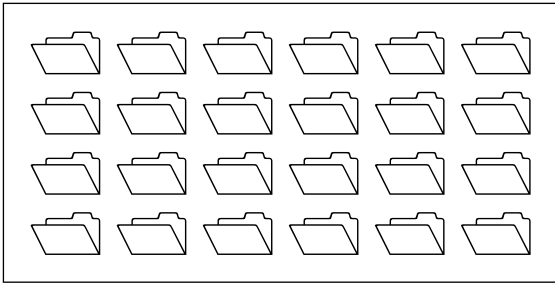


1. Jamil counted the folders on the table.



How many folders?

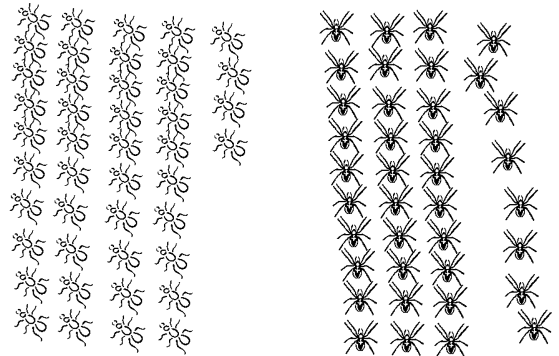
2. There are flowers in a vase.


The students made tally marks to show the number of flowers.




How many flowers in the vase?


3. Joshua saw ants and spiders at the science academy.




Look at the ants .

Place the correct number in each box.

Tens	Ones	total number of 

Look at the spiders .

Place the correct number in each box.

Tens	Ones	total number of 

4. Which is smaller than 3 tens and 5 ones?

- A. 3 tens and 6 ones
- B. 3 tens and 2 ones
- C. 4 tens and 2 ones
- D. 3 tens and 8 ones

5. There are 6 in the fish tank.



There are 5 in the fish tank.



How many fish in the tank altogether?

Use the ten frames to show your answer.

Write the number sentence.

6. The deli has 11 bagels on the top rack and 3 bagels on the bottom rack.

How many fewer bagels are on the bottom rack?

Write a subtraction number sentence with a for the missing number.

Write an addition sentence to help find the missing number.

7. Nan gave her sister a coin with a value between 1¢ and 20¢. Which coin is it?

A.



B.



C.



8. Mrs. Roderick places 2 small tomatoes on top of each salad.

Salads	1	2	3	4	5
Tomatoes					

Fill in the table.

How many small tomatoes does Mrs. Roderick place on 5 salads?

9. Alexia wants to count the number of hair bands.

She made a table to help her count the hair bands.

Package	Number of Hair Bands
1	2
2	4
3	
4	


Complete the table.


How many hair bands in 4 packages?

10. Two shelves hold 15 books in all. The bottom shelf has 1 less book than the top shelf.

How many books on each shelf?

- A. Bottom Shelf has 5. Top Shelf has 6.
- B. Bottom Shelf has 8. Top Shelf has 9.
- C. Bottom Shelf has 6. Top Shelf has 7.
- D. Bottom Shelf has 7. Top Shelf has 8.

11. Twelve  are crawling on a leaf.

Seven fly away. How many  are left on the leaf?

12. At the school game night, Patty played math games to win tickets.

Patty won 14 tickets to trade for prizes.



5 tickets



8 tickets



7 tickets



6 tickets

What 2 prizes can she get if she uses all 14 tickets?

Write the different groups of 2 prizes that Patty can get if she uses less than 14 tickets.

2 prizes	Number of Tickets

13. Haley needs 11 bananas to make banana bread. Haley has 7 bananas.

How many bananas does Haley still need?

Write a number sentence with a for the unknown number.

Solve the number sentence.

14. The Man of Iron must travel to each true number sentence to reach the city.

Circle every true number sentence to help The Man of Iron reach the city.



$3 + 1 = 5$	$4 + 0 = 4$	$6 + 8 = 14$
$10 = 2 + 7$	$17 = 8 + 9$	$6 + 3 = 8$
$1 = 1$	$2 + 6 = 8$	$7 = 3 + 2$



15. Which number should be put in the box to make this equation true?

$$6 + 16 + 3 = \square + 6$$

- A. 3 B. 9 C. 19 D. 22

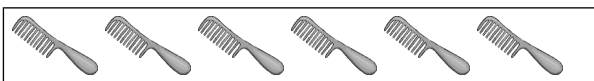
16. Jairus placed 8 strawberries in the bowl. He placed 3 more strawberries in the bowl. Then he placed 2 more strawberries in the bowl.



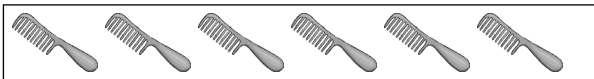
How many strawberries did Jairus place in the bowl altogether?

- A. 5 B. 10 C. 11 D. 13

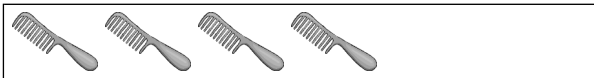
17. Jackie has:



Avery has:



Tamia has:



How many more combs does Jackie have than Tamia?

How many more combs does Avery have than Jackie?

How many combs in all?

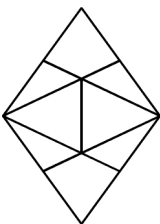
18. Rachelle counted 6 pants, 8 shorts and 3 blouses at the store.

How many more shorts than pants?

How many pants and blouses?

How many pieces of clothing in all?

19. Tim's older brother made an art object out of wire.

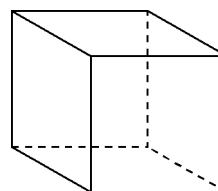


How many triangles can you find in the art object?

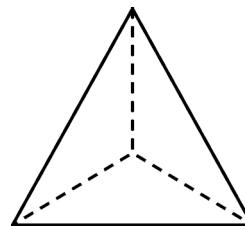
- A. 2 B. 8 C. 10

20. Look at the cube. How many *faces* does it have?

- A. 4 B. 6
C. 8 D. 12



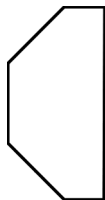
21. How many edges does the pyramid have?



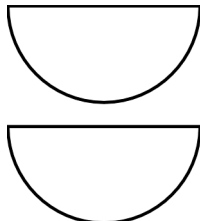
- A. 3 B. 4 C. 5 D. 6

22. Which two shapes can be put together to make a circle?

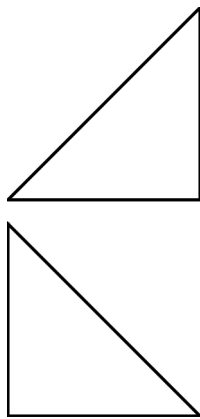
A.



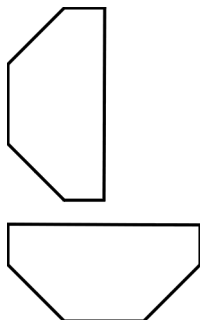
B.



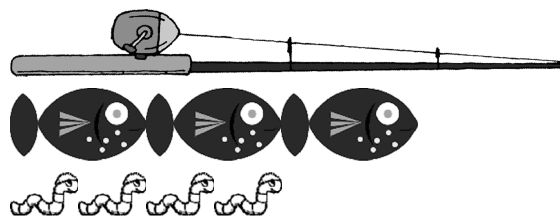
C.



D.



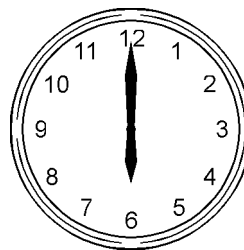
23. The fishing pole is 7 fish long.



How many worms long is the fishing pole?

- A. 8 B. 12 C. 14

24. Alberto has basketball practice at the time shown.

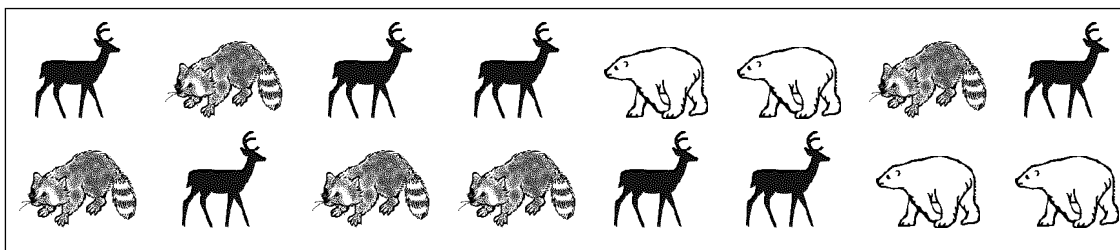


What time is basketball practice?

Alberto's brother goes to soccer practice one-half hour later.




What time is soccer practice?

25.






Which tally chart shows the correct number of animals in the box?




A.

	
	
	I




B.

C.


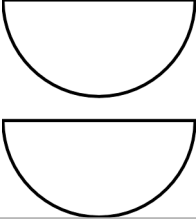
	
	
	

D.

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GR-1

Num	Scoring	Standard	Answer
1		1.02A	24
2		1.02A	21
3		1.02B	4, 4, 44; 3, 8, 38
4	B	1.02D	3 tens and 2 ones
5		1.03B	11; $6 + 5 = 11$
6		1.03D	8 fewer on bottom rack; $11 - 8 = \square$; $3 + 8 = 11$
7	A	1.04A	
8		1.05B	10
9		1.05B	8
10	D	1.05D	Bottom Shelf has 7. Top Shelf has 8.
11		1.05D	5
12		1.05D	Cat and Plane; Bear and Cat, 13, Bear and Truck, 12, Bear and Plane, 11
13		1.05D	$7 + \square = 11$; Haley needs 4 bananas.
14		1.05E	$1 = 1$ $2 + 6 = 8$ $17 = 8 + 9$ $4 + 0 = 4$ $6 + 8 = 14$
15	C	1.05F	19
16	D	1.05G	13
17		1.05G	2; 0; 16
18		1.05G	2; 9; 17
19	C	1.06A	10
20	B	1.06E	6
21	D	1.06E	6
22	B	1.06F	
23	C	1.07C	14
24		1.07E	6:00; 6:30

25 C 1.08A



|||| ||

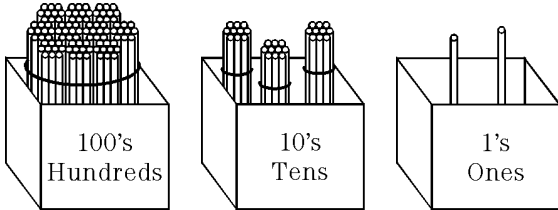


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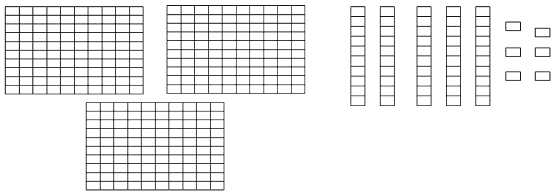
||||

1. Miss Barnwill's class put a straw in the place value box for each day they came to school. How many days have they been at school so far?



- A. 123 B. 232 C. 231 D. 132

2. Rudy bought blue marbles for his collection. The model below shows the number of blue marbles he bought. How do you read this number?

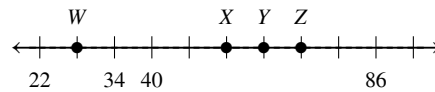


- A. three hundred ninety
B. three hundred fifty-six
C. three hundred nine
D. thirty-nine

3. Ricardo was playing a math game on the computer. He watched as his score went higher each time. Which numbers are in the order he would have seen them?

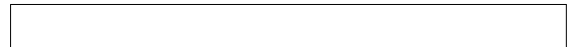
- A. 350, 550, 650, 575
B. 500, 700, 850, 915
C. 875, 640, 500, 450
D. 625, 760, 675, 900

4. Which point represents 58 on the number line?



- A. W B. X C. Y D. Z

5. Mrs. Branson wants to cut the ribbon into two equal parts.



Show how this can be done.

What is the name of each part?

6. Brenda counted the number of nails in three boxes.

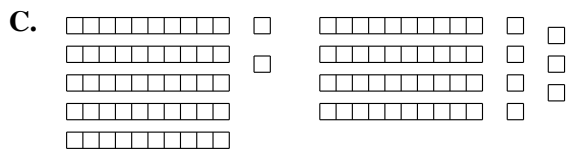
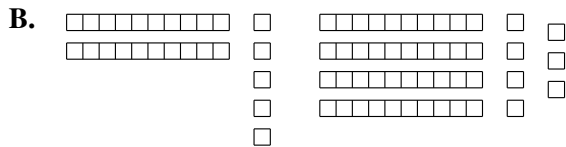
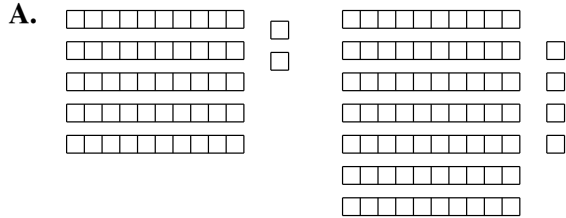
$$42 + 10 + 15 = \square$$

Which of these makes a true number sentence?

- A. $70 + 7$ B. $30 + 37$ C. $32 + 25$

7. Jon used base 10 blocks to add 25 and 47.

Which shows the base 10 blocks that he used?



8. Samantha bought a gel pen for 49¢ and 2 pencils for 15¢ each. Which collection of coins shows how much money she spent?



9. Patsy has



Jesse has



Frank has



How much money do Patsy and Frank have altogether?

How much more money does Patsy have than Jesse?

If Frank and Jesse add their money together, will they have more money than Patsy? Explain your thinking.

10. Anthony has this much money in his pocket. If he buys a toy boat for eighty-five cents, how much money will he have left?



- A. \$0.25 B. \$0.30
C. \$0.35 D. \$0.55

11. There are 861 people seated at a baseball game. Then 10 people leave their seats.

What is $861 - 10$?

A. 761 B. 851 C. 860 D. 871

12. Three friends threw a frisbee.

The table shows how far each boy threw the frisbee.

Name	Distance (feet)
Jerry	24
Kenny	19
Lyle	32

Which number sentence can be used to find how many more feet Lyle threw the frisbee than Kenny?

A. $32 + 24 = \square$

B. $24 - 19 = \square$

C. $32 - 19 = \square$

13. There are 32 cookies on a tray. There are 58 cookies on a different tray.

Which shows how to use regrouping to find out how many cookies in all?

A. $30 + 2 + 50 + 8 = 30 + 50 + 8$

B. $30 + 2 + 50 + 8 = 30 + 50 + 10$

C. $30 + 2 + 50 + 8 = 30 + 50 + 100$

D. $30 + 2 + 50 + 8 = 3 + 5 + 20 + 80$

14. Sydney, Jennifer and Kristin are doctors who treat patients. Sydney treated 2 fewer patients than Jennifer. Jennifer treated 6 patients. Kristin treated 8 patients.

How many patients did the three doctors treat in all?

A. 14 B. 12 C. 16 D. 18

15. Sam took 13 steps forward, 5 steps backward, 7 steps forward, and 15 steps backward. Where did he end up?

A. 3 steps ahead of where he started

B. exactly where he started

C. 1 step behind where he started

D. 26 steps ahead of where he started

16. There are 47 rugs.

Some are small and some are large.

If there are 28 small rugs, how many rugs are large?

17. Mr. Morgan asked his students to describe a cube.

Sally said, "It has four equal sides."

Greg said, "Its faces are all squares."

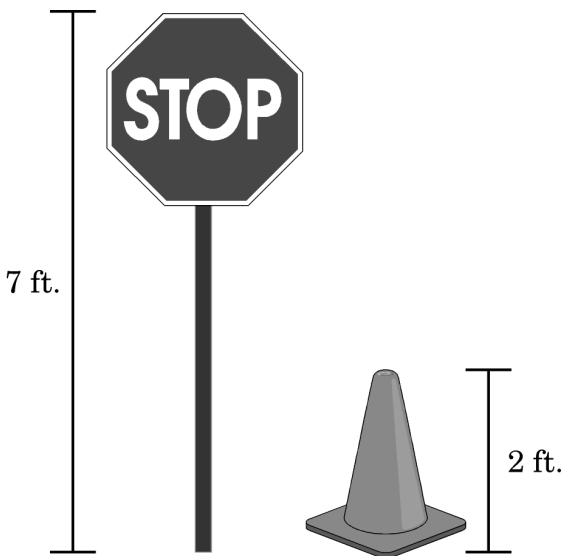
Kris said, "It looks like an open box."

Joey said, "It's a small rectangle."

Which student gave the right answer?

A. Sally **B.** Greg **C.** Kris **D.** Joey

18. Catherine saw a stop sign and a traffic cone.



Which is taller?

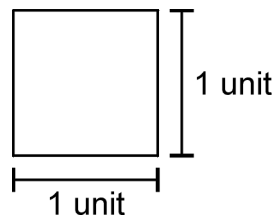
How much taller?

19. Gerald measured something that was about 1 meter wide.

Which item could he have measured?

- A.** shoe
B. airplane
C. dog house

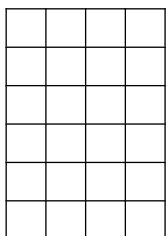
20. Mrs. Jackson hung a unit square on the bulletin board.



A unit square is used to—

- A.** measure perimeter
B. measure volume
C. measure area
D. measure centimeters

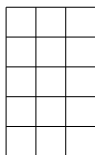
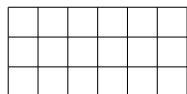
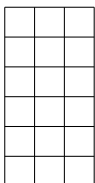
21. Diana used unit squares to cover a figure. There were no spaces between the squares. Diana made sure that no square was placed on top of another square.



What is the area of the figure?

- A. 24 units B. 24 square units
C. 4 units D. 4 square units

22.



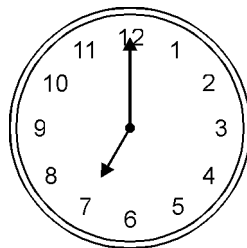
Circle the rectangle that has 3 rows and 6 columns.

Write the number of same-size squares under each rectangle.

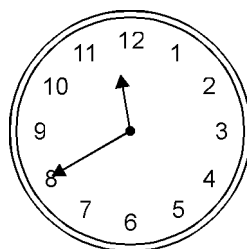
23. Mr. Reynolds walks the dog each day between 11:00 and 12:00.

Which clock shows a time when Mr. Reynolds might walk the dog?

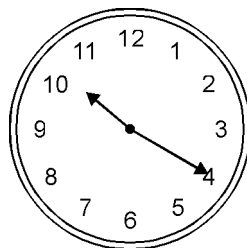
A.



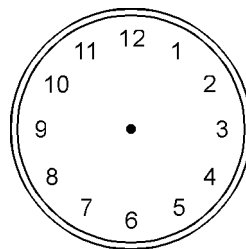
B.



C.



24. Robert must eat dinner between 5:00 and 5:30 because he has football practice at 6:45. Draw the hands on the clock to show a time that Robert might eat.



25. Choose a color for each snack and color the graph to show the number of snacks.



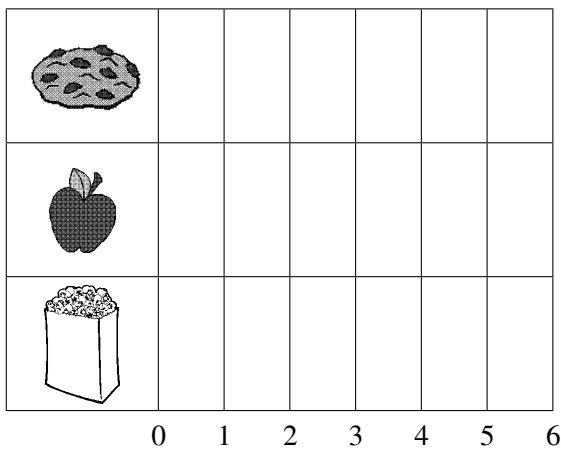
5 cookies



3 apples



4 bags of
Popcorn




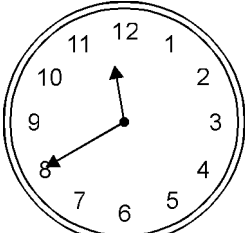
How many more  than  ?

How many snacks are *not* popcorn?

How many  and  ?

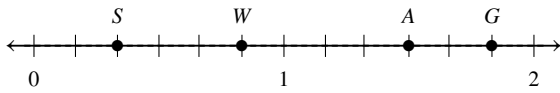
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GR-2

Num	Scoring	Standard	Answer
1	D	2.02A	132
2	B	2.02B	three hundred fifty-six
3	B	2.02D	500, 700, 850, 915
4	C	2.02E	Y
5		2.03A	[graph]; half
6	B	2.04B	$30 + 37$
7	B	2.04C	<div style="display: flex; align-items: center;"> <div style="display: flex; flex-direction: column; gap: 5px;"> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> </div> <div style="display: flex; flex-direction: column; gap: 5px; margin: 0 10px;"> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> </div> <div style="display: flex; flex-direction: column; gap: 5px;"> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> </div> <div style="display: flex; flex-direction: column; gap: 5px; margin-left: 10px;"> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> <div><input type="checkbox"/></div> </div> </div>
8	C	2.05A	
9		2.05A	42¢; 13¢; Yes, Frank and Jesse will have 29¢ together, which is greater than Patsy's 25¢.
10	B	2.05B	\$0.30
11	B	2.07B	851
12	C	2.07C	$32 - 19 = \square$
13	B	2.07C	$30 + 2 + 50 + 8 = 30 + 50 + 10$
14	D	2.07C	18
15	B	2.07C	exactly where he started
16		2.07C	19 large rugs
17	B	2.08B	Greg
18		2.09A	stop sign; 5 ft
19	C	2.09E	dog house
20	C	2.09F	measure area
21	B	2.09F	24 square units
22		2.09F	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 40px; height: 40px; margin-right: 10px;"> <div style="border: 1px solid black; width: 30px; height: 30px; margin: 5px;"></div> </div> <div> ; 18, 18, 15 </div> </div>
23	B	2.09G	

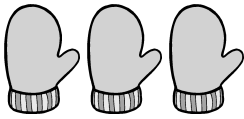
24	2.09G	
25	2.10C	1; 8; 8

1. Which point best represents $\frac{5}{6}$?



A. S B. W C. A D. G

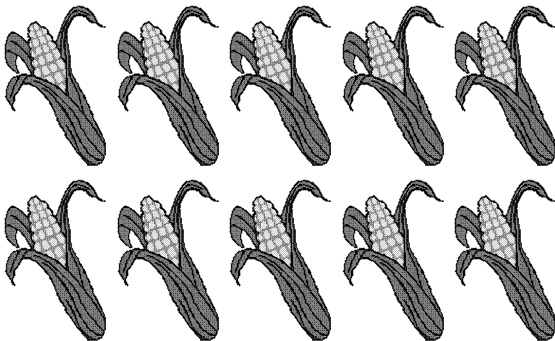
2. Alma found 3 mittens at the bottom of her closet.



Write 3 as a fraction.

A. $\frac{1}{3}$ B. $\frac{3}{3}$ C. $\frac{0}{3}$ D. $\frac{3}{1}$

3. Mr. Long grilled 10 pieces of corn-on-the-cob for dinner.



Mr. Long's family ate 6 pieces.

What fraction of the corn-on-the-cob did the family eat?

A. $\frac{4}{10}$ B. $\frac{10}{6}$ C. $\frac{4}{6}$ D. $\frac{6}{10}$

4. The model below represents Ozzo's garden. He has already watered the area of the garden that is shaded.



Which shaded model below represents a fraction that is equivalent to $\frac{4}{6}$?



5. Which number will complete the number sentence?

$$23 - \square = \square + 5$$

A. 10 B. 9 C. 5 D. 2

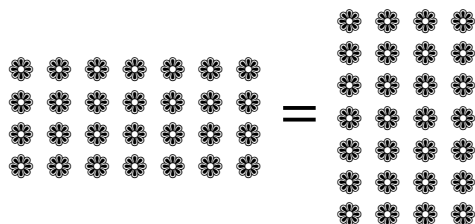
6. For a community project the third graders collected 125 cans of food, 67 blankets, and 88 coats. How many coats and blankets did the third graders collect?

A. 280 B. 213 C. 192 D. 155

7. Andrew has 117 pennies and Dion has 83 pennies. Which would be the best way to estimate how many pennies they have altogether?

A. $110 + 80$ B. $110 + 90$
C. $120 + 80$ D. $120 + 90$

8.



Using the commutative property and the diagram above, $4 \times 7 = \underline{\hspace{2cm}}$

A. 48×1 B. 7×4
C. 4×7 D. 24×2

9. Delaney began at 18. She skip-counted until she reached 27. By which number could Delaney have skip-counted?

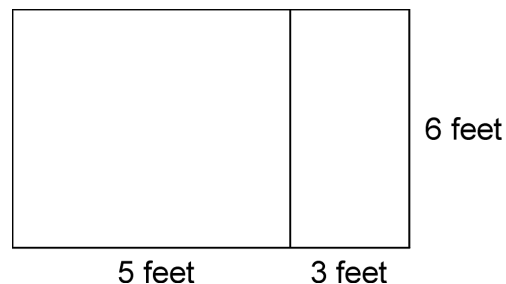
A. threes B. fours
C. fives D. sixes

10. Brent placed 5 paper plates in each stack. He made 60 stacks.

Which of these tells how many paper plates in all?

A. 30 ones B. 10 ones
C. 30 tens D. 10 tens

11. Mrs. Borden measured two sections of the loading dock. She wrote an expression to describe the area.



$$(6 \times 5) + (6 \times 3)$$

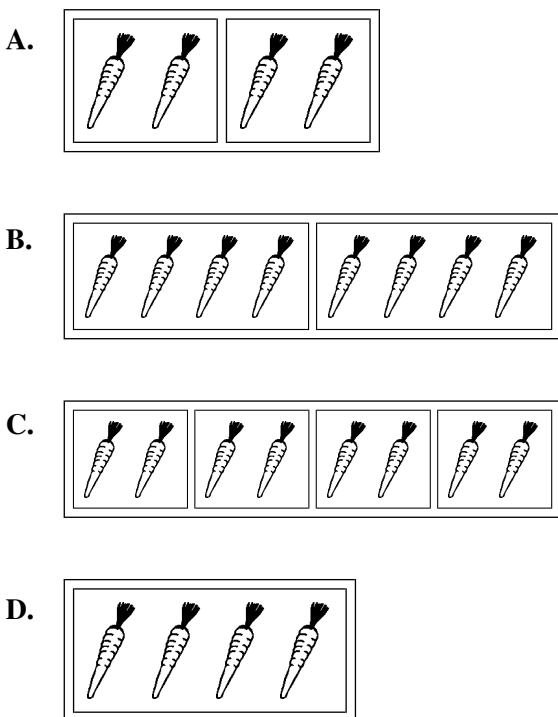
Which of these is another way to describe the area?

A. $6 + (5 + 3)$ B. $6 \times (5 + 3)$
C. $5 \times (6 + 3)$ D. $6 \times (5 \times 3)$

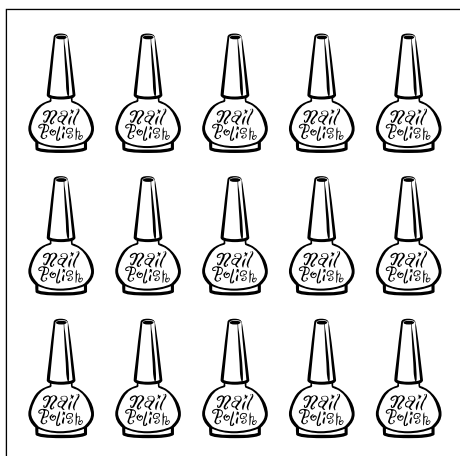
12. Mrs. Henry has a large penny jar. She counted and found that she had exactly 509 pennies. She gave 105 pennies to her daughter. Then her husband poured 210 pennies into the jar. What could Mrs. Henry do to determine how many pennies are in her jar now?

A. Subtract 105 from 509.
B. Add 509 and 105 and 210.
C. Subtract 210 from 509. Then add 105 to the difference.
D. Subtract 105 from 509. Then add 210 to the difference.

13. Jerry had 4 groups of carrots. There were 2 carrots in each group. Which picture shows how many carrots Jerry had?



14. The beauty store sells nail polish in gift boxes. If each gift box contains 3 bottles of nail polish, how many gift boxes can be made from the bottles of nail polish shown?



- A. 3 B. 4 C. 5 D. 6

15. Edith helps out at the pet store after school each day. She has to put a new shipment of 75 goldfish into 5 tanks. She wants to put the same number of fish in each tank. Which number sentence could be used to find how many fish she should put in each tank?

- A. $75 + 5 = \square$ B. $75 - 5 = \square$
 C. $75 \times 5 = \square$ D. $75 \div 5 = \square$

16. Rachel had a basket of pears she shared equally with her family. She and 4 family members each got 4 pears.

How many pears did Rachel have in her basket before she shared?

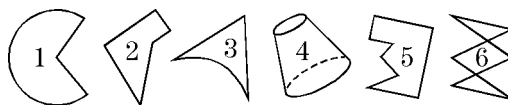
- A. 12 B. 16 C. 18 D. 20

17. A raisin weighs 2 grams. A box of raisins weighs 40 grams.

How many times heavier is the box of raisins?

- A. 2 B. 20 C. 40 D. 100

18. Which of the shapes are *not* polygons?



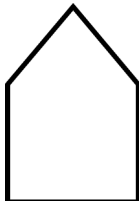
- A. 1, 2, 3, 4 B. 2, 4, 6
 C. 1, 4, 5, 6 D. 1, 3, 4, 6

19. Which figure represents a quadrilateral?

A.



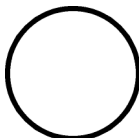
B.



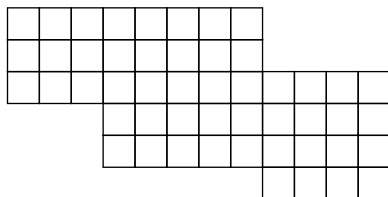
C.



D.



20. Mrs. Winchel cut out paper squares and made this pattern on a classroom wall:



Each piece of paper is a square foot. Which expression can represent the total area of the pattern?

A. 6×12

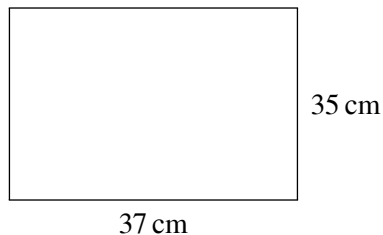
B. $(3 \times 3) + (5 \times 5) + (4 \times 4)$

C. $(3 + 3) \times (5 + 5) \times (4 + 4)$

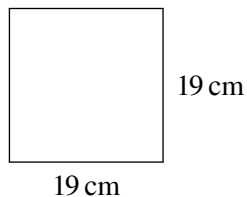
D. $1 + 2 + 2 + 3 + 3 + 4 + 4 + 4 + 5 + 8$

21. Which of the following figures has a perimeter of 72 centimeters?

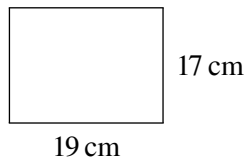
A.



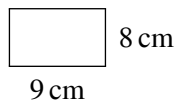
B.



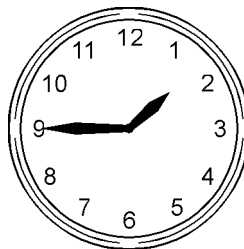
C.



D.



22. Laura has a dental appointment at 3:00 pm. The time is now 1:45 pm. How much time does she have before her appointment?



A. 15 min.

B. 1 hr. 15 min.


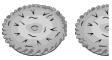


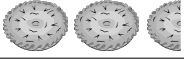
C. 1 hr. 30 min.


D. 1 hr. 45 min.

23. Sarah's teacher held an object in each hand and said they contain an equal amount of matter. What measure must be the same for the two objects?

A. Weight B. Mass
C. Capacity D. Volume

24. Five third-grade classes held a pie sale to raise money for art supplies.

Mr. Baker	
Ms. Cromley	
Mrs. Decker	
Mr. Everly	
Mr. Flint	

each  represents 10 pies





Who was the teacher of the class that sold between 30 and 50 pies?

A. Mr. Baker B. Mr. Flint
C. Mrs. Decker D. Ms. Cromley

25. Jack has the money shown below.







Which of the following shows a greater amount of money than what Jack has?

- A. 
- B. 
- C. 
- D. 

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GR-3

Num	Scoring	Standard	Answer
1	B	3.03A	W
2	D	3.03A	$\frac{3}{1}$
3	D	3.03E	$\frac{6}{10}$
4	D	3.03F	
5	B	3.04A	9
6	D	3.04A	155
7	C	3.04B	$120 + 80$
8	B	3.04E	7×4
9	A	3.04E	threes
10	C	3.04E	30 tens
11	B	3.04K	$6 \times (5 + 3)$
12	D	3.05A	Subtract 105 from 509. Then add 210 to the difference.
13	C	3.05B	
14	C	3.05B	5
15	D	3.05B	$75 \div 5 = \square$
16	D	3.05B	20
17	B	3.05C	20
18	D	3.06A	1, 3, 4, 6
19	A	3.06B	
20	B	3.06D	$(3 \times 3) + (5 \times 5) + (4 \times 4)$
21	C	3.07B	
22	B	3.07C	1 hr. 15 min.
23	B	3.07D	Mass
24	C	3.08B	Mrs. Decker

25

B

3.04C



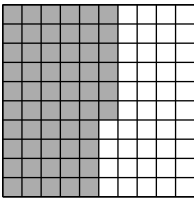
1. Buster kept track of his scores as he played a computer game.

1635 3418

Compare the value of 3 in each number.

- A. The 3 in 3418 is 100 times larger than the 3 in 1635.
- B. The 3 in 3418 is 10 times larger than the 3 in 1635.
- C. The 3 in 1635 is 100 times larger than the 3 in 3418.
- D. The 3 in 1635 is 10 times larger than the 3 in 3418.

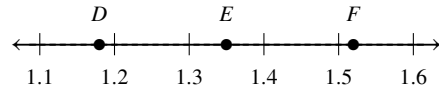
2. There are 100 schools in a city. The shaded part of the model shows how many of the schools are elementary schools.



Which fraction and decimal describe the shaded part of the model?

- A. $\frac{4}{100}$ and 0.4 B. $\frac{6}{100}$ and 0.6
- C. $\frac{44}{100}$ and 0.44 D. $\frac{56}{100}$ and 0.56

3. Which is a good estimate for the value of point *D*?

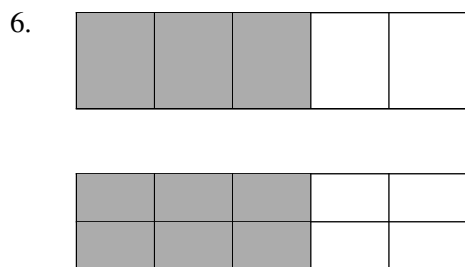
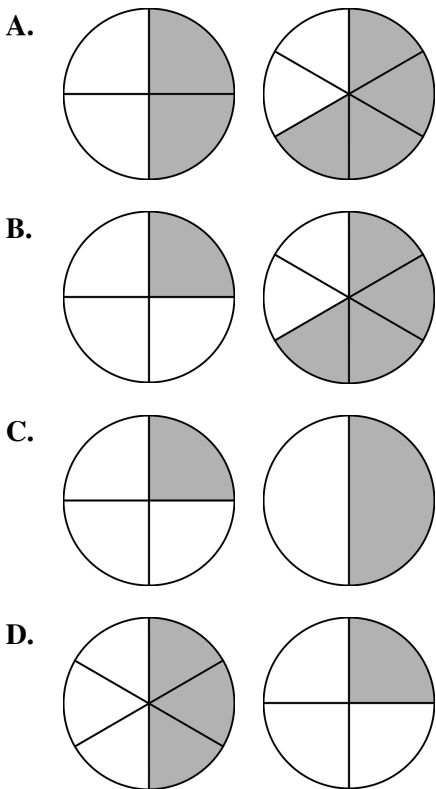


- A. 1.8 B. 1.18 C. 1.11 D. 1.15

4. Jaylin said that she washed $1\frac{2}{3}$ pounds of fruit this morning. How is $1\frac{2}{3}$ written as an improper fraction? Use a manipulative to build a model.

- A. $\frac{5}{3}$ B. $\frac{3}{5}$ C. $\frac{2}{3}$ D. $\frac{2}{5}$

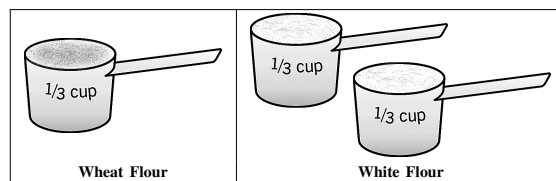
5. Mr. LeGraves tacked onto the bulletin board the pairs of circles below. Which pair of circles shows $\frac{1}{4} < \frac{4}{6}$?



The models are shaded to show that—

- A. $\frac{3}{5} = \frac{6}{10}$ B. $\frac{2}{5} = \frac{6}{10}$
 C. $\frac{3}{5} < \frac{4}{10}$ D. $\frac{2}{5} > \frac{6}{10}$

7. Ben is making pancakes for breakfast. The recipe calls for $\frac{1}{3}$ cup of wheat flour and $\frac{2}{3}$ cup of white flour. What is the total amount of flour that goes into the pancakes?



- A. 2 cups B. 1 whole cup
 C. $\frac{3}{9}$ of a cup D. $\frac{2}{6}$ of a cup
8. A gas tank holds 22.5 gallons when full. Lisa filled the tank on Friday, but now there are only 6.7 gallons left in the tank. How much gas has been used?
- A. 17.8 gal B. 17.2 gal
 C. 15.8 gal D. 6.8 gal
9. Kylie has \$27.18. She and Tina have \$49.27 altogether. How much money does Tina have?
- A. \$22.09 B. \$50.29
 C. \$76.45 D. none of these
10. Mr. Kuhn paid a total of \$328 for 8 tickets to sit in the fourth row at a hockey game. He paid the same amount for each ticket. Which is the best estimate for the cost of 1 ticket?
- A. \$35 B. \$40 C. \$45 D. \$50

11. Gabriel's mom gave him \$25 to buy lunch. He saw this menu at the snack bar:

<u>LUNCH ITEMS</u>	
Sandwiches – \$3 each	
Chips – \$2 each	

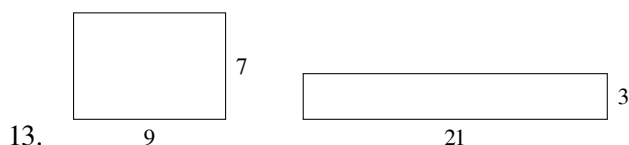
Gabriel wanted to buy 3 sandwiches and one bag of chips. To determine whether he had enough money, what should he do?

- A. Multiply \$5 by 3 and compare the product to \$25.
- B. Add \$5 and \$2 and compare the sum to \$25.
- C. Subtract \$5 from \$25 and compare the difference to \$25.
- D. Add \$2 to the product of \$5 and 3 and compare the sum to \$25.

12. What is the perimeter of this rectangle if its width is 30 units and its length is twice its width?



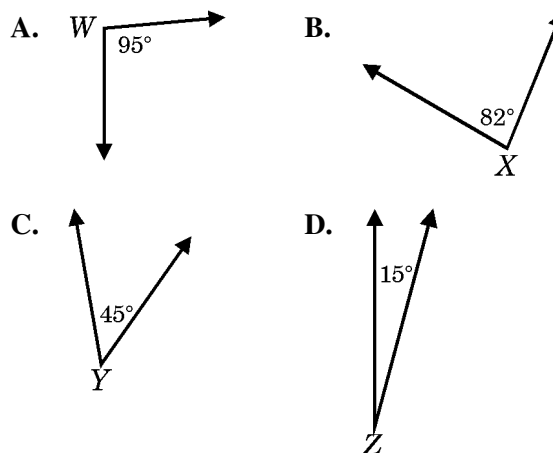
- A. 30 B. 60 C. 120 D. 180



Which statement about the figures is true?

- A. They both have the same perimeter.
- B. They both have the same area.
- C. They both have the same length.
- D. They both have the same width.

14. Which angle is *not* acute?

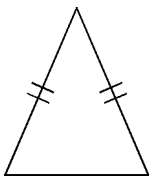


15. Which letter has a line of symmetry?

- A. S B. R C. W D. P

16. The best name for the given triangle is _____.

- A. isosceles
- B. scalene
- C. right
- D. equiangular

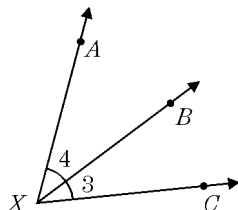


17. Which drawing best represents a figure with *no* parallel lines?

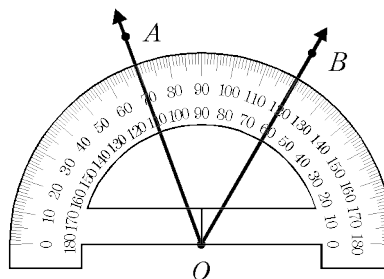
- A.
- B.
- C.
- D.

18. Another name for $\angle 4$ is _____.

- A. $\angle AXB$
- B. $\angle AXC$
- C. $\angle CXB$
- D. $\angle 3$



19. Find the measure of $\angle AOB$.



- A. 50°
- B. 60°
- C. 70°
- D. 120°

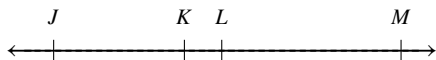
20. Jason's dad drove him 2 miles to the grocery store. Which model shows how far they drove to the grocery store?

- A.
- B.
- C.
- D.

21. Jonathan measured the distance between the park and his house and found the distance was 92 yards. How many feet is this?

- A. 23 ft
- B. 276 ft
- C. 1104 ft
- D. 3312 ft

22. Find the length of \overline{JK} if JL is 12, JM is 24, and KM is 14.

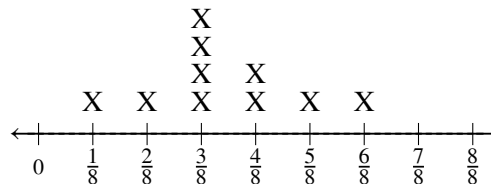


- A. 2 units B. 10 units
C. 14 units D. 24 units
23. Mrs. Beeler began shopping at ten o'clock in the morning and shopped for three hours. At what time did she finish shopping?
- A. 12:00 pm B. 1:00 pm
C. 2:00 pm D. 3:00 pm
24. Tonya must leave for school by 7:40 am. It takes her 50 minutes to get ready in the morning. What is the latest that Tonya can get up and still be ready on time?

- A. 6:40 am B. 6:45 am
C. 6:50 am D. 8:30 am

25. Lemurs use a unique method to find food. They tap on trees to find grubs. Then they gnaw holes in the wood and insert the narrow middle finger to pull out the grubs. Mr. Whitefield kept track of the amount of grubs collected by one lemur.

Grubs Collected (ounces)

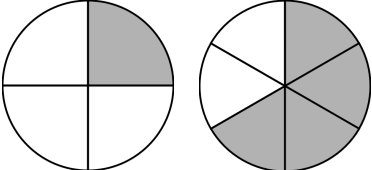
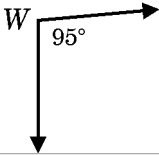
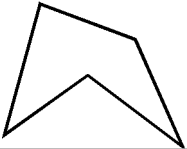
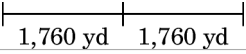


What is the weight of grubs collected most often?

- A. $\frac{1}{4}$ ounce B. $\frac{3}{8}$ ounce
C. $\frac{5}{8}$ ounce D. $\frac{3}{4}$ ounce

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GR-4

Num	Scoring	Standard	Answer
1	A	4.02A	The 3 in 3418 is 100 times larger than the 3 in 1635.
2	D	4.02G	$\frac{56}{100}$ and 0.56
3	B	4.02H	1.18
4	A	4.03A	$\frac{5}{3}$
5	B	4.03D	
6	A	4.03D	$\frac{3}{5} = \frac{6}{10}$
7	B	4.03E	1 whole cup
8	C	4.04A	15.8 gal
9	A	4.04A	\$22.09
10	B	4.04G	\$40
11	D	4.05A	Add \$2 to the product of \$5 and 3 and compare the sum to \$25.
12	D	4.05D	180
13	B	4.05D	They both have the same area.
14	A	4.06A	
15	C	4.06B	W
16	A	4.06C	isosceles
17	A	4.06D	
18	A	4.07A	$\angle AXB$
19	A	4.07C	50°
20	C	4.08B	
21	B	4.08B	276 ft
22	B	4.08C	10 units
23	B	4.08C	1:00 pm
24	C	4.08C	6:50 am
25	B	4.09B	$\frac{3}{8}$ ounce

1. The size of a computer screen is determined by the measure of its diagonal. If the diagonal of a certain computer screen is 17.25 inches, what is the size of the screen to the nearest whole number?

A. 10 in. B. 16 in.
C. 17 in. D. 18 in.

2. The Home & Garden Center sells lamps. The chart shows how many lamps were sold in a 3-year period.

	Number of Lamps Sold
Year 1	1490
Year 2	895
Year 3	1102

Which is the best estimate of the total number of lamps sold?

A. 2,500 B. 3,000
C. 3,500 D. 4,000

3. Gregory washes and folds towels at the hotel. He puts the towels into 10 equal piles and has some left over. Which of the numbers shows how many towels he might have left over?

A. 6 B. 10 C. 12 D. 20

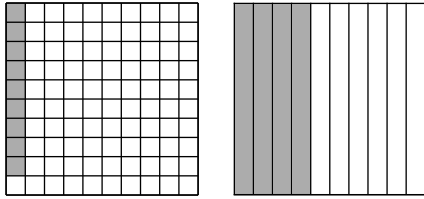
4. Jacob bought 3 birthday presents. The cheapest present cost \$2.50 and the most expensive present cost \$7.50. Which is the best estimate for the total amount that Jacob spent?

A. Between \$2.50 and \$7.50
B. Between \$7.50 and \$10.00
C. Between \$10.00 and \$12.50
D. Between \$12.50 and \$17.50

5. In which of these situations would it *not* be a good idea to round the numbers?

A. the number of times an audience laughs during a movie
B. the amount of water it takes to wash down one elephant
C. the number of free buttons to be handed out for a political candidate
D. the amount of air space between planes trying to land at an airport

6. At the shoe store, $\frac{9}{100}$ of the high-heeled shoes were discounted and $\frac{4}{10}$ of the athletic shoes were discounted.



$$\frac{9}{100} + \frac{4}{10} = \square$$

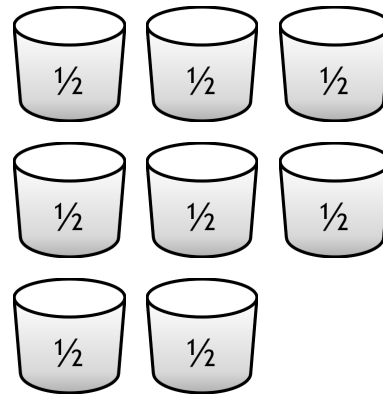
What is the total fraction of discounted shoes?

- A. $\frac{9}{100} + \frac{4}{100} = \frac{13}{100}$
 B. $\frac{9}{100} + \frac{40}{100} = \frac{49}{100}$
 C. $\frac{9}{10} + \frac{4}{100} = \frac{94}{100}$
 D. $\frac{9}{10} + \frac{4}{10} = \frac{13}{10}$

7. Tania bought 3 pizzas for a birthday party. After the party, there was $\frac{3}{8}$ of a pizza left. How much pizza was eaten during the party?

- A. $\frac{3}{4}$ B. $1\frac{1}{4}$ C. $1\frac{5}{8}$ D. $2\frac{5}{8}$

8. Look at the drawing.



$$\frac{8}{2} = 8 \times \frac{1}{2}$$

Choose the story that matches the drawing.

- A. Janet served $\frac{1}{2}$ cup cooked broccoli to each of the 8 guests.
 B. Bristol served 8 cups cooked cereal to each of the 2 guests.
 C. David served $\frac{1}{8}$ cup raisins to each of the 8 guests.
 D. Sharon served $\frac{1}{2}$ cup black beans to each of the 2 guests.
9. A small dam can hold a maximum of 634.73 acre-feet of water. Just before the rain season starts, the dam actually holds 137.45 acre-feet of water. How much water can flow into the dam before it overflows?
- A. 398.92 B. 497.28
 C. 609.39 D. none of these

10. Four more than the product of eight and a number is 44. Which equation would help you find the number?

A. $(8 - 4) + 44 = n$ B. $8n + 44 = 4$
C. $(n - 4) + 8 = 44$ D. $8n + 4 = 44$

11. Look at the expression.

$$7z$$

- A. 7 times some number
B. 7 equals z
C. $7z$
D. 7 more than a number

How do you read the expression?

- A. B only B. C only
C. A and C only D. D only

12. Given $y = 5$, what is $(y - 3)(y + 4)$?

A. 6 B. 12 C. 14 D. 18

13. Elizabeth bought 3 hardcover books that normally cost \$22.50 each. She used a coupon that reduced the price of each by \$1.75. Which equation can be used to find c , the total cost of the books (before tax)?

A. $c = 22.5 \times 3 \times 1.75$
B. $c = 3(22.5) - 1.75$
C. $c = 3(22.5 + 1.75)$
D. $c = 3(22.5 - 1.75)$

14. A blimp at a major college football game will take a group of people for a ride above the stadium for \$250. If nine friends get together to share a blimp ride, how much will it cost each person (to the nearest cent)?

A. \$29.32 B. \$27.78
C. \$23.81 D. none of these

15. What is a rule for the following pattern?

3, 6, 4, 8, 6, ...

A. add 3, subtract 2
B. add 3, add 2
C. multiply by 2, subtract 3
D. multiply by 2, subtract 2

16. Sammy has a cat and a dog. His cat, Fluff, eats 2 cups of food each day. His dog, Spook, eats 4 cups of food each day. How many cups of cat food will Fluff have eaten when Spook eats 20 cups of dog food?

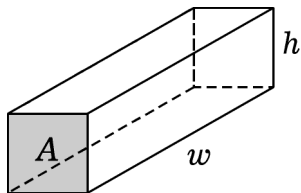
A. 8 B. 10 C. 12 D. 16

17. Four boxes weigh a total of 48 pounds 8 ounces. If each box weighs the same amount, which expression could be used to determine the weight of one box in *ounces*?

A. $(48 + 8) \cdot 6$ B. $(48 \cdot 16 + 8) \div 4$
C. $(48 \cdot 16 + 8) \cdot 4$ D. $(48 \cdot 16) \div 4 - 8$

18. In the figure, A is the area of one face of the rectangular prism. What expression represents the volume?

A. Ah^2
B. A^2wh
C. Aw
D. Awh



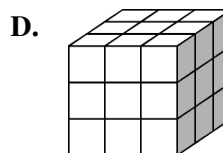
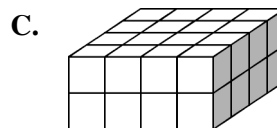
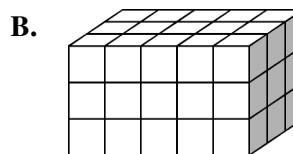
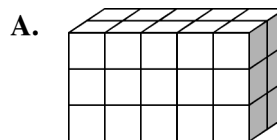
19. Darryl works as a stock boy in a local store. He notices a three foot high rectangular box that is labeled as having a volume of 60 cubic feet. What is a possible set of dimensions for the base of the box?

A. 5 ft by 4 ft B. 4 ft by 6 ft
C. 7 ft by 3 ft D. 4 ft by 3 ft

20. Which can measure the amount of space inside the International Space Station?

A. square feet B. cubic feet
C. miles D. square miles

21. Which of the following rectangular prisms have a volume of 30 cubic units?



22. $1.05 \text{ L} - 0.52 \text{ L} = \square \text{ mL}$

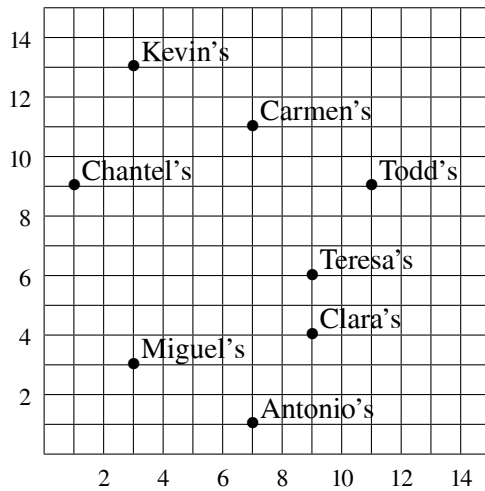
A. 0.53 B. 5.3 C. 530 D. 5300

23. An average size apple has a mass of 160 g. How many apples will there be in a 3.2 kg container of apples?

A. 2 B. 10 C. 20 D. 200

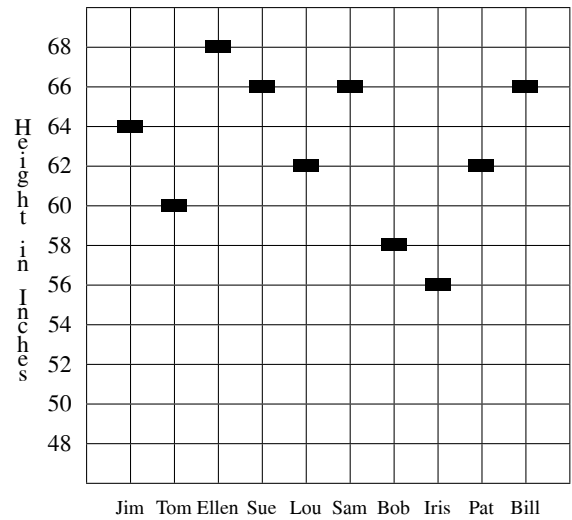
24. The people who live at the points (7, 11) and (9, 4) are best friends. Who are they?

Map of Clarkstown



- A. Miguel and Clara
- B. Carmen and Teresa
- C. Clara and Antonio
- D. Carmen and Clara

25. The graph shows the heights of 10 sixth-grade students.

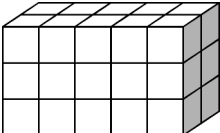


What was the greatest difference in height among these 10 students?

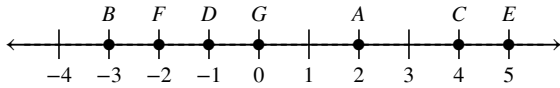
- A. 20 in.
- B. 14 in.
- C. 12 in.
- D. 10 in.

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GR-5

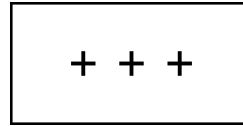
Num	Scoring	Standard	Answer
1	C	5.02C	17 in.
2	C	5.03A	3,500
3	A	5.03A	6
4	D	5.03A	Between \$12.50 and \$17.50
5	D	5.03A	the amount of air space between planes trying to land at an airport
6	B	5.03H	$\frac{9}{100} + \frac{40}{100} = \frac{49}{100}$
7	D	5.03H	$2\frac{5}{8}$
8	A	5.03I	Janet served $\frac{1}{2}$ cup cooked broccoli to each of the 8 guests.
9	B	5.03K	497.28
10	D	5.04B	$8n + 4 = 44$
11	C	5.04B	A and C only
12	D	5.04B	18
13	D	5.04B	$c = 3(22.5 - 1.75)$
14	B	5.04B	\$27.78
15	D	5.04C	multiply by 2, subtract 2
16	B	5.04C	10
17	B	5.04E	$(48 \cdot 16 + 8) \div 4$
18	C	5.04G	Aw
19	A	5.04H	5 ft by 4 ft
20	B	5.06A	cubic feet
21	A	5.06B	
22	C	5.07-	530
23	C	5.07-	20
24	D	5.08C	Carmen and Clara
25	C	5.09C	12 in.

1. This number line satisfies which of the following conditions?

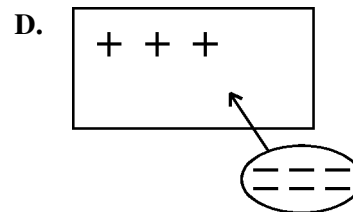
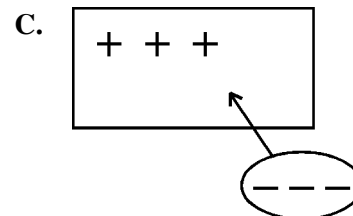
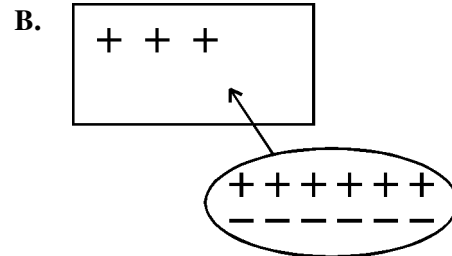
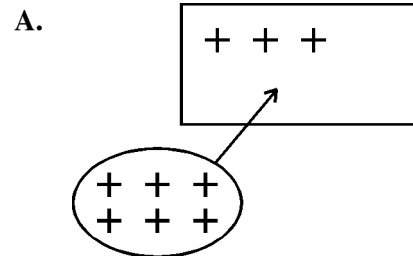


- A. $A > 0$ B. $A = 0$
 C. $B > 0$ D. $C = 0$

2. The following picture could be used to begin modeling $3 - 6$.



Which picture could be used to model the next step in solving the problem?



3. Which of the following statements are true according to the Commutative Property of Multiplication?

I. $(3 \times 5) - 2 = (5 \times 3) - 2$

II. $3 \times 2(5 - 1) = 2 \times 3(5 - 1)$

III. $3 \times (5 - 1) = 3 \times 5 + 3 \times 1$

- A. I only B. I and II
C. I and III D. all three

4. Bill is in charge of the local tennis association's tournament. He has 36 yellow tennis balls, 48 green tennis balls, and 24 orange tennis balls. He must bundle the balls in packages so that each package has the same number of each of the different colored balls. What is the largest number of packages that Bill can make?

- A. 3 B. 4 C. 6 D. 12

5. Students in a microbiology class found the ratio of amoeba to paramecium in a sample to be 3 to 1. If the number of paramecium found was 1500, how many amoeba were present?

- A. 500 B. 3000 C. 4500 D. 6000

6. When Cristobal views video blogs online, he views 7 blogs per session.

Number of Sessions	Number of Video Blogs
1	7
3	21
6	42
15	?

How many blogs will Cristobal view in 15 sessions?

- A. 57 B. 70 C. 84 D. 105

7. Greta collected data about art students at two middle schools and recorded the information in the table.

Art Students

School	Art Students	Total Students
Maple Valley Middle	280	800
Oakwood Middle	150	500

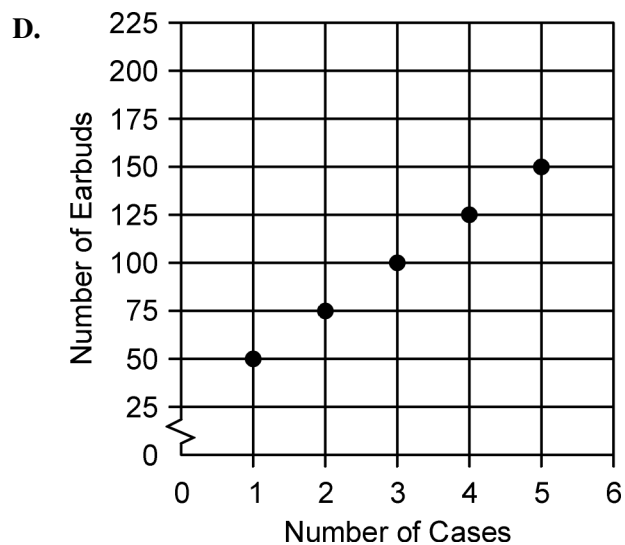
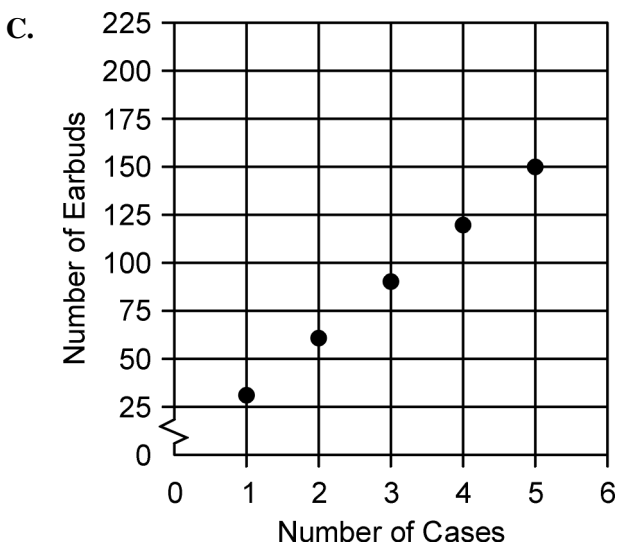
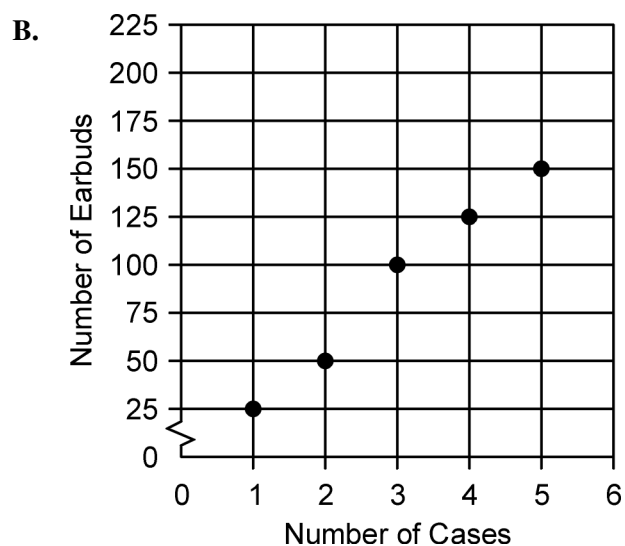
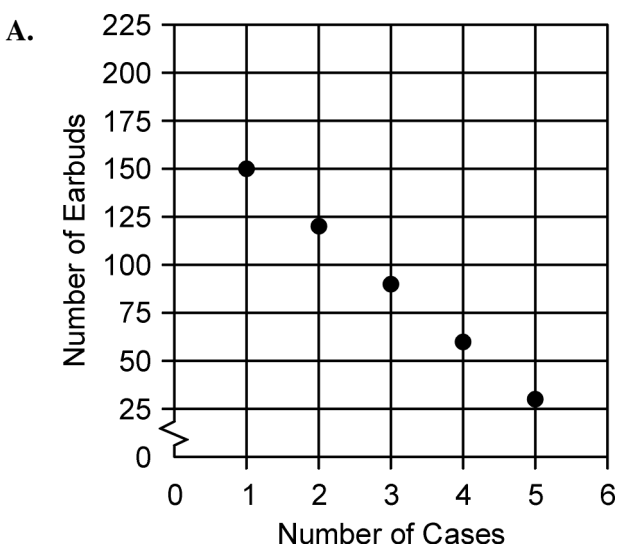
Which school has the higher percentage of art students?

- A. Maple Valley because $280\% > 150\%$ B. Oakwood because $800 > 500$
C. Maple Valley because $35\% > 30\%$ D. Oakwood because $20\% > 15\%$

8. Franco works at *Ugo*, a mall kiosk that sells mobile device accessories. The table shows the number of earbuds in different numbers of cases.

Number of Cases	Number of Earbuds
1	30
2	60
3	90
4	120
5	150

Which graph correctly plots the pairs of values in the table?



9. In a linear relationship, the y variable is dependant on the x variable. In other words, what happens to the y variable depends on what happens to the x variable. Which of the following x and y variables are *not* correct according to this rule?

- A. x = number of grocery items purchased,
 y = total cost of grocery bill
- B. x = number of candy bars sold, y = profit
- C. x = number of family members attending a trip, y = total cost of family vacation
- D. x = money made from working,
 y = number of hours worked

10. Which situation could be represented by the equation $d = 36t$?

- A. d is the time in hours of t seconds.
- B. d is the distance in inches of t yards.
- C. d is the volume in ounces t quarts.
- D. d is the distance in yards of t miles.

11. How are the factors $3 \times 3 \times 5$ expressed in exponential notation?

- A. $2^3 \times 5$
- B. $3^2 \times 5$
- C. 3×5^2
- D. $3^2 \times 5^2$

12. $(6a^2b^5c)(2a^4b^5c^2)$ is best described as a(n):

- A. variable
- B. coefficient
- C. expression
- D. constant

13. Translate the verbal expression “the quotient of seven times f and eight less than g .”

- A. $\frac{7}{(f + 8 - g)}$
- B. $\frac{7f}{(g - 8)}$
- C. $\frac{7}{f(g - 8)}$
- D. $\frac{7(f + 8)}{g}$

14. One beanie and one pair of gloves sell for \$5.75 each. Last week, a store sold both beanies and gloves. Look at an expression to describe the amount of sales from the items, if b represents the number of beanies and g represents the number of gloves.

$$5.75b + 5.75g$$

Which of these correctly rewrites the expression?

- A. $11.50(n + c)$
- B. $5.75(nc)$
- C. $5.75 + (nc)$
- D. $5.75(n + c)$

15. Simplify: $-g - 8g$

- A. $-9g^2$
- B. $-9g$
- C. $-7g$
- D. $8g$

16. Sonya is asked to find the shortest side of $\triangle MOP$. She knows that:

$$\begin{aligned} m\angle M &= x + 14 \\ m\angle O &= 3x + 7 \\ m\angle P &= 2x + 15 \end{aligned}$$

What should Sonya answer?

- A. \overline{MP} B. \overline{MO} C. \overline{OP}
D. no shortest side, $\triangle MOP$ is equilateral

17. If the sides of a cube have length $3x$, what is the formula for finding the volume, V , of the cube?

- A. $V = 27x^3$ B. $V = 3x^3$
C. $V = 9x^2$ D. $V = 27x^2$

18. Which of the following dimensions describes the parallelogram that has the greatest area?

- A. base 6 cm, altitude 5 cm
B. base 4 cm, altitude 6 cm
C. base 5 cm, altitude 7 cm
D. base 4 cm, altitude 7 cm

19. You could use the equation $127 - m = 94$ to solve the following problem:

Brad has 127 marbles. He gave some to his sister and he has 94 left. How many marbles did Brad give to his sister?

What does the “ m ” in the equation represent?

- A. the number of marbles Brad received from his sister
B. the number of marbles Brad has now
C. the number of marbles Brad’s sister received
D. the number of marbles Brad had at the beginning

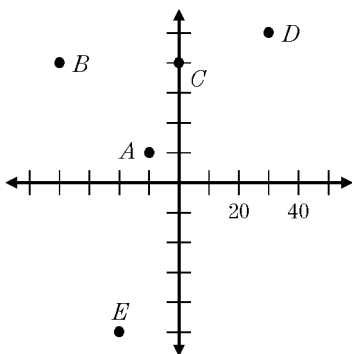
20. Laura knows that to have 80 or more as her average for the year in biology, her 2 semester grades must total at least 160. If her first semester grade was 74, which inequality could she use to find G , her second semester grade which would earn her an average of 80 or more?

- A. $74 + G \geq 160$ B. $G - 160 < 74$
C. $G + 74 \leq 160$ D. $\frac{74 + G}{2} \geq 160$

21. If $0.08d = 4.8$, what is the value of d ?

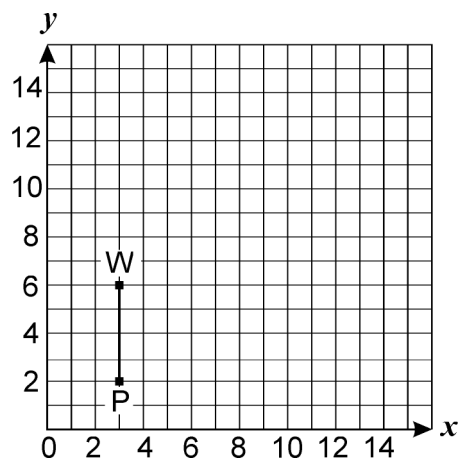
- A. 0.224 B. 32
C. 60 D. 224

22. For which point is $x \geq 20$ and $y > 40$?



- A. A B. B C. D D. E

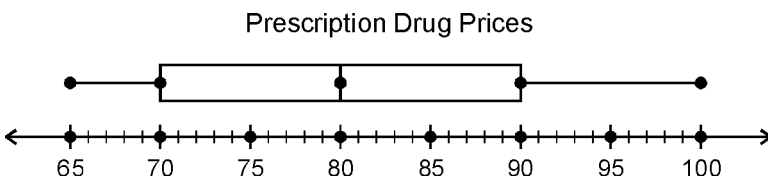
23. Point W is at $(3, 6)$. Point P is at $(3, 2)$.



Which of these shows how to find the number of units from point W to point P ?

- A. Add: $6 + 2$ B. Add: $6 + 3$
C. Subtract: $6 - 2$ D. Subtract: $6 - 3$

24. Box-and-whisker plots are helpful in interpreting the distribution of data. Dr. Brown created one using the cost of prescription drugs regularly prescribed in his practice. What would happen to the box-and-whisker plot if a new drug came out that only cost \$10?



- A. The range would change dramatically.
- B. The upper quartile would increase dramatically.
- C. The lower quartile would stay the same.
- D. There would be no change.

25. Read the questions.

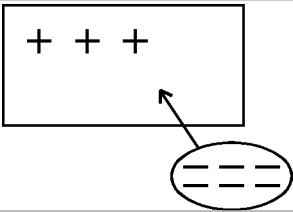
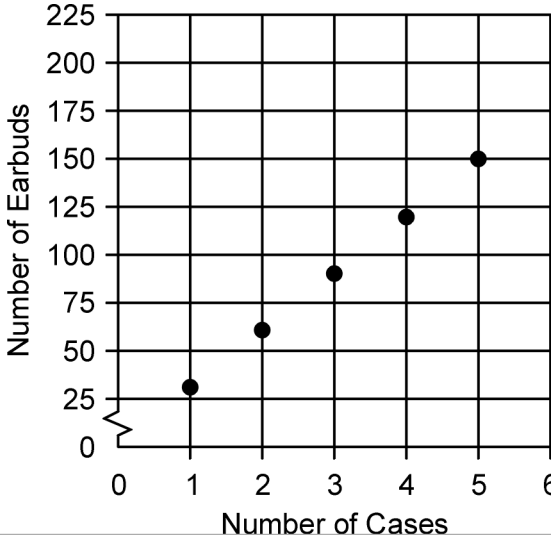
- a. What is the wheelbase of a Camaro?
- b. What is the wheelbase of various mini-van models?
- c. What is the wheelbase of various hybrid models?
- d. What is the wheelbase of a Volt?

Which of the above are statistical questions?

- A. a only
- B. b and c only
- C. b, c and d only
- D. a, b and d only

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GR-6

Num	Scoring	Standard	Answer
1	A	6.02C	$A > 0$
2	D	6.03C	
3	B	6.03D	I and II
4	D	6.03D	12
5	C	6.04B	4500
6	D	6.04C	105
7	C	6.04G	Maple Valley because $35\% > 30\%$
8	C	6.05A	
9	D	6.06A	x = money made from working, y = number of hours worked
10	B	6.06C	d is the distance in inches of t yards.
11	B	6.07A	$3^2 \times 5$
12	C	6.07B	expression
13	B	6.07B	$\frac{7f}{(g-8)}$
14	D	6.07C	$5.75(n+c)$
15	B	6.07D	$-9g$
16	A	6.08A	\overline{MP}
17	A	6.08C	$V = 27x^3$
18	C	6.08D	base 5 cm, altitude 7 cm
19	C	6.09A	the number of marbles Brad's sister received
20	A	6.09A	$74 + G \geq 160$

21	C	6.10A	60
22	C	6.11-	<i>D</i>
23	C	6.11-	Subtract: $6 - 2$
24	A	6.13A	The range would change dramatically.
25	B	6.13B	b and c only

1. Simplify: $(9)^{-2}$

- A. -81 B. $-\frac{1}{81}$ C. $\frac{1}{81}$ D. 81

2. If a negative number is multiplied by $-\frac{1}{2}$, which statement is always true?

- A. The product is between zero and one.
 B. The product is less than the original number.
 C. The product is half the size of the original number and positive.
 D. The product is twice the original number and negative.

3. Simplify: $7 \times (-3) + (-15)$

- A. -36 B. -11 C. -6 D. 36

4. The table shows the cost of the components of one lanyard-style badge holder.

Item	Cost (US Dollars)
one-loop lanyard	0.42
swivel hook	0.10
plastic name badge	0.05

What is the approximate number of lanyard-style badge holders that can be assembled with a budget of 1 thousand dollars?

- A. 2000 badge holders
 B. 2500 badge holders
 C. 1700 badge holders
 D. 20,000 badge holders

5. Manufacturing defects in computer chips average about 9.5%. If Warp Speed Computer manufacturer makes 4100 computer chips per month, what is a reasonable estimate of the number of chips that have to be discarded?

- A. 100 B. 400 C. 450 D. 900

6. Mickey is taking the Amtrak train to visit his cousin who lives 750 miles away. If the train traveled 334 miles in 4 hours, which proportion could be used to determine how many hours the entire trip will take?

- A. $\frac{4}{x} = \frac{334}{216}$ B. $\frac{x}{4} = \frac{334}{750}$
 C. $\frac{x}{4} = \frac{216}{750}$ D. $\frac{x}{4} = \frac{750}{334}$

7. A small warehouse store is open for business each day for twelve hours. The table shows the number of cases of bottled water that were sold by the store in one day. What is the best estimate for the number of cases of bottled water that were sold, on average, each hour by the store on Wednesday?

Day	Bottled Water Sold (cases)
Monday	96
Tuesday	109
Wednesday	121
Thursday	63

A. 8 B. 9 C. 10 D. 12

8. Mr. Clark went to the grocery store. Yummy Yogurt is on sale 15 containers for \$12. Tasty Yogurt is on sale 12 containers for \$10.80. If Mr. Clark wants to buy the yogurt that costs the least per container, which yogurt should he buy?

- A. Yummy Yogurt
 B. Tasty Yogurt
 C. either, since all of the containers of yogurt cost the same
 D. Tasty Yogurt, because the total cost is less than Yummy Yogurt

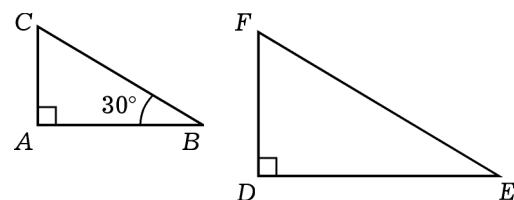
9. Two moon-craters can be described as similar triangles. The side of crater A is 3360 feet and the corresponding side of crater B is 1120 feet. The base of crater A is 1506 feet. What is the base of crater B?

- A. 1506 ft B. 502 ft
 C. 300 ft D. 201 ft

10. Nickel-plated pipe, which is used when a sink has exposed plumbing, is available in three-foot segments which cost \$13.50. If it's possible to purchase less than a full segment, how much will 28 inches of the pipe cost?

- A. \$10.50 B. \$9.70
 C. \$1.31 D. none of these

11. Triangles ABC and DEF are similar.

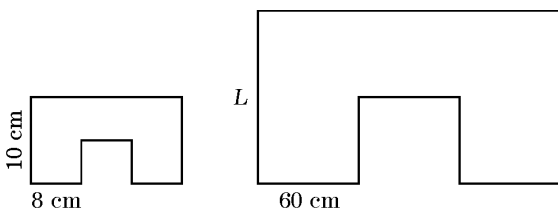


What is the measure of angle F ?

- A. 10° B. 30° C. 60° D. 120°

12. Which of the following statements *must* be true?
- I. An acute triangle and an isosceles triangle are similar.
 - II. Two triangles are similar if corresponding angles are congruent.
 - III. Any two rectangles are similar.
 - IV. Any two circles are similar.
- A. IV only B. I and II only
C. III and IV only D. all are true

13. Rhonda drew a larger model of Figure A as shown below in Figure B.



Which of the following *best* describes the length of side L in Figure B?

- A. 480 cm B. 80 cm
C. 62 cm D. 75 cm
14. Arthur's family has to pick a name for his new baby sister. Her first name will be Michelle, Ashley, or Isabelle. Her middle name will be Leigh or Anne. How many different combinations of names do they have to choose?
- A. 3 B. 4 C. 6 D. 8

15. A student uses a simulation to determine the probability of a batter with a batting average of 0.275 having a hit in one at bat. He generates six random numbers between 1 and 1000, with any number less than or equal to 275 being a hit. He generates the numbers 5, 245, 300, 789, 532 and 216. What is the experimental probability of having a hit?

A. $\frac{1}{2}$ B. $\frac{2}{3}$ C. $\frac{1}{3}$ D. $\frac{1}{6}$

16. An airline food service found that a recent flight of 120 passengers ordered dinner as depicted in the table. Based on the data, estimate how many lasagna dinners are likely to be needed for a flight with 380 passengers.

Dinner	Frequency
Chicken	63
Fish	30
Lasagna	25
Vegetarian	2

A. 301 B. 206 C. 85 D. 80

17. Erica's math teacher said the questions on the test next week will be composed of exactly 40% multiple choice questions, 30% true/false questions, 20% fill-in-the-blank questions and 10% essay questions. Based on this information which of the following is true?

- A. There will be more essay questions than true/false questions.
- B. More than half of the test will be essay questions.
- C. The number of true/false questions will equal the combined number of fill-in-the-blank questions and essay questions.
- D. There will be more fill-in-the-blank questions than true/false questions.

18. Which number could represent the probability of an event?

- A. -3 B. 0.05 C. $\frac{27}{15}$ D. π

19. If a certain event has a probability (P) of occurring of 3 out of 10, what is the probability that the event will *not* occur?

- A. 70% B. 30% C. 10% D. 40%

20. A chair is listed at price p . A customer bought it for 15% off. She paid 6% sales tax. She later sold it for an amount of S , which was 70% of what she originally paid. What is S in terms of p ?

- A. $S = (0.85)(1.06)(0.7)p$
- B. $S = 0.85p$
- C. $S = \frac{(1.06)(0.85)p}{(0.7)}$
- D. $S = \frac{(0.92)(0.7)}{(1.06)}$

21. A pyramid has a volume of 250 cm^3 . What would be the volume of a rectangular prism with the same base and height as the pyramid?

- A. 125 cm^3
- B. 750 cm^3
- C. 1000 cm^3
- D. cannot be determined

22. Which of the following is equivalent to $2(5x + 6) = 29$?

- A. $7x + 8 = 29$ B. $10x + 6 = 29$
- C. $10x + 12 = 29$ D. $22x = 29$

23. The winner of a poetry contest receives \$150, plus the revenue from the entry fees for the contest, less a 40% commission. If the winner is given \$396, what is the amount of revenue from the entry fees?

- A. \$390 B. \$400 C. \$406 D. \$410

24. Paulie's pizza is considering expanding into the pizza truck business. They calculate that the costs of a pizza truck will be \$1,420 per month. If they sell pizzas for \$12 each, how many will they have to sell in a month to make a profit of *at least* \$3,400?

- A. 165 pizzas B. 201 pizzas
C. 284 pizzas D. 402 pizzas

25. If $a = 4$, what is the value of $4a^2 - 7a - 1$?

- A. 3 B. 30 C. 35 D. 58

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GR-7

Num	Scoring	Standard	Answer
1	C	7.02-	$\frac{1}{81}$
2	C	7.02-	The product is half the size of the original number and positive.
3	A	7.03A	-36
4	C	7.03B	1700 badge holders
5	B	7.03B	400
6	D	7.04A	$\frac{x}{4} = \frac{750}{334}$
7	C	7.04B	10
8	A	7.04B	Yummy Yogurt
9	B	7.04C	502 ft
10	A	7.04D	\$10.50
11	C	7.05A	60°
12	A	7.05A	IV only
13	D	7.05C	75 cm
14	C	7.06A	6
15	A	7.06B	$\frac{1}{2}$
16	D	7.06C	80
17	C	7.06D	The number of true/false questions will equal the combined number of fill-in-the-blank questions and essay questions.
18	B	7.06E	0.05
19	A	7.06E	70%
20	A	7.07-	$S = (0.85)(1.06)(0.7)p$
21	B	7.09A	750 cm ³
22	C	7.11A	$10x + 12 = 29$
23	D	7.11A	\$410
24	A	7.11A	165 pizzas
25	C	7.11B	35

1. Which of the following numbers are *irrational*?

I. $\sqrt{25}$

II. $\sqrt{12}$

III. $2.\overline{33}$

- A. I only B. II only
C. III only D. II and III

2. The area of a circle is $75\pi\text{ cm}^2$. Since the formula for finding this area is $A = \pi r^2$, the radius must be $\sqrt{75}$ cm. Approximately how long is this radius?

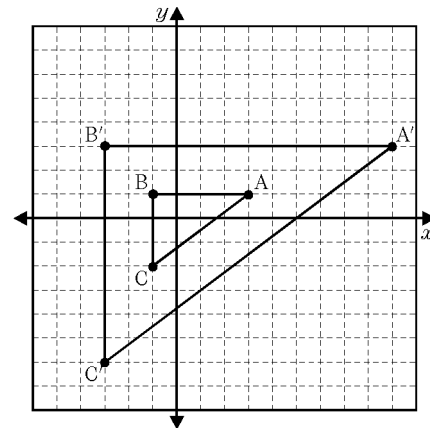
- A. about 8.1 cm B. about 8.2 cm
C. about 8.5 cm D. about 8.7 cm

3. The distance of Uranus from the Sun expressed in scientific notation is _____.

Planet	Mass (tons)	Distance from Sun (miles)
Mercury	0.364×10^{21}	36,000,000
Venus	5.37×10^{21}	67,200,000
Earth	6.58×10^{21}	93,000,000
Mars	0.708×10^{21}	141,600,000
Jupiter	209.3×10^{21}	483,800,000
Saturn	6.27×10^{21}	890,900,000
Uranus	95.7×10^{21}	1,784,800,000
Neptune	113×10^{21}	2,793,100,000
Pluto	0.0138×10^{21}	3,647,200,000

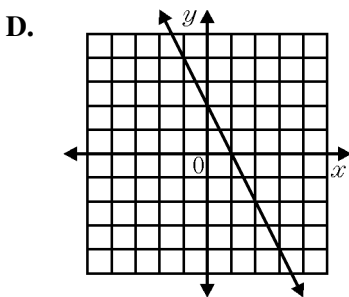
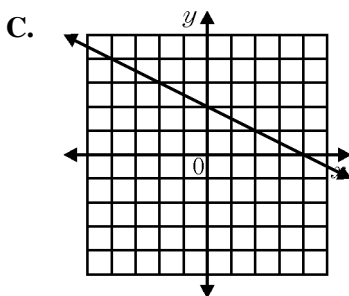
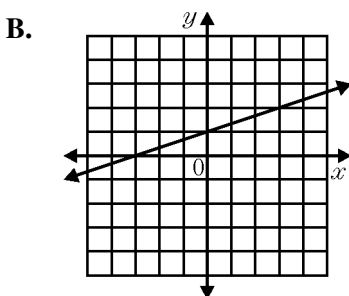
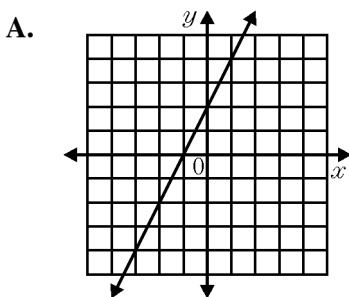
- A. 1.7848×10^9 B. 17.848×10^8
C. $.17848 \times 10^8$ D. 178.48×10^6

4. What is the scale factor of the dilation that maps $\triangle ABC \rightarrow \triangle A'B'C'$?



- A. $\frac{1}{2}$ B. 2 C. 3 D. 6

5. Which graph represents $y = \frac{1}{3}x + 1$?



6. Which ordered pair is a solution of $y = 3x + 5$?

- A. (2, 21) B. (0, 3)
C. (1, 8) D. (3, 15)

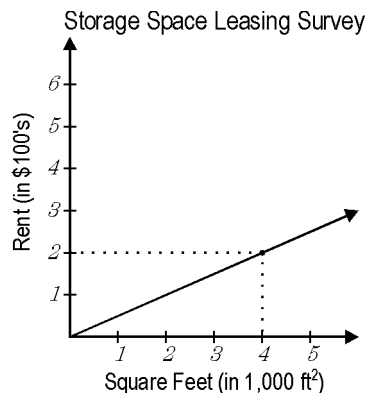
7. Arsenio kept track of the total number of magazine offers he received at his new address, as shown in the table.

x days	2	4	5	7
y total offers	4	10	13	19

Which of the following is the best equation to describe the relationship between the number of days at his house and the number of magazine offers received?

- A. $y = 2x$ B. $y = 2x + 2$
C. $y = 3x + 2$ D. $y = 3x - 2$

8. Which of the following *best* describes the slope of the line ($m = \frac{1}{2}$)?

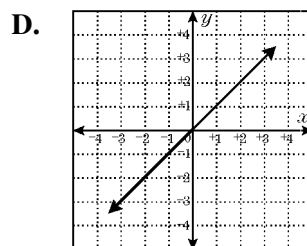
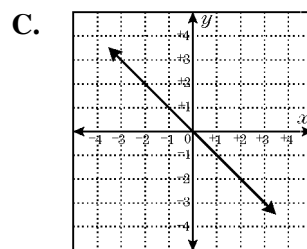
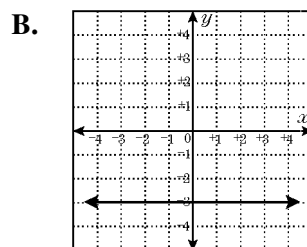
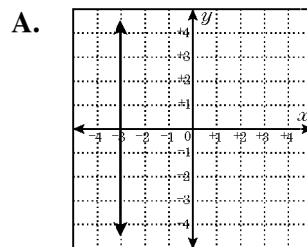


- A. For every 1,000 ft², there is a decrease of \$200.
B. For every 2,000 ft², there is a decrease of \$100.
C. For every 2,000 ft², there is an increase of \$100.
D. For every 2,000 ft², there is an increase of \$200.

9. Heather (x) and Susan (y) were judges at a dance team tryout. If the scores from these two judges were graphed and almost all of them fell above the line $y = x$, what statement could be made about the judges?

- A. Heather gave higher scores than did Susan.
- B. Susan gave higher scores than did Heather.
- C. All the dancers trying out were poor dancers.
- D. There is not enough information to make a comparison statement.

10. Which of the following graphs is *not* a function?



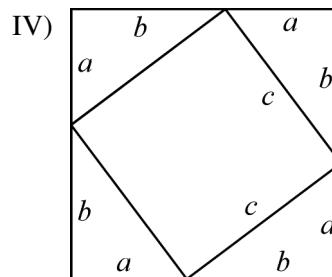
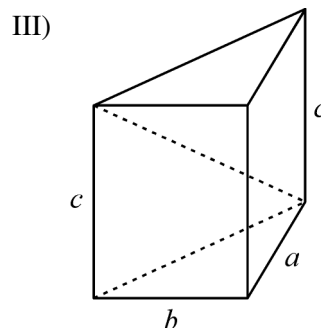
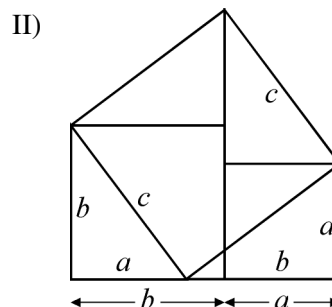
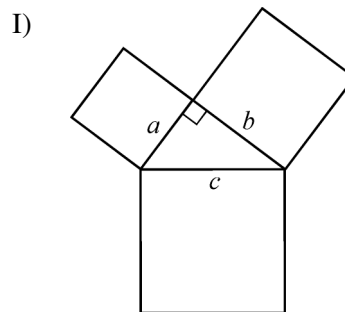
11. The graph of which of the following would show a linear relationship?

- A. The number of roses ordered from February 1st to February 28th recorded daily.
- B. The distance covered by a motorcycle going across Grandfather Mountain recorded every 10 minutes.
- C. The appropriate number of candles on a person's birthday cake recorded yearly.
- D. Delivery of new textbooks from March to October recorded monthly.

12. A lineman for the telephone company makes \$12.35 less per hour than twice what his supervisor makes per hour. If ℓ represents the hourly wage of the lineman and v represents the hourly wage of his supervisor, which equation best shows their current relationship?

- A. $\ell = \frac{1}{2}v + 12.35$
- B. $\ell = \frac{1}{2}v - 12.35$
- C. $\ell = 2v + 12.35$
- D. $\ell = 2v - 12.35$

13. Look at the figures.



Which figures, if any, are useful for proving the Pythagorean Theorem?

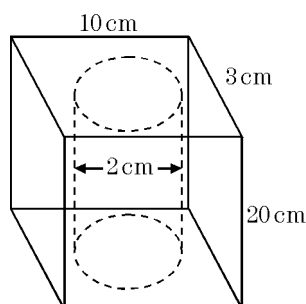
- A. I and IV only
- B. I and III only
- C. all except II
- D. all except III

14. An ice cream cone which measured 4 inches high and had a base with a radius of 1.5 inches was filled with chocolate pudding. Which formula would you use to determine the volume of pudding that the ice cream cone can hold?

- A. $V = \frac{1}{3} \times 4 \times 1.5$
 B. $V = \frac{1}{3} \times 3.14 \times 1.5 \times 4$
 C. $V = \frac{1}{3} \times 3.14 \times 1.5 \times 1.5 \times 4$
 D. $V = 3.14 \times 1.5 \times 1.5 \times 4$

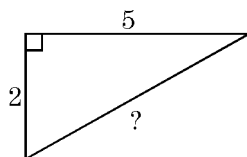
15. A cylinder is cut from a rectangular prism as shown. To the nearest square centimeter, what is the surface area of the resulting solid?

- A. 564 cm^2
 B. 594 cm^2
 C. 654 cm^2
 D. 699 cm^2

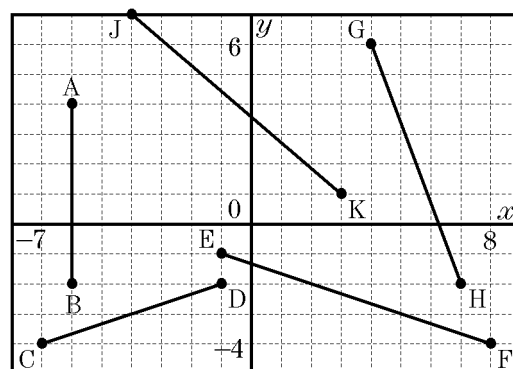


16. What is the length of the unmeasured side of this triangle?

- A. $\sqrt{2^2 + 5^2}$
 B. $2^2 + 5^2$
 C. $\frac{2^2 + 5^2}{2}$
 D. $\sqrt{2+5}$



17. Find the sum of the lengths of line segments EF and CD .



- A. $\sqrt{40}$
 B. $5\sqrt{10}$
 C. $\sqrt{130}$
 D. $\sqrt{234}$

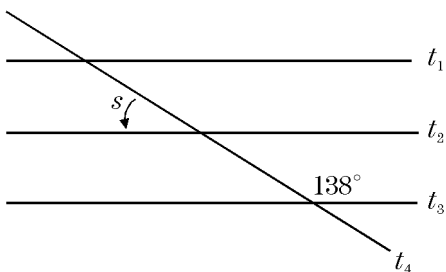
18. Look at the equation.

$$3 + \underline{\hspace{2cm}} = 3(5 + x)$$

Which of these creates an equation with only one solution?

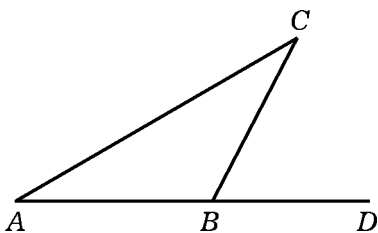
- A. $3(4 + x)$
 B. $-3x$
 C. $3(x + 1)$
 D. $3x$

19. Lines t_1 , t_2 , and t_3 are parallel lines intersected by line t_4 . What is the measure of $\angle s$?



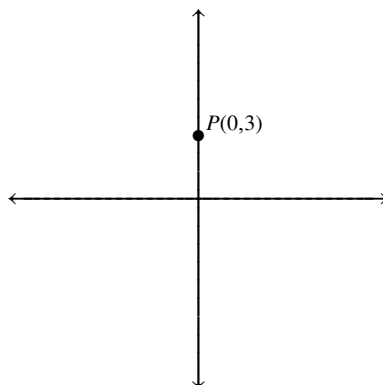
- A. 42° B. 48° C. 138°
D. Not enough information.

20. In the accompanying diagram, side \overline{AB} is extended to D . If $m\angle ACB = 2x - 10$, $m\angle CAB = x + 10$, and $m\angle CBD = 4x - 25$, what is the value of x ?



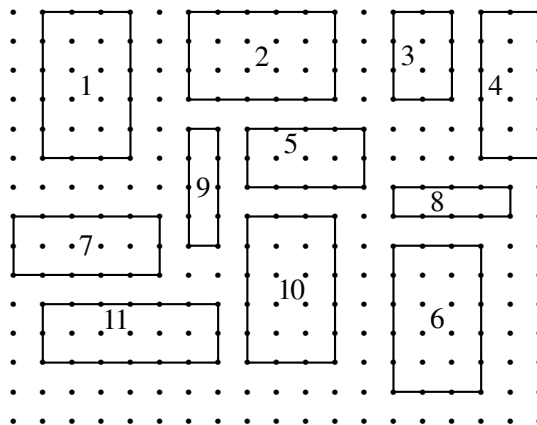
- A. 16 B. 20 C. 25 D. 45

21. Point P is reflected across the line $x = y$. What are the coordinates of the new point?



- A. $(0, -3)$ B. $(-3, 0)$
C. $(3, 0)$ D. $(0, 3)$

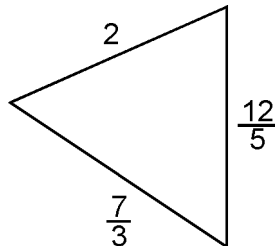
22. Which pair of figures are *not* congruent?



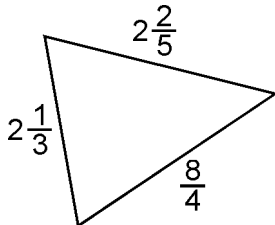
- A. 1 and 6 B. 2 and 10
C. 4 and 11 D. 8 and 9

23. The four triangles below are not drawn to scale.

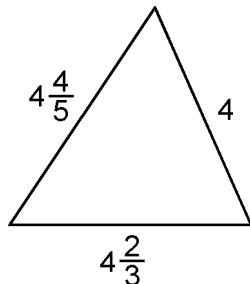
I.



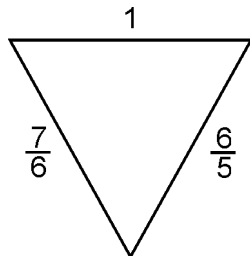
II.



III.



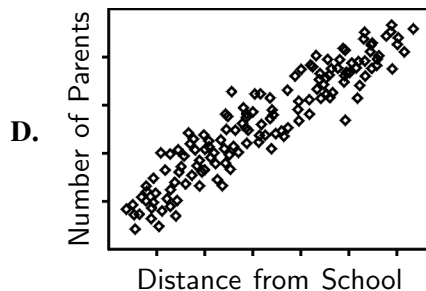
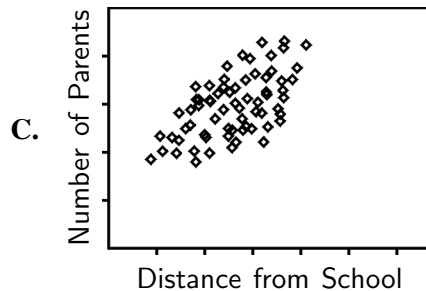
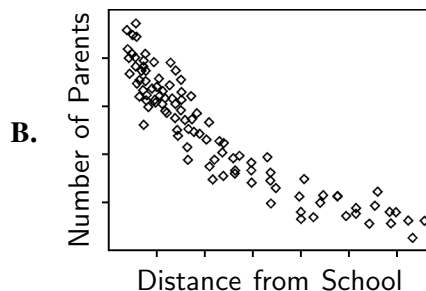
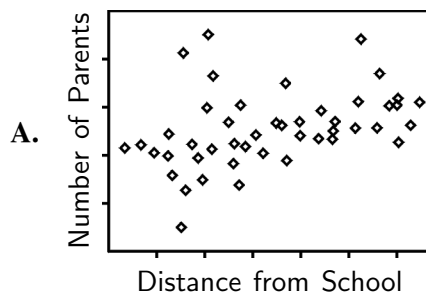
IV.



Based on the given information, which of the following groups name triangles that are similar to one another but *not* congruent?

- A. I, II and III B. I, II and IV
C. II, III and IV D. none of these

24. Last year the Athletic Department kept track of the number of parents who attended away-games for school sports. Which graph most likely shows the relationship between the distance of the away-games and the number of parents who attended?



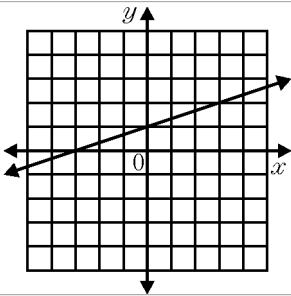
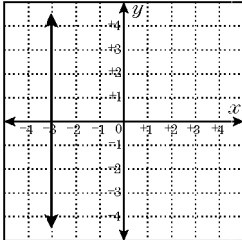
25. A tour guide books 8 passengers on her bus, which can only hold 7 passengers. However, 1 out of every 6 passengers cancels. The tour guide wants to determine the experimental probability of not overbooking and performs a simulation in order to do this. Which of the following simulation tool(s) could be used to determine this probability?

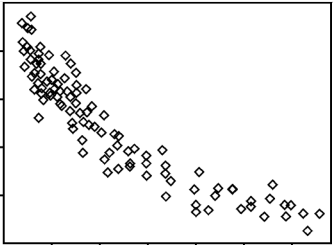
- I. a die
- II. six cards
- III. a random number generator
- IV. a coin
- V. a spinner

- A. I only
- B. III and V only
- C. II, III and V only
- D. I, II, III and V only

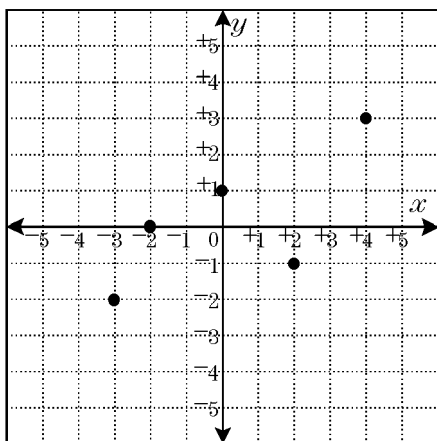
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GR-8

Num	Scoring	Standard	Answer
1	B	8.02A	II only
2	D	8.02B	about 8.7 cm
3	A	8.02C	1.7848×10^9
4	C	8.03B	3
5	B	8.05B	
6	C	8.05B	(1, 8)
7	D	8.05B	$y = 3x - 2$
8	C	8.05D	For every 2,000 ft ² , there is an increase of \$100.
9	B	8.05D	Susan gave higher scores than did Heather.
10	A	8.05G	
11	C	8.05G	The appropriate number of candles on a person's birthday cake recorded yearly.
12	D	8.05I	$\ell = 2v - 12.35$
13	D	8.06C	all except III
14	C	8.07A	$V = \frac{1}{3} \times 3.14 \times 1.5 \times 1.5 \times 4$
15	D	8.07B	699 cm ²
16	A	8.07C	$\sqrt{2^2 + 5^2}$
17	B	8.07D	$5\sqrt{10}$
18	B	8.08C	$-3x$
19	A	8.08D	42°
20	C	8.08D	25
21	C	8.10A	(3, 0)
22	C	8.10B	4 and 11
23	C	8.10B	II, III and IV

24	B	8.11A	<div><div>Number of Parents</div><div></div><div>Distance from School</div></div>	
25	D	8.11C	I, II, III and V only	

1. What is the range of the graphed relation?



- A. $\{-3, -2, 1, 2, 4\}$
 B. $\{-2, -1, 0, 1, 3\}$
 C. $\{-2, -1, 0, 1, 4\}$
 D. $\{-2, -1, 0, 1, 2, 3\}$

2. Which function corresponds to the ordered pairs in the table?

x	y
-5	-15
-3	-9
-1	-3
2	6

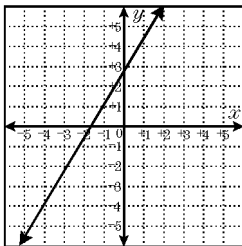
- A. $f(x) = -3x^2$ B. $f(x) = 3x$
 C. $f(x) = -3x$ D. $f(x) = 3x^2 - 1$

3. The perimeter of a rectangular field is 194 m. Three times the width of the garden is 5 meters more than its length. Which system of equations could be used to find the length (L) and the width (W) of the field?

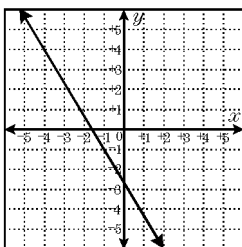
- A. $2(L + W) = 97$
 $3W = L - 5$
 B. $L + W = 194$
 $3W = L + 5$
 C. $2(L + W) = 194$
 $3W = L + 5$
 D. $2(L + W) = 97$
 $3W = L + 5$

4. Which of the following is the graph of $5x + 3y = 8$?

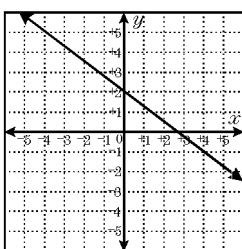
A.



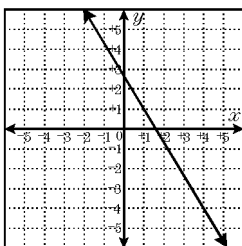
B.



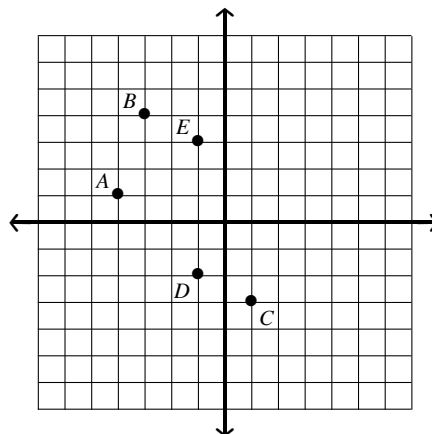
C.



D.



5. Graph a line with a slope of $-\frac{3}{4}$ and a x -intercept of 3. Which of the following points lies on the graph?



- A. A B. C C. D D. E

6. Which of the following statements imply a negative correlation?

- I. The greater the temperature, the more ice cream sold.
- II. The more I study, the less time I spend watching TV.
- III. The greater the depth under water, the greater the pressure.

- A. I only B. II only
C. I and II only D. I and III only

7. This data shows the growth in U.S. computer sales from 1991 to 1997. It is assumed that sales growth is linear and that this growth will continue in the same trend as established by the data. Which of the following best represents the sales (in millions) expected in the year 2000?

	U.S. Computer Sales	
	Year	Dollar Sales to Dealers (millions)
A. 16,000	1991	4,287
B. 18,500	1992	6,825
C. 22,900	1993	8,190
D. 27,700	1994	10,088
	1995	12,600
	1996	15,040
	1997	16,585

8. Which of the following equations does *not* result in an answer of $x = 6$?

- A. $64 = 4x + 7x - 8 + x$
 B. $5 + 2(3x + 4) = 43$
 C. $2(4x - 12) + 3x = 6x + 6$
 D. $2(4x + 7) = 4(2x + 4) - 2$

9. Noble Crown Books sells discounted books through the internet. To buy from that store, however, you must have a membership which costs \$25. The average book turns out to be \$12.47. The equation $b = 12.47a + 25$ represents the amount of money a member will have spent (b) after buying a certain number of books (a).

Alex intends to spend *no more than* \$110 on books this year. How many books can he buy from Noble Crown during the year?

- A. 6 books B. 8 books
 C. 9 books D. 10 books

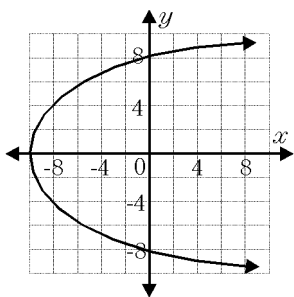
10. If $(3, 5)$ is a solution to the system

$$\begin{aligned} ax + by &= 21 \\ ax - by &= -9 \end{aligned}$$

then the values of a and b are:

- A. 2 and -3 B. -2 and 3
 C. 4 and $\frac{21}{5}$ D. 2 and 3

11. Given the following graph and equation, which has the larger range for x ?

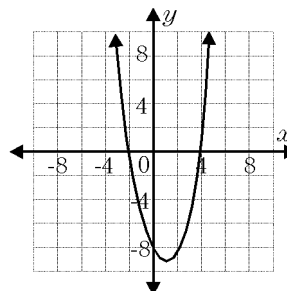


$$x = (y + 2)(y - 4)$$

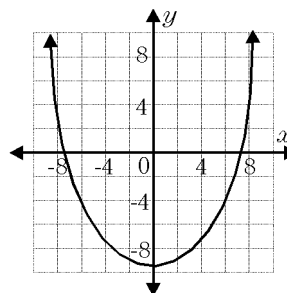
- A. graph; $x \geq -10$
- B. equation; $x \geq -8$
- C. equation; $x \geq -9$
- D. ranges are equal; $x \geq -8$
12. The Pretty Pool company is building a pool in Michael's back yard. The pool is to be 8 ft longer than it is wide and cover 240 square feet of the back yard. Which equation best represents the situation if x is the width of the pool?
- A. $x(x + 8) = 240$
- B. $x(x - 8) = 240$
- C. $x^2 - 8x - 240 = 0$
- D. $x^2 - 8 = 240$

13. Which of the following is the graph of the quadratic function $y = (x + 5)(x - 7)$?

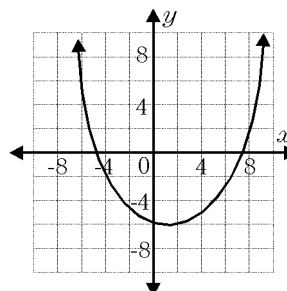
A.



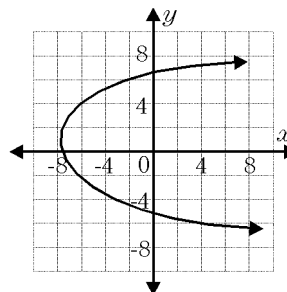
B.



C.



D.



14. One of the roots of the equation $x^2 - 7x + 8 = 0$ is _____.

- A. $\frac{7 + \sqrt{17}}{4}$ B. $\frac{-7 + \sqrt{17}}{4}$
 C. $\frac{7 - \sqrt{17}}{2}$ D. $\frac{-7 + \sqrt{17}}{2}$

15. The parabola $y = x^2$ is changed to the form $y = a(x - p)^2 + q$ by translating the parabola 3 units up and 4 units left and expanding it vertically by a factor of 2. What are the values of a , p , and q ?

- A. $a = 3, p = 4, q = 2$
 B. $a = 4, p = 2, q = 3$
 C. $a = 2, p = 3, q = 4$
 D. $a = 2, p = -4, q = 3$

16. Consider the equation: $x(x - 2) = 3x$

Kiana found the solution by:

- dividing both sides by x to get $x - 2 = 3$, then
- adding 2 to each side to get $x = 5$.

What mistakes, if any, did she make?

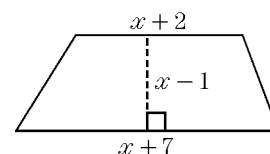
- A. no mistakes
 B. step I was wrong
 C. step II was wrong
 D. steps I and II were wrong

17. The graph of $(\frac{1}{2})^x = y$ lies only in _____.

- A. quadrant I
 B. quadrant II
 C. quadrants I and II
 D. quadrants I and IV

18. Given the trapezoid shown, express the area in terms of x .

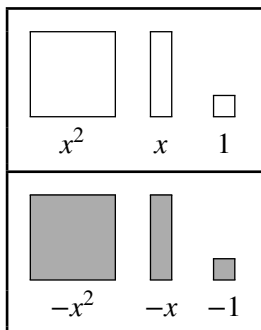
- A. $2x^2 - 7x - 9$
 B. $x^2 + \frac{15}{2}x + \frac{7}{2}$
 C. $x^2 + 5x + 6$
 D. $x^2 + \frac{7}{2}x - \frac{9}{2}$



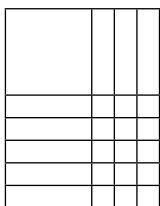
19. Multiply: $(x^2 - 2x - 3)(x^2 + 3x + 4)$

- A. $x^4 + x^3 - 5x^2 - 17x - 12$
 B. $x^4 + x^3 - 5x^2 + 17x - 12$
 C. $x^4 - x^3 + 5x^2 + 17x - 12$
 D. $x^4 - x^3 - 5x^2 + 17x - 12$

20. Use this key to answer the following question(s).



The modeled form of $x^2 + 8x + 15$ is shown here:



What are the factors?

21. Simplify as much as possible: $\frac{2\sqrt{6}}{\sqrt{2}} - \frac{3\sqrt{3}}{\sqrt{5}}$

- A. $\sqrt{15} - 4\sqrt{3}$ B. $4\sqrt{3} - 3\sqrt{15}$
 C. $\frac{4\sqrt{15} - 6\sqrt{3}}{\sqrt{7}}$ D. $\frac{2\sqrt{15} - 4\sqrt{3}}{\sqrt{5}}$

22. Divide/simplify: $\frac{3wx^2}{4z^3} \div \frac{4x^5}{5w^3z^2} \div \frac{5w^2z^4}{6x^3}$
 Identify the sum of the four digits (including exponents) of the final result.

- A. 15 B. 18 C. 21 D. 24

23. The graph of a function contains the points $(-8, -31)$, $(-4, -11)$, $(0, 1)$ and (x, y) . Which of the following could be (x, y) ?

- A. $(-2, 4)$ B. $(4, 5)$
 C. $(4, -1)$ D. $(12, -11)$

24. Find the first five terms for the following arithmetic sequence $t_n = -3n + 20$.

- A. 17, 14, 11, 8, 5
 B. 17, 37, 57, 77, 97
 C. 20, 17, 14, 11, 8
 D. 20, 23, 26, 29, 32

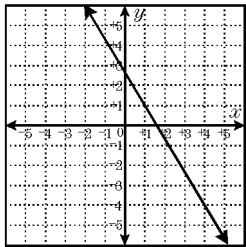
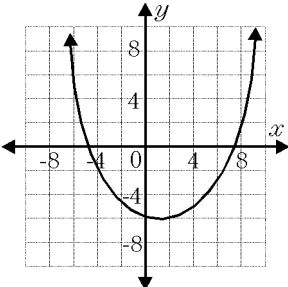
25. Write an expression for the general term of the sequence.

$$\frac{2}{3}, \frac{3}{5}, \frac{4}{7}, \frac{5}{9}, \dots$$

- A. $\frac{n+1}{2n-1}$ B. $\frac{n+1}{2n+1}$
 C. $\frac{n+1}{n+2}$ D. $\frac{11}{15} - \frac{1}{15}n$

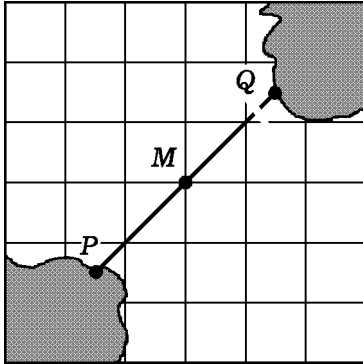
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HS-A

Num	Scoring	Standard	Answer
1	B	A.02A	$\{-2, -1, 0, 1, 3\}$
2	B	A.02C	$f(x) = 3x$
3	C	A.02I	$2(L + W) = 194$ $3W = L + 5$
4	D	A.03C	
5	D	A.03C	E
6	B	A.04A	II only
7	C	A.04C	22,900
8	B	A.05A	$5 + 2(3x + 4) = 43$
9	A	A.05B	6 books
10	D	A.05C	2 and 3
11	A	A.06A	graph; $x \geq -10$
12	A	A.06C	$x(x + 8) = 240$
13	C	A.07A	
14	C	A.07B	$\frac{7 - \sqrt{17}}{2}$
15	D	A.07C	$a = 2, p = -4, q = 3$
16	B	A.08A	step I was wrong
17	C	A.09D	quadrants I and II
18	D	A.10B	$x^2 + \frac{7}{2}x - \frac{9}{2}$
19	A	A.10B	$x^4 + x^3 - 5x^2 - 17x - 12$
20	A	A.10E	$(x + 3)(x + 5)$
21	D	A.11A	$\frac{2\sqrt{15} - 4\sqrt{3}}{\sqrt{5}}$
22	D	A.11B	24
23	D	A.12A	$(12, -11)$
24	A	A.12C	17, 14, 11, 8, 5

25	B	A.12D	$\frac{n+1}{2n+1}$
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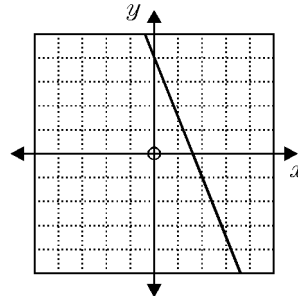
1. The graph below shows a bridge between two islands. The bridge is represented as \overline{PQ} , with point M as the midpoint.



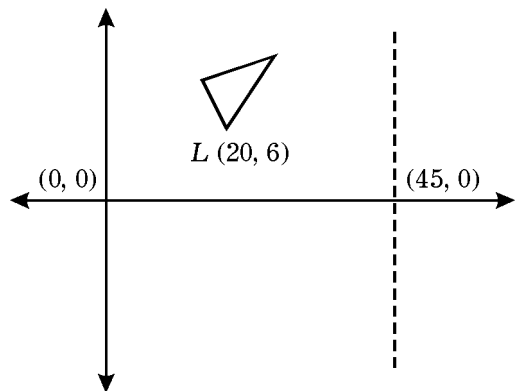
On the graph, P and M have coordinates $(\frac{3}{2}, \frac{3}{2})$ and $(3, 3)$, and each unit represents 500 feet. To the nearest foot, what is the actual length of the bridge from P to Q ?

- A. 2121 feet B. 1500 feet
C. 1061 feet D. 707 feet
2. The coordinates of the vertices of triangles are given below. Which is a right triangle?
- A. $D(-8, -2)$, $E(-1, -5)$, $F(2, 3)$
B. $A(5, -1)$, $B(3, 5)$, $C(-2, -3)$
C. $K(0, 1)$, $L(-3, -8)$, $M(3, -5)$
D. $X(-7, 2)$, $Y(-4, -3)$, $Z(2, 0)$

3. What is the equation of the line that passes through the point $(-3, -2)$ and is parallel to the line shown in the diagram?

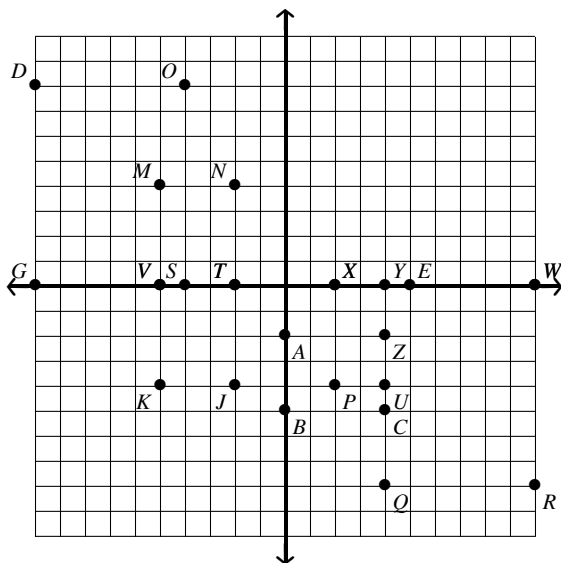


- A. $5x + 2y = -19$ B. $5x - 2y = -11$
C. $2x + 5y = -16$ D. $5x + 3y = -16$
4. A graphic artist designing a company's logo wants to reflect triangle LMN across the dotted line to form triangle $L'M'N'$. What will be the coordinates of L' ?



- A. $(-20, 6)$ B. $(40, 12)$
C. $(45, 6)$ D. $(70, 6)$

5. $AZCB$ has coordinates $A(0, -2)$, $Z(4, -2)$, $C(4, -5)$ and $B(0, -5)$. Draw the figure on the grid below.



The figure undergoes these transformations:

- rotation $\frac{1}{4}$ rotation clockwise
- reflection about the x -axis
- dilation by a factor of 2

Which of the following is the image figure?

- | | |
|-----------|-----------|
| A. $TJKV$ | B. $SODG$ |
| C. $YQRW$ | D. $GVST$ |

6. Complete the following statement with the most accurate information:

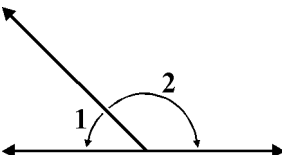
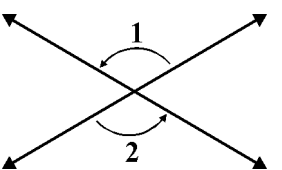
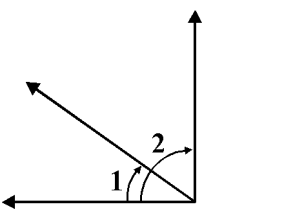
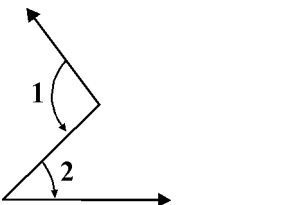
A rhombus is a quadrilateral in which _____.

- A. opposite sides are parallel and equal, opposite angles are equal, consecutive angles add to 180° , and the diagonals bisect each other.
- B. opposite sides are parallel and equal, each angle is 90° , and diagonals are equal.
- C. opposite sides are parallel, all four sides are equal, diagonals bisect at right angles, and diagonals bisect the angles.
- D. opposite sides are equal, each angle is 45° , and diagonals bisect each other.

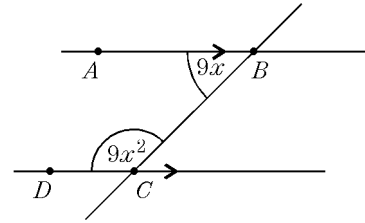
7. Consider the statement:

Adjacent angles are coplanar angles with a common side and a common vertex.

Which of the following figures disproves the statement?

- A. 
- B. 
- C. 
- D. 

8. In the diagram, line AB is parallel to line CD . If the measure of $m\angle ABC = (9x)^\circ$ and the measure of $m\angle DCB = (9x^2)^\circ$, then what is the measure of $\angle DCB$?



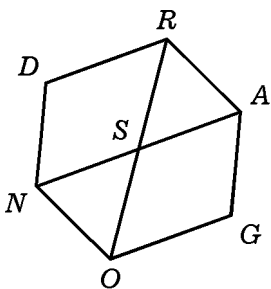
- A. 96° B. 136° C. 144° D. 152°

9. Which of the following statements are always true?

- I. A trapezoid has two pairs of supplementary angles.
- II. If all sides of a quadrilateral are the same length, then the quadrilateral is a square.
- III. If three side of a quadrilateral are the same length, then the quadrilateral must have at least one right angle.
- IV. A quadrilateral has at least one pair of opposite parallel sides.

- A. I only B. I and II
C. I and III D. I and IV

10.



In hexagon DRAGON the diagonals \overline{RO} and \overline{AN} bisect each other. Jared's geometry class is writing a proof to show that $\overline{RA} \cong \overline{ON}$.

Statement	Reason
1. \overline{RO} bisects \overline{AN} , \overline{AN} bisects \overline{RO}	1. given
2. $\overline{RS} \cong \overline{SO}$, $\overline{AS} \cong \overline{SN}$	2. Definition of segment bisector
3. $\angle OSN \cong \angle ASR$	3. _____
4. $\triangle NOS \cong \triangle ARS$	4. SAS
5. $\overline{RA} \cong \overline{ON}$	5. CPCTC

The teacher asks Jared to justify step three. What should he answer?

- | | |
|--|--|
| A. Adjacent angles are congruent. | B. Vertical angles are congruent. |
| C. Alternate Interior angles are congruent. | D. Definition of angle bisector. |

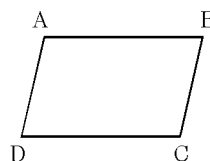
11. $\triangle ABC$ is reflected in the y-axis so that the image of $\triangle ABC$ is $\triangle A'B'C'$. Which of the following statements are true about any reflection?

- I. The distances AB' and BA' are equal.
- II. $\angle B = \angle B'$
- III. The orientation of the figure stays the same. That is, if $\triangle ABC$ is read clockwise, then $\triangle A'B'C'$ is read clockwise.
- IV. The reflection image is congruent to the original figure.

- A. I only B. III only
C. I and II only D. II and IV only

12. Given: $AB = DC$
 $\overline{AB} \parallel \overline{DC}$

Prove: $m\angle DAC = m\angle BCA$



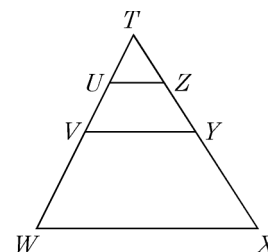
statement	reason
Join \overline{AC}	
$\overline{AB} \parallel \overline{DC}$	(1)
$AB = DC$	(2)
$m\angle BAC = m\angle DCA$	(3)
$AC = AC$	(4)
$\triangle ADC \cong \triangle CBA$	(5)
$m\angle DAC = m\angle BCA$	(6)

In the above proof, what is reason (5)?

- A. SSS B. ASA C. SAS
D. alternate interior angles

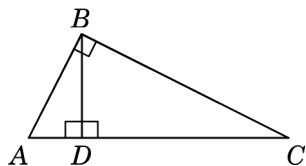
13. V and Y are midpoints of \overline{TW} and \overline{TX} , and U and Z are midpoints of \overline{TV} and \overline{TY} . If $VY = 7$, find the length of \overline{UZ} .

- A. 3.5
B. 14
C. 21
D. 10.5



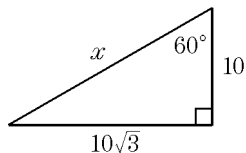
14. In $\triangle ABC$, $AC = 10$, $BC = 8$, $m\angle B = 90^\circ$ and $m\angle BDA = 90^\circ$. How long is \overline{AD} ?

- A. 3.6
B. 4
C. 5.4
D. 9



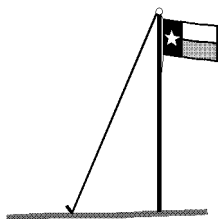
15. Which equation correctly determines the length of side x ?

- A. $x = 10 \sin 60^\circ$
B. $x = 10\sqrt{3} \cos 60^\circ$
C. $x = \frac{10}{\sin 60^\circ}$
D. $x = \frac{10\sqrt{3}}{\sin 60^\circ}$



16. The angle of elevation to the top of a flagpole is 52° . If the angle of elevation was measured 23 m from the center of the flagpole's base, what is its height to 1 decimal place?

- A. 18.0 m
B. 29.4 m
C. 30.1 m
D. 37.4 m



17. Two towers are 32.2 m apart. From the top of the shorter one, the angle of elevation to the top of the other is 26.9° , while the angle of depression to the base is 78.7° . Find the *sum* of the tower heights to the nearest tenth of a meter.

- A. 16.3 m B. 177.4 m
C. 249.0 m D. 338.6 m

18. A plane passes through exactly two of the vertices (corners) of a rectangular solid. Which of these shapes can result from the intersection of the plane and the rectangular solid?

- I. triangle
II. square
III. trapezoid

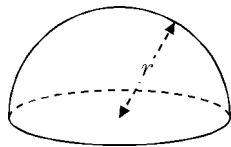
- A. I only B. II only
C. I and II only D. I, II and III

19. A cylinder has a volume of 216 cm^3 . By what factor must the dimensions of the cylinder be multiplied to give a similar cylinder and reduce the volume by 208 cm^3 ?

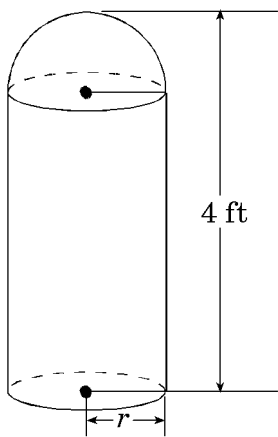
- A. $\frac{1}{9}$ B. $\frac{1}{6}$ C. $\frac{1}{4}$ D. $\frac{1}{3}$

20. Find the surface area, in square centimeters, of the hemisphere with radius $r = 23$ cm. Include the area of the base of the hemisphere in the calculation. Express your answer to two decimal places.

- A. 3647.61 cm^2
 B. 4985.71 cm^2
 C. 8309.51 cm^2
 D. 50965.01 cm^2



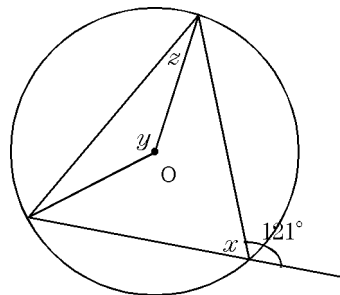
21. A fast-food restaurant has hired a company to design a trash can that is in the shape of a cylinder. The top is spherical with an opening for the trash to go through.



The can must be 4 feet tall and hold about 4 cubic feet of trash (not counting the top). What should be radius of the trash can to the nearest 0.1 inch?

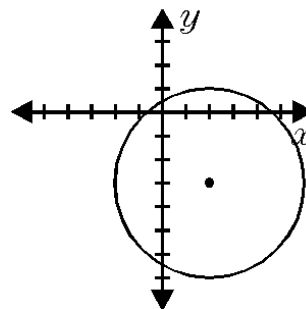
- A. 5.5 in B. 6.9 in
 C. 7.4 in D. 8.3 in

22. Given the diagram, find the values of x , y , and z .



- A. $x = 69^\circ$, $y = 138^\circ$, $z = 21^\circ$
 B. $x = 31^\circ$, $y = 62^\circ$, $z = 31^\circ$
 C. $x = 59^\circ$, $y = 118^\circ$, $z = 31^\circ$
 D. $x = 59^\circ$, $y = 118^\circ$, $z = 59^\circ$

23. Given the graph of the circle, find the equation.



- A. $(x - 2)^2 + (y + 3)^2 = 4$
 B. $(x - 2)^2 + (y + 3)^2 = 16$
 C. $(x + 2)^2 + (y - 3)^2 = 16$
 D. $(x + 2)^2 + (y - 3)^2 = 4$

24. How many different arrangements can be made from the letters in KINDERGARTEN?

- A. $\frac{12!}{3!3!}$ B. $\frac{12!}{2!3!}$
C. $\frac{12!}{2!2!2!}$ D. $12!$

25. Two cards are chosen from a deck, without replacement. Let A , B , C and D represent these events.

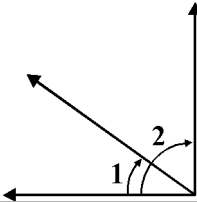
- A) The first card is a heart.
B) The first card is *not* a heart.
C) The second card is a heart.
D) The second card is *not* a heart.

Select the statements that are true.

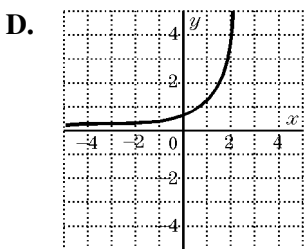
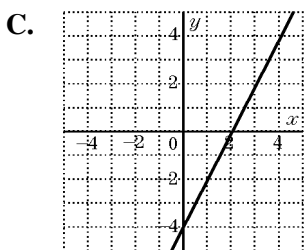
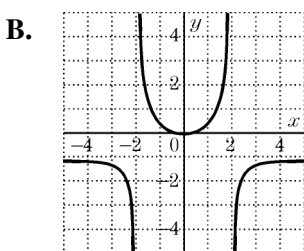
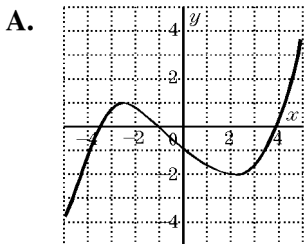
- I. A and C are dependent.
II. A and D are independent.
III. B and C are independent.
IV. B and D are dependent.
- A. I only
B. III and IV only
C. I and IV only
D. I, II, III and IV only

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HS-G

Num	Scoring	Standard	Answer
1	A	G.02A	2121 feet
2	C	G.02B	$K(0, 1)$, $L(-3, -8)$, $M(3, -5)$
3	A	G.02C	$5x + 2y = -19$
4	D	G.03B	$(70, 6)$
5	B	G.03B	<i>SODG</i>
6	C	G.04A	opposite sides are parallel, all four sides are equal, diagonals bisect at right angles, and diagonals bisect the angles.
7	C	G.04C	
8	C	G.05A	144°
9	A	G.05A	I only
10	B	G.06A	Vertical angles are congruent.
11	D	G.06C	II and IV only
12	C	G.06E	SAS
13	A	G.07B	3.5
14	A	G.08B	3.6
15	D	G.09A	$x = \frac{10\sqrt{3}}{\sin 60^\circ}$
16	B	G.09A	29.4 m
17	D	G.09A	338.6 m
18	D	G.10A	I, II and III
19	D	G.10B	$\frac{1}{3}$
20	B	G.11C	4985.71 cm^2
21	C	G.11D	7.4 in
22	C	G.12A	$x = 59^\circ$, $y = 118^\circ$, $z = 31^\circ$
23	B	G.12E	$(x - 2)^2 + (y + 3)^2 = 16$
24	C	G.13A	$\frac{12!}{2!2!2!}$
25	C	G.13C	I and IV only

1. Which of the following could be the graph of a rational function that is *not* a polynomial function?



2. Given:

a. $y = x$

b. $y = |x|$

c. $y = x^2$

d. $y = \sqrt{x}$

e. $y = a^x$, where $a > 0$ and a is not equal to 1

f. $y = \log_a x$

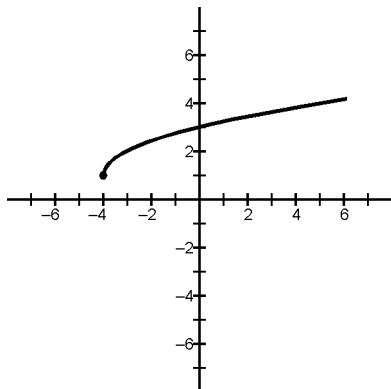
g. $y = \frac{1}{x}$, x is not equal to 0

How many of these functions have a vertical asymptote?

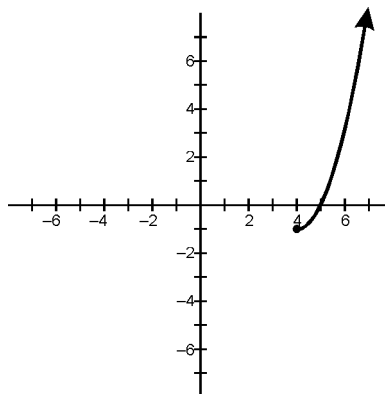
- A. 1 B. 2 C. 3 D. 4

3. Which of the following is the graph of $f^{-1}(x)$ if $f(x) = \sqrt{x+1} + 4$?

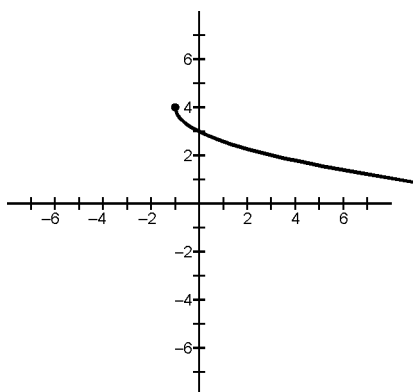
A.



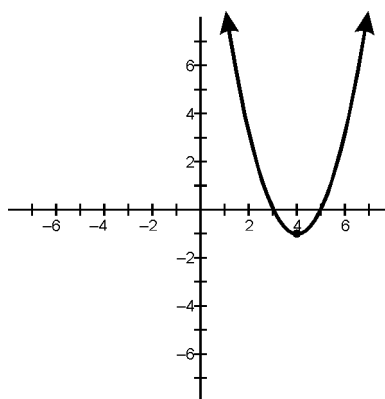
B.



C.



D.



4. Find the inverse of $y = 9^x$.

I. $y = x^9$

II. $y = \log_x 9$

III. $x = 9^y$

IV. $y = \log_9 x$

A. I and II

B. II and III

C. I and IV

D. III and IV

5. Use Cramer's rule to find the value of y ?

$$x - 3y - 4z = 6$$

$$x - 5y = 6$$

$$x + y + 3z = 0$$

hint: $\begin{vmatrix} 1 & -3 & -4 \\ 1 & -5 & 0 \\ 1 & 1 & 3 \end{vmatrix} = -30$

A. -2

B. $-\frac{4}{5}$

C. 2

D. $\frac{4}{5}$

6. You own your own small business that sells hand-crafted greeting cards. You have large cards (4×6) and small cards (2×3). You also sell decorative pens to go along with your gift cards. You have decided to sell in bundles during the holidays in order to entice buyers to purchase your product.

Bundle 1:	4 packs of small cards
Cost = \$41.50	6 packs of large cards
	2 decorative pens

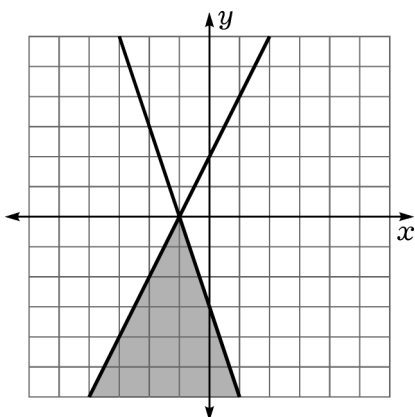
Bundle 2:	2 packs of small cards
Cost = \$25.25	4 packs of large cards
	1 decorative pen

Bundle 3:	1 packs of small cards
Cost = \$11.75	2 packs of large cards

Using matrices, determine the cost of each pack of small cards.

- A. \$2.75 B. \$4.50
C. \$2.50 D. none of these

7.



The correct system for the graph is:

- A. $3x - y \geq -3$ B. $3x - y \leq 2$
 $2x + y \geq -2$ $2x - y \geq 2$
 C. $3x - y \geq -3$ D. $3x + y \leq -3$
 $2x + y \geq -2$ $2x - y \geq -2$

8. Find the area of a triangle defined by the given system.

$$\begin{aligned} 4x - y + 6 &> 0 \\ 4x + 6y - 8 &< 0 \\ y &> -2 \end{aligned}$$

- A. 14 units² B. 18 units²
C. 24 units² D. 28 units²

9. A soundperson for a television station is using a parabolic dish receiver to pick up sound bites. The focus of the parabolic dish is 0.6m from the vertex. What distance from the vertex represents optimal placement of the microphone?

- A. 0m B. 0.3m
C. 0.6m D. 1.2m

10. Given: $f(x) = a(x - h)^2 + k$ is the vertex form of a parabola

If $a < 0$, $h > 0$ and $k < 0$, then which of the following are true?

- I. the vertex of $f(x)$ is in quadrant 2
 II. the vertex of $f(x)$ is in quadrant 4
 III. $f(x)$ has no x -intercepts
 IV. $f(x)$ has no y -intercepts

- A. I and IV B. II and IV
C. I and III D. II and III

11. Solve the equation $x^2 - 4x = -13$ for all complex numbers.

- A. $2 \pm 3i$ B. $3 - 2i$
C. $\pm 3i$ D. $2 + 3i, 1 - 2i$

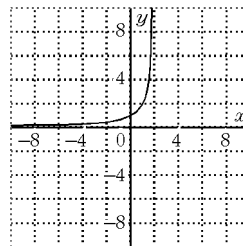
12. Assume you are given the equation $y = ax^2 + bx + c$ and you know that:

- a , b , and c are integers; and
- the equation has two distinct roots which are both integers.

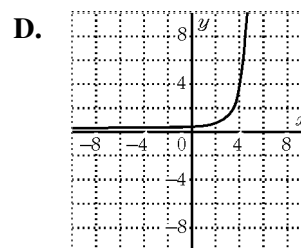
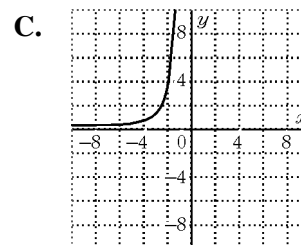
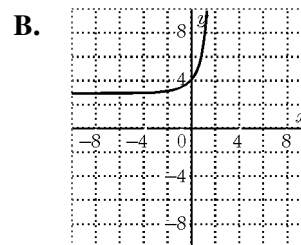
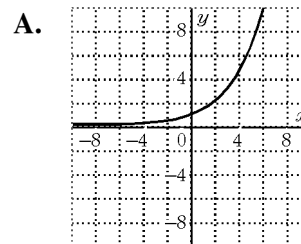
You may reasonably conclude that the discriminant of the equation, $b^2 - 4ac$, is:

- A. equal to zero
B. a square number
C. any positive integer
D. an imaginary number

- 13.



The graph of $y = 4^x$ is given. Which is the graph of $y = 4^{x+3}$?



14. The value of your home over time can be found by using the equation

$$V(t) = P(1.08)^t$$

where P represents the initial purchase price, and V represents the value of your home after t number of years. You bought your home for \$420,000 and its value increases each year by 8%. Approximately, how many years will it take for the house to be worth \$600,000?

- A. 4.6 years B. 4.8 years
C. 5.0 years D. 5.2 years

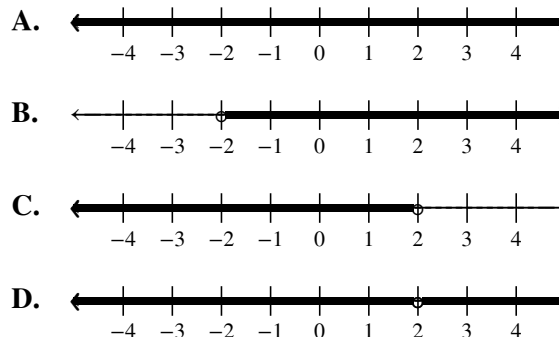
15. What impact does a have on the graph of $f(x) = a|x + 6| - 8$ if the value of a changes from $a = 2$ to $a = \frac{1}{2}$.

- A. The vertex remains unchanged, but the slopes of the two sides become steeper.
B. The vertex remains unchanged, but the slopes of the two sides are not as steep.
C. The vertex changes from $(-6, -8)$ to $(-3, -2.5)$.
D. The graph is unchanged.

16. Given the inequality:

$$|6 - 3x| > 0$$

Which graph shows the solution?



17. Solve: $\frac{3}{x^2 + x - 2} + \frac{3}{x - 1} = \frac{1}{x + 2}$

- A. -3 B. -5 C. 2 D. 5

18. What are the vertical and horizontal asymptotes of the following function?

$$f(x) = \frac{x^3 + 9x^3 + 24x + 20}{4x^3 + 28x + 13}$$

- A. $y = 3$
B. $x = -5, x = -2$
C. $x = -0.5, x = -6.5$
D. $y = x + 1$

19. Express $\sqrt{-8} + 2\sqrt{-50}$ as a monomial in terms of the imaginary unit i .

- A. $12i\sqrt{2}$ B. $-12i\sqrt{2}$
 C. $8i\sqrt{2}$ D. $-8i\sqrt{2}$

20. Write the division statement for $(2f^4 - 19f^3 + 34f^2 + 10f - 13) \div (f - 7)$.

- A. $(f - 7)(2f^3 - 33f^2 + 11f - 1) - 5$
 B. $(f - 7)(2f^3 - 5f^2 - f + 3) + 8$
 C. $(f + 7)(2f^3 + 10f^2 + 17f + 109) - 36$
 D. $(f + 7)(2f^3 - 5f^2 + f + 17) + 106$

21. Simplify: $\frac{x^2 - 4x + 3}{x^2 - 9} \div \frac{9 - x^2}{x^2 + 6x + 9}$

- A. $\frac{x - 1}{3 - x}$ B. $-\frac{(x - 3)^2}{(x + 3)^2}$
 C. -1 D. 1

22. Which of the following tables shows the value of y decreasing at an exponential rate?

A.

x	y
0	3
1	1
2	-3
3	-7
4	-11

B.

x	y
-7	1164
-6	588
-5	300
-4	72
-3	84

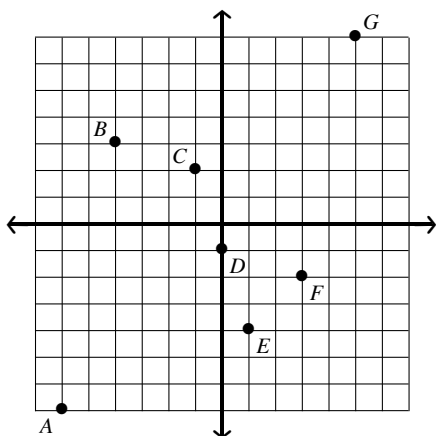
C.

x	y
-10	4
-6	2
-2	0
2	2
4	4

D.

x	y
0	1
1	-2.5
2	6.25
3	-15.63
4	39.06

23.



Use a calculator to find the cubic regression equation for the data points in the graph. Answer accurate to two decimal places.

Note: Each horizontal and vertical line represents 1 unit.

- A. $y = 0.12x^3 + 0.18x^2 - 2.22x - 0.95$
- B. $y = 5.52x^3 + 7.15x^2 - 0.71x - 5.26$
- C. $y = 2.72x^3 + 2.77x^2 - 5.27x - 7.63$
- D. $y = 8.26x^3 + 2.47x^2 - 2.24x - 7.94$

24. The population of the Philippines since 1975 is listed in the table below.

Year 1975 treated as zero (x)	Population in millions (y)
0	41.3
5	47.4
10	54.3
15	61.9
20	69.6
25	77.6

Use a calculator to find the exponential regression equation for the data. Answer accurate to three decimal places.

- A. $y = 52.753 (1.032)^x$
- B. $y = 45.533 (1.260)^x$
- C. $y = 41.889 (1.025)^x$
- D. $y = 53.161 (1.312)^x$

25. Edna owns seven lots in a small development community. An outbreak of lawn-eating insects called chinch bugs forces her to spread insecticide granules. Deciding to conduct an experiment, Edna spreads different amounts of insecticide on each lot, and records the results after 2 weeks in the table as shown.

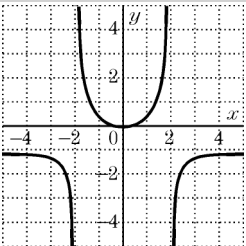
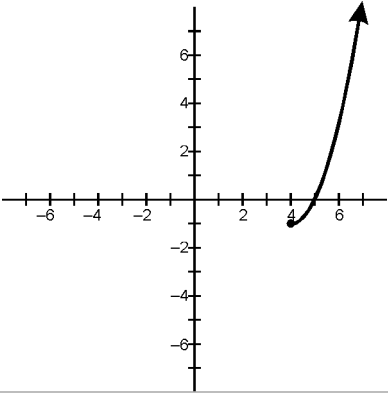
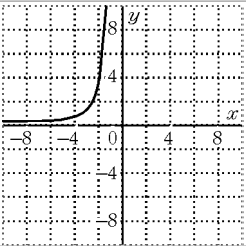

Amount of insecticide (in pounds)	Damage inflicted by chinch bugs (in sq ft)
8	1350
20	1100
60	375
42	700
35	850
70	200
47	650

If x represents pounds of insecticide and y represents square feet of damage, use the data to create a linear regression and interpret the meaning of your y -intercept.

- A. y -intercept is 1517 and represents the expected damage if there is no bug prevention
- B. y -intercept is 1487 and represents the expected damage if there is no bug prevention
- C. y -intercept is 80.4 and represents the amount to spend to kill all of the bugs
- D. y -intercept is 80.4 and predicts the minimum possible damage inflicted by the bugs

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HS-L

Num	Scoring	Standard	Answer
1	B	L.02A	
2	B	L.02A	2
3	B	L.02B	
4	D	L.02D	III and IV
5	B	L.03B	$-\frac{4}{5}$
6	A	L.03B	\$2.75
7	D	L.03E	$3x + y \leq -3$ $2x - y \geq -2$
8	A	L.03F	14 units ²
9	C	L.04B	0.6 m
10	D	L.04B	II and III
11	A	L.04F	$2 \pm 3i$
12	B	L.04F	a square number
13	C	L.05A	
14	A	L.05D	4.6 years
15	B	L.06C	The vertex remains unchanged, but the slopes of the two sides are not as steep.
16	D	L.06F	

17		L.06I													
18		L.06K													
19	A	L.07A	$12i\sqrt{2}$												
20	B	L.07C	$(f - 7)(2f^3 - 5f^2 - f + 3) + 8$												
21	A	L.07F	$\frac{x - 1}{3 - x}$												
22	B	L.08A	<table><tr><td>x</td><td>y</td></tr><tr><td>-7</td><td>1164</td></tr><tr><td>-6</td><td>588</td></tr><tr><td>-5</td><td>300</td></tr><tr><td>-4</td><td>72</td></tr><tr><td>-3</td><td>84</td></tr></table>	x	y	-7	1164	-6	588	-5	300	-4	72	-3	84
x	y														
-7	1164														
-6	588														
-5	300														
-4	72														
-3	84														
23	A	L.08B	$y = 0.12x^3 + 0.18x^2 - 2.22x - 0.95$												
24	C	L.08B	$y = 41.889(1.025)^x$												
25	B	L.08C	y-intercept is 1487 and represents the expected damage if there is no bug prevention												

1. $y = x^3$ is an example of an odd function. If k is a positive integer, which of the following transformations allows the function to retain its odd symmetry?

I. $y = (x + k)^3$

II. $y = x^3 + k$

III. $y = kx^3$

- A. II B. I and III
C. II and III D. III

2. Given the function $f(x) = 4 \cos\left(2x + \frac{\pi}{3}\right)$, in which domain is the inverse function undefined?

A. $\left[-\frac{2\pi}{3}, -\frac{\pi}{2}\right]$ B. $\left[-\frac{\pi}{6}, \frac{\pi}{6}\right]$

C. $\left[0, \frac{\pi}{3}\right]$ D. $\left[\frac{3\pi}{2}, 2\pi\right]$

3. A sinusoidal function of the form $y = a \sin(x - c) + d$ is changed by decreasing c by $\frac{\pi}{2}$. The new graph will have moved:

A. $\frac{\pi}{2}$ units up

B. $\frac{\pi}{2}$ units down

C. $\frac{\pi}{2}$ units left

D. vertical compression by a factor of $\frac{\pi}{2}$

4. Determine the period of the function:

$$y = \frac{1}{3} \sin\left(\frac{x}{2} - \pi\right)$$

- A. $\frac{\pi}{2}$ B. π C. 2π D. 4π

5. Let $f(x) = \frac{x - 2}{x^3 - 10x^2 + 16x}$.

Find the limit of $f(x)$ as x approaches 2.

- A. $-\frac{1}{12}$ B. 0
C. 1 D. does not exist

6. What are the equations of the asymptotes for $y = 2 \cot 5x$? In the answers, n is an integer.

- A. $x = 10n\pi$ B. $x = 4n\pi$
C. $x = \frac{n\pi}{5}$ D. $x = n\pi$

7. The points $(4\sqrt{3}, \frac{\pi}{6})$, $(4, \frac{\pi}{3})$, and $(0, \frac{\pi}{2})$ all lie on a polar graph. Find a polar equation and a corresponding rectangular equation that contains this set of points.

- A. $r = 8 \cos \theta$; $(x - 4)^2 + y^2 = 16$
B. $r = 8 \sin \theta$; $x^2 + (y - 4)^2 = 16$
C. $r = 4 \sin \theta$; $x^2 + (y - 2)^2 = 4$
D. $r = 4 \cos \theta$; $(x - 2)^2 + y^2 = 4$

8. A catapult launches a rock at a 60° angle. The horizontal path is modeled by $x(t) = 40t$ and vertical path by $y(t) = -16t^2 + 69.3t + 3.1$, where x and y are measured in feet, and t in seconds. At what time will the rock be k ft above the ground vertically and k ft from the base of the catapult horizontally?

A. 0 sec B. 1.93 sec
C. 2.19 sec D. 4.38 sec

9. Graph the following conic section to determine its line(s) of symmetry.

$$8x^2 + 48x + 8y^2 - 16y = 0$$

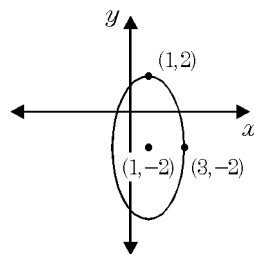
A. $x = -3, y = 1$
B. $x = 3, y = -1$
C. $x = 9, y = 1$
D. infinite lines of symmetry (circle)

10. First write the equation in standard form, then identify the graph of the conic section:

$$x^2 + y^2 + 4x + -6y = -9$$

A. $(x + 2)^2 + (y - 3)^2 = 1$, circle
B. $(x + 2)^2 + (y - 3)^2 = 4$, circle
C. $(x + 2)^2 - (y + 3)^2 = 1$, hyperbola
D. $(x - 2)^2 - (y + 3)^2 = 4$, hyperbola

11. What is the equation of the given ellipse?



A. $\frac{(x - 1)^2}{4} + \frac{(y + 2)^2}{16} = 1$
B. $\frac{(x + 1)^2}{4} + \frac{(y + 2)^2}{16} = 1$
C. $\frac{(x + 1)^2}{4} + \frac{(y - 2)^2}{16} = 1$
D. $\frac{(x + 1)^2}{2} + \frac{(y - 2)^2}{4} = 1$

12. The graph of the equation $x^2 - y^2 - 36 = 0$ is expanded vertically by a factor of 4. Write the equation for the transformed graph.

A. $x^2 - \frac{1}{16}y^2 - 36 = 0$
B. $x^2 - \frac{1}{4}y^2 - 36 = 0$
C. $x^2 - 4y^2 - 36 = 0$
D. $4x^2 - y^2 - 36 = 0$

13. If both $\sin x$ and $\cos x$ increase as x increases, then x must be an angle in quadrant _____.

A. one B. two C. three D. four

14. Find in degrees the acute angle x if $\sin x = \cos(3x - 10^\circ)$.

A. 25° B. 18° C. 20° D. 30°

15. The angle θ is in the third quadrant and $\tan \theta = \frac{4}{5}$. Point P is on the terminal arm of angle θ .

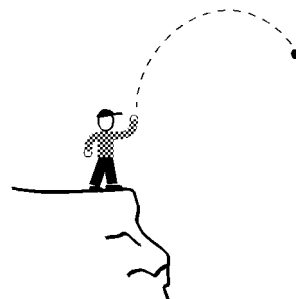
Which is a possible coordinate for P ?

A. $(-4, 10)$ B. $(4, 5)$
C. $(10, 8)$ D. $(-10, -8)$

16. Two sides of a triangle are a and b and the angle between them is $C = 120^\circ$. Side c is equal to:

A. $\sqrt{a^2 + b^2 - ab}$ B. $\sqrt{a^2 + b^2 - 2ab}$
C. $\sqrt{a^2 + b^2 + ab}$ D. $\sqrt{a^2 + b^2 + 2ab}$

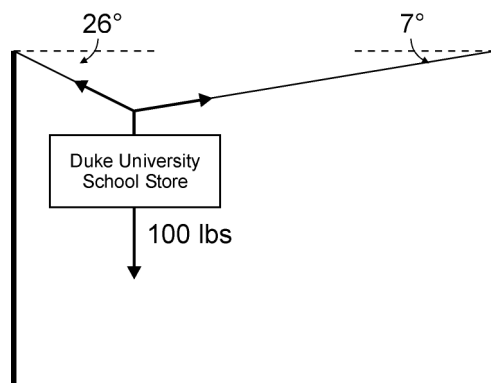
17. The diagram represents an baseball being thrown of a cliff at an angle of 80° with the horizontal at a velocity of 88 meters per second.



Find the magnitude of the vertical component of the ball's initial velocity to the nearest tenth of a meter per second.

A. 84.5 m/s B. 85.9 m/s
C. 86.4 m/s D. 86.7 m/s

18. The school store sign is suspended by two cables as shown.



If the sign weighs 100 pounds, what is the tension in the shorter cable?

A. 165.0 B. 170.4
C. 182.2 D. 304.9

19. The recursive definition of a geometric sequence is

$$a_n = \begin{cases} a_1 = a_1 \\ a_n = a_{n-1}r, n \geq 2 \end{cases}$$

What is the recursive equation for the sequence 3, 9, 27, 81 ...?

- A. $a_1 = 3$
 $a_n = \frac{1}{3}a_{n-1}$
- B. $a_1 = 3$
 $a_n = 3a_{n-1}$
- C. $a_1 = 3$
 $a_n = a_{n-1} + 3$
- D. $a_1 = 3$
 $a_n = a_{n-1} - 3$

20. Students in a shop class are building a step pyramid using blocks that measure 4 inches \times 4 inches \times 4 inches. The base is a border of 20 blocks, as shown in Figure 1. Each successive level contains blocks that overlap by 2 inches, as shown in Figure 2.

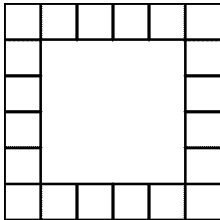


Figure 1

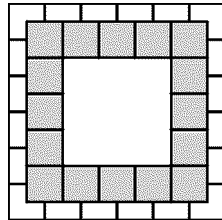


Figure 2

The top level of the completed pyramid will have just one block. What is the total number of blocks in the completed pyramid?

- A. 35 B. 60 C. 61 D. 120

21. Assume you have arrived at the term $165x^8y^3$ in the binomial expansion of $(x + y)^n$, and you have not made any mistakes. What is the next term?

- A. $330x^7y^4$ B. $55x^7y^4$
- C. $55x^9y^2$ D. $440x^7y^4$

22. Willamena has been offered positions at two different companies. Both have a starting salary of \$40000 per year with salary increases based on job performance. Job A offers a yearly salary increase of \$2000. Job B offers a yearly salary increase of 4.5%. If she chooses Job B, how long until the yearly salary exceeds that of Job A? Use the table below.

Salary per Year

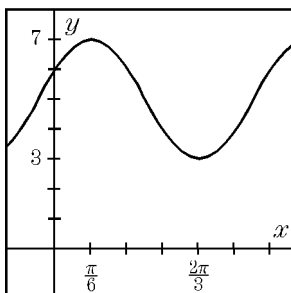
Year	Job A	Job B
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

- A. 7 years B. 5 years
- C. 8 years D. 6 years

23. If $\cot \theta = \frac{3a}{a-1}$, $a \neq 1$, find the $\csc \theta$.

- A. $\frac{\sqrt{10a^2 - 2a + 1}}{3a}$ B. $\frac{\sqrt{10a^2 + 1}}{3a}$
 C. $\frac{\sqrt{10a^2 + 1}}{a-1}$ D. $\frac{\sqrt{10a^2 - 2a + 1}}{a-1}$

24. For the graph shown, what is the equation in the form $y = a \cos b(x - c) + d$?



- A. $2 \cos 2 \left(x - \frac{\pi}{6} \right) + 5$
 B. $\cos 2 \left(x + \frac{\pi}{6} \right) + 5$
 C. $2 \cos 2 \left(x + \frac{\pi}{6} \right) + 5$
 D. $2 \cos \left(x + \frac{\pi}{6} \right) + 5$

25. If $\csc A = -\frac{5}{3}$ and $\csc B = -\frac{13}{5}$ with $\angle A$ and $\angle B$ are in quadrant III. What is the value of $\sin(A + B)$?

- A. $\frac{16}{65}$ B. $\frac{33}{65}$ C. $\frac{56}{65}$ D. $\frac{63}{65}$

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HS-P

Num	Scoring	Standard	Answer
1	D	P.02D	III
2	D	P.02E	$\left[\frac{3\pi}{2}, 2\pi \right]$
3	C	P.02G	$\frac{\pi}{2}$ units left
4	D	P.02I	4π
5	A	P.02K	$-\frac{1}{12}$
6	C	P.02L	$x = \frac{n\pi}{5}$
7	A	P.03B	$r = 8 \cos \theta$; $(x - 4)^2 + y^2 = 16$
8	B	P.03C	1.93 sec
9	D	P.03G	infinite lines of symmetry (circle)
10	B	P.03G	$(x + 2)^2 + (y - 3)^2 = 4$, circle
11	A	P.03H	$\frac{(x - 1)^2}{4} + \frac{(y + 2)^2}{16} = 1$
12	A	P.03I	$x^2 - \frac{1}{16}y^2 - 36 = 0$
13	D	P.04E	four
14	A	P.04F	25°
15	D	P.04F	$(-10, -8)$
16	C	P.04H	$\sqrt{a^2 + b^2 + ab}$
17	D	P.04I	86.7 m/s
18	C	P.04K	182.2
19	B	P.05B	$a_1 = 3$ $a_n = 3a_{n-1}$
20	C	P.05E	61
21	A	P.05F	$330x^7y^4$
22	A	P.05I	7 years
23	D	P.05M	$\frac{\sqrt{10a^2 - 2a + 1}}{a - 1}$
24	A	P.05N	$2 \cos 2 \left(x - \frac{\pi}{6} \right) + 5$
25	C	P.05N	$\frac{56}{65}$

1. Corey, Bryan and Dorris have the same type of cell phone. Using a ruler, they each measure the cell phone's length. Corey measures the phone to be 12 cm, Bryan measures his phone to be 12.85 cm and Dorris measures the phone to be 13.3 cm. If the actual length of the cell phone is 12.5 cm, whose measurement was the more accurate?

- A. Bryan's measurement was the more accurate.
 B. Corey's measurement was the more accurate.
 C. Dorris' measurement was the more accurate.
 D. Corey and Bryan's measurements were both equally the more accurate.

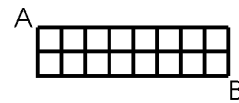
2. What is the number of different arrangements of the word 'CAPTURED' if the arrangements begin and end in a vowel?

- A. 362880 B. 40320
 C. 4320 D. 84605

3. Eight people from a list of ten are being chosen to participate on a TV show about survival. If Roger is chosen then Amber must be chosen and vice versa. If Gerry is chosen then Keith must not be chosen and vice versa. In how many ways can the eight people be chosen?

- A. 35 B. 25 C. 18 D. 13

4. In how many ways can person A walk to person B if the trip takes exactly 10 blocks?



- A. 45 B. 34 C. 20 D. 16

5. The North Side Shoe Store's inventory of shoes is:

Men's Shoes: 79 Dress, 159 Running, 119 Boots, 199 Walking

Women's Shoes: 199 Boots, 319 Dress, 39 Running, 119 Walking

The South Side Shoe Store's inventory of shoes is:

Men's Shoes: 387 Dress, 232 Boots, 309 Running, 232 Walking

Women's Shoes: 0 Running, 309 Boots, 154 Dress, 309 Walking

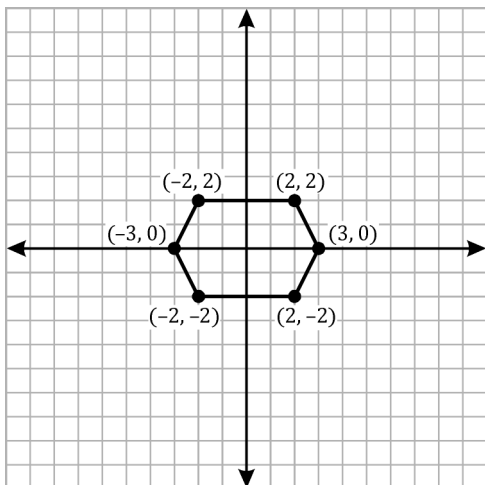
Which matrix represents the North Side Shoe Store's inventory?

- A. $\begin{bmatrix} 79 & 159 & 119 & 199 \\ 319 & 39 & 199 & 119 \end{bmatrix}$
 B. $\begin{bmatrix} 466 & 468 & 351 & 431 \\ 473 & 39 & 508 & 428 \end{bmatrix}$
 C. $\begin{bmatrix} 426 & 340 & 255 & 255 \\ 169 & 0 & 340 & 340 \end{bmatrix}$
 D. $\begin{bmatrix} 79 & 39 & 119 & 199 \\ 319 & 159 & 199 & 119 \end{bmatrix}$

6. The matrix below contains the vertices of the hexagon in the picture.

$$\begin{bmatrix} 2 & 3 & 2 & -2 & -3 & -2 \\ 2 & 0 & -2 & -2 & 0 & 2 \end{bmatrix}$$

Which matrix represents tripling the size of this object?



- A. $\begin{bmatrix} 1 & 1.5 & 4 & -2 & -3 & -2 \\ 2 & 0 & -2 & -2 & 0 & 2 \end{bmatrix}$
- B. $\begin{bmatrix} 4 & 6 & 4 & -4 & -4 & -4 \\ 4 & 0 & -4 & -4 & 0 & 4 \end{bmatrix}$
- C. $\begin{bmatrix} -1 & 0 & -1 & -5 & -6 & -5 \\ -1 & -3 & -5 & -5 & -3 & -1 \end{bmatrix}$
- D. $\begin{bmatrix} 6 & 9 & 6 & -6 & -9 & -6 \\ 6 & 0 & -6 & -6 & 0 & 6 \end{bmatrix}$

7. Perform the indicated operation:

$$3 \begin{bmatrix} -6 & 2 & -2 \\ 4 & 5 & 9 \end{bmatrix} - 2 \begin{bmatrix} -4 & -4 & -2 \\ 0 & -11 & 1 \end{bmatrix}$$

- A. $\begin{bmatrix} -10 & 14 & -2 \\ 12 & 37 & 25 \end{bmatrix}$
- B. $\begin{bmatrix} 11 & -1 & 4 \\ -6 & -2 & -14 \end{bmatrix}$
- C. $\begin{bmatrix} -10 & -2 & -4 \\ 4 & -6 & 10 \end{bmatrix}$
- D. $\begin{bmatrix} -7 & -11 & -4 \\ -2 & -30 & -2 \end{bmatrix}$

8. $A = \begin{bmatrix} 1 & -2 \\ 3 & 4 \end{bmatrix}$ $B = \begin{bmatrix} 2 & -4 & 5 \\ 1 & 0 & -3 \end{bmatrix}$ $C = \begin{bmatrix} 1 & 6 & -2 \\ 3 & -3 & 4 \\ -2 & 2 & 1 \end{bmatrix}$ $D = \begin{bmatrix} 1 \\ -5 \end{bmatrix}$ $E = \begin{bmatrix} 2 \\ 1 \\ -3 \end{bmatrix}$

Find $(BC)E$.

- A. $\begin{bmatrix} 39 \\ 29 \end{bmatrix}$ B. $\begin{bmatrix} -39 \\ -29 \end{bmatrix}$ C. $\begin{bmatrix} 39 \\ -29 \end{bmatrix}$ D. undefined

9. A survey is done of classifying students in a school according to their sex and participation in school sports. The number of students in each category is given in the table:

	Male	Female
Basketball	200	150
Track	160	75
Soccer	100	160

Data supplied by shoe manufacturers shows the percentage of students using a particular brand of shoe:

	Nike	Adidas	Reebok	Fila
Male	0.45	0.30	0.25	0.10
Female	0.50	0.20	0.25	0.05

If matrix A is a 3×2 matrix representing the participation, and matrix B is a 2×4 matrix representing the type of shoe, what does matrix the entry in row 2 column 1 of the matrix product AB represent?

- A. The total number of students in track that use Nike.
- B. The total number of students in basketball that use Adidas.
- C. The total number of males and females that use Nike.
- D. The number of male basketball players that wear Nike.

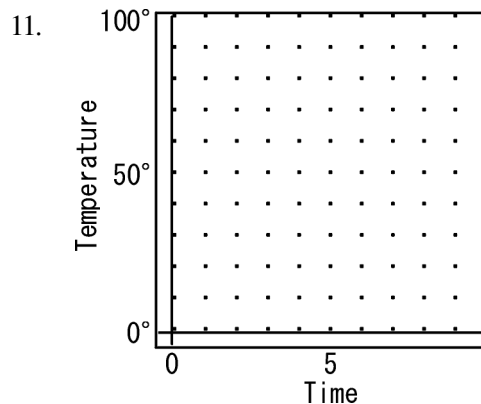
10. Given triangle JKL with vertices $(1, 3)$, $(-4, 4)$, and $(0, -6)$, which matrix expression expands triangle JKL horizontally by a factor of four and vertically by a factor of three?

A. $\begin{bmatrix} 3 & 0 \\ 0 & 4 \end{bmatrix} \begin{bmatrix} 1 & -4 & 0 \\ 3 & 4 & -6 \end{bmatrix}$

B. $\begin{bmatrix} 0 & 3 \\ 4 & 0 \end{bmatrix} \begin{bmatrix} 1 & -4 & 0 \\ 3 & 4 & -6 \end{bmatrix}$

C. $\begin{bmatrix} 4 & 0 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} 1 & -4 & 0 \\ 3 & 4 & -6 \end{bmatrix}$

D. $\begin{bmatrix} 0 & 4 \\ 3 & 0 \end{bmatrix} \begin{bmatrix} 1 & -4 & 0 \\ 3 & 4 & -6 \end{bmatrix}$



A metal is heated then allowed to cool. This table shows its temperature over time:

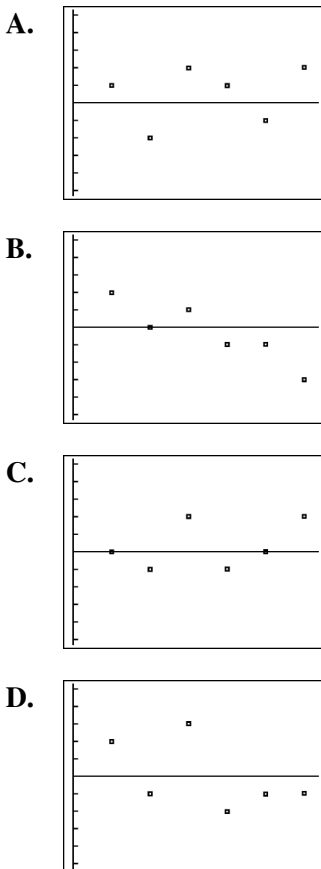
Total time (minutes)	0	1	7	9
Temperature ($^{\circ}\text{C}$)	90	87	55	40

Determine the median point by using the graph to plot the points.

- A. $(4.5, 72.5)$
- B. $(4, 72.5)$
- C. $(4.5, 72)$
- D. $(4, 71)$

12. For the data points in the table below, Anne estimates the line of best fit to be $y = x + 3$. Which of the following is the graph of the set of residuals for this data with respect to Anne's line?

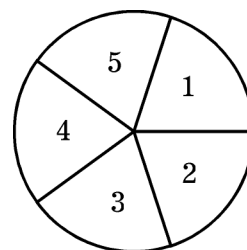
x	y
1	5
2	3
3	8
4	8
5	7
6	11



13. The figure shows the face of a spinner. The numbers are all equally likely to occur.

What is the probability that the pointer will land on a 2 first, then on an odd number, and finally on an even number?

- A. $\frac{1}{25}$ B. $\frac{1}{20}$
C. $\frac{6}{125}$ D. $\frac{3}{216}$



14. Two packets each contain 8 seeds. Of the seeds from the first package, three will produce red flowers and five will produce white flowers. Of the seeds from the second package, four will produce red flowers and four will produce white flowers. A seed is chosen that produces a white flower. What is the probability of the seed coming from the first package? (The probability of choosing each packet is $\frac{1}{2}$.)

- A. $\frac{7}{16}$ B. $\frac{3}{16}$ C. $\frac{3}{7}$ D. $\frac{5}{9}$

15. A certain disease randomly found in 0.5% of the general population. A blood test is 99% effective in detecting the presence of this disease; that is, it will yield an accurate positive result in 99 percent of the cases where the disease is actually present. But it also yields false-positive results in 5% of the cases where the disease is not present. What is the probability that a person who test negative actually does have the disease?

- A. 0.00005 B. 0.0905
C. 0.8956 D. 0.99995

16. There are 208 students enrolled in the local high school. The foreign language department offers French, German, and Spanish.

- 4 students take all three languages.
- 48 students study French.
- There are twice as many students who study both French and Spanish (but not German) as who study both French and German (but not Spanish), and 4 times as many as who study all 3.
- 124 students study Spanish.
- 27 students do not study any foreign language.
- The group of students who study both French and Spanish (but not German) is exactly the same size as the group made up of students who study both German and Spanish.

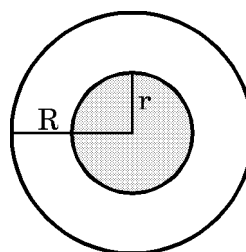
What is the probability that a student studies German or French but not Spanish?

- A. $\frac{57}{208}$ B. $\frac{3}{52}$ C. $\frac{1}{26}$ D. $\frac{1}{13}$

17. Statistics show that 90.5% of women aged 73 will live another year. If an insurance company wants to make a \$60 profit on each \$5000 policy, then how much should they charge a 73 year old woman for a one year term policy?

- A. \$535 B. \$424.18
C. \$500 D. \$553

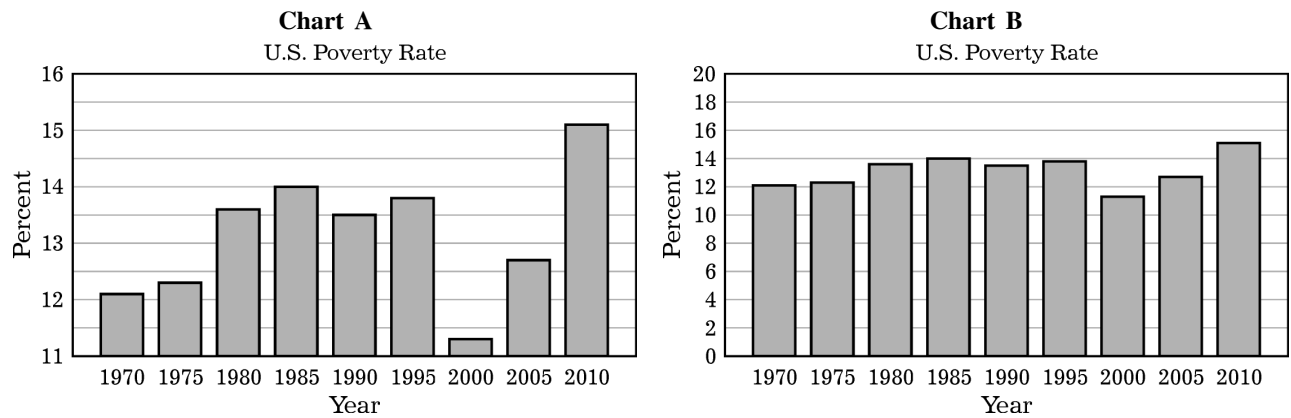
18.



In the diagram $R = 2r$. A game is played by randomly throwing a dart at the target. Which of the following games favor the player?

- I. Land on shaded win \$8. Land on plain lose \$4.
II. Land on shaded win \$9. Land on plain lose \$3.
III. Land on shaded win \$7. Land on plain lose \$2.
- A. I only B. II only
C. III only D. II and III only

19.



*Source: U.S. Census Bureau, Current Population Survey, 1960–2013 Annual Social and Economic Supplements

The charts show the U.S. Poverty Rate between 1970–2010. Which statements about the the charts are true?

- I. Graph A shows a larger fluctuation in the poverty rate.
- II. Graph B is misleading because the y-axis is not evenly spaced.
- III. Politicians would use Chart A to argue the poverty rate has drastically increased since 2000.

- A.** I only **B.** II only **C.** III only **D.** I, II and III

20. A sample of students from a school was taken by obtaining an alphabetical list of all 1000 students, assigning a different number to each student on the list, and finding the sampling interval by dividing the total number of students in the school by the number of students to be sampled. A random starting point n was then chosen by randomly selecting a number from 1 to the sampling interval. Every n^{th} student in the list was then sampled and asked to fill out a survey.

Which sampling method best describes this sampling technique?

- A. Systematic Sampling
- B. Clustered Sampling
- C. Convenience Sampling
- D. Simple Random Sampling

21. A hardware store purchases batteries from a supplier. There are reports that the batteries are defective. To determine if this is true the store manager created five methods of data collection. to test the quality of the suppliers batteries

Which one of them is an example of simple random sampling.

- I. Number each battery in the store and randomly select from the list.
- II. Group the batteries by type and randomly select from type.
- III. Assign each battery a number and go down the list and select every 20th battery.
- IV. Select the first 30 batteries in a box.
- V. Select 3 boxes choose the batteries in those boxes.

- A. I only
- B. III only
- C. IV only
- D. V only

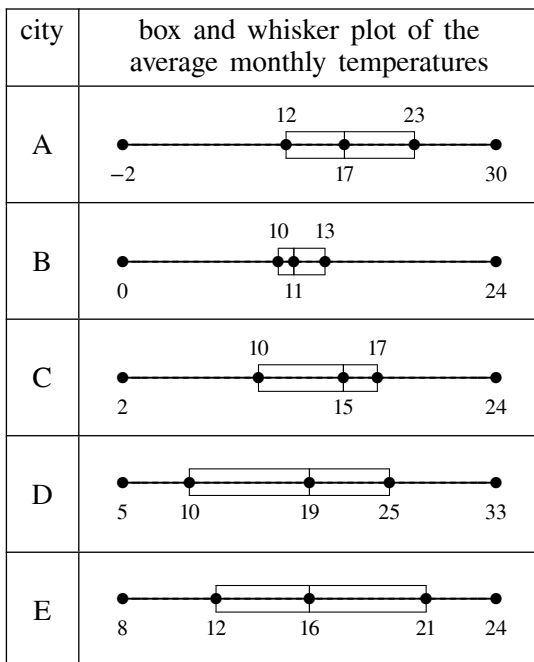
22. Which of the following statements are true?

- A. Voluntary response bias is a result of under-representation with strong opinions.
- B. Surveys with non-neutral wording are likely to have response bias.
- C. Convenience surveys often lead to over-coverage bias.
- D. None of the above are true.

23. A researcher plans a study to examine the depth of belief in the strength of the economy among the adult population. He obtains a simple random sample of 100 adults as they eat lunch in an expensive downtown restaurant. 99 of the people agree to answer his question. What type of bias might be present?

- A. Nonresponse
- B. Selection bias
- C. Voluntary response
- D. Wording of the question

24. Scott wants to live in a city which has approximately the same temperature all year round.



Which of the cities shown in the table should he choose to live in?

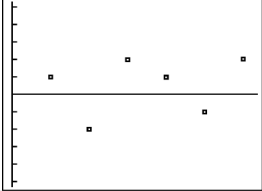
- A. B
- B. C
- C. D
- D. E

25. Charity measured her blood pressure for three consecutive mornings with an automatic blood pressure machine, and then had her mother measure her blood pressure manually the following two mornings. Why might the average of blood pressure readings be invalid?

- A. There was not enough time elapsed between measurements.
- B. The average may not come out to be an integer.
- C. Blood pressure was measured at the same time every day.
- D. Different ways to measure blood pressure were used.

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HS-Q

Num	Scoring	Standard	Answer
1	A	Q.02A	Bryan's measurement was the more accurate.
2	C	Q.02E	4320
3	D	Q.02E	13
4	A	Q.02E	45
5	A	Q.02F	$\begin{bmatrix} 79 & 159 & 119 & 199 \\ 319 & 39 & 199 & 119 \end{bmatrix}$
6	D	Q.02F	$\begin{bmatrix} 6 & 9 & 6 & -6 & -9 & -6 \\ 6 & 0 & -6 & -6 & 0 & 6 \end{bmatrix}$
7	A	Q.02F	$\begin{bmatrix} -10 & 14 & -2 \\ 12 & 37 & 25 \end{bmatrix}$
8	A	Q.02F	$\begin{bmatrix} 39 \\ 29 \end{bmatrix}$
9	A	Q.02F	The total number of students in track that use Nike.
10	C	Q.02F	$\begin{bmatrix} 4 & 0 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} 1 & -4 & 0 \\ 3 & 4 & -6 \end{bmatrix}$
11	D	Q.03A	(4, 71)
12	A	Q.03A	
13	C	Q.04C	$\frac{6}{125}$
14	D	Q.04C	$\frac{5}{9}$
15	A	Q.04C	0.00005
16	A	Q.04C	$\frac{57}{208}$
17	A	Q.04F	\$535
18	C	Q.04F	III only
19	C	Q.04K	III only
20	A	Q.04M	Systematic Sampling
21	A	Q.04M	I only
22	B	Q.04O	Surveys with non-neutral wording are likely to have response bias.
23	B	Q.04O	Selection bias
24	A	Q.04P	B
25	D	Q.04Q	Different ways to measure blood pressure were used.