

Session 1

Session 1 Directions

You may NOT use a calculator in this session. When you have finished this session, you may check over your work in this session only.

1. Which of the following represents a linear function?

A. $f(x) = 3^x$

B. $f(x) = x^3$

C. $f(x) = 3x^2$

D. $f(x) = x + 3$

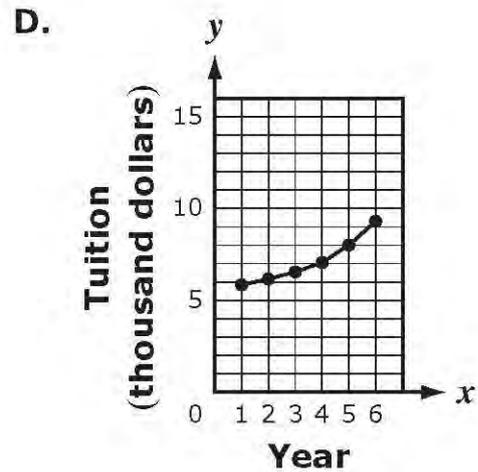
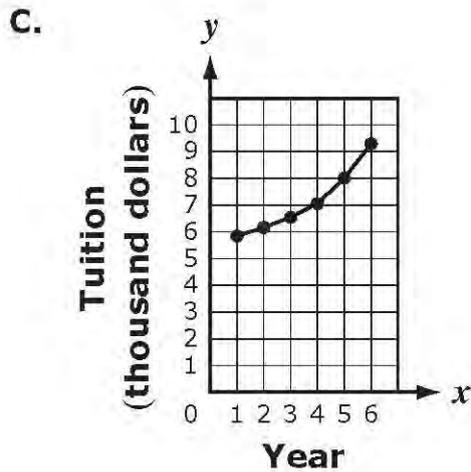
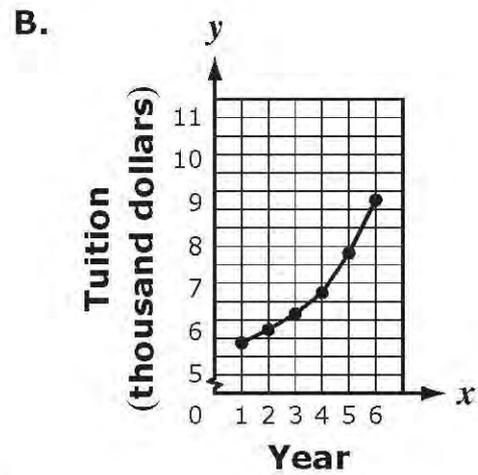
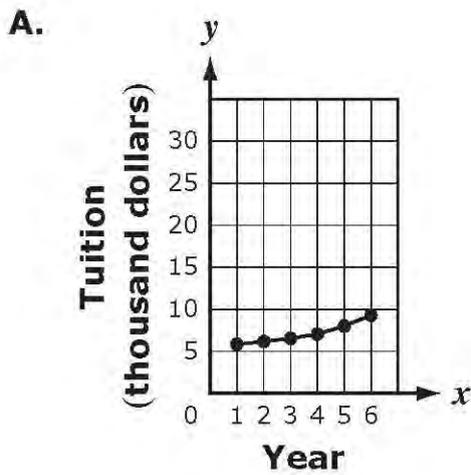


2. The tuition rates for in-state residents to attend a state college are shown in the table below.

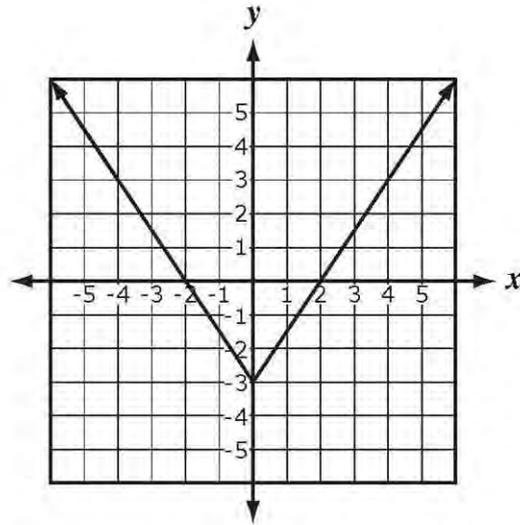
State College Tuition

| Year | 1 | 2 | 3 | 4 | 5 | 6 |
|---------|---------|---------|---------|---------|---------|---------|
| Tuition | \$5,840 | \$6,162 | \$6,546 | \$7,054 | \$8,008 | \$9,296 |

Which of the following data displays would best accompany an article entitled "State College: Six Years of Consistently Low and Affordable Tuition"?



3. Consider the graph below.



Which function best represents this graph?

- A. $f(x) = \frac{3}{2}|x - 3|$
- B. $f(x) = \left|\frac{3}{2}\right|x - 3$
- C. $f(x) = \left|\frac{3}{2}x\right| - 3$
- D. $f(x) = \left|\frac{3}{2}x - 3\right|$
4. Express $\frac{\sqrt{2} + \sqrt{6}}{\sqrt{3}}$ with a rational denominator.

- A. $\frac{\sqrt{2} + \sqrt{6}}{3}$
- B. $\frac{\sqrt{6} + 3\sqrt{2}}{3}$
- C. $\sqrt{6} + \sqrt{2}$
- D. $2\sqrt{2}$

5. Which of the following describes the graph of the function $f(x) = (-x + 3)(x - 5)$?
- A. opens up and x -intercepts at $(-5, 0)$ and $(3, 0)$
 - B. opens up and x -intercepts at $(3, 0)$ and $(5, 0)$
 - C. opens down and x -intercepts at $(-5, 0)$ and $(-3, 0)$
 - D. opens down and x -intercepts at $(3, 0)$ and $(5, 0)$

6. Consider the table below.

| x | y |
|-----|-----|
| 0 | 3 |
| 1 | 6 |
| 2 | r |

What value of r will make the table a representation of an exponential function? Explain your answer.

7. Consider the system of equations below.

$$\begin{aligned}x + y &= 6 \\ y &= -x + 2\end{aligned}$$

Which statement correctly describes the graphs of these equations?

- A. The lines are parallel.
- B. The lines coincide.
- C. The lines intersect at $(2, 4)$.
- D. The lines intersect at $(-2, 8)$.



8. Solve $4x^2 - 10x + 6 = 0$.

A. $x = -\frac{1}{2}$ or $x = 3$

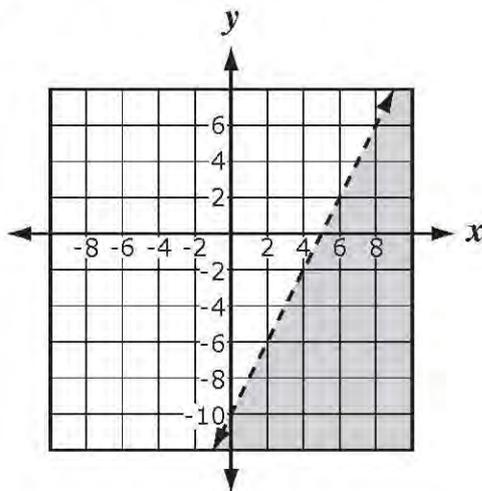
B. $x = -1$ or $x = \frac{3}{2}$

C. $x = \frac{3}{4}$ or $x = 2$

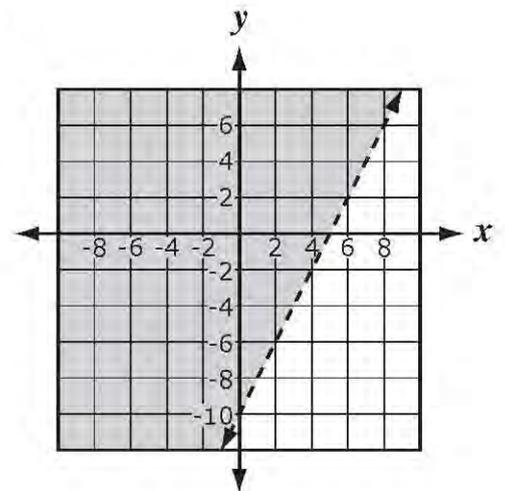
D. $x = \frac{3}{2}$ or $x = 1$

9. Which graph best represents $2x - y < 10$?

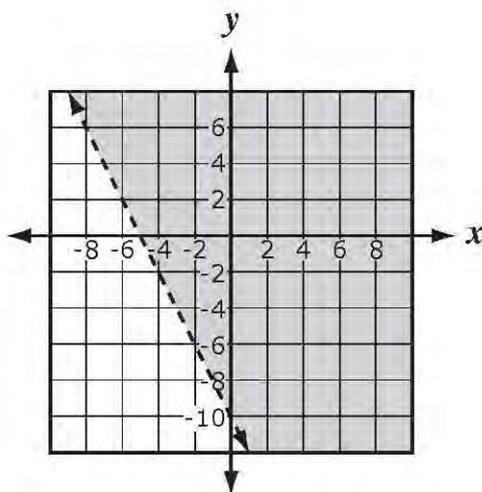
A.



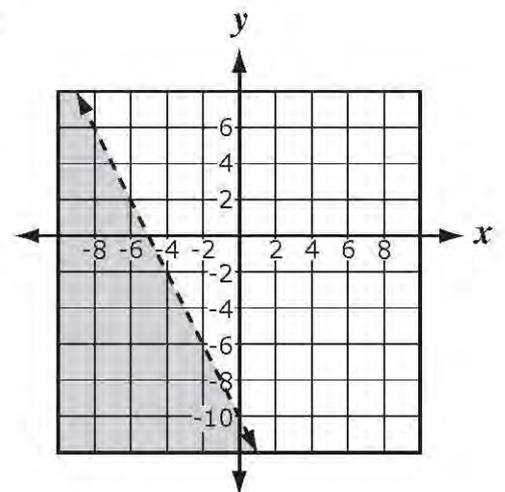
B.



C.



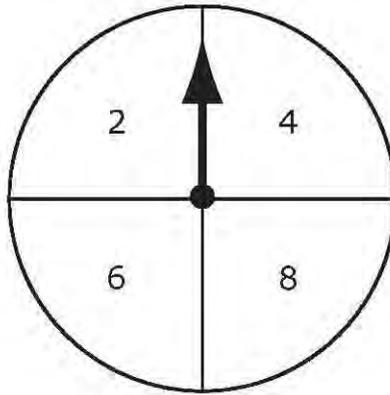
D.



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10. Pat spins the spinner below and rolls a cube with sides numbered 1 through 6 one time each.

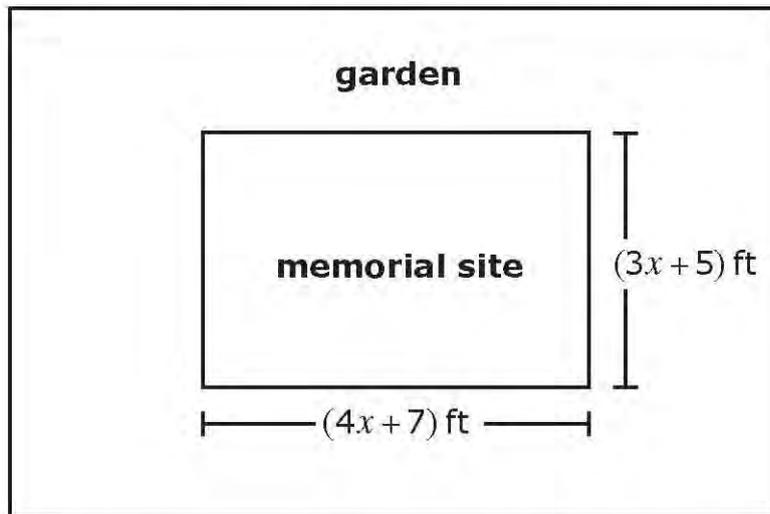


What is the probability that the spinner and number cube both land on 2?

- A. $\frac{1}{24}$
- B. $\frac{1}{6}$
- C. $\frac{2}{3}$
- D. $\frac{22}{24}$
11. What is the vertex of the graph of $f(x) = 2x^2 - 4x$?
- A. (0, 0)
- B. (0, 2)
- C. (1, -2)
- D. (1, 6)



12. City officials are putting a garden around a memorial site as shown below.



- Part A** Determine the area of the memorial site in terms of x . Write your answer as a trinomial and include units. Show or explain your work.
- Part B** The outside edges of the garden form a rectangle whose length and width are proportional to the sides of the memorial site, increased by a scale factor of 3. Determine the lengths of the outside edges of the garden. Write your answer in simplest form.
- Part C** Determine the area of the garden in terms of x . Write your answer in simplest form. Show or explain your work.

13. The point on a pin has a diameter of approximately 1×10^{-4} meters. If an atom has a diameter of 2×10^{-10} meters, about how many atoms could fit across the diameter of the point of a pin?

- A. 50,000
- B. 500,000
- C. 2,000,000
- D. 5,000,000

14. Which equation represents a line that intersects $y = -\frac{1}{2}x - 5$ at exactly one point?

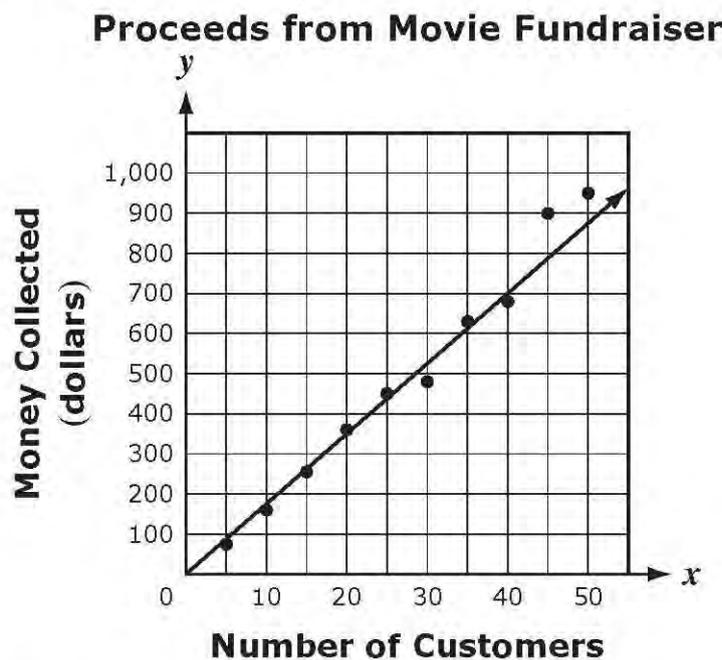
A. $y = -\frac{2}{3}x - 3$

B. $y = -\frac{1}{2}x - 2$

C. $y = -\frac{2}{4}x - 5$

D. $y = -\frac{1}{2}x + 5$

15. A movie theater sells tickets and refreshments as a fundraiser. The data points below show the amount of money collected after every five customers completed all of their purchases.



What does the slope of the line of best fit represent?

- A. the cost of one ticket
- B. the exact amount of money spent by each customer
- C. the average amount of money spent by each customer
- D. the difference between the amounts spent by any group of two customers

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- 16.** Chris and Kim worked together to paint skateboards. Kim painted 10 more than twice the number of skateboards that Chris painted. Together they painted 100 skateboards. Which of these equations can be used to find the number of skateboards (x) that Chris painted?

- A.** $2x + 10 = 90$
- B.** $3x + 10 = 90$
- C.** $2x + 10 = 100$
- D.** $3x + 10 = 100$

- 17.** Solve $6 - 3(4x - 5) = 7$.

- A.** $x = -\frac{4}{3}$
- B.** $x = \frac{7}{6}$
- C.** $x = \frac{11}{6}$
- D.** $x = \frac{7}{3}$

- 18.** The total mass of a cart loaded with equally sized metal blocks made from the same metal can be represented by the linear function $f(b) = 500b + 5,500$, where $f(b)$ is the total mass in grams and b is the number of metal blocks on the cart.

Part A What does the coefficient 500 represent in $f(b)$? Include appropriate units in your answer.

Part B What does the y -intercept of $f(b)$ represent?

19. Which of the following numbers is irrational?

A. $\sqrt{2^4}$

B. $\sqrt{900}$

C. $\sqrt{10(2.5)}$

D. $\sqrt{10(80)}$

20. Simplify $(2 - \sqrt{5})(4 + \sqrt{5})$.

A. 3

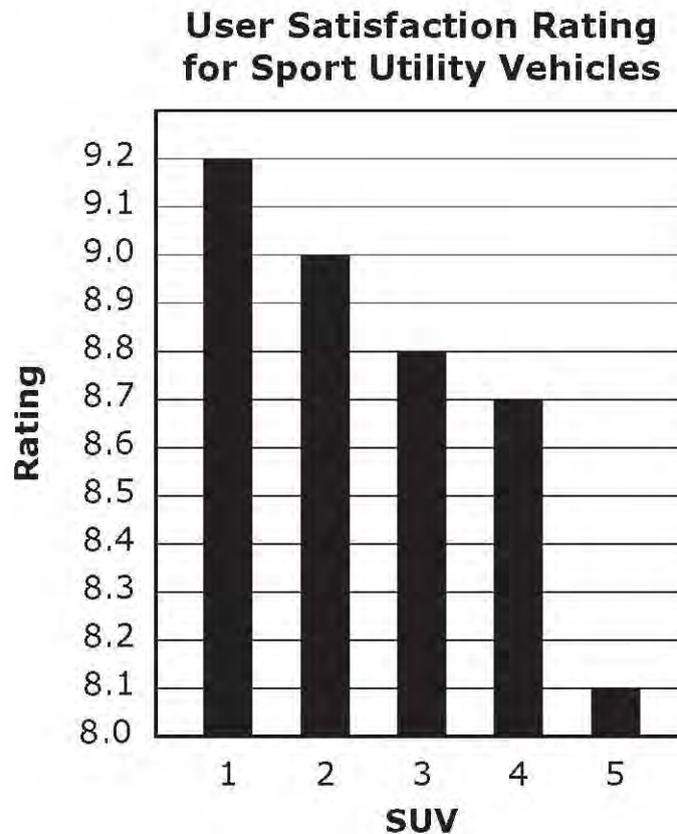
B. 6

C. $3 - 2\sqrt{5}$

D. $13 - 2\sqrt{5}$



21. Owners of 5 different Sport Utility Vehicles (SUVs) were asked to rate their satisfaction with their vehicle on a scale of 1 to 10. A score of 10 meant they were extremely satisfied with their SUV. The graph below shows the average User Satisfaction Ratings of the 5 SUVs.

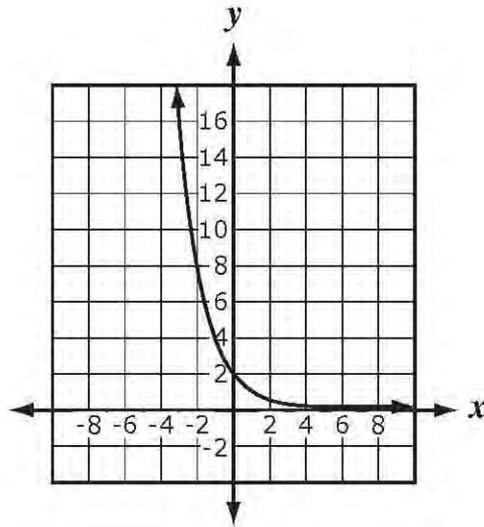


Which statement best describes who would be most interested in publishing the data as presented in the graph above?

- A. The manufacturer of SUV-1, interested in selling more vehicles.
- B. The manufacturer of SUV-5, interested in showing the comparison of the SUVs on the market.
- C. A government vehicle safety commission, interested in promoting the equality of SUVs in production.
- D. An independent rater interested in showing consumers that all of the SUVs represented in the graph have equally satisfied owners.



22. Consider the graph below.



Which function is best represented by this graph?

- A. $f(x) = 2^x$
- B. $f(x) = -2^x$
- C. $f(x) = \left(\frac{1}{2}\right)^x$
- D. $f(x) = 2\left(\frac{1}{2}\right)^x$

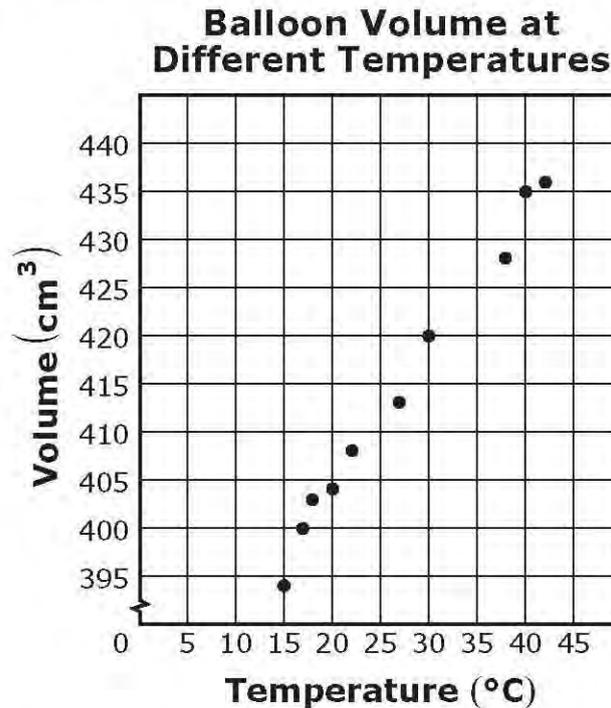
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23. Solve $|3x + 2| = -1$.

- A. $x = -1$ only
- B. $x = 1$ only
- C. $x = -1$ or $x = -\frac{1}{3}$
- D. no solution

24. The graph below shows the volume of a balloon at different temperatures.



Using the graph, predict the volume of the balloon in cubic centimeters at 35°C. Justify your answer.



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Session 2

Session 2 Directions

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25. Solve $S = \pi rL + \pi r^2$ for L .

A. $L = S - r$

B. $L = r - S$

C. $L = \frac{\pi r^2 - S}{\pi r}$

D. $L = \frac{S - \pi r^2}{\pi r}$

26. A restaurant's menu features 5 appetizers, 7 entrées, and 3 desserts. A customer orders only one appetizer, only one entrée, and only one dessert. How many different meals can be ordered?

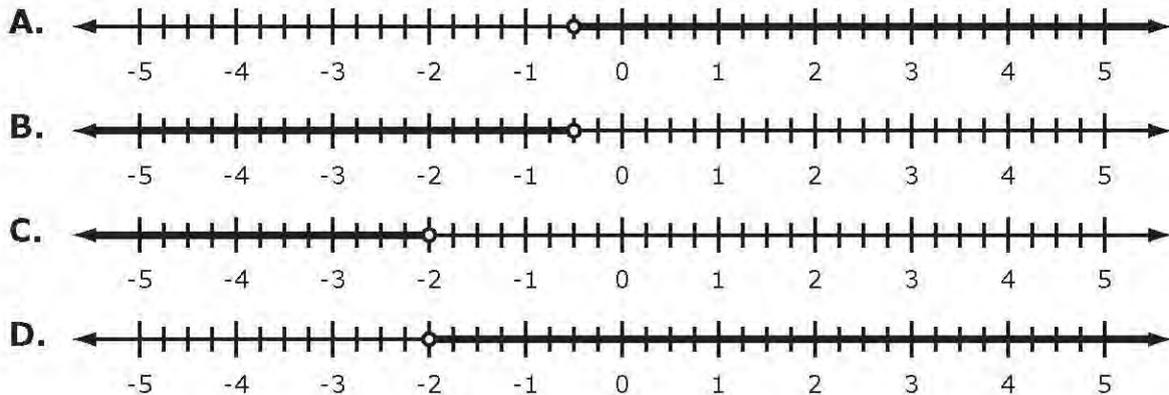
A. 3

B. 15

C. 35

D. 105

27. Which graph represents the solution set for $\frac{1}{2} - \frac{2}{3}x < \frac{5}{6}$?



28. Factor $2x^3 + 8x^2 - 24x$.

- A. $2x(x+6)(x-2)$
- B. $2x(x-6)(x+2)$
- C. $2x(x+4)(x-3)$
- D. $2x(x-4)(x+3)$

29. Consider the table below.

Car Rental

| Trip | Time | Distance Traveled | Cost |
|-------------|--------|-------------------|----------|
| First Trip | 2 days | 275 miles | \$140.75 |
| Second Trip | 1 day | 95 miles | \$59.75 |

A salesman rents a car for two trips from the same rental company. The rental company charges a daily fee plus a charge for each mile driven. According to this table, how much did the rental company charge per day and per mile?

- A. \$17 per day and \$0.45 per mile
- B. \$36 per day and \$0.25 per mile
- C. \$8.45 per day and \$0.54 per mile
- D. \$70.38 per day and \$0.63 per mile

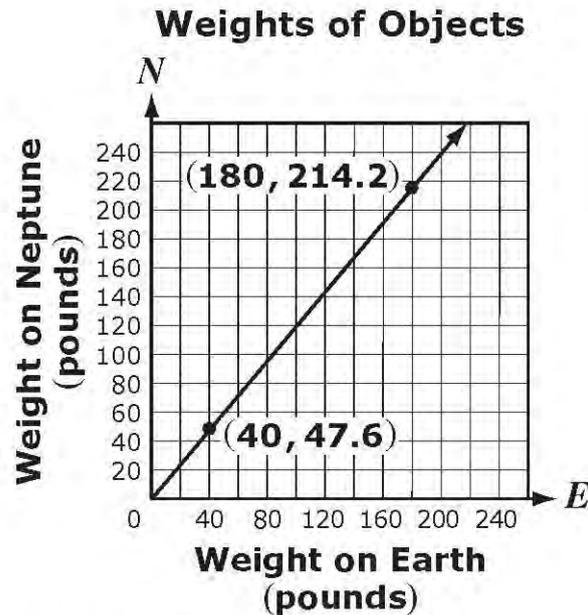
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30. Write $x^2(x+2) - 3x(x+2) + 2(x+7)$ as a simplified polynomial. Show or explain your work.
31. The legs of a right triangle have lengths $x+2$ and $x+6$. The hypotenuse has length $2x$. Find the perimeter of the triangle.
- A. 26 units
 - B. 30 units
 - C. 38 units
 - D. 48 units
32. Simplify completely $\sqrt{y^5 z^{10}}$.
- A. $y^2 z^2 \sqrt{y^2 z^5}$
 - B. $y^2 |z|^5 \sqrt{y}$
 - C. $y^2 z^5 \sqrt{y}$
 - D. $|z|^5 \sqrt{y^5}$
33. In a sample of 50 randomly selected students at a school, 38 students eat breakfast every morning. There are 652 students in the school. Using these results, predict the number of students that eat breakfast.
- A. 76
 - B. 123
 - C. 247
 - D. 496

34. A data set contains the numbers 691, 313, 324, 244, and 244. What will happen to the mean and median of this data set, if the number 486 is added to the list?
- A. the mean and the median will both increase
 - B. the mean and the median will both decrease
 - C. the mean will increase and the median will decrease
 - D. the mean will decrease and the median will increase
35. An athletic club charges a monthly membership fee of \$52.00. Members may choose to take classes for an additional \$10 per class. Next month, the club will have a special that includes 3 free classes for new members. Which function can be used to calculate $C(x)$, the total cost for a new member who takes x classes next month where $x \geq 3$?
- A. $C(x) = 3x + 52$
 - B. $C(x) = 10x + 52$
 - C. $C(x) = 3(x - 10) + 52$
 - D. $C(x) = 10(x - 3) + 52$



36. The graph below shows the relationship between the weights of objects on Earth and Neptune.



- Part A** Write an equation that represents the relationship between the weight (E) of an object on Earth and the weight (N) of the object on Neptune. Show or explain your work.
- Part B** What is the weight in pounds of an object on Earth if the weight of the object on Neptune is 280 pounds? Show or explain your work.
- Part C** If the weight of an object on Earth increases by 2 pounds, what is the equivalent weight increase in pounds on Neptune? Explain your reasoning.

37. The height (h) in feet of a ball t seconds after being dropped is given by the function $h(t) = 9 - 16t^2$. From what height in feet was the ball initially dropped?

A. 0

B. $\frac{3}{4}$

C. $\frac{4}{3}$

D. 9

38. Simplify $\frac{(x^{-2}y^{10})^2}{x^5y^{-3}}$ to an expression with only positive exponents.

A. $\frac{y^{17}}{x}$

B. $\frac{y^{15}}{x^5}$

C. $\frac{y^{23}}{x^9}$

D. $\frac{y^{26}}{x^7}$



39. Solve $\frac{4x+y}{3y} = 2$ for y .

A. $y = x$

B. $y = \frac{4x}{7}$

C. $y = \frac{4x}{5}$

D. $y = \frac{3}{2x}$

40. Solve $|5x - 4| = 19$.

A. $x = -\frac{23}{5}$ or $x = \frac{23}{5}$

B. $x = -3$ or $x = \frac{23}{5}$

C. $x = -\frac{1}{5}$ or $x = \frac{39}{5}$

D. $x = 3$ or $x = \frac{23}{5}$

41. A computer program for burning CDs allows the user to adjust the speed and file settings. There are 3 times as many speed settings as file settings. Let x represent the number of file settings. Which expression represents the number of different combinations of speed and file settings?
- A. $3x$
 - B. $3x^2$
 - C. $3x + x$
 - D. $(3+2+1)x$
42. Given $y = 7$, solve $(x+3)^2 + (y-4)^2 = 5^2$ for all values of x . Show or explain your work.
43. Convert 42 miles per hour to feet per second (to the nearest tenth).
- A. 63.0 feet per second
 - B. 61.6 feet per second
 - C. 58.3 feet per second
 - D. 28.6 feet per second
44. Which description best compares the graphs given by the equations $-6x + 15y = 5$ and $30x + 12y = 4$?
- A. parallel
 - B. coincident
 - C. perpendicular
 - D. intersecting but not perpendicular



45. Consider the inequality $6x + y < p$. What must be true about the value of p in order for the origin to be part of the solution?
- A. $p \geq 0$
 - B. $p > 0$
 - C. $p \leq 0$
 - D. $p < 0$
46. Simplify $(a^3 - 5a + b - 2) - (3a^3 + 5a - b + 2)$.
- A. $-2a^3$
 - B. $-2a^3 + 2b$
 - C. $-2a^3 - 10a + 2b$
 - D. $-2a^3 - 10a + 2b - 4$
47. Karen has taken 4 science quizzes. Her scores were 72, 80, 84, and 92. What minimum score must she get on her next quiz to have an average score of at least 84?
- A. 82
 - B. 84
 - C. 92
 - D. 95