Problem Solving and Data Analysis Drill 1

This section contains two types of questions. For multiple-choice questions, solve each problem and circle the letter of the answer that you think is the best of the choices given. For Student-Response questions, denoted by the grid-in icon, write your answer in the blank space provided.

Different Types of Light Bulbs

Type of Bulb	Cost	Life Span
Incandescent	$0.50	Approximately 1,000 hours
Compact Florescent Lamp (CFL)	$1.50	Approximately 10,000 hours
Light Emitting Diode (LED)	$10	Approximately 25,000 hours

1. The table above shows the cost of the life span of several different types of light bulb. What is the ratio of the cost, in cents per hour of life span, of a compact florescent lamp to that of a light emitting diode?

   A) 1.5 to 5
   B) 3 to 8
   C) 3 to 10
   D) 4 to 5

2. A graphic designer creates an image for a t-shirt that measures 8 inches tall and 10 inches wide. She can use this image for small and medium t-shirts, but she must increase the size for a large t-shirt. She wants her final image for the large t-shirts to measure 9 inches tall and 11.25 inches wide. At what percent must she print out the image to obtain these measurements?

   A) 88.89%
   B) 107.5%
   C) 112.5%
   D) 125%

3. Target heart rates for various health benefits are calculated by taking different percents of a person's maximum heart rate, defined as the difference between 220 and the person's age. A heart rate in the aerobic zone is about 75% of the maximum heart rate and a heart rate in the fat-burning zone is about 55% of the maximum heart rate. What is the difference between the fat-burning heart rate and the aerobic heart rate of a person who is 35 years old?

   A) 37
   B) 44
   C) 51
   D) 55

Original Thrift Store Prices

Cost of items purchased on Monday	Cost of items purchased on Wednesday
$1.50	$0.98
$2.99	$1.99
$2.99	$2.55
$3.49	$4.98
$3.99	

4. Anya shops at a thrift store only on sale days. On Mondays, members with a savings card receive a 25% discount on all items. On select Wednesdays, members receive a 30% discount on all items. The chart above shows the original costs of the items Anya bought one week that included the special Wednesday discount. A tax of 6.25% of the total purchase is applied to the total after all discounts. What is the total amount Anya spent at the thrift store this week, including tax?

   A) $17.41
   B) $18.57
   C) $19.49
   D) $19.73

Density of Substances

Substance	Density (g/cm^3)
Aluminum	1.71
Copper	9.0
Iron	7.87
Lead	11.4
Osmium	?
Silver	10.5

5. The densities of various substances are listed in the table above. The ratio of the density of aluminum to the density of lead is 3 to x. The ratio of the density of osmium to the density of copper is x to 8. What is the density of osmium in grams per cubic centimeter?

Problem Solving and Data Analysis Drill 2

This section contains two types of questions. For multiple-choice questions, solve each problem and circle the letter of the answer that you think is the best of the choices given. For Student-Response questions, denoted by the grid-in icon, write your answer in the blank space provided.

1. The density of silver is 10.5 grams per cubic centimeter. If a nugget of silver weighs 2,100 grams, what is the volume of the nugget, in cubic centimeters?

2. One liter of water has a mass of 1000 grams. If there are 1000 milliliters in a liter, and 1 milliliter is equal to 1 cubic centimeter, what is the density of water, in grams per cubic centimeter?

   A) 1
   B) 1.1
   C) 10
   D) 11

3. A block of copper weighs 2,230 grams and measures 10 cm by 5 cm by 5 cm. Given that density is mass divided by volume, what is the density of copper in grams per cubic centimeter?

   A) 0.11
   B) 8.92
   C) 44.6
   D) 89.2

4. One match releases approximately 1,100 joules of heat energy when it is lit. If 1 joule equals 0.239 calories, how many of these matches must be lit to produce 2,100 calories of heat energy?

   A) 2
   B) 3
   C) 8
   D) 62

5. A certain 3D printer creates objects by building layers on top of each other. The average layer thickness is 102 μm (micrometers). There are 1,000,000 micrometers in a meter, and 1 inch equals 0.0254 meters. Approximately how many layers are needed to print an object one inch thick?

A) 250
B) 630
C) 2,540
D) 4,015

6. A certain 3D printer has a maximum build volume of 230 mm × 170 mm × 200 mm. If 1 inch equals 25.4 millimeters, which of the following is the best approximation of the printer's maximum build volume in cubic inches?

A) 782
B) 477
C) 308
D) 148

7. A typical race car is travelling at its maximum speed along a straight section of track. The distance it covers in 1 second is equal to the length of a football field, which is 120 yards or 360 feet. Given that there are 5,280 feet in a mile, what is the race car's maximum speed, in miles per hour?

A) 27
B) 82
C) 245
D) 528

8. During the typical Indy 500, the average pit stop is 15 seconds long and involves 6 crew members. Each of the 33 cars that race makes an average of 5 stops per race. If all cars finish the race, using full crews and making the expected number of pit stops, what is the total number of active work hours put in by the crews during pit stops?

A) 4.125
B) 41.25
C) 206.25
D) 247.5

9. Superman can run so fast that he can run on water as well as land, and he never gets tired. His average running speed is Mach 4, or 4 times the speed of sound. For fun, he decides to run around the Earth's equator, a distance of 40,075 kilometers. If the speed of sound is 340.29 meters per second, and there are 1,000 meters in a kilometer, approximately how many hours will it take for Superman to complete his run?

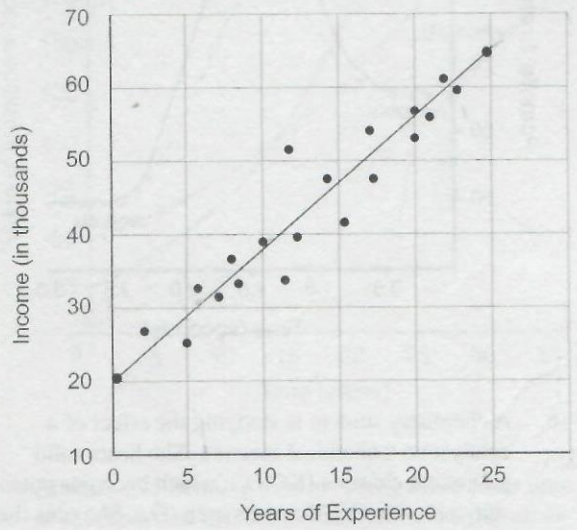
A) 1.5
B) 8
C) 29
D) 118

Problem Solving and Data Analysis Drill 3

This section contains two types of questions. For multiple-choice questions, solve each problem and circle the letter of the answer that you think is the best of the choices given. For Student-Response questions, denoted by the grid-in icon, write your answer in the blank space provided.

Questions 1 through 5 refer to the following graph.

INCOME BASED ON YEARS OF EXPERIENCE AT COMPANY X



1. The scatterplot above shows the income, in thousands, of all the employees of Company X, based on years of experience in the industry. Based on the line of best fit to the data represented, what is the minimum starting salary, in thousands of dollars, at Company X?

2. The scatterplot above shows the income, in thousands, of all the employees of Company X, based on years of experience in the industry. Based on the line of best fit to the data represented, which of the following is the closest to the expected number of years of experience of an employee whose income is $30,000?

   A) 5
   B) 5.55
   C) 37
   D) 74

3. The scatterplot to the left shows the income, in thousands, of all the employees of Company X, based on years of experience in the industry. Based on the line of best fit to the data represented, which of the following is the expected income of an employee with 35 years of experience?

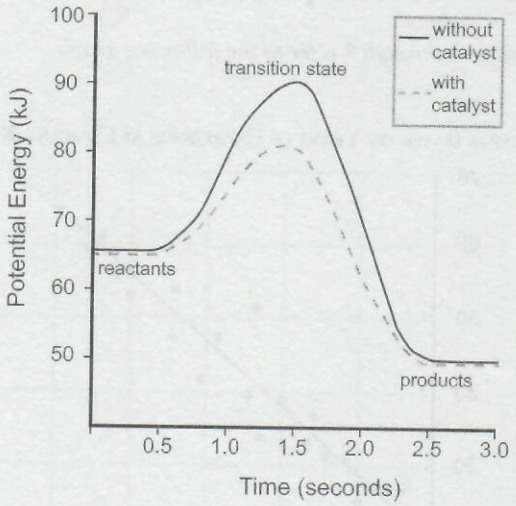
   A) $61,800
   B) $65,000
   C) $83,000
   D) $96,000

4. The scatterplot to the left shows the income, in thousands, of all the employees of Company X, based on years of experience in the industry. Based on the line of best fit to the data represented, which of the following is the closest to the average increase in income per additional year of experience?

   A) $900
   B) $1,800
   C) $4,500
   D) $9,000

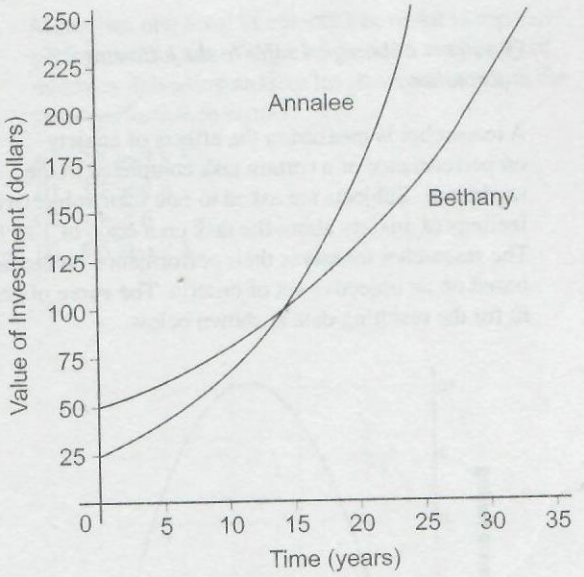
5. The scatterplot on the previous page shows the income, in thousands, of all the employees of Company X, based on years of experience in the industry. Which of the following could be the equation of the line of best fit to the data represented, as shown on the graph?

A) $y = 1.8x + 20$
B) $y = 2x + 20{,}000$
C) $y = 70x + 25$
D) $y = 1{,}800x + 20{,}000$



6. A chemistry student is studying the effect of a catalyst on a chemical reaction. She heats solid potassium chlorate ($KClO_3$), which becomes potassium chloride (KCl) and oxygen (O_2). She runs the reaction again, adding solid manganese dioxide (MnO_2) as a catalyst. She graphs the potential energy, in kilojoules, as a function of time. Which of the following statements is true of the graph above?

A) The potential energy of the reactants was less than that of the products.
B) The potential energy of the reaction was lowest during the transition state.
C) The addition of the catalyst lowered the potential energy of the reaction during the transition state.
D) The addition of the catalyst had no effect on the potential energy of the reaction.



7. Annalee and Bethany start investing at the same time in accounts that will earn interest compounded annually. Both women intend to leave their investments in place until the total value reaches \$250. After the initial deposit ($t = 0$), Annalee and Bethany check and record the value of their investments once every year. The value of the two investments was graphed and fitted with a smooth curve, as shown above, where each curve represents the value of one investment, in dollars, as a function of time, in years. Which of the following is a true statement regarding the investment values shown above?

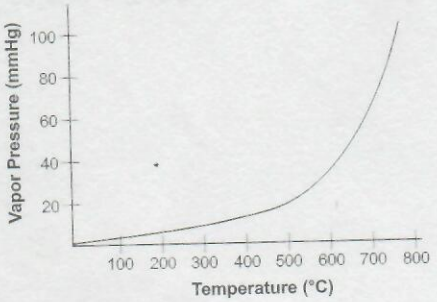
A) For the first 15 years, Bethany's investment is growing at a higher average rate than Annalee's investment.
B) At $t = 0$, both investments are worth \$100.
C) At $t = 0$, the value of Annalee's investment is 200% that of Bethany's investment.
D) At $t = 0$, Annalee has reached 10% of her goal and Bethany has reached 20% of hers.

Problem Solving and Data Analysis Drill 4

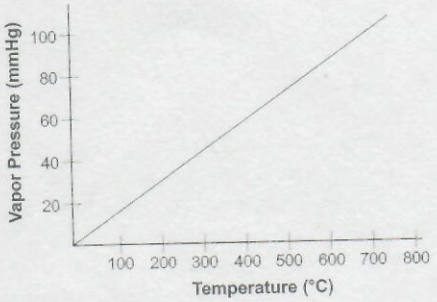
This section contains two types of questions. For multiple-choice questions, solve each problem and circle the letter of the answer that you think is the best of the choices given. For Student-Response questions, denoted by the grid-in icon, write your answer in the blank space provided.

1. When the vapor pressure of water at various temperatures is graphed, the values for the pressure increase slowly at lower temperatures. As the temperatures increase, the vapor pressure grows more rapidly. As the water reaches the boiling point of 100°C, the vapor pressure reaches 1 atm, or one standard atmosphere. If 760 mmHg is equivalent to one standard atmosphere, which of the following could be the graph of the vapor pressure of water?

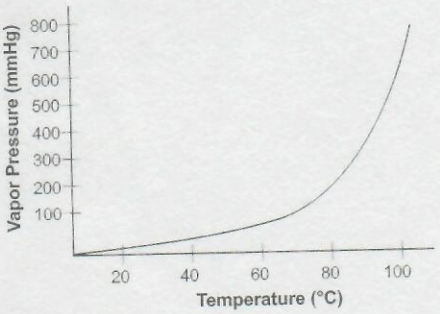
A)



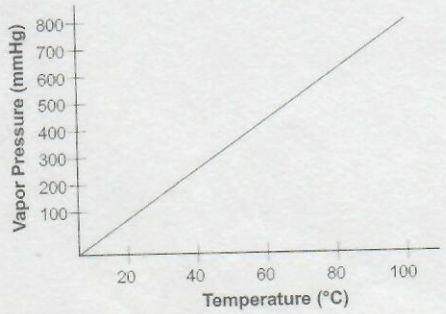
B)



C)

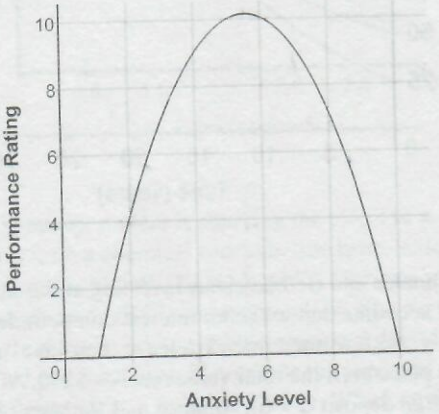


D)



Questions 2 through 4 refer to the following information.

A researcher is measuring the effects of anxiety on performance of a certain task completed in the workplace. Subjects are asked to rate their subjective feelings of anxiety about the task on a scale of 1 to 10. The researcher measures their performance on the task based on an objective set of criteria. The curve of best fit for the resulting data is shown below.



2. What level of anxiety could result in a performance score of 4?

3. What would be considered the optimal level of anxiety an employee should feel to perform at her best on this task?

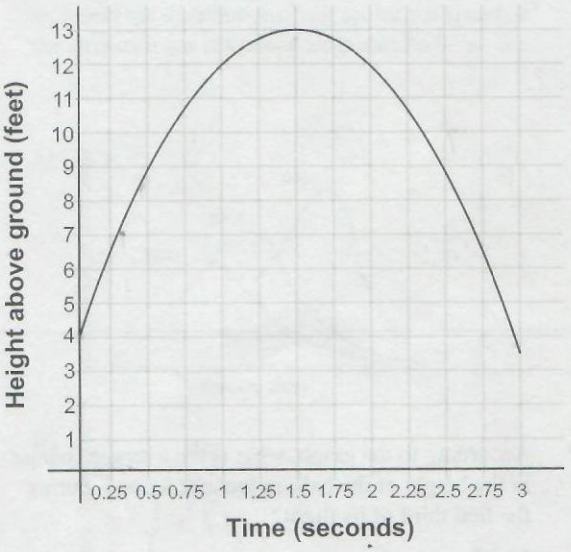
A) 0
B) 5
C) 5.5
D) 10

4. More than one level of anxiety can result in a given performance score. Which of the following pairs of numbers indicating anxiety levels would result in the same performance score?

A) 2.5 and 8.5
B) 3.5 and 8
C) 4 and 6
D) 4.5 and 7.5

Questions 5 through 7 refer to the following information.

Two softball players are standing in a field facing each other. One player throws the ball up into the air and the other player catches it. A third player videotapes the throw and catch, and the three players analyze the film. They make the following graph of the ball's height above the ground as a function of time.



5. According to the graph, what is the height above the ground of the ball as it left the first player's hand?

A) 0
B) 3
C) 4
D) 13

6. If a point on the graph is to be defined as (x, y), where the x-coordinate is the time in seconds and the y-coordinate is the height of the ball in feet, which of the following shows the coordinates of the maximum height attained by the ball during its flight?

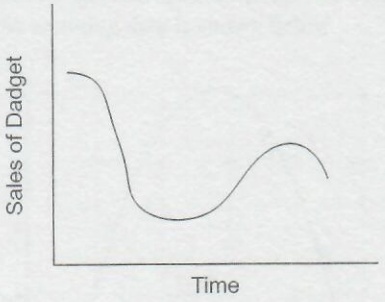
A) (1.5, 13)
B) (4, 3)
C) (8, 1)
D) (13, 1.5)

7. According to the graph, what is the average change in the height of the ball, in feet per second, during the first third of its flight?

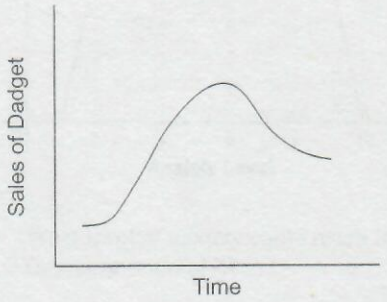
A) 4
B) 8
C) 9
D) 12

8. A hot new product, the Dadget, comes on the market at the beginning of the year. Sales quickly take off, until it is discovered that the Dadget tends to catch fire easily. Sales plummet as the word spreads, while engineers scramble to correct the problem. They finally fix the issue, and sales increase once more, but lack of confidence in the Dadget prevents the company from reaching previous sales levels. Which of the following could be the graph of sales of the Dadget for the year?

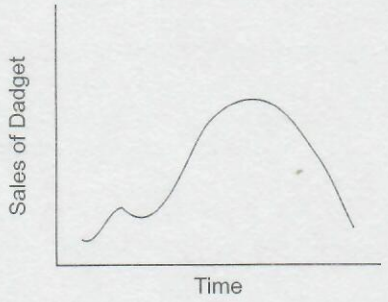
A)



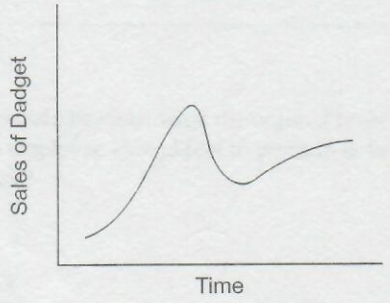
B)



C)

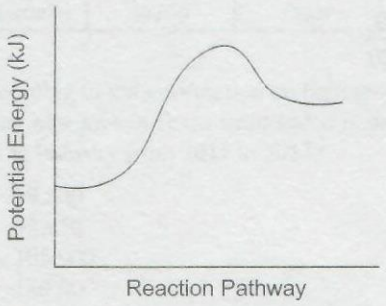


D)

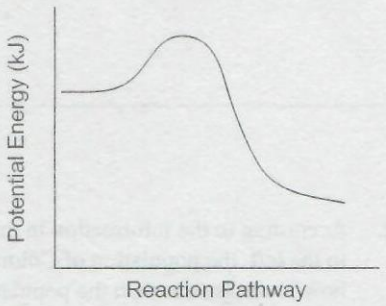


9. A student is graphing the potential energy, in kilojoules, of a certain chemical reaction. At the start of the reaction, the reactants have a constant level of potential energy. As the reactants reach their transition state, the potential energy increases and then drops off as the reaction nears completion. The resulting products have less potential energy than the reactants did. Which of the following could be the graph of the potential energy of this chemical reaction?

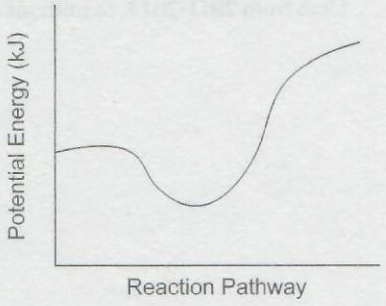
A)



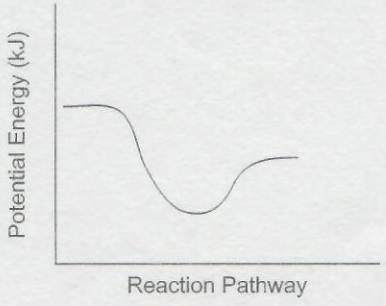
B)



C)

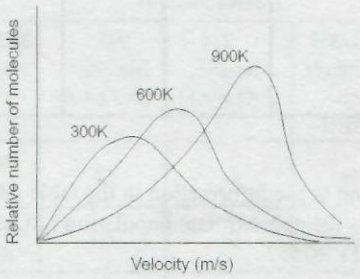


D)

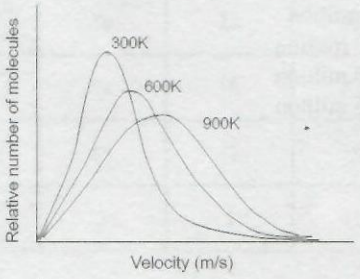


10. A chemistry teacher is giving a lesson on the kinetic molecular theory of gases. She explains to her students that they will be making graphs of the distribution of different speeds of molecules of an unknown gas at varying temperatures. At a given temperature, the graph peaks at the speed at which most molecules are moving. As the temperature is increased, the most probable speed increases, but the curve becomes broader as the spread of speeds increases. Given this information, which of the following graphs could represent the distribution of the molecular speeds of the unknown gas at various temperatures?

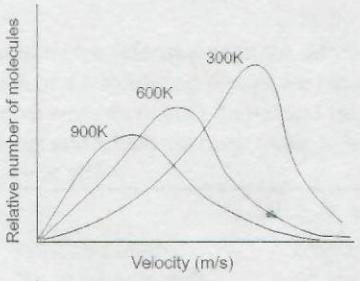
A)



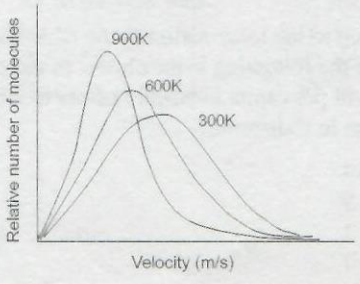
B)



C)



D)



Problem Solving and Data Analysis Drill 5

This section contains two types of questions. For multiple-choice questions, solve each problem and circle the letter of the answer that you think is the best of the choices given. For Student-Response questions, denoted by the grid-in icon, write your answer in the blank space provided.

Questions 1 through 5 refer to the following information.

TOP FIVE STATES FOR NEW JOB GROWTH PER CAPITA, 2011-2013

	California	Colorado	North Dakota	Texas	Utah
Total Jobs Added in State	904,500	146,325	65,450	794,250	98,600
New Jobs per 10,000 Residents	235	275	945	300	330

1. According to the information in the table above, what was the approximate population of California from 2011-2013?

   A) 3.8 million
   B) 21.2 million
   C) 38.5 million
   D) 90.5 million

2. According to the information in the table above, which of the following is the closest to the ratio of job growth per capita in North Dakota to job growth per capita in California?

   A) 1 to 4
   B) 2 to 9
   C) 3 to 1
   D) 4 to 1

3. According to the information in the table to the left, approximately what fraction of the jobs added in the top five states for job growth were added in Utah?

   A) $\frac{1}{25}$
   B) $\frac{1}{20}$
   C) $\frac{1}{5}$
   D) $\frac{9}{20}$

4. According to the information in the table to the left, the population of Colorado was how much greater than the population of Utah from 2011-2013, in millions?

Further data was gathered regarding the job growth in Texas by industry. The following chart shows the results.

New Jobs by Industry per 150,000 Jobs Added

Energy	25,000	Business Services	5,000
Construction	10,000	Finance/ Real Estate	5,000
Trade	15,000	Information Systems	30,000
Manufactuting	20,000	Other	40,000

5. According to the information on both tables, how many new jobs in Texas were added in the manufacturing industry from 2011 to 2013?

A) 19,500
B) 52,950
C) 105,900
D) 120,600

Questions 6 and 7 refer to the following information.

A media market research company surveyed 200,000 randomly selected people in each of 6 age groups regarding the ways in which they receive their news. Participants were asked if they received their news on the preceding day through traditional media (newspapers, television, and radio), through digital media (Internet, E-mail, social media, or podcasts), through both traditional and digital media, or if they did not get news from any of these sources. The results are shown in the table below.

How Americans Get Their News by Age Group
(in thousands)

	Traditional Media Only	Digital Media Only	Both Traditional and Digital	No News Source
18- to 24-year olds	40	32	66	62
25- to 29-year olds	60	30	68	42
30- to 39-year olds	50	24	90	36
40- to 49-year olds	78	16	82	24
50- to 64-year olds	88	12	78	22
65 years and older	124	2	42	32

6. Based on the information in the table, people in which of the following groups are most likely to receive news from both digital and traditional sources and which are most likely to have no news source at all?

	No News Source	Both Traditional and Digital Sources
A)	50- to 64-year-olds	65 years and older
B)	30- to 39-year-olds	18- to 24-year-olds
C)	25- to 29-year olds	40- to 49-year-olds
D)	18- to 24-year-olds	30- to 39-year-olds

7. Based on the information in the table, which type of news source is inversely associated with age?

A) Traditional only
B) Digital only
C) Both traditional and digital
D) No news source

Problem Solving and Data Analysis Drill 6

For each question in this section, solve the problem and circle the letter of the answer that you think is the best of the choices given.

Questions 1 through 3 refer to the following information.

A media market research company surveyed 200,000 randomly selected people in each of 6 age groups regarding the ways in which they receive their news. Participants were asked if they received their news on the preceding day through traditional media (newspapers, television, and radio), through digital media (Internet, E-mail, social media, or podcasts), through both traditional and digital media, or if they did not get news from any of these sources. The results are shown in the table below.

How Americans Get Their News by Age Group
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40- to 49-year olds	78	16	82	24
50- to 64-year olds	88	12	78	22
65 years and older	124	2	42	32

1. If the United States population at the time of this survey included approximately 21 million people ages 25 to 29, approximately how many people ages 25 to 29 got news from digital media on a typical day at that time?

   A) 10.3 million
   B) 7.14 million
   C) 6.3 million
   D) 3.15 million

2. An additional 1,500 people in the 40- to 49-year-old age group were surveyed. Which of the following is most likely the number of people from the follow-up survey that reported they received their news exclusively from traditional media?

   A) 375
   B) 585
   C) 615
   D) 660

3. Of the 50- to 64-year-olds whose only source of news was traditional media, 1,000 were selected at random to do an additional survey in which they were asked what traditional media they preferred. There were 375 people in this follow-up survey who said they preferred print media, and the other 625 preferred a different traditional media. Using the data from both surveys, which of the following is most likely to be an accurate statement?

   A) About 16,500 people 50 to 64 years old would report preferring print media for their news source.
   B) About 24,250 people 50 to 64 years old would report preferring print media for their news source.
   C) About 33,000 people 50 to 64 years old would report preferring print media for their news source.
   D) About 55,000 people 50 to 64 years old would report preferring print media for their news source.

Top Five States for New Job Growth per Capita, 2011-2013

	California	Colorado	North Dakota	Texas	Utah
Total Jobs Added in State	904,500	146,325	65,450	794,250	98,600
New Jobs per 10,000 Residents	235	275	945	300	330

4. According to the information given in the table above, which of the following conclusions can be drawn about per capita job growth in the top five states?

   A) Job growth was greatest in North Dakota because it had the greatest number of jobs added per 10,000 residents.
   B) Job growth was greatest in Texas because it had the greatest number of total jobs added.
   C) Job growth was lowest in North Dakota because it had the fewest number of total jobs added.
   D) Job growth was lowest in Colorado because it had the fewest number of jobs added per 10,000 residents.

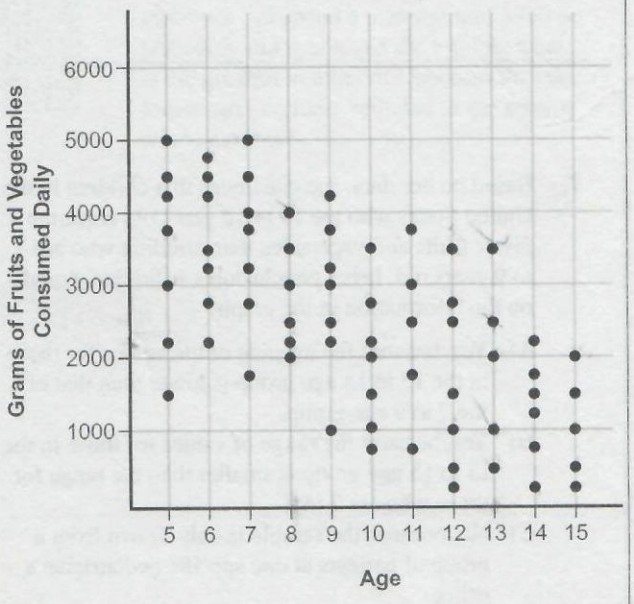
Problem Solving and Data Analysis Drill 7

This section contains two types of questions. For multiple-choice questions, solve each problem and circle the letter of the answer that you think is the best of the choices given. For Student-Response questions, denoted by the grid-in icon, write your answer in the blank space provided.

Questions 1 through 7 refer to the following information.

A dietician working in a pediatrician's office is examining the diets of the patients seen there. She has the parents of each patient record their child's consumption of fruits and vegetables each day for four weeks. She then averages the values for each child to find the grams of fruits and vegetables consumed daily by that child, rounded to the nearest quarter of a thousand. Each child's average consumption is marked as a dot on the graph below.

Fruits and Vegetables Consumed by Age



1. What is the mode of the data gathered, in grams of fruits and vegetables, consumed daily?

2. Which of the following ages has the greatest range of values for fruits and vegetables consumed daily?

   A) Age 5
   B) Age 7
   C) Age 9
   D) Age 12

3. The median consumption value for 8-year-olds is how much greater than the median consumption value for 13-year-olds?

   A) 2,750
   B) 2,000
   C) 1,250
   D) 750

4. Which of the following children has an average daily consumption of fruits and vegetables, in grams, that is farthest away from the mean for his age group?

   A) The 7-year-old whose average consumption is 1,750 grams daily
   B) The 9-year-old whose average consumption is 1,000 grams daily
   C) The 12-year-old whose average consumption is 3,500 grams daily
   D) The 13-year-old whose average consumption is 3,500 grams daily

5. For which of the following age groups is the median value for daily consumption of fruits and vegetables, in grams, closest to the mean of that group?

   A) The 6-year-old group
   B) The 10-year-old group
   C) The 13-year-old group
   D) The 15-year-old group

6. Which of the following is the closest to the mean consumption of fruits and vegetables, in grams, of children over 11 years of age?

   A) 1,500
   B) 1,650
   C) 2,350
   D) 3,000

7. Based on her data, she concludes that children in the United States who are 13 to 15 years old consume fewer fruits and vegetables than children who are 7 to 9 years old. Is her conclusion a valid one, based on the information in the graph?

   A) Yes, because the average of the values for those in the 13 to 15 age group is lower than that of the 7 to 9 age group.
   B) Yes, because the range of values for those in the 13 to 15 age group is smaller than the range for those who are 7 to 9.
   C) No, because the sample is only drawn from a group of patients at one specific pediatrician's office.
   D) No, because the data was provided by the children's parents and not the children themselves.

Problem Solving and Data Analysis Drill 8

This section contains two types of questions. For multiple-choice questions, solve each problem and circle the letter of the answer that you think is the best of the choices given. For Student-Response questions, denoted by the grid-in icon, write your answer in the blank space provided.

Questions 1 and 2 refer to the following information.

An online payment system allows users to purchase a virtual currency called "Dabcoin" with any legal currency, such as U.S. dollars or Japanese yen. When the user purchases Dabcoins, the online payment system converts the user's home currency into Dabcoins at the daily exchange rate, and then charges a customer service fee that is 5% of the value of the customer's Dabcoins.

1. On Monday, the official exchange rate, in U.S. dollars per Dabcoin, is $34. If a customer can spend a maximum of $750 on Dabcoins and is charged the 5% fee, what is the greatest number of Dabcoins the customer can purchase, rounded to the nearest whole number?

2. On Tuesday, the customer service fee was increased to 11.6% of the value of the customer's Dabcoins. If the maximum number of Dabcoins that could be purchased for $750 on Tuesday is equal to the number of Dabcoins that could be purchased for $750 on Monday, what was the exchange rate, in U.S. dollars per Dabcoin, on Tuesday? (Round your answer to the nearest whole number.)

Questions 3 through 5 refer to the following information.

John is conducting an experiment for his Economics class. Each morning on eight consecutive days, he sells homemade waffles in front of the school cafeteria. On the first day, he charges $1 per waffle, and he raises the price by one dollar per day for the duration of the experiment. He records both the price and his net profits per day in the table below, but neglects to fill in his profits on days 2 and 7. To find the missing values for days 2 and 7, he writes a quadratic equation that accurately models the relationship between price and net profits.

Price per waffle (in dollars)	Net profits (in dollars)
1	7
2	
3	15
4	16
5	15
6	12
7	
8	0

3. What is the sum of the net profits, in dollars, that John earned on days 2 and 7? (Disregard the $ sign when gridding in your answer.)

4. John discovers that the quadratic equation that accurately models his results is of the form $N = -(p - a)^2 + c$, where p is the price, N is the net profits, and a and c are constants. What is the value of $a + c$?

5. Suppose that John added a ninth day to the experiment, and raised the price of waffles to \$9 per waffle. If the quadratic equation he wrote is accurate, what would John's net loss be, in dollars, on day 9? (Disregard the \$ sign when gridding in your answer.)