

VA SOL High School Math Samples

1. Simplify:  $\frac{3x^3y^2}{4xy} \times \frac{(2xy)^2}{5xy}$

A  $\frac{3x^3y}{5}$

B  $\frac{3x^3y^2}{5}$

C  $\frac{3}{5x^3y^2}$

D  $\frac{3x^2y^3}{5}$

2. Consider the following patterns:

64, 32, 16, 8, 4, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,  
\_\_\_\_\_, \_\_\_\_\_

and

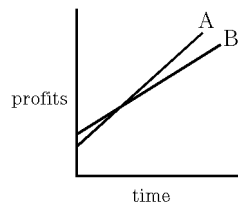
$2^6, 2^5, 2^4, 2^3, 2^2, \_\_\_\_\_\_, \_\_\_\_\_\_, \_\_\_\_\_\_,$   
 $\_\_\_\_\_\_, \_\_\_\_\_\_$

- Complete each pattern.
- What is the connection between the two patterns?
- Come up with a rule about exponents that explains the pattern.

3. The difference between two numbers is 4. When three times the larger number is subtracted from five times the smaller number, the result is -16. What is the larger number?

- A 6      B 2      C 0      D -4

4. The following graph represents a comparison of profits at local lemonade stands. Line A represents the profits earned by Friendly's Lemonade Stop and line B represents profits earned by Happy's Lemonade Shack.

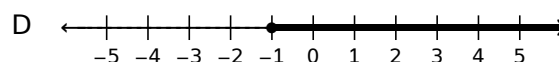
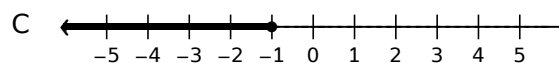
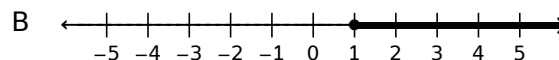
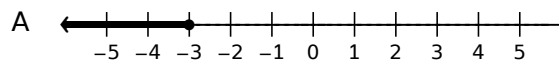


- Which stand earned the most money?
- What does the point where the two lines cross represent?
- Why does the graph for both stands start at a point higher than zero?

5. Mrs. Flanagan manages a hotel. One day, she received a certain number of cancellations. Then she received reservations that were 13 more than 4 times the number of cancellations. There were 79 hotel reservations in all.

How many cancellations did Mrs. Flanagan receive?

6. Which graph represents the solution to  $5x + 2 \leq 2x - 1$ ?



7. Gloria uses the following steps to simplify  $3(3x - 1.23) - 2y \geq 2x + 5(y + 1.67)$ .
- I.  $3(3x - 1.23) - 2y \geq 2x + 5(y + 1.67)$
  - II.  $9x - 3.69 - 2y \geq 2x + 5y + 8.35$
  - III.  $-2y - 5y \geq 2x - 9x + 8.35 + 3.69$
  - IV.  $-7y \geq -7x + 12.04$
  - V.  $y \geq x - 1.72$

Where does the first error occur?

- A no errors                      B step II  
 C step III                        D step V
8. If the ordered pair  $(-4, k)$  lies on the graph of  $3x - 2y = -2$ , then what is the value of  $k$ ?

- A -5    B 5    C 6    D 7

9. State the domain and range of the function  $y = -3x - 2$ .

- A  $x \in \mathbb{R}$  and  $y \in \mathbb{R}$   
 B  $x \in \mathbb{R}$  and  $y > 0$   
 C  $x \neq 0$  and  $y \neq 0$   
 D  $x \in \mathbb{R}$  and  $y > -2$

10. When rice is cooked, the amount of water required varies directly with the amount of rice. Complete the table by writing the correct number in each empty box.

Rice (cups)	Water (cups)
2	4.5
5	
	13.5
10	

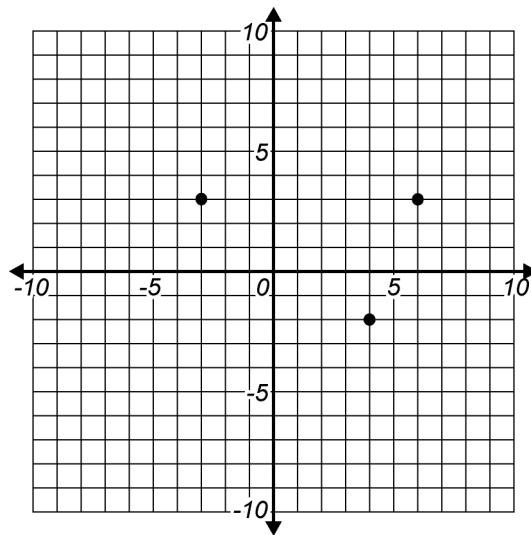
11. Calculate the distance between points  $Q(4, 6)$  and  $R(-7, 6)$ .

- A 2    B 3    C 11    D 13

12. The line represented by  $y = 3x - 1$  and a line perpendicular to it intersect at  $R(1, 2)$ . Determine the equation of the perpendicular line.

- A  $y = -\frac{1}{3}x - \frac{7}{3}$             B  $y = \frac{1}{3}x + \frac{7}{3}$   
 C  $y = -\frac{1}{3}x + \frac{7}{3}$             D  $y = -3x - 1$

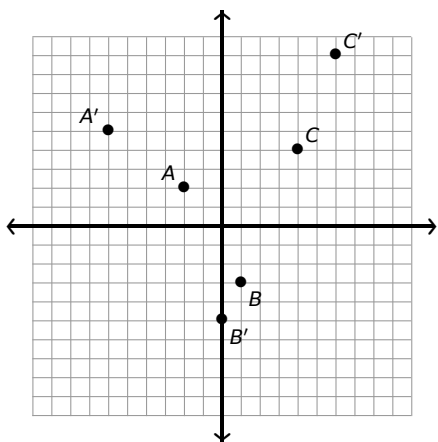
13. The figure shows three points on a coordinate plane. Suppose you wanted to add a fourth point to form a parallelogram. What should the coordinates of the fourth point be?



- A (5, 2)                            B (-5, -2)  
 C (-6, -2)                        D (-5, 1)

14. a) Plot the points  $A(4, 3)$ ,  $B(2, 1)$ ,  $C(-3, -1)$ ,  $D(-1, 1)$ . Use the midpoint formula to show that the diagonals of quadrilateral  $ABCD$ ,  $\overline{AC}$  and  $\overline{BD}$ , have the same midpoint.  
 b) What kind of quadrilateral is  $ABCD$ ?  
 c) How long is  $\overline{AB}$ ?

15.  $\triangle ABC$  is the original figure and  $\triangle A'B'C'$  represents its dilation image. What is the center of dilation?



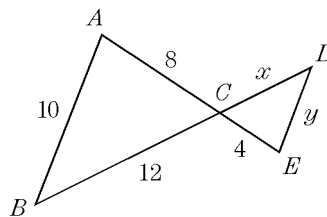
- A (0, 0)                      B (2, -1)  
C (-2, 1)                      D (2, 1)

16. In some computer programs, you can “flip” or “flop” a shape that you draw. Flip means a reflection across a vertical line. Flop means a reflection across a horizontal line. In both cases, you can assume the line of reflection passes through the center of the shape.

Which of the following shapes, when flopped, will *always* coincide with the original shape?

- equilateral triangle
- rhombus
- regular octagon
- circle

17. Given  $\triangle ABC \sim \triangle EDC$ .

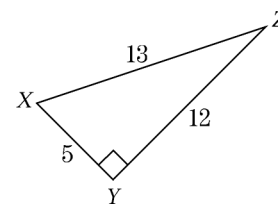


What is the value of  $y$ ?

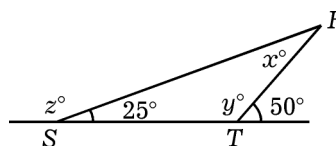
- A 20      B 5      C 4      D 3

18. Which of the following statements is *incorrect* for  $\triangle XYZ$ ?

- A  $\sin Z = \frac{5}{13}$   
B  $YZ = 12$   
C  $\tan Y = \frac{5}{12}$   
D  $\cos X = \frac{5}{13}$

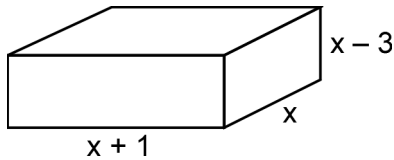


19. Find the missing angles.



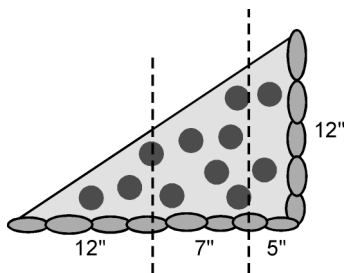
20. What is the length of the arc that subtends a central angle of  $139^\circ$  in a circle of radius 7.5 cm? Answer correct to 2 decimal places.

21. The dimensions of a rectangular container are shown in the figure.



The function  $f(x)$  gives the volume of the container. If the volume is  $60 \text{ in}^3$ , which polynomial function can be used to solve for  $x$ ?

- A  $f(x) = x^3 + 2x^2 - 3x$   
 B  $f(x) = x^3 - 2x^2 - 3x$   
 C  $f(x) = x^3 + 2x^2 + 3x$   
 D  $f(x) = x^3 - 2x^2 + 3x$
22. At the end of the Math Club meeting, there are a lot of leftovers. Julian, Luka and Rose agree to split the leftover pizza equally. Julian cuts the pizza as shown. Luka says the portions are not equal. Explain who is right.

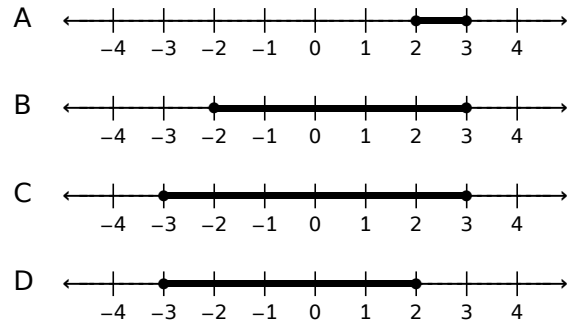


23. Simplify:  $\frac{3x^2 - 5x - 28}{2x - 8}$

- A  $\frac{3x + 7}{2}$   
 B  $\frac{3x - 2}{x + 3}$   
 C  $\frac{3x + 2}{3x - 2}$   
 D does not simplify

24. Which graph is the solution to this inequality?

$$|2x - 5| \leq 1$$



25. Solve:  $-6 < -2x < 14$

- A  $-7 < x < 3$       B  $-3 < x < 7$   
 C  $3 < x < -7$       D  $7 < x < -3$

26. What is an expression for the  $n$ th term in this sequence?

Position of term	1st	2nd	3rd	4th	$n$ th
Value of term	3	5	9	17	

- A  $2^n + 1$       B  $2^n + (-1)^n$   
 C  $3^{n-1}$       D  $4^n - 1$

27. What is the explicit definition for the sequence defined by the recursive equation shown below?

$$\begin{cases} a_1 = 4 \\ a_n = \left(\frac{1}{2}\right) a_{n-1} \end{cases}$$

- A  $a_n = 4 \left(\frac{1}{2}\right)^{n-1}$       B  $a_n = \left(\frac{1}{2}\right) (4)^{n-1}$   
 C  $a_n = \left(\frac{1}{2}\right) a_{n-1}$       D  $a_n = 4a_{n-1}$

28. Evaluate the arithmetic series:  $\sum_{j=1}^{20} \frac{3}{2}j$

- A 264    B 315    C 420    D 630

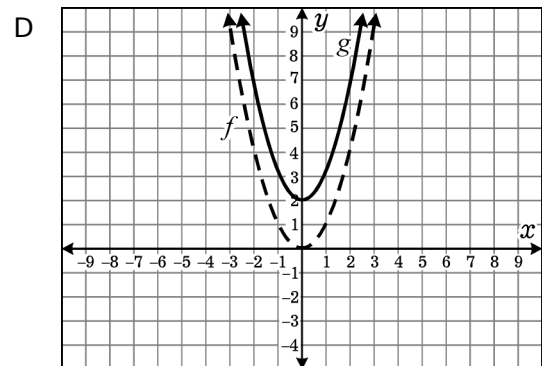
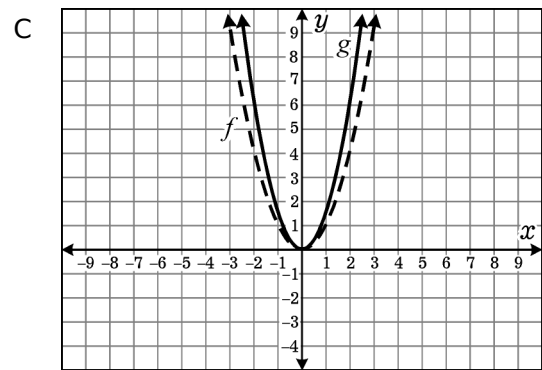
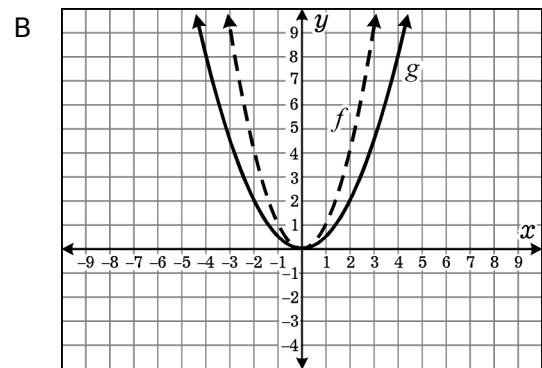
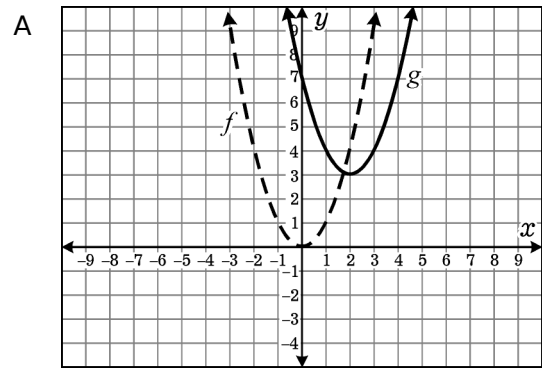
29. Complete the table using the following numbers.

-68887	-34447	-3829
3829	34447	68887

The table below shows values for  $t_1$  and  $r$  for four different geometric series. Find the sum of the first nine terms for each series.

$t_1$	$r$	Sum
7	3	
7	-3	
-7	-3	
-7	3	

30. The graph of  $f(x) = x^2$  is transformed to create the graph of  $g(x) = \frac{3}{2}f(x)$ . Which graph best represents  $f$  and  $g$ ?



31. Graph the relation  $y = -\log_2(x + 4)$ . On the graph, clearly indicate all intercepts and asymptotes.

32. The number of hits that a web site receives in 10 days is as follows:

45, 48, 25, 37, 40, 32, 25, 41, 38, 29

Find the standard deviation for this data.

A 57.8    B 7.6    C 8.0    D 64.0

33. If there are 12 people on a jury, what is the probability that at least two of the 12 will have the same birthday? (Assume that there are 365 days in a year.)

A 0.140                      B 0.167  
C 0.524                      D 0.510

34. Express  $\tan \frac{\theta}{2}$  in terms of  $\cos \theta$ .

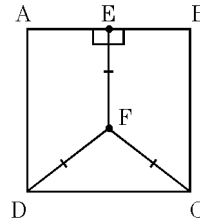
A  $\pm \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}}$     B  $\pm \sqrt{\frac{1 - \cos^2 \theta}{1 + \cos^2 \theta}}$   
C  $\pm \sqrt{\frac{1 - \cos \theta}{\cos \theta}}$     D  $\pm \sqrt{\frac{1 + \cos \theta}{1 - \cos \theta}}$

35. Simplify:  $\frac{\tan(A + B) - \tan A}{1 + \tan(A + B)\tan A}$

36. Square  $ABCD$  has sides of 20 cm. If  $EF = FD = FC$ , and  $\overline{EF} \perp \overline{AB}$ , then:

a) how long is  $\overline{FD}$ ?  cm

b) what is the measure of  $\angle FDC$  to 1 decimal place? °



37. The heights (cm) and weights (kg) of members of the school soccer team are measured. The correlation between weight versus height is found to be 0.70. What is the correlation coefficient of height measured in feet versus weight measured in pounds?

A 0.7  
B 0.3  
C 0.05  
D cannot be determined from information given

38. A popular writer in the local newspaper asked his readers, "Should teenage drivers be restricted to driving from 6 am to 11 pm?" 80% of the readers who wrote in said there should be restrictions. Identify the sample.

A readers of the newspaper  
B readers of the newspaper who read his column  
C readers of the newspaper who read the column and wrote to the writer  
D adults who do think teenage drivers are dangerous

39. A margin of error is sometimes reported along with the results of a survey. An unbiased poll of 900 voters found that 62% favored lowering the voting age. The margin of error was  $\pm 2\%$ .

Choose a number from each list to correctly complete the sentence.

Between 

2
50
56
58
60

 % and 

64
66
68
70
90

 % of those

surveyed favored lowering the voting age.

40. A number between 1 and 5, inclusive, is picked randomly. A number between 6 and 10, inclusive, is picked randomly. Find each probability.

a)  $P(\text{sum is less than 7}) = \boxed{\phantom{00}}$

b)  $P(\text{sum is exactly 8 or 9}) = \boxed{\phantom{00}}$

41. A math contest requires each contestant to build a cube, labelling the faces with single digit numerals of their choice. Describe the numerals you would put on the die, given the following conditions and goals:

- I. Each number can only be used once.
- II. Each person will roll three times and sum their rolls.
- III. The winner is the person that ends with an odd number.
- IV. The lowest sum will win any tie.

42. To celebrate the end of the season, the lacrosse team decide to go bowling. The bowling alley has three pricing options. All options include shoe rental.

- **Regular:** \$11 per person per game.
- **Lane Rental:** \$42 per game for a lane. Up to 4 people per lane.
- **Party Package:** \$300 for up to 16 people, 2 games. \$25 for each additional person.

- a) Write an equation for each option that relates total price ( $P$ ) to the number of people who bowl ( $b$ ). Assume the lacrosse team will play 2 games.

Regular: \_\_\_\_\_

Lane Rental: \_\_\_\_\_

Party Package: \_\_\_\_\_

- b) On the same graph, show the three options. Label each option with its equation.
- c) If the coach expects the whole team to come, 38 players, which option should she buy? How much will she spend?
- d) 27 lacrosse players show up to the bowling alley. Is the option the coach purchased in the previous part still the cheapest? Explain.

43. Evaluate  $\log_{20} 3$  to 2 decimal places.

- A 0.37    B 0.96    C 1.22    D 2.73

44. If  $\log r = x$ , then  $\log \frac{r^2}{s}$  equals:

- A  $2x - s$                       B  $2x - 2s$   
C  $2x - \log s$                   D  $\frac{2x}{\log s}$

45. Solve for  $x$ :  $\log(3x + 2) - \log x = 1$

46. Find the magnitude of the vector  $\mathbf{v} = \langle -2, 2 \rangle$ .

- A 4            B  $\sqrt{2}$         C  $2\sqrt{2}$         D  $8\sqrt{2}$

47. Find the unit vector in the direction of  $\langle 3, 4 \rangle$ .

- A  $\langle 1.5, 2.0 \rangle$                   B  $\langle -0.6, -0.8 \rangle$   
C  $\langle -0.3, -0.4 \rangle$               D  $\langle 0.6, 0.8 \rangle$

48. Simplify:  $\begin{bmatrix} 0 & -6 \\ 2 & -1 \end{bmatrix} - \begin{bmatrix} 7 & -3 \\ 5 & 6 \end{bmatrix}$

- A  $\begin{bmatrix} 7 & 3 \\ 3 & 7 \end{bmatrix}$                       B  $\begin{bmatrix} -3 & -7 \\ -7 & -3 \end{bmatrix}$   
C  $\begin{bmatrix} -7 & -3 \\ -3 & -7 \end{bmatrix}$                     D  $\begin{bmatrix} -7 & -7 \\ -3 & -3 \end{bmatrix}$

49. Find the inverse of the following matrix.

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 1 & 2 & 2 \end{bmatrix}$$

- A  $\begin{bmatrix} -\frac{2}{3} & \frac{2}{3} & 1 \\ \frac{2}{3} & -\frac{1}{3} & 2 \\ 1 & 0 & -1 \end{bmatrix}$                       B  $\begin{bmatrix} -\frac{2}{3} & \frac{2}{3} & -1 \\ -\frac{2}{3} & -\frac{1}{3} & 2 \\ 1 & 0 & -1 \end{bmatrix}$   
C  $\begin{bmatrix} \frac{2}{3} & \frac{2}{3} & -1 \\ \frac{2}{3} & \frac{1}{3} & 2 \\ 1 & 0 & -1 \end{bmatrix}$                       D  $\begin{bmatrix} -\frac{2}{3} & -\frac{2}{3} & -1 \\ -\frac{2}{3} & -\frac{1}{3} & 2 \\ -1 & 0 & -1 \end{bmatrix}$

50. Given  $f(x) = \frac{1}{x}$ , show that  $f(A) - f(B) = f\left(\frac{AB}{B-A}\right)$ .



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VA SOL High School Math Samples 12/29/2023

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|--|--|
| 1.<br>Answer: B<br>Objective: A.2a<br>Points: 1  | 12.<br>Answer: C<br>Objective: G.3b<br>Points: 1   |
| 2.<br>Answer: 2, 1, $\frac{1}{2}$ , $\frac{1}{4}$ , $\frac{1}{8}$ ; $2^1$ , $2^0$ , $2^{-1}$ , $2^{-2}$ , $2^{-3}$ ;<br>[Answers will vary.]<br>Objective: A.2a<br>Points: 1 | 13.<br>Answer: B<br>Objective: G.3b<br>Points: 1   |
| 3.<br>Answer: B<br>Objective: A.4e<br>Points: 1  | 14.<br>Answer: $(\frac{1}{2}, 1)$ , [proof]; parallelogram; $2\sqrt{2}$<br>Objective: G.3b<br>Points: 1              |
| 4.<br>Answer: Friendly's Lemonade Stop<br>Objective: A.4e<br>Points: 1   | 15.<br>Answer: B<br>Objective: G.3d<br>Points: 1   |
| 5.<br>Answer: 22<br>Objective: A.4e<br>Points: 1   | 16.<br>Answer: 4<br>Objective: G.3d<br>Points: 1   |
| 6.<br>Answer: C<br>Objective: A.5a<br>Points: 1  | 17.<br>Answer: B<br>Objective: G.7<br>Points: 1  |
| 7.<br>Answer: D<br>Objective: A.5b<br>Points: 1  | 18.<br>Answer: C<br>Objective: G.8c<br>Points: 1   |
| 8.<br>Answer: A<br>Objective: A.6b<br>Points: 1  | 19.<br>Answer: $x^\circ = 25^\circ$ , $y^\circ = 130^\circ$ , $z^\circ = 155^\circ$<br>Objective: G.10b<br>Points: 1 |
| 9.<br>Answer: A<br>Objective: A.7b<br>Points: 1  | 20.<br>Answer: 18.20 cm<br>Objective: G.11c<br>Points: 1   |
| 10.<br>Answer: 11.25, 6, 22.5<br>Objective: A.8<br>Points: 1   | 21.<br>Answer: B<br>Objective: G.13<br>Points: 1   |
| 11.<br>Answer: C<br>Objective: G.3a<br>Points: 1   | 22.<br>Answer: Luka is correct<br>Objective: G.14d<br>Points: 1  |

23.  
 Answer: A  
 Objective: AII.1a  
 Points: 1

24.  
 Answer: A  
 Objective: AII.3a  
 Points: 1

25.  
 Answer: A  
 Objective: AII.3a  
 Points: 1

26.  
 Answer: A  
 Objective: AII.5  
 Points: 1

27.  
 Answer: A  
 Objective: AII.5  
 Points: 1

28.  
 Answer: B  
 Objective: AII.5  
 Points: 1

29.  
 Answer: [F][E][B][A]  
 Objective: AII.5  
 Points: 1

30.  
 Answer: C  
 Objective: AII.6b  
 Points: 1

31.  
 Answer: [graph]  
 Objective: AII.7i  
 Points: 1

32.  
 Answer: B  
 Objective: AII.11a  
 Points: 1

33.  
 Answer: B  
 Objective: AII.12  
 Points: 1

34.  
 Answer: A  
 Objective: T.5  
 Points: 1

35.  
 Answer:  $\tan B$   
 Objective: T.5  
 Points: 1

36.  
 Answer: 12.5, 36.9  
 Objective: T.8  
 Points: 1

37.  
 Answer: A  
 Objective: PS.05  
 Points: 1

38.  
 Answer: C  
 Objective: PS.10  
 Points: 1

39.  
 Answer: 5, 1  
 Objective: PS.10  
 Points: 1

40.  
 Answer:  $0, \frac{1}{5}$   
 Objective: PS.13  
 Points: 1

41.  
 Answer: [list of numerals]  
 Objective: PS.14  
 Points: 1

42.  
 Answer:  $P = 22b$ ,  $P = \frac{84b}{4}$ ,  
 $P = 300 + 25(b - 16)$ ; [graph];  
 Regular, \$836; No. \$575 for Party  
 Package vs \$594 for Regular  
 Objective: DA.05  
 Points: 1

43.  
 Answer: A  
 Objective: MA.02  
 Points: 1

44.  
 Answer: C  
 Objective: MA.02  
 Points: 1

45.  
 Answer:  $\frac{2}{7}$   
 Objective: MA.02  
 Points: 1

46.  
 Answer: C  
 Objective: MA.07  
 Points: 1

47.  
Answer: D  
Objective: MA.07  
Points: 1

48.  
Answer: C  
Objective: MA.09  
Points: 1

49.  
Answer: B  
Objective: MA.09  
Points: 1

50.  
Answer: [proof]  
Objective: MA.14  
Points: 1