Concert Tickets

A high school band is selling concert tickets as a fundraiser. Adult tickets sell for $5 each, and student tickets sell for $3 each.

1. Let $x$ represent the number of adult tickets sold and $y$ represent the number of student tickets sold. The equation $5x + 3y = 300$ represents $300 in ticket sales. Find the $x$- and $y$-intercepts of this equation. What do the intercepts represent? Then graph the equation.

2. The first five tickets Theo sold were numbered 192, 196, 202, 206, and 210. Do these ticket numbers form an arithmetic sequence? Explain.

3. The first ticket Amy sold was an adult ticket. All the other tickets she has sold were student tickets.
   a. Write a rule that can be used to find Amy's total ticket sales in dollars after she sells $n$ tickets.
   b. Use the rule to find Amy's total ticket sales in dollars after she sells 20 tickets. Show your work.

4. On the first day of ticket sales, 15 adult tickets and 20 student tickets were sold.
   a. What is the ratio of adult tickets sold to student tickets sold?
   b. Suppose the ratio of adult tickets to student tickets remains the same throughout the ticket sale. If 350 tickets were sold, how many of them were adult tickets? Show your work.
5. There are 10 band CDs to be given away at the concert. Numbered stubs of each of the 350 tickets sold are put in a barrel. Stubs will be pulled out one at a time and not put back in the barrel.

a. What is the probability of winning the first CD to be given away? Show your work.

b. What is the probability of winning the tenth CD to be given away? Show your work.

c. Are the events in Parts a and b independent or dependent? Explain.

d. Brandon and Brianna go to the show together. What is the probability that they will win the first two CDs? Show your work.

e. What are the odds of winning a CD at the concert? Explain.

6. Suppose \( n \) tickets are sold. Ten different CDs will be given away, so each stub is placed back in the barrel after being drawn.

a. What is the probability that the same stub will be drawn twice in a row? Explain.

b. Rewrite the probability using a negative exponent.
Solar System Relationships

The following diagram shows some information about the earth and the moon.

Distance \( r = 384,000 \text{ km} \)

Earth
- Diameter \( d = 12,700 \text{ km} \)
- Mass \( m = 5.97 \times 10^{24} \text{ kg} \)

Moon
- Diameter \( d = 3,400 \text{ km} \)
- Mass \( m = 7.35 \times 10^{22} \text{ kg} \)

1. a. Write the diameters of the earth and the moon in scientific notation.

1. b. The circumference of the earth is approximately 40,000 km. Write this number in scientific notation.

2. The earth and the moon are both spheres, so they are similar figures. Write and solve a proportion to calculate the circumference of the moon. Use the measurements in the figure above and in Problem 1b. Show your work.

3. The force of gravity, in Newtons, between two objects can be calculated using the formula

\[ F_g = (6.67 \times 10^{-11}) \frac{m_1 m_2}{r^2} \]

In this formula, \( m_1 \) and \( m_2 \) represent the mass of the earth and the mass of the moon in kilograms, and \( r \) represents the distance between the center of the earth and the center of the moon in kilometers. Use the values in the figure above to determine the force of gravity between the earth and the moon in Newtons. Show your work.
4. The following diagram shows some information about another planet in the solar system and its moon.

\[ \text{Distance (r) = } xyz^2 \]

Planet
\[ \text{Diameter (d) = } \frac{a^2b}{c} \]
\[ \text{Mass (m) = } x^2y^3 + x^3y^2z \]

Moon
\[ \text{Diameter (d) = } ab \]
\[ \text{Mass (m) = } xyz \]

a. The planet is similar to its moon, which has a circumference of \( abcd \). Use a proportion to write an expression that represents the circumference of the planet. Show your work.

b. Factor the expression for the mass of the planet using the GCF.

c. Use the formula \( F_G = (6.67 \times 10^{-11}) \frac{m_1m_2}{r^2} \) to determine the force of gravity between the planet and its moon.
The Consumer Price Index (CPI) is issued monthly by the U.S. Department of Labor to report the average changes in prices of goods and services purchased by urban households throughout the United States. Government, businesses, and private citizens use the CPI to help them make economic decisions. CPI points can be compared to reference points of 100 based on data collected for the years 1982-1983.

1. The CPI-U, which is shown in the graph above, represents purchases made by approximately 87% of the U.S. population. During October, 2006, the U.S. population was estimated to have reached 300 million. Solve a proportion to find approximately how many people the CPI-U represented in October, 2006. Show your work.

2. Between which two consecutive years shown in the graph above did the CPI-U have the greatest change? Use slope to explain your answer.

3. A line drawn on the graph above from the point for 2001 to the point for 2006 would show the average rate of change in the CPI-U from 2001 to 2006.
   a. Draw that line.
   b. Find the slope of the line you drew to find the average annual rate of change in the CPI-U from 2001 to 2006. Show your work.
   c. Describe how the annual changes for each pair of years in the CPI-U from 2001 to 2006 compare to the average annual rate of change for that time period.
4. The table at the right shows the 2006 CPI-U for several expenditures.

a. What percent of the amount paid for rent in 1982-1984 is the average rent for 2006? Show your work.

b. Suppose your grandparents told you that they spent $500 per month to rent an apartment in 1982-1984. Based on the CPI-U, how much would they pay for a similar apartment in 2006? Show your work.

5. Believe it or not! The cost of some items did go down from the 1980s to 2006.

a. What percent of the amount paid for a personal computer in 1982-1984 is the average cost of a personal computer in 2006? Show your work.

b. Suppose you paid $550 for a personal computer in 2006. Based on the CPI-U, how much would someone have had to pay for a personal computer in 1982-1984? Show your work.

6. According to the Consumer Price Index, the average price of a 1-pound loaf of white bread in October, 2007, was $1.27 to the nearest cent. This is at least twice as much as a 1-pound loaf of white bread cost in October, 1997, less $0.50. Write an inequality that expresses the possible cost of a loaf of white bread in October, 1997.
Retail involves selling goods to consumers—people who will use the goods. Retailers may sell goods they produce themselves. Usually, though, retailers buy their goods from a manufacturer or a wholesaler. A wholesaler buys from a manufacturer to sell to a retailer.

The price a retailer pays for an item is the wholesale price. The price a retailer charges a customer for an item is the retail price. The change from the wholesale price to the retail price is the markup and is usually given as a percent.

1. Gifts Galore sells a robotic pet dog. It pays the wholesaler $25 for this item and marks it up 110%.
   a. What is the retail price of the robotic pet? Remember the retail price is the wholesale price plus the markup. Show your work.

   b. During a sale, Gifts Galore discounts the retail price of the robotic dog 30%. What is the sale price of the dog? Show your work.

   c. During the first hour of the sale, Gifts Galore offers a 20% discount off the sale price of the dog. What is the percent of decrease in the original retail price? Show your work.

2. Dollar Discount buys the same robotic dog from a wholesaler for $5 less than Gifts Galore does. It marks up this item 70%. Will a shopper get a better buy on the dog at Dollar Discount or at Gifts Galore? Explain your answer.
3. Gifts Galore has three sizes of gift boxes in the shape of a cube. Their volumes are 512 cubic inches; 1,728 cubic inches; and 8,000 cubic inches. Which gift box(es) could be used to pack the robotic dog? Explain.

4. Commission is an amount paid to a salesperson for making a sale. It is usually a percent of the amount of the sale. Monica works as a salesperson 40 hours a week at Gifts Galore. She earns a weekly salary of $100 plus an 8% commission on all the sales she makes.

   a. Write an equation in slope-intercept form to represent this situation. Define the variables. Then graph the equation.

   b. Troy works 40 hours a week at a discount store and earns $8.50 an hour. What amount of sales must Monica make in a week to earn the same amount as Troy? Show your work. Use the graph or the equation from part a.

5. The manager of Gifts Galore has set a goal of at least $500 a day in sales for each salesperson. Write and graph an inequality to model this goal.

6. A survey of stores in one area shows the following retail prices for one model of robotic cat: $43, $45, $39, $42, $32, $38, $42, $41. Which measure of central tendency—mean, median, or mode—best describes the price of a robotic cat? Explain your answer.
Basketball

Basketball was invented by Dr. James Naismith in the winter of 1891–1892 in Massachusetts. One of Dr. Naismith's students gave the game its name because the ball was originally shot into a peach basket.

1. Regulation basketball courts have different dimensions for junior high, high school, and college. The diagram shows the length and width of a regulation NCAA (National Collegiate Athletic Association) court.
   a. A person is taping the outline of the court on a gym floor. What is the perimeter of the court? Show your work.

   b. The court is 44 feet longer than it is wide. Let $x$ represent the width of the court. Write an expression to represent the length of the court.

   c. Use the formula for the perimeter of a rectangle to find the length and width of the court. Show your work.

2. The expression $-16t^2 + vt + i$ represents the height of a basketball in feet after $t$ seconds. The initial velocity in feet per second at which the ball is thrown upward is represented by $v$, and the height in feet from which the ball is thrown is represented by $i$. Greg throws a basketball up from 7 feet at an initial velocity of 25 feet per second. At the same time, Victor throws a basketball up from 5 feet with an initial velocity of 20 feet per second.
   a. Write an expression that represents the difference in the heights of the players' balls after $t$ seconds. Show your work.

   b. Greg's ball reaches its maximum height approximately 0.8 second after it is thrown. About how high above the floor is it? What is the height of Victor's ball at this time? Show your work.
3. The table shows the number of games won by the ten women's basketball coaches who won the greatest number of games in NCAA Division I colleges through 2007.

<table>
<thead>
<tr>
<th>Name</th>
<th>School</th>
<th>Number of Games Won</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geno Auriemma</td>
<td>Connecticut</td>
<td>621</td>
</tr>
<tr>
<td>Jim Foster</td>
<td>Ohio State</td>
<td>634</td>
</tr>
<tr>
<td>Sylvia Hatchell</td>
<td>North Carolina</td>
<td>751</td>
</tr>
<tr>
<td>Andy Landers</td>
<td>Georgia</td>
<td>684</td>
</tr>
<tr>
<td>Debbie Ryan</td>
<td>Florida International</td>
<td>651</td>
</tr>
<tr>
<td>Robin Selvig</td>
<td>Montana</td>
<td>672</td>
</tr>
<tr>
<td>Vivian Stringer</td>
<td>Rutgers</td>
<td>777</td>
</tr>
<tr>
<td>Pat Summitt</td>
<td>Tennessee</td>
<td>947</td>
</tr>
<tr>
<td>Tara VanDerveer</td>
<td>Stanford</td>
<td>689</td>
</tr>
<tr>
<td>Kay Yow</td>
<td>North Carolina State</td>
<td>708</td>
</tr>
</tbody>
</table>

a. Display the data using a box-and-whisker plot. Identify any outliers.

b. Half of these coaches' records are between which numbers? Explain.

4. In 2000, a season ticket for one college's basketball games cost $480. In 2006, a season ticket cost $510. Suppose the cost of a season ticket continued to rise at the same rate.

a. Write an equation in slope-intercept form to represent this situation. Show your work.

b. What will the cost of a season ticket be in 2010? Show your work.

5. A season basketball ticket at one college costs $525. A season ticket holder can buy single-game tickets for $25 each. Otherwise, single-game tickets cost $30 each. Mr. and Mrs. Miller know they will attend most, but not all games in the season. Mr. Miller must decide whether to buy a season ticket for himself and single-game tickets for his wife or to buy only single-game tickets for both himself and his wife. Graph a system of equations to find for how many games the cost of both ticket options are the same and what that cost is.