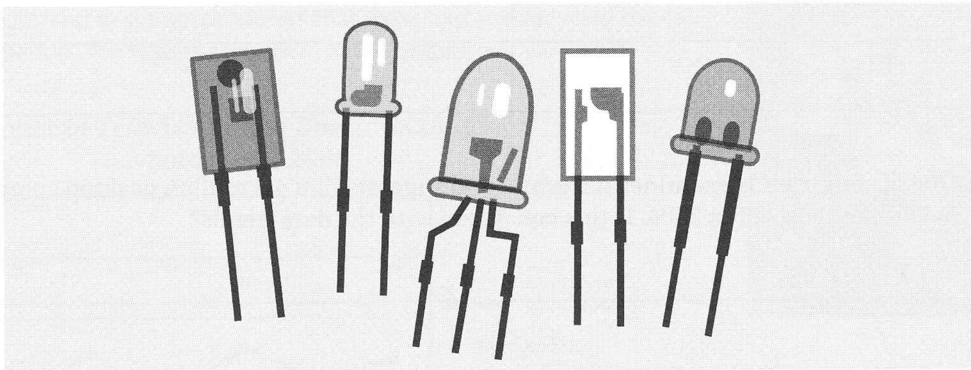
Name ____________________ Date ____________________

DRESS REHEARSAL
(continued)

Use the scenario below to answer questions 9–13.

Light-emitting diodes (LEDs) are semiconductor devices that convert electricity directly into light. Compared to traditional incandescent lightbulbs, LEDs are smaller, produce much less heat, and have longer lifetimes.



After completing a unit on semiconductors, students in a high-school physics lab investigated how the chemical composition of an LED related to its band-gap energy and the color of light it produced when a voltage was applied. Students experimented with four different semiconductors composed of gallium phosphide (GaP) and arsenide (As): $GaP_{1.00}As_{0.00}$, $GaP_{0.85}As_{0.15}$, $GaP_{0.65}As_{0.35}$, and $GaP_{0.40}As_{0.60}$. The subscript next to each elemental symbol represents the fraction of that element in the semiconductor material.

Relationship between LED Composition, Color, Wavelength, and Energy of Light

LED Composition	Color of Light	Wavelength of Light (nm)	Band-Gap Energy (eV)
$GaP_{1.00}As_{0.00}$	green	540	2.2
$GaP_{0.85}As_{0.15}$	yellow	585	2.1
$GaP_{0.65}As_{0.35}$	orange	590	2.0
$GaP_{0.40}As_{0.60}$	red	650	1.8

9) What type of relationship exists between the band gap energy of an LED and the wavelength of light that it produces? Explain your reasoning.

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Name ____________________ Date ____________________

DRESS REHEARSAL
(continued)

10) What type of relationship exists between the amount of gallium phosphide in an LED and the band-gap energy of that LED? Explain your reasoning.

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11) What type of relationship exists between the amount of gallium phosphide and arsenide in these LEDs? Explain your reasoning.

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12) Which composition of gallium phosphide and arsenide will produce light with the longest wavelength?

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13) The frequency of light varies inversely with its wavelength. Based on this information and the data above, which of the colors of light in the table has the highest frequency?

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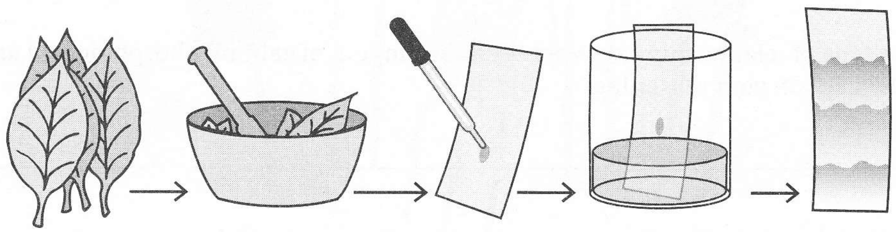
SHOW TIME
INDEPENDENT PRACTICE

Use the scenario below to answer questions 1–4.

Plant leaves contain a variety of pigments, including chlorophylls, carotenoids, and xanthophylls, each of which possesses distinguishing colors. In one study, plant biochemists used paper chromatography to separate and study the mixture of pigments found in a leafy vegetable. A leaf sample was pulverized and mixed with a small amount of solvent to create a thick solution, which was then spotted onto the bottom of a strip of paper. The lower end of the paper was placed into one of three solvents: pure acetone, 70/30 ether/propanone, or 90/10 ether/acetone. As the solvent climbed up the paper strip, each pigment was carried along to a different extent.



After the pigments separated, the scientists removed the paper strips and measured R_f values for each pigment. R_f values indicate the relative distance a substance traveled up the paper strip, with a value of 0 meaning no distance traveled and a value of 1 being the greatest possible distance traveled.

R_f Values of Several Plant Pigments in Three Solvents

Plant Pigment	R_f value		
	Solvent: 100% Acetone	Solvent: 70% Ether, 30% Propanone	Solvent: 90% Ether, 10% Acetone
Xanthophyll	0.35	0.44	0.40
Chlorophyll b	0.50	0.48	0.15
Chlorophyll a	0.60	0.58	0.25
Carotene	0.95	0.96	0.99

1) What general trend do the pigments' R_f values show when either pure acetone or 70/30 ether/propanone is used as solvent?

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Name ______________________ Date ______________________

SHOW TIME
(continued)

2) Is the data from the 90/10 ether/acetone experiment consistent with the trend described above? Explain why or why not.

3) What is the relationship between the R_f value of carotene and the amount of ether used in the solvent? Explain your reasoning.

4) Do the R_f values of any of the compounds show inverse relationships with the amount of ether in the solvent? If so, which ones?

SHOW TIME
(continued)

Use the scenario below to answer questions 5–8.

To investigate the relationship between pressure, temperature, and volume of a gas, a group of physicists conducted two experiments. In Experiment 1, the scientists filled a chamber fitted with one movable piston with a sample of an inert gas. Scientists held the temperature constant and increased the pressure on the gas in 50-atmosphere increments and measured the resulting volume of the gas sample. The results are shown in Table 1. In Experiment 2, the scientists maintained a constant pressure of 1 atmosphere and increased the temperature in 50-Kelvin (K) increments. The scientists recorded the corresponding changes in the volume of the gas.

Table 1: Pressure and Volume for an Inert Gas at 400 K

Pressure (atm)	Volume (L)
1.0	32.81
50.0	0.644
100.0	0.318
150.0	0.212
200.0	0.161
250.0	0.131
300.0	0.112
350.0	0.100
400.0	0.090
450.0	0.084
500.0	0.078

Table 2: Temperature and Volume for an Inert Gas at 1 Atmosphere Pressure

Temperature (K)	Volume (L)
300	24.62
350	28.72
400	32.81
450	36.92
500	41.03
550	45.13
600	49.23

5) What type of relationship exists between the volume and pressure of a gas? ____________

6) In an experiment, Imani records the pressure inside a cylinder as 2 atm. She then decreases the volume by half, and records that the pressure decreases to 4 atm. Her lab partner Boris questions whether she completed the experiment correctly. Explain why Boris was skeptical.

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Name ______________________ Date ______________________

SHOW TIME
(continued)

7) After recording the data in the second table shown above, they heated their sample to 650 K. At that temperature, do you expect the volume of the gas to be greater or less than 49.23 L? Explain.

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8) The pressure of a sample of gas at 600 K is increased to 4 atm. Do you expect that its volume will be greater or less than 49.23 L? Explain.

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