

# INTEGRATED ALGEBRA

## PROBLEM SOLVING STRAND

(A.PS.1-A.PS.10)

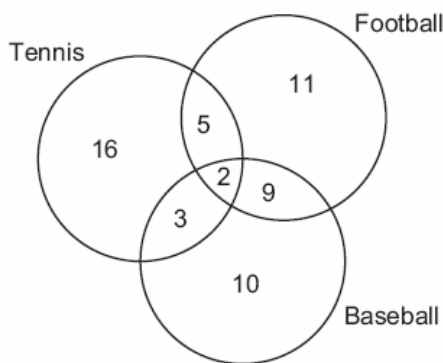
## REASONING AND PROOF STRAND

(A.RP.1-A.RP.12)

A.RP.11: Use a Venn diagram to support a logical argument.

- The accompanying diagram shows the results of a survey asking which sports the members of the Key Club watch on television.

**Sports Watched on Television**

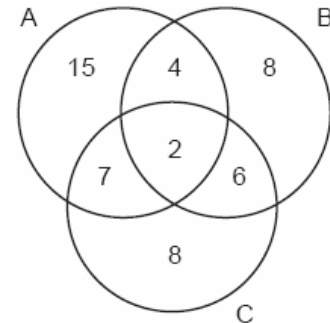


Which statement or statements are true?

- I The most watched sport is tennis.
- II The least watched sport is baseball.
- III More Key Club members watch tennis than football.

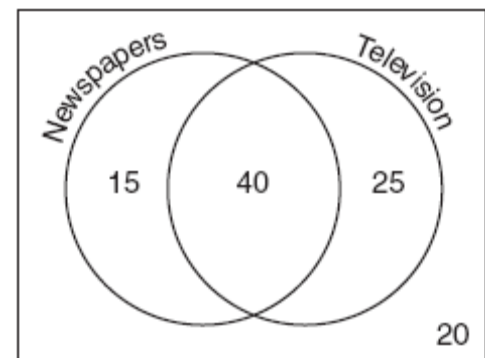
- [A] II and III, only      [B] I and II, only  
[C] I, only                      [D] II, only

- The accompanying Venn diagram shows the number of students who take various courses. All students in circle A take mathematics. All in circle B take science. All in circle C take technology. What percentage of the students take mathematics or technology?



- The accompanying Venn diagram shows the results of a survey asking 100 people if they get news by reading newspapers or by watching television.

**Sources of News**



What is the probability that a person selected at random from this survey does *not* claim television as a source of getting the news?

- [A]  $\frac{75}{100}$       [B]  $\frac{35}{100}$       [C]  $\frac{15}{100}$       [D]  $\frac{55}{100}$

4. In a class of 450 students, 300 are taking a mathematics course and 260 are taking a science course. If 140 of these students are taking both courses, how many students are not taking either of these courses?  
[A] 140 [B] 110 [C] 30 [D] 40
5. In a class of 50 students, 18 take music, 26 take art, and 2 take both art and music. How many students in the class are not enrolled in either music or art?  
[A] 6 [B] 24 [C] 16 [D] 8
6. The senior class at South High School consists of 250 students. Of these students, 130 have brown hair, 160 have brown eyes, and 90 have both brown hair and brown eyes. How many members of the senior class have *neither* brown hair *nor* brown eyes?
7. In a telephone survey of 100 households, 32 households purchased Brand A cereal and 45 purchased Brand B cereal. If 10 households purchased both items, how many of the households surveyed did *not* purchase either Brand A or Brand B cereal?
8. In a survey of 400 teenage shoppers at a large mall, 240 said they shopped at Abernathy's, 210 said they shopped at Bongo Republic, and 90 said they shopped at both stores. How many of the teenage shoppers surveyed did not shop at either store?
9. In Clark Middle School, there are 60 students in seventh grade. If 25 of these students take art only, 18 take music only, and 9 do not take either art or music, how many take both art and music?
10. A car dealer has 22 vehicles on his lot. If 8 of the vehicles are vans and 6 of the vehicles are red, and 10 vehicles are neither vans nor red, how many red vans does he have on his lot?
11. A school district offers hockey and basketball. The result of a survey of 300 students showed:  
120 students play hockey, only  
90 students play basketball, only  
30 students do not participate in either sport  
Of those surveyed, how many students play both hockey and basketball?
12. Seventy-eight students participate in one or more of three sports: baseball, tennis, and golf. Four students participate in all three sports; five play both baseball and golf, only; two play both tennis and golf, only; and three play both baseball and tennis, only. If seven students play only tennis and one plays only golf, what is the total number of students who play only baseball?  
[A] 60 [B] 44 [C] 56 [D] 12
13. There are 30 students on a school bus. Of these students, 24 either play in the school band or sing in the chorus. Six of the students play in the school band but do not sing in the chorus. Fourteen of the students sing in the chorus and also play in the school band. How many students on the school bus sing in the chorus but do not play in the band?
14. Jose surveyed 20 of his friends to find out what equipment they use to play recorded movies. He found that 12 of his friends have only DVD players, 5 have both DVD players and VCRs, and 2 have neither type of player. The rest of his friends have only VCRs. What is the total number of his friends that have VCRs?
15. In Ms. Wright's English class, 16 students are in band, 7 students play sports, 3 students participate in both activities, and 9 students are not in band and do not play sports. How many students are in Ms. Wright's English class?  
[A] 7 [B] 10 [C] 26 [D] 29

## COMMUNICATION STRAND

(A.CM.1-A.CM.13)

## CONNECTIONS STRAND

(A.CN.1-A.CN.8)

## REPRESENTATION STRAND

(A.R.1-A.R.8)

## NUMBER SENSE AND OPERATIONS STRAND

(A.N.1-A.N.8)

A.N.1: Identify and apply the properties of real numbers.

16. If  $a$  and  $b$  are integers, which equation is always true?

- [A]  $a + b = b + a$       [B]  $\frac{a}{b} = \frac{b}{a}$   
[C]  $a + 2b = b + 2a$       [D]  $a - b = b - a$

17. If  $M$  and  $A$  represent integers,  $M + A = A + M$  is an example of which property?

- [A] associative      [B] distributive  
[C] commutative      [D] closure

18. Which expression is an example of the associative property?

- [A]  $(x + y) + z = x + (y + z)$   
[B]  $x + y + z = z + y + x$   
[C]  $x \cdot 1 = x$       [D]  $x(y + z) = xy + xz$

19. Which equation illustrates the associative property of addition?

- [A]  $3(x + 2) = 3x + 6$   
[B]  $x + y = y + x$   
[C]  $(3 + x) + y = 3 + (x + y)$   
[D]  $3 + x = 0$

20. The equation  $*(\Delta + \diamond) = * \Delta + * \diamond$  is an example of the

- [A] associative law      [B] distributive law  
[C] commutative law      [D] transitive law

21. Which equation illustrates the distributive property?

- [A]  $5(a + b) = 5a + 5b$       [B]  $a + 0 = a$   
[C]  $a + (b + c) = (a + b) + c$   
[D]  $a + b = b + a$

22. Which equation illustrates the distributive property for real numbers?

- [A]  $\sqrt{3} + 0 = \sqrt{3}$   
[B]  $-3(5 + 7) = (-3)(5) + (-3)(7)$   
[C]  $(1.3 \times 0.07) \times 0.63 = 1.3 \times (0.07 \times 0.63)$   
[D]  $\frac{1}{3} + \frac{1}{2} = \frac{1}{2} + \frac{1}{3}$

23. Tori computes the value of  $8 \times 95$  in her head by thinking  $8(100 - 5) = 8 \times 100 - 8 \times 5$ . Which number property is she using?

- [A] closure      [B] associative  
[C] distributive      [D] commutative

24. While solving the equation  $4(x + 2) = 28$ , Becca wrote  $4x + 8 = 28$ . Which property did she use?

- [A] distributive      [B] identity  
[C] associative      [D] commutative

25. Which property is illustrated by the equation  $\frac{3}{2}x + 0 = \frac{3}{2}x$ ?
- [A] distributive property  
[B] additive inverse property  
[C] commutative property of addition  
[D] additive identity property
26. Which equation is an illustration of the additive identity property?
- [A]  $x + 0 = x$       [B]  $x - x = 0$   
[C]  $x \cdot \frac{1}{x} = 1$       [D]  $x \cdot 1 = x$
27. Which statement best illustrates the additive identity property?
- [A]  $6 + 2 = 2 + 6$       [B]  $6 + 0 = 6$   
[C]  $6 + (-6) = 0$       [D]  $6(2) = 2(6)$
28. Which equation illustrates the multiplicative identity element?
- [A]  $x \cdot \frac{1}{x} = 1$       [B]  $x \cdot 1 = x$   
[C]  $x + 0 = x$       [D]  $x - x = 0$
29. Which expression must be added to  $3x - 7$  to equal 0?
- [A]  $-3x + 7$       [B]  $-3x - 7$   
[C]  $0$       [D]  $3x + 7$
30. What is the additive inverse of  $\frac{2}{3}$ ?
- [A]  $-\frac{2}{3}$     [B]  $\frac{3}{2}$     [C]  $-\frac{3}{2}$     [D]  $\frac{1}{3}$
31. Which property of real numbers is illustrated by the equation  $-\sqrt{3} + \sqrt{3} = 0$ ?
- [A] additive identity  
[B] commutative property of addition  
[C] associative property of addition  
[D] additive inverse
32. If  $a \neq 0$  and the sum of  $x$  and  $\frac{1}{a}$  is 0, then
- [A]  $x = 1 - a$       [B]  $x = -\frac{1}{a}$   
[C]  $x = -a$       [D]  $x = a$
33. What is the multiplicative inverse of  $\frac{3}{4}$ ?
- [A]  $-\frac{4}{3}$     [B]  $-1$     [C]  $\frac{4}{3}$     [D]  $-\frac{3}{4}$
34. The multiplicative inverse of  $-\frac{1}{3}$  is
- [A]  $\frac{1}{3}$       [B]  $-3$       [C]  $3$       [D]  $-\frac{1}{3}$
35. Which equation illustrates the multiplicative inverse property?
- [A]  $-1 \cdot x = -x$       [B]  $1 \cdot 0 = 0$   
[C]  $1 \cdot x = x$       [D]  $x \cdot \frac{1}{x} = 1$
36. Ramón said that the set of integers is *not* closed for one of the basic operations (addition, subtraction, multiplication, or division). You want to show Ramón that his statement is correct. For the operation for which the set of integers is *not* closed, write an example using:
- o a positive even integer and a zero
  - o a positive and a negative even integer
  - o two negative even integers
- Be sure to explain why *each* of your examples illustrates that the set of integers is *not* closed for that operation.
37. Which set is closed under division?
- [A] integers      [B]  $\{1\}$   
[C] whole numbers    [D] counting numbers

38. An addition table for a subset of real numbers is shown below. Which number is the identity element? Explain your answer.

| + | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| 0 | 0 | 1 | 2 | 3 |
| 1 | 1 | 2 | 3 | 4 |
| 2 | 2 | 3 | 4 | 0 |
| 3 | 3 | 4 | 0 | 1 |

39. The operation element @ is determined by the following table:

| @ | a | b | c |
|---|---|---|---|
| a | a | b | c |
| b | b | c | a |
| c | c | a | b |

What is the identity element of this operation?

- [A]  $b$ , only                      [B]  $a$ , only  
[C]  $a$  and  $b$                       [D]  $c$
40. What is the identity element for ♣ in the accompanying table?

| ♣ | r | s | t | u |
|---|---|---|---|---|
| r | t | r | u | s |
| s | r | s | t | u |
| t | u | t | s | r |
| u | s | u | r | t |

- [A]  $u$                       [B]  $s$                       [C]  $t$                       [D]  $r$

41. In the addition table for a subset of real numbers shown below, which number is the inverse of 3? Explain your answer.

| ⊕ | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 1 |
| 2 | 3 | 4 | 1 | 2 |
| 3 | 4 | 1 | 2 | 3 |
| 4 | 1 | 2 | 3 | 4 |

42. The operation  $*$  for the set  $\{p, r, s, v\}$  is defined in the accompanying table. What is the inverse element of  $r$  under the operation  $*$ ?

| * | p | r | s | v |
|---|---|---|---|---|
| p | s | v | p | r |
| r | v | p | r | s |
| s | p | r | s | v |
| v | r | s | v | p |

- [A]  $r$                       [B]  $p$                       [C]  $s$                       [D]  $v$

A.N.2: Simplify radical terms (no variable in the radicand).

43. The expression  $\sqrt{50}$  can be simplified to  
[A]  $5\sqrt{2}$                       [B]  $25\sqrt{2}$   
[C]  $2\sqrt{25}$                       [D]  $5\sqrt{10}$

44. When  $\sqrt{72}$  is expressed in simplest  $a\sqrt{b}$  form, what is the value of  $a$ ?  
[A] 3                      [B] 8                      [C] 6                      [D] 2

A.N.3: Perform the four arithmetic operations using like and unlike radical terms and express the result in simplest form.

45. Expressed in simplest radical form, the product of  $\sqrt{6} \cdot \sqrt{15}$  is  
[A]  $3\sqrt{15}$                       [B]  $\sqrt{90}$   
[C]  $9\sqrt{10}$                       [D]  $3\sqrt{10}$

46. The expression  $\frac{6\sqrt{20}}{3\sqrt{5}}$  is equivalent to  
 [A]  $3\sqrt{15}$  [B]  $2\sqrt{15}$  [C] 8 [D] 4
47. The sum of  $\sqrt{18}$  and  $\sqrt{72}$  is  
 [A]  $3\sqrt{10}$  [B]  $\sqrt{90}$   
 [C]  $6\sqrt{3}$  [D]  $9\sqrt{2}$
48. The sum of  $\sqrt{75}$  and  $\sqrt{3}$  is  
 [A] 18 [B] 15 [C]  $\sqrt{78}$  [D]  $6\sqrt{3}$
49. The expression  $\sqrt{27} + \sqrt{12}$  is equivalent to  
 [A]  $5\sqrt{6}$  [B]  $\sqrt{39}$   
 [C]  $5\sqrt{3}$  [D]  $13\sqrt{3}$
50. The expression  $2\sqrt{50} - \sqrt{2}$  is equivalent to  
 [A]  $49\sqrt{2}$  [B]  $9\sqrt{2}$   
 [C] 10 [D]  $2\sqrt{48}$
51. The expression  $\sqrt{90} \cdot \sqrt{40} - \sqrt{8} \cdot \sqrt{18}$  simplifies to  
 [A] 48 [B] 3,456 [C] 22.9 [D] 864
52. The expression  $\sqrt{50} + \sqrt{32}$  is equivalent to  
 [A] 18 [B]  $\sqrt{82}$  [C] 6 [D]  $9\sqrt{2}$
53. The expression  $\sqrt{28} + \sqrt{63}$  is equivalent to  
 [A]  $\sqrt{91}$  [B]  $13\sqrt{7}$   
 [C]  $6\sqrt{7}$  [D]  $5\sqrt{7}$
54. What is the sum of  $5\sqrt{7}$  and  $3\sqrt{28}$ ?  
 [A]  $8\sqrt{35}$  [B]  $9\sqrt{7}$   
 [C]  $60\sqrt{7}$  [D]  $11\sqrt{7}$
55. What is the sum of  $\sqrt{50}$  and  $\sqrt{32}$ ?  
 [A]  $20\sqrt{20}$  [B]  $\sqrt{2}$   
 [C]  $\sqrt{82}$  [D]  $9\sqrt{2}$

A.N.4: Understand and use scientific notation to compute products and quotients of numbers.

56. What is the sum of  $6 \times 10^3$  and  $3 \times 10^2$ ?  
 [A]  $9 \times 10^6$  [B]  $18 \times 10^5$   
 [C]  $9 \times 10^5$  [D]  $6.3 \times 10^3$
57. If  $3.85 \times 10^6$  is divided by  $385 \times 10^4$ , the result is  
 [A]  $3.85 \times 10^4$  [B]  $3.85 \times 10^{10}$   
 [C] 0.01 [D] 1
58. What is the value of  $\frac{6.3 \times 10^8}{3 \times 10^4}$  in scientific notation?  
 [A]  $2.1 \times 10^{-4}$  [B]  $2.1 \times 10^2$   
 [C]  $2.1 \times 10^4$  [D]  $2.1 \times 10^{-2}$
59. If the number of molecules in 1 mole of a substance is  $6.02 \times 10^{23}$ , then the number of molecules in 100 moles is  
 [A]  $6.02 \times 10^{22}$  [B]  $6.02 \times 10^{25}$   
 [C]  $6.02 \times 10^{21}$  [D]  $6.02 \times 10^{24}$
60. If the mass of a proton is  $1.67 \times 10^{-24}$  gram, what is the mass of 1,000 protons?  
 [A]  $1.67 \times 10^{-21}$  [B]  $1.67 \times 10^{-27}$   
 [C]  $1.67 \times 10^{-23}$  [D]  $1.67 \times 10^{-22}$
61. The distance from Earth to the imaginary planet Med is  $1.7 \times 10^7$  miles. If a spaceship is capable of traveling 1,420 miles per hour, how many days will it take the spaceship to reach the planet Med? Round your answer to the nearest day.

62. Two objects are  $2.4 \times 10^{20}$  centimeters apart. A message from one object travels to the other at a rate of  $1.2 \times 10^5$  centimeters per second. How many seconds does it take the message to travel from one object to the other?

[A]  $1.2 \times 10^{15}$       [B]  $2.0 \times 10^{15}$   
[C]  $2.88 \times 10^{25}$       [D]  $2.0 \times 10^4$

A.N.5: Solve algebraic problems arising from situations that involve fractions, decimals, percents (decrease/increase and discount), and proportionality/direct variation.

63. The expression  $\frac{5x}{6} + \frac{x}{4}$  is equivalent to

[A]  $\frac{3x}{5}$     [B]  $\frac{13x}{12}$     [C]  $\frac{5x}{24}$     [D]  $\frac{5x^2}{10}$

64. Solve for  $x$ :  $\frac{1}{16}x + \frac{1}{4} = \frac{1}{2}$

65. What is the value of  $x$  in the equation

$$\frac{x}{2} + \frac{x}{6} = 2?$$

[A] 8      [B] 12      [C] 3      [D]  $\frac{1}{4}$

66. What is the solution set of the equation

$$\frac{x}{5} + \frac{x}{2} = 14?$$

[A] {20}    [B] {49}    [C] {4}    [D] {10}

67. What is the value of  $n$  in the equation  $0.6(n + 10) = 3.6$ ?

[A] -4    [B] -0.4    [C] 4    [D] 5

68. Mr. Perez owns a sneaker store. He bought 350 pairs of basketball sneakers and 150 pairs of soccer sneakers from the manufacturers for \$62,500. He sold all the sneakers and made a 25% profit. If he sold the soccer sneakers for \$130 per pair, how much did he charge for one pair of basketball sneakers?

69. In a town election, candidates A and B were running for mayor. There were 30,500 people

eligible to vote, and  $\frac{3}{4}$  of them actually

voted. Candidate B received  $\frac{1}{3}$  of the votes cast. How many people voted for candidate B? What percent of the votes cast, to the nearest tenth of a percent, did candidate A receive?

70. After an ice storm, the following headlines were reported in the *Glacier County Times*:  
Monday: Ice Storm Devastates County - 8 out of every 10 homes lose electrical power  
Tuesday: Restoration Begins - Power

restored to  $\frac{1}{2}$  of affected homes

Wednesday: More Freezing Rain - Power lost by 20% of homes that had power on Tuesday

Based on these headlines, what fractional portion of homes in Glacier County had electrical power on Wednesday?

71. In his will, a man leaves one-half of his money to his wife, one-half of what is then left to his older child, and one-half of what is then left to his younger child. His two cousins divide the remainder equally, each receiving \$2,000. What was the total amount of money in the man's will?

[A] \$32,000      [B] \$16,000

[C] \$24,000      [D] \$40,000

72. A boy got 50% of the questions on a test correct. If he had 10 questions correct out of the first 12, and  $\frac{1}{4}$  of the remaining questions correct, how many questions were on the test?

[A] 28    [B] 26    [C] 16    [D] 24

73. There are 28 students in a mathematics class. If  $\frac{1}{4}$  of the students are called to the guidance office,  $\frac{1}{3}$  of the remaining students are called to the nurse, and, finally,  $\frac{1}{2}$  of those left go to the library, how many students remain in the classroom?
74. A 14-gram serving of mayonnaise contains 11 grams of fat. What percent of the mayonnaise, to the *nearest tenth of a percent*, is fat?
75. Twenty-five percent of 88 is the same as what percent of 22?  
[A] 100%                      [B] 40%  
[C] 50%                        [D]  $12\frac{1}{2}\%$
76. Ninety percent of the ninth grade students at Richbartville High School take algebra. If 180 ninth grade students take algebra, how many ninth grade students do *not* take algebra?
77. Linda paid \$48 for a jacket that was on sale for 25% of the original price. What was the original price of the jacket?  
[A] \$60    [B] \$72    [C] \$96    [D] \$192
78. A painting that regularly sells for a price of \$55 is on sale for 20% off. The sales tax on the painting is 7%. Will the final total cost of the painting differ depending on whether the salesperson deducts the discount before adding the sales tax or takes the discount after computing the sum of the original price and the sales tax on \$55?
79. In bowling leagues, some players are awarded extra points called their "handicap." The "handicap" in Anthony's league is 80% of the difference between 200 and the bowler's average. Anthony's average is 145. What is Anthony's "handicap"?
80. Sue bought a picnic table on sale for 50% off the original price. The store charged her 10% tax and her final cost was \$22.00. What was the original price of the picnic table?
81. Walter is a waiter at the Towne Diner. He earns a daily wage of \$50, plus tips that are equal to 15% of the total cost of the dinners he serves. What was the total cost of the dinners he served if he earned \$170 on Tuesday?
82. A recent survey shows that the average man will spend 141,288 hours sleeping, 85,725 hours working, 81,681 hours watching television, 9,945 hours commuting, 1,662 hours kissing, and 363,447 hours on other tasks during his lifetime. What percent of his life, to the *nearest tenth of a percent*, does he spend sleeping?
83. The Edison Lightbulb Company tests 5% of their daily production of lightbulbs. If 500 bulbs were tested on Tuesday, what was the total number of bulbs produced that day?  
[A] 1,000                      [B] 100,000  
[C] 10,000                    [D] 25
84. The world population was 4.2 billion people in 1982. The population in 1999 reached 6 billion. Find the percent of change from 1982 to 1999.
85. Rashawn bought a CD that cost \$18.99 and paid \$20.51, including sales tax. What was the rate of the sales tax?  
[A] 5%    [B] 2%    [C] 3%    [D] 8%
86. A factory packs CD cases into cartons for a music company. Each carton is designed to hold 1,152 CD cases. The Quality Control Unit in the factory expects an error of less than 5% over or under the desired packing number. What is the *least* number and the *most* number of CD cases that could be packed in a carton and still be acceptable to the Quality Control Unit?



87. Which equation represents the direct variation relationship of the equation  $\frac{x}{y} = \frac{1}{2}$ ?

- [A]  $y = 2x$                       [B]  $y = 3x$   
[C]  $y = x + \frac{1}{2}$                       [D]  $x = 2y$

88. Julio's wages vary directly as the number of hours that he works. If his wages for 5 hours are \$29.75, how much will he earn for 30 hours?

89. Which table does *not* show an example of direct variation?

- |   |    |
|---|----|
| x | y  |
| 2 | 24 |
| 4 | 12 |
| 6 | 8  |
| 8 | 6  |
- |    |     |
|----|-----|
| x  | y   |
| -4 | -20 |
| -3 | -15 |
| -2 | -10 |
| -1 | -5  |
- |   |               |
|---|---------------|
| x | y             |
| 1 | $\frac{1}{2}$ |
| 2 | 1             |
| 3 | $\frac{3}{2}$ |
| 4 | 2             |
- |   |    |
|---|----|
| x | y  |
| 1 | 4  |
| 2 | 8  |
| 3 | 12 |
| 4 | 16 |

A.N.6: Evaluate expressions involving factorial(s), absolute value(s), and exponential expressions.

90. The value of  $5!$  is  
[A] 5    [B]  $\frac{1}{5}$     [C] 120    [D] 20
91. The value of  $\frac{7!}{3!}$  is  
[A] 24    [B] 840    [C] 4    [D] 7
92. What is the value of  $\frac{8!}{4!}$ ?  
[A] 1,680    [B]  $4!$     [C]  $2!$     [D] 2
93. Which value is equivalent to  ${}_3P_3$ ?  
[A] 27    [B] 1    [C] 9    [D]  $3!$

94. The expression  ${}_9C_2$  is equivalent to  
[A]  $\frac{9!}{2!}$     [B]  ${}_9P_2$     [C]  ${}_9C_7$     [D]  ${}_9P_7$

95. The expression  $-|-7|$  is equivalent to  
[A] 0    [B] -7    [C] 1    [D] 7

96. If  $r = 2$  and  $s = -7$ , what is the value of  $|r| - |s|$ ?  
[A] 9    [B] 5    [C] -9    [D] -5

A.N.7: Determine the number of possible events, using counting techniques or the Fundamental Principle of Counting.

97. Max goes through the cafeteria line and counts seven different meals and three different desserts that he can choose. Which expression can be used to determine how many different ways Max can choose a meal and a dessert?  
[A]  $7! \cdot 3!$                       [B]  ${}_7P_3$   
[C]  ${}_7C_3$                       [D]  $7 \cdot 3$
98. Robin has 8 blouses, 6 skirts, and 5 scarves. Which expression can be used to calculate the number of different outfits she can choose, if an outfit consists of a blouse, a skirt, and a scarf?  
[A]  $8!6!5!$                       [B]  ${}_{19}C_3$   
[C]  $8 + 6 + 5$                       [D]  $8 \cdot 6 \cdot 5$
99. Leo purchased five shirts, three pairs of pants, and four pairs of shoes. Which expression represents how many different outfits consisting of one shirt, one pair of pants, and one pair of shoes Leo can make?  
[A]  $5 + 3 + 4$                       [B]  ${}_{12}C_3$   
[C]  ${}_{12}P_3$                       [D]  $5 \cdot 3 \cdot 4$
100. How many different outfits consisting of a hat, a pair of slacks, and a sweater can be made from two hats, three pairs of slacks, and four sweaters?  
[A] 9    [B] 24    [C] 29    [D] 12

101. Juan has three blue shirts, two green shirts, seven red shirts, five pairs of denim pants, and two pairs of khaki pants. How many different outfits consisting of one shirt and one pair of pants are possible?  
[A] 420 [B] 84 [C] 130 [D] 19
102. Paloma has 3 jackets, 6 scarves, and 4 hats. Determine the number of different outfits consisting of a jacket, a scarf, and a hat that Paloma can wear.
103. The school cafeteria offers five sandwich choices, four desserts, and three beverages. How many different meals consisting of one sandwich, one dessert, and one beverage can be ordered?  
[A] 3 [B] 1 [C] 12 [D] 60
104. A deli has five types of meat, two types of cheese, and three types of bread. How many different sandwiches, consisting of one type of meat, one type of cheese, and one type of bread, does the deli serve?  
[A] 10 [B] 25 [C] 30 [D] 75
105. Cole's Ice Cream Stand serves sixteen different flavors of ice cream, three types of syrup, and seven types of sprinkles. If an ice cream sundae consists of one flavor of ice cream, one type of syrup, and one type of sprinkles, how many different ice cream sundaes can Cole serve?  
[A] 26 [B] 3 [C] 336 [D] 10,836
106. In a school building, there are 10 doors that can be used to enter the building and 8 stairways to the second floor. How many different routes are there from outside the building to a class on the second floor?  
[A] 18 [B] 80 [C] 10 [D] 1
107. Jeremy's bedroom has two doors leading into the hallway. His house has four doors leading to the outside. Using the doorways, in how many different ways can Jeremy leave his room and go outside?  
[A] 4 [B] 8 [C] 6 [D] 5
108. A certain car comes in three body styles with a choice of two engines, a choice of two transmissions, and a choice of six colors. What is the minimum number of cars a dealer must stock to have one car of every possible combination?  
[A] 36 [B] 42 [C] 72 [D] 13
109. Debbie goes to a diner famous for its express lunch menu. The menu has five appetizers, three soups, seven entrees, six vegetables, and four desserts. How many different meals consisting of either an appetizer *or* a soup, one entree, one vegetable, and one dessert can Debbie order?
110. When Kimberly bought her new car, she found that there were 72 different ways her car could be equipped. Her choices included four choices of engine and three choices of transmission. If her only other choice was color, how many choices of color did she have?  
[A] 12 [B] 65 [C] 60 [D] 6
- A.N.8: Determine the number of possible arrangements (permutations) of a list of items.*
111. How many different 6-letter arrangements can be formed using the letters in the word "**ABSENT**," if each letter is used only once?  
[A] 46,656 [B] 720 [C] 36 [D] 6
112. How many different 4-letter arrangements can be formed using the letters of the word "**JUMP**," if each letter is used only once?  
[A] 4 [B] 24 [C] 16 [D] 12
113. What is the total number of different four-letter arrangements that can be formed from the letters in the word "**VERTICAL**," if each letter is used only once in an arrangement?  
[A] 8 [B] 40,320  
[C] 1,680 [D] 6,720

114. A locker combination system uses three digits from 0 to 9. How many different three-digit combinations with no digit repeated are possible?  
[A] 30 [B] 720 [C] 504 [D] 1,000
115. How many different five-digit numbers can be formed from the digits 1, 2, 3, 4, and 5 if each digit is used only once?  
[A] 20 [B] 24 [C] 120 [D] 60
116. All seven-digit telephone numbers in a town begin with 245. How many telephone numbers may be assigned in the town if the last four digits do *not* begin or end in a zero?
117. Julia has four different flags that she wants to hang on the wall of her room. How many different ways can the flags be arranged in a row?  
[A] 1 [B] 16 [C] 24 [D] 10
118. Six members of a school's varsity tennis team will march in a parade. How many different ways can the players be lined up if Angela, the team captain, is always at the front of the line?
119. There were seven students running in a race. How many different arrangements of first, second, and third place are possible?
120. The telephone company has run out of seven-digit telephone numbers for an area code. To fix this problem, the telephone company will introduce a new area code. Find the number of new seven-digit telephone numbers that will be generated for the new area code if both of the following conditions must be met:  
o The first digit cannot be a zero or a one.  
o The first three digits cannot be the emergency number (911) or the number used for information (411).
121. In Jackson County, Wyoming, license plates are made with two letters (A through Z) followed by three digits (0 through 9). The plates are made according to the following restrictions:  
o the first letter must be *J* or *W*, and the second letter can be any of the 26 letters in the alphabet  
o no digit can be repeated  
How many different license plates can be made with these restrictions?
122. A certain state is considering changing the arrangement of letters and numbers on its license plates. The two options the state is considering are:  
Option 1: three letters followed by a four-digit number with repetition of both letters and digits allowed  
Option 2: four letters followed by a three-digit number without repetition of either letters or digits  
[Zero may be chosen as the first digit of the number in either option.]  
Which option will enable the state to issue more license plates? How many *more* different license plates will that option yield?

## ALGEBRA STRAND

(A.A.1-A.A.45)

A.A.1: Translate a quantitative verbal phrase into an algebraic expression.

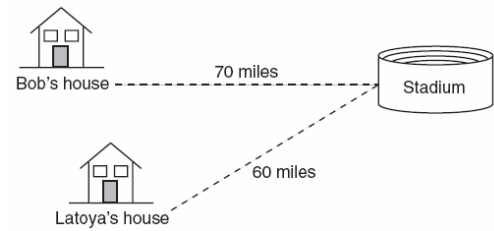
123. Which expression represents the number of yards in  $x$  feet?  
[A]  $\frac{x}{12}$  [B]  $3x$  [C]  $\frac{x}{3}$  [D]  $12x$
124. If rain is falling at the rate of 2 inches per hour, how many inches of rain will fall in  $x$  minutes?  
[A]  $\frac{30}{x}$  [B]  $\frac{x}{30}$  [C]  $2x$  [D]  $\frac{60}{x}$

125. A car travels 110 miles in 2 hours. At the same rate of speed, how far will the car travel in  $h$  hours?
- [A]  $55h$  [B]  $220h$  [C]  $\frac{h}{55}$  [D]  $\frac{h}{220}$
126. Tara buys two items that cost  $d$  dollars each. She gives the cashier \$20. Which expression represents the change she should receive?
- [A]  $20 - d$  [B]  $20 - 2d$   
[C]  $2d - 20$  [D]  $20 + 2d$
127. The sum of Scott's age and Greg's age is 33 years. If Greg's age is represented by  $g$ , Scott's age is represented by
- [A]  $33 - g$  [B]  $33g$   
[C]  $g + 33$  [D]  $g - 33$
128. Which expression represents "5 less than the product of 7 and  $x$ "?
- [A]  $7 + x - 5$  [B]  $5 - 7x$   
[C]  $7(x - 5)$  [D]  $7x - 5$
129. A store advertises that during its Labor Day sale \$15 will be deducted from every purchase over \$100. In addition, after the deduction is taken, the store offers an early-bird discount of 20% to any person who makes a purchase before 10 a.m. If Hakeem makes a purchase of  $x$  dollars,  $x > 100$ , at 8 a.m., what, in terms of  $x$ , is the cost of Hakeem's purchase?
- [A]  $0.20x - 3$  [B]  $0.20x - 15$   
[C]  $0.80x - 12$  [D]  $0.85x - 20$
130. If the number represented by  $n-3$  is an odd integer, which expression represents the next greater odd integer?
- [A]  $n - 2$  [B]  $n - 1$  [C]  $n - 5$  [D]  $n + 1$
131. If  $n + 4$  represents an odd integer, the next larger odd integer is represented by
- [A]  $n + 6$  [B]  $n + 2$   
[C]  $n + 5$  [D]  $n + 3$
132. Which expression represents the product of two consecutive odd integers, where  $n$  is an odd integer?
- [A]  $n(n + 1)$  [B]  $2n + 1$   
[C]  $n(n + 3)$  [D]  $n(n + 2)$
133. Ashanti and Maria went to the store to buy snacks for their back-to-school party. They bought bags of chips, pretzels, and nachos. They bought three times as many bags of pretzels as bags of chips, and two fewer bags of nachos than bags of pretzels. If  $x$  represents the number of bags of chips they bought, express, in terms of  $x$ , how many bags of snacks they bought in all.
134. A hockey team played  $n$  games, losing four of them and winning the rest. The ratio of games won to games lost is
- [A]  $\frac{4}{n}$  [B]  $\frac{n-4}{4}$  [C]  $\frac{n}{4}$  [D]  $\frac{4}{n-4}$
- A.A.6: Analyze and solve verbal problems whose solution requires solving a linear equation in one variable or linear inequality in one variable.*
135. The mean (average) weight of three dogs is 38 pounds. One of the dogs, Sparky, weighs 46 pounds. The other two dogs, Eddie and Sandy, have the same weight. Find Eddie's weight.
136. If 6 and  $x$  have the same mean (average) as 2, 4, and 24, what is the value of  $x$ ?
- [A] 5 [B] 10 [C] 36 [D] 14
137. During each marking period, there are five tests. If Vanita needs a 65 average to pass this marking period and her first four grades are 60, 72, 55, and 80, what is the *lowest* score she can earn on the last test to have a passing average?
- [A] 65 [B] 100 [C] 80 [D] 58
138. The exact average of a set of six test scores is 92. Five of these scores are 90, 98, 96, 94, and 85. What is the other test score?
- [A] 86 [B] 91 [C] 89 [D] 92

139. TOP Electronics is a small business with five employees. The mean (average) weekly salary for the five employees is \$360. If the weekly salaries of four of the employees are \$340, \$340, \$345, and \$425, what is the salary of the fifth employee?
140. The students in Woodland High School's meteorology class measured the noon temperature every schoolday for a week. Their readings for the first 4 days were Monday,  $56^{\circ}$ ; Tuesday,  $72^{\circ}$ ; Wednesday,  $67^{\circ}$ ; and Thursday,  $61^{\circ}$ . If the mean (average) temperature for the 5 days was exactly  $63^{\circ}$ , what was the temperature on Friday?
141. For five algebra examinations, Maria has an average of 88. What must she score on the sixth test to bring her average up to exactly 90?  
[A] 100 [B] 98 [C] 92 [D] 94
142. Judy needs a mean (average) score of 86 on four tests to earn a midterm grade of B. If the mean of her scores for the first three tests was 83, what is the *lowest* score on a 100-point scale that she can receive on the fourth test to have a midterm grade of B?
143. In his first three years coaching baseball at High Ridge High School, Coach Batty's team won 7 games the first year, 16 games the second year, and 4 games the third year. How many games does the team need to win in the fourth year so that the coach's average will be 10 wins per year?  
[A] 13 [B] 9 [C] 10 [D] 3
144. Tamika could not remember her scores from five mathematics tests. She did remember that the mean (average) was exactly 80, the median was 81, and the mode was 88. If all her scores were integers with 100 the highest score possible and 0 the lowest score possible, what was the *lowest* score she could have received on any one test?
145. Angelo, Brandon, and Carl work in the same office. Angelo's age is 4 years more than twice Carl's age. Brandon is 5 years younger than Carl. The average of the three ages is 41. Find the age of *each* of the men.
146. On the first six tests in her social studies course, Jerelyn's scores were 92, 78, 86, 92, 95, and 91. Determine the median and the mode of her scores. If Jerelyn took a seventh test and raised the mean of her scores exactly 1 point, what was her score on the seventh test?
147. If  $2x + 5 = -25$  and  $-3m - 6 = 48$ , what is the product of  $x$  and  $m$ ?  
[A] 270 [B] -270 [C] 3 [D] -33
148. If  $-2x + 3 = 7$  and  $3x + 1 = 5 + y$ , the value of  $y$  is  
[A] 1 [B] 10 [C] 0 [D] -10
149. At the beginning of her mathematics class, Mrs. Reno gives a warm-up problem. She says, "I am thinking of a number such that 6 less than the product of 7 and this number is 85." Which number is she thinking of?  
[A] 637 [B] 84 [C] 13 [D]  $11\frac{2}{7}$
150. Every month, Omar buys pizzas to serve at a party for his friends. In May, he bought three more than twice the number of pizzas he bought in April. If Omar bought 15 pizzas in May, how many pizzas did he buy in April?
151. Sara's telephone service costs \$21 per month plus \$0.25 for each local call, and long-distance calls are extra. Last month, Sara's bill was \$36.64, and it included \$6.14 in long-distance charges. How many local calls did she make?
152. The sum of the ages of the three Romano brothers is 63. If their ages can be represented as consecutive integers, what is the age of the middle brother?

153. Mario paid \$44.25 in taxi fare from the hotel to the airport. The cab charged \$2.25 for the first mile plus \$3.50 for each additional mile. How many miles was it from the hotel to the airport?  
[A] 10 [B] 13 [C] 12 [D] 11
154. Parking charges at Superior Parking Garage are \$5.00 for the first hour and \$1.50 for each additional 30 minutes. If Margo has \$12.50, what is the maximum amount of time she will be able to park her car at the garage?  
[A]  $3\frac{1}{2}$  hours [B] 6 hours  
[C]  $2\frac{1}{2}$  hours [D]  $6\frac{1}{2}$  hours
155. A candy store sells 8-pound bags of mixed hazelnuts and cashews. If  $c$  pounds of cashews are in a bag, the price  $p$  of the bag can be found using the formula  $p = 2.59c + 1.72(8 - c)$ . If one bag is priced at \$18.11, how many pounds of cashews does it contain?
156. A girl can ski down a hill five times as fast as she can climb up the same hill. If she can climb up the hill and ski down in a total of 9 minutes, how many minutes does it take her to climb up the hill?  
[A] 7.2 [B] 4.5 [C] 1.8 [D] 7.5
157. A truck traveling at a constant rate of 45 miles per hour leaves Albany. One hour later a car traveling at a constant rate of 60 miles per hour also leaves Albany traveling in the same direction on the same highway. How long will it take for the car to catch up to the truck, if both vehicles continue in the same direction on the highway?
158. Two trains leave the same station at the same time and travel in opposite directions. One train travels at 80 kilometers per hour and the other at 100 kilometers per hour. In how many hours will they be 900 kilometers apart?

159. A truck travels 40 miles from point  $A$  to point  $B$  in exactly 1 hour. When the truck is halfway between point  $A$  and point  $B$ , a car starts from point  $A$  and travels at 50 miles per hour. How many miles has the car traveled when the truck reaches point  $B$ ?  
[A] 60 [B] 40 [C] 50 [D] 25
160. Bob and Latoya both drove to a baseball game at a college stadium. Bob lives 70 miles from the stadium and Latoya lives 60 miles from it, as shown in the accompanying diagram. Bob drove at a rate of 50 miles per hour, and Latoya drove at a rate of 40 miles per hour. If they both left home at the same time, who got to the stadium first?



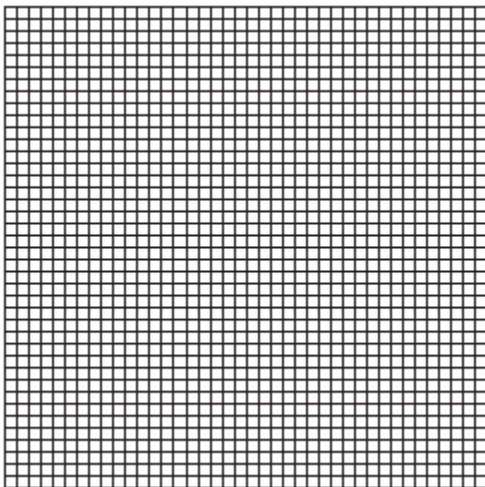
161. A bicyclist leaves Bay Shore traveling at an average speed of 12 miles per hour. Three hours later, a car leaves Bay Shore, on the same route, traveling at an average speed of 30 miles per hour. How many hours after the car leaves Bay Shore will the car catch up to the cyclist?  
[A] 2 [B] 8 [C] 5 [D] 4
162. If one-half of a number is 8 less than two-thirds of the number, what is the number?  
[A] 48 [B] 24 [C] 32 [D] 54
163. If  $a + b$  is less than  $c + d$ , and  $d + e$  is less than  $a + b$ , then  $e$  is  
[A] less than  $c$  [B] equal to  $c$   
[C] greater than  $d$  [D] less than  $d$

164. On June 17, the temperature in New York City ranged from  $90^\circ$  to  $99^\circ$ , while the temperature in Niagara Falls ranged from  $60^\circ$  to  $69^\circ$ . The difference in the temperatures in these two cities must be between
- [A]  $20^\circ$  and  $30^\circ$       [B]  $30^\circ$  and  $40^\circ$   
[C]  $20^\circ$  and  $40^\circ$       [D]  $25^\circ$  and  $35^\circ$
165. There are 461 students and 20 teachers taking buses on a trip to a museum. Each bus can seat a maximum of 52. What is the *least* number of buses needed for the trip?
- [A] 9      [B] 10      [C] 8      [D] 11
166. In a hockey league, 87 players play on seven different teams. Each team has at least 12 players. What is the largest possible number of players on any one team?
- [A] 13      [B] 15      [C] 14      [D] 21
167. A doughnut shop charges \$0.70 for each doughnut and \$0.30 for a carryout box. Shirley has \$5.00 to spend. At most, how many doughnuts can she buy if she also wants them in one carryout box?
168. A swimmer plans to swim at least 100 laps during a 6-day period. During this period, the swimmer will increase the number of laps completed each day by one lap. What is the *least* number of laps the swimmer must complete on the first day?
- A.A.7: Analyze and solve verbal problems whose solution requires solving systems of linear equations in two variables.
169. Tanisha and Rachel had lunch at the mall. Tanisha ordered three slices of pizza and two colas. Rachel ordered two slices of pizza and three colas. Tanisha's bill was \$6.00, and Rachel's bill was \$5.25. What was the price of one slice of pizza? What was the price of one cola?
170. When Tony received his weekly allowance, he decided to purchase candy bars for all his friends. Tony bought three Milk Chocolate bars and four Creamy Nougat bars, which cost a total of \$4.25 without tax. Then he realized this candy would not be enough for all his friends, so he returned to the store and bought an additional six Milk Chocolate bars and four Creamy Nougat bars, which cost a total of \$6.50 without tax. How much did *each* type of candy bar cost?
171. Alexandra purchases two doughnuts and three cookies at a doughnut shop and is charged \$3.30. Briana purchases five doughnuts and two cookies at the same shop for \$4.95. All the doughnuts have the same price and all the cookies have the same price. Find the cost of one doughnut and find the cost of one cookie.
172. Ramón rented a sprayer and a generator. On his first job, he used each piece of equipment for 6 hours at a total cost of \$90. On his second job, he used the sprayer for 4 hours and the generator for 8 hours at a total cost of \$100. What was the hourly cost of *each* piece of equipment?
173. Three times as many robins as cardinals visited a bird feeder. If a total of 20 robins and cardinals visited the feeder, how many were robins?
- [A] 20      [B] 15      [C] 5      [D] 10
174. Sal keeps quarters, nickels, and dimes in his change jar. He has a total of 52 coins. He has three more quarters than dimes and five fewer nickels than dimes. How many dimes does Sal have?
- [A] 18      [B] 20      [C] 21      [D] 13
175. At a concert, \$720 was collected for hot dogs, hamburgers, and soft drinks. All three items sold for \$1.00 each. Twice as many hot dogs were sold as hamburgers. Three times as many soft drinks were sold as hamburgers. The number of soft drinks sold was
- [A] 120      [B] 240      [C] 480      [D] 360

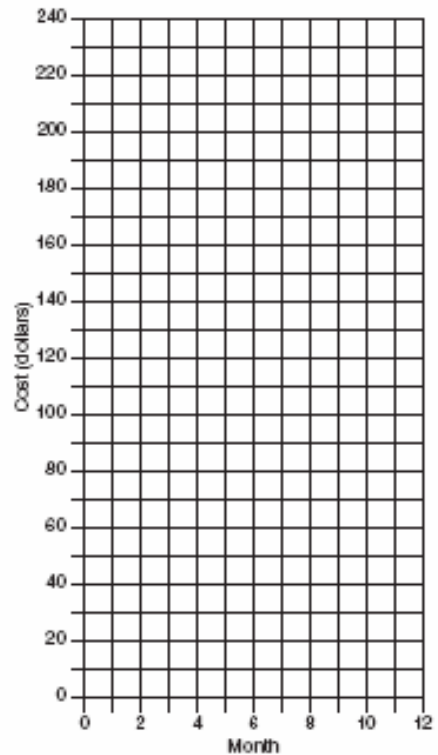
176. A group of 148 people is spending five days at a summer camp. The cook ordered 12 pounds of food for each adult and 9 pounds of food for each child. A total of 1,410 pounds of food was ordered.
- a* Write an equation or a system of equations that describes the above situation and define your variables.
- b* Using your work from part *a*, find:
- (1) the total number of adults in the group
  - (2) the total number of children in the group
177. Seth has one less than twice the number of compact discs (CDs) that Jason has. Raoul has 53 more CDs than Jason has. If Seth gives Jason 25 CDs, Seth and Jason will have the same number of CDs. How many CDs did *each* of the three boys have to begin with?
178. Arielle has a collection of grasshoppers and crickets. She has 561 insects in all. The number of grasshoppers is twice the number of crickets. Find the number of *each* type of insect that she has.
179. Mary and Amy had a total of 20 yards of material from which to make costumes. Mary used three times more material to make her costume than Amy used, and 2 yards of material was not used. How many yards of materials did Amy use for her costume?
180. Ben had twice as many nickels as dimes. Altogether, Ben had \$4.20. How many nickels *and* how many dimes did Ben have?
181. Using only 32-cent and 20-cent stamps, Charlie put \$3.36 postage on a package he sent to his sister. He used twice as many 32-cent stamps as 20-cent stamps. Determine how many of *each* type of stamp he used.
182. The owner of a movie theater was counting the money from 1 day's ticket sales. He knew that a total of 150 tickets were sold. Adult tickets cost \$7.50 each and children's tickets cost \$4.75 each. If the total receipts for the day were \$891.25, how many of *each* kind of ticket were sold?
183. There were 100 more balcony tickets than main-floor tickets sold for a concert. The balcony tickets sold for \$4 and the main-floor tickets sold for \$12. The total amount of sales for both types of tickets was \$3,056.
- a* Write an equation or a system of equations that describes the given situation. Define the variables.
- b* Find the number of balcony tickets that were sold.
184. The ninth graders at a high school are raising money by selling T-shirts and baseball caps. The number of T-shirts sold was three times the number of caps. The profit they received for each T-shirt sold was \$5.00, and the profit on each cap was \$2.50. If the students made a total profit of \$210, how many T-shirts *and* how many caps were sold?
185. The tickets for a dance recital cost \$5.00 for adults and \$2.00 for children. If the total number of tickets sold was 295 and the total amount collected was \$1,220, how many adult tickets were sold? [Only an algebraic solution can receive full credit.]
186. A ribbon 56 centimeters long is cut into two pieces. One of the pieces is three times longer than the other. Find the lengths, in centimeters, of both pieces of ribbon.
187. Sharu has \$2.35 in nickels and dimes. If he has a total of thirty-two coins, how many of *each* coin does he have?
188. The ratio of Tariq's telephone bill to Pria's telephone bill was 7:5. Tariq's bill was \$14 more than Pria's bill. What was Tariq's bill?
- [A] \$21 [B] \$49 [C] \$35 [D] \$28
189. Two numbers are in the ratio 2:5. If 6 is subtracted from their sum, the result is 50. What is the larger number?
- [A] 40 [B] 45 [C] 35 [D] 55
190. Jamie is 5 years older than her sister Amy. If the sum of their ages is 19, how old is Jamie?
- [A] 7 [B] 14 [C] 5 [D] 12



191. A total of 600 tickets were sold for a concert. Twice as many tickets were sold in advance than were sold at the door. If the tickets sold in advance cost \$25 each and the tickets sold at the door cost \$32 each, how much money was collected for the concert?
192. At the local video rental store, José rents two movies and three games for a total of \$15.50. At the same time, Meg rents three movies and one game for a total of \$12.05. How much money is needed to rent a combination of one game and one movie?
193. The cost of a long-distance telephone call is determined by a flat fee for the first 5 minutes and a fixed amount for each additional minute. If a 15-minute telephone call costs \$3.25 and a 23-minute call costs \$5.17, find the cost of a 30-minute call.
194. Juan has a cellular phone that costs \$12.95 per month plus 25¢ per minute for each call. Tiffany has a cellular phone that costs \$14.95 per month plus 15¢ per minute for each call. For what number of minutes do the two plans cost the same?
195. The senior class is sponsoring a dance. The cost of a student disk jockey is \$40, and tickets sell for \$2 each. Write a linear equation and, on the accompanying grid, graph the equation to represent the relationship between the number of tickets sold and the profit from the dance. Then find how many tickets must be sold to break even.

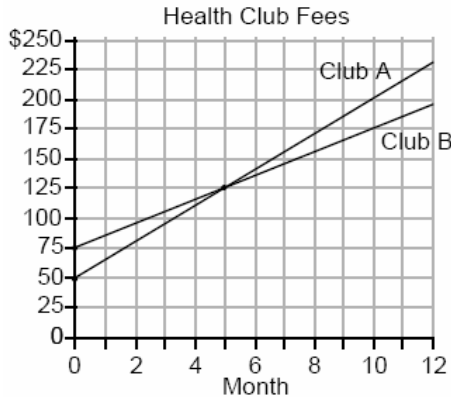


196. At Ron's Rental, a person can rent a big-screen television for \$10 a month plus a one-time "wear-and-tear" fee of \$100. At Josie's Rental, the charge is \$20 a month and an additional charge of \$20 for delivery with no "wear-and-tear" fee.
- a If  $c$  equals the cost, write one equation representing the cost of the rental for  $m$  months at Ron's Rental and one equation representing the cost of the rental for  $m$  months at Josie's Rental.
- b On the accompanying grid, graph and label each equation.
- c From your graph, determine in which month Josie's cost will equal Ron's cost.



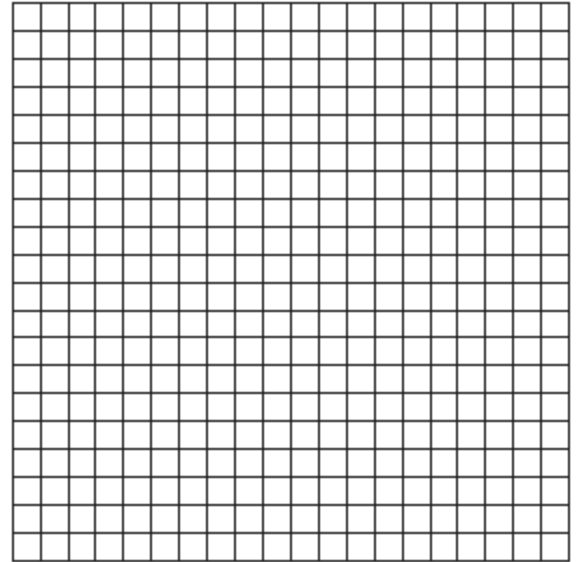
197. The Eye Surgery Institute just purchased a new laser machine for \$500,000 to use during eye surgery. The Institute must pay the inventor \$550 each time the machine is used. If the Institute charges \$2,000 for each laser surgery, what is the *minimum* number of surgeries that must be performed in order for the Institute to make a profit?

198. Two health clubs offer different membership plans. The graph below represents the total cost of belonging to Club A and Club B for one year.



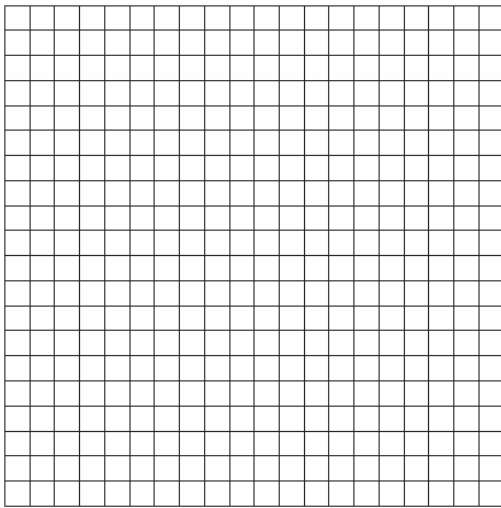
- a If the yearly cost includes a membership fee plus a monthly charge, what is the membership fee for Club A?
- b (1) What is the number of the month when the total cost is the same for both clubs?  
(2) What is the total cost for Club A when both plans are the same?
- c What is the monthly charge for Club B?
199. The Excel Cable Company has a monthly fee of \$32.00 and an additional charge of \$8.00 for each premium channel. The Best Cable Company has a monthly fee of \$26.00 and additional charge of \$10.00 for each premium channel. The Horton family is deciding which of these two cable companies to subscribe to.
- a For what number of premium channels will the total monthly subscription fee for the Excel and Best Cable companies be the same?
- b The Horton family decides to subscribe to 2 premium channels for a period of one year.
- (1) Which cable company should they subscribe to in order to spend less money?
- (2) How much money will the Hortons save in one year by using the less expensive company?

200. Currently, Tyrone has \$60 and his sister has \$135. Both get an allowance of \$5 each week. Tyrone decides to save his entire allowance, but his sister spends all of hers each week plus an additional \$10 each week. After how many weeks will they each have the same amount of money?  
[The use of the grid is optional.]



201. A hotel charges \$20 for the use of its dining room and \$2.50 a plate for each dinner. An association gives a dinner and charges \$3 a plate but invites four nonpaying guests. If each person has one plate, how many paying persons must attend for the association to collect the exact amount needed to pay the hotel?  
[A] 60 [B] 40 [C] 44 [D] 20
202. A cellular telephone company has two plans. Plan A charges \$11 a month and \$0.21 per minute. Plan B charges \$20 a month and \$0.10 per minute. After how much time, to the nearest minute, will the cost of plan A be equal to the cost of plan B?  
[A] 1 hr 36 min [B] 81 hr 48 min  
[C] 81 hr 8 min [D] 1 hr 22 m

203. Island Rent-a-Car charges a car rental fee of \$40 plus \$5 per hour or fraction of an hour. Wayne's Wheels charges a car rental fee of \$25 plus \$7.50 per hour or fraction of an hour. Under what conditions does it cost *less* to rent from Island Rent-a-Car? [The use of the accompanying grid is optional.]



A.A.8: Analyze and solve verbal problems that involve quadratic equations.

204. The height of a golf ball hit into the air is modeled by the equation  $h = -16t^2 + 48t$ , where  $h$  represents the height, in feet, and  $t$  represents the number of seconds that have passed since the ball was hit. What is the height of the ball after 2 seconds?  
[A] 64 ft [B] 32 ft [C] 80 ft [D] 16 ft

205. When Albert flips open his mathematics textbook, he notices that the product of the page numbers of the two facing pages that he sees is 156. Which equation could be used to find the page numbers that Albert is looking at?  
[A]  $x + (x + 1) = 156$   
[B]  $(x + 1)(x + 3) = 156$   
[C]  $(x + 1) + (x + 2) = 156$   
[D]  $x(x + 1) = 156$

206. Three brothers have ages that are consecutive even integers. The product of the first and third boys' ages is 20 more than twice the second boy's age. Find the age of *each* of the three boys.
207. Tamara has two sisters. One of the sisters is 7 years older than Tamara. The other sister is 3 years younger than Tamara. The product of Tamara's sisters' ages is 24. How old is Tamara?
208. Find three consecutive odd integers such that the product of the first and the second exceeds the third by 8.
209. A ball is thrown straight up at an initial velocity of 54 feet per second. The height of the ball  $t$  seconds after it is thrown is given by the formula  $h(t) = 54t - 12t^2$ . How many seconds after the ball is thrown will it return to the ground?  
[A] 4.5 [B] 4 [C] 9.2 [D] 6
210. If the equation  $x^2 - kx - 36 = 0$  has  $x = 12$  as one root, what is the value of  $k$ ?  
[A] 9 [B] -3 [C] 3 [D] -9
211. For which equation is the sum of the roots equal to the product of the roots?  
[A]  $x^2 - 8x - 4 = 0$  [B]  $x^2 + 3x - 6 = 0$   
[C]  $x^2 + x + 1 = 0$  [D]  $x^2 - 4x + 4 = 0$

A.A.9: Analyze and solve verbal problems that involve exponential growth and decay.

212. A population of wolves in a county is represented by the equation  $P(t) = 80(0.98)^t$ , where  $t$  is the number of years since 1998. Predict the number of wolves in the population in the year 2008.
213. The height,  $f(x)$ , of a bouncing ball after  $x$  bounces is represented by  $f(x) = 80(0.5)^x$ . How many times higher is the first bounce than the fourth bounce?  
[A] 16 [B] 4 [C] 8 [D] 2

214. On January 1, 1999, the price of gasoline was \$1.39 per gallon. If the price of gasoline increased by 0.5% per month, what was the cost of one gallon of gasoline, to the *nearest cent*, on January 1 one year later?
215. A used car was purchased in July 1999 for \$11,900. If the car depreciates 13% of its value each year, what is the value of the car, to the *nearest hundred dollars*, in July 2002?
216. The Franklins inherited \$3,500, which they want to invest for their child's future college expenses. If they invest it at 8.25% with interest compounded monthly, determine the value of the account, in dollars, after 5 years. Use the formula  $A = P(1 + \frac{r}{n})^{nt}$ , where  $A =$  value of the investment after  $t$  years,  $P =$  principal invested,  $r =$  annual interest rate, and  $n =$  number of times compounded per year.

A.A.10: Solve systems of two linear equations in two variables algebraically.

217. Which ordered pair is the solution of the following system of equations?  
 $3x + 2y = 4$   
 $-2x + 2y = 24$
- [A] (2,-5)                      [B] (2,-1)  
 [C] (-4,8)                      [D] (-4,-8)
218. What point is the intersection of the graphs of the lines  $2x - y = 3$  and  $x + y = 3$ ?
- [A] (1, 2)                      [B] (2, 1)  
 [C] (3, 3)                      [D] (3, 0)
219. Which ordered pair satisfies the system of equations below?  
 $3x - y = 8$   
 $x + y = 2$
- [A] (2.5, -0.5)                      [B] (5, -3)  
 [C] (3, -1)                      [D] (2.5, 0.5)

220. What is the value of  $y$  in the following system of equations?

$$2x + 3y = 6$$

$$2x + y = -2$$

- [A] -3      [B] 4      [C] 1      [D] 2

221. When solved graphically, which system of equations will have exactly one point of intersection?

[A]  $y = -x - 20$

[B]  $y = \frac{3}{5}x + 12$

$y = x + 17$

$y = 0.6x - 19$

[C]  $y = -x + 15$

[D]  $y = 0.5x + 30$

$y = -x + 25$

$y = 0.5x - 30$

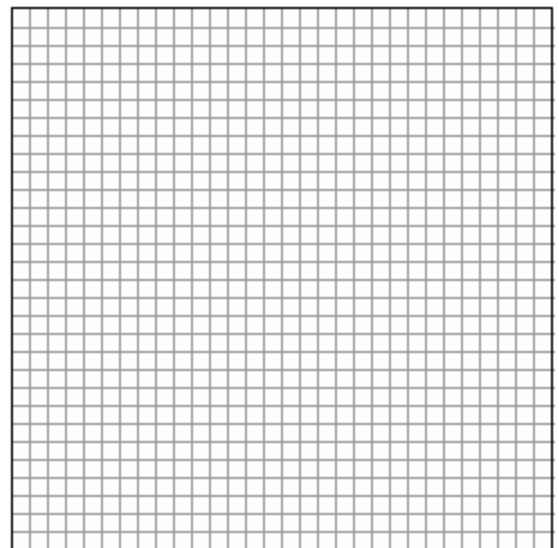
A.A.11: Solve a system of one linear and one quadratic equation in two variables, where only factoring is required. Note: The quadratic equation should represent a parabola and the solution(s) should be integers.

222. Solve the following system of equations:

$$y = x^2 + 4x + 1$$

$$y = 5x + 3$$

[The use of the grid is optional.]



223. The graphs of the equations  $y = x^2 + 4x - 1$  and  $y + 3 = x$  are drawn on the same set of axes. At which point do the graphs intersect?

- [A] (1, 4)                      [B] (1, -2)  
[C] (-2, -5)                  [D] (-2, 1)

224. Solve the following system of equations algebraically.

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

$$y = 2x + 1$$

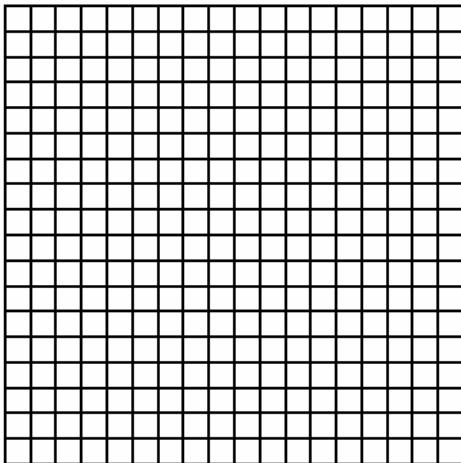
225. Solve the following system of equations algebraically or graphically for  $x$  and  $y$ :

$$y = x^2 + 2x - 1$$

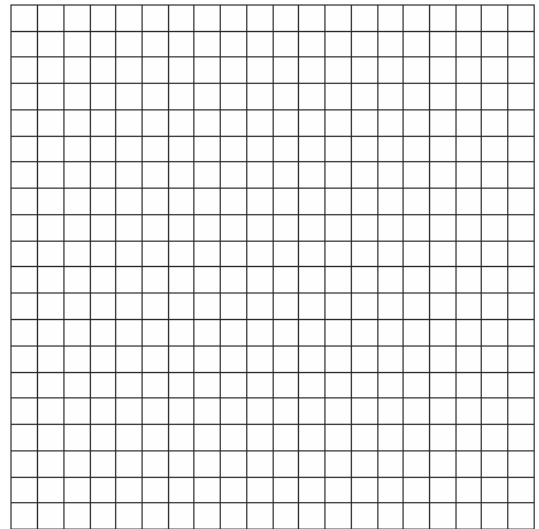
$$y = 3x + 5$$

For an algebraic solution, show your work here .

For a graphic solution, show your work here.



226. A pelican flying in the air over water drops a crab from a height of 30 feet. The distance the crab is from the water as it falls can be represented by the function  $h(t) = -16t^2 + 30$ , where  $t$  is time, in seconds. To catch the crab as it falls, a gull flies along a path represented by the function  $g(t) = -8t + 15$ . Can the gull catch the crab before the crab hits the water? Justify your answer. [The use of the accompanying grid is optional.]



A.A.12: Multiply and divide monomial expressions with a common base, using the properties of exponents. Note: Use integral exponents only.

227. The expression  $8^{-4} \cdot 8^6$  is equivalent to

- [A]  $8^{-24}$     [B]  $8^2$     [C]  $8^{-2}$     [D]  $8^{10}$

228. The expression  $3^2 \cdot 3^3 \cdot 3^4$  is equivalent to

- [A]  $27^9$     [B]  $3^9$     [C]  $3^{24}$     [D]  $27^{24}$

229. The expression  $2^3 \cdot 4^2$  is equivalent to

- [A]  $2^7$     [B]  $8^6$     [C]  $8^5$     [D]  $2^{12}$

230. The expression  $(x^2 z^3)(xy^2 z)$  is equivalent to

- [A]  $x^3 y^3 z^4$                       [B]  $x^4 y^2 z^5$   
[C]  $x^2 y^2 z^3$                       [D]  $x^3 y^2 z^4$

231. The product of  $2x^3$  and  $6x^5$  is  
 [A]  $12x^{15}$  [B]  $10x^{15}$   
 [C]  $12x^8$  [D]  $10x^8$
232. The product of  $3x^2y$  and  $-4xy^3$  is  
 [A]  $12x^2y^3$  [B]  $-12x^3y^4$   
 [C]  $-12x^2y^3$  [D]  $12x^3y^4$
233. The product of  $3x^5$  and  $2x^4$  is  
 [A]  $6x^9$  [B]  $5x^9$  [C]  $5x^{20}$  [D]  $6x^{20}$
234. The product of  $4x^2y$  and  $2xy^3$  is  
 [A]  $8x^3y^4$  [B]  $8x^2y^3$   
 [C]  $8x^2y^4$  [D]  $8x^3y^3$
235. What is the product of  $\frac{1}{3}x^2y$  and  $\frac{1}{6}xy^3$ ?  
 [A]  $\frac{1}{2}x^2y^3$  [B]  $\frac{1}{18}x^2y^3$   
 [C]  $\frac{1}{9}x^3y^4$  [D]  $\frac{1}{18}x^3y^4$
236. What is the product of  $10x^4y^2$  and  $3xy^3$ ?  
 [A]  $30x^4y^6$  [B]  $30x^5y^6$   
 [C]  $30x^5y^5$  [D]  $30x^4y^5$
237. Expressed in its simplest form,  $(3x^3)(2y)^2(4x^4)$  is equivalent to  
 [A]  $48x^{12}y^2$  [B]  $24x^{12}y^2$   
 [C]  $24x^7y^2$  [D]  $48x^7y^2$
238. The expression  $(6x^3y^6)^2$  is equivalent to  
 [A]  $36x^5y^8$  [B]  $12x^6y^{12}$   
 [C]  $6x^6y^{12}$  [D]  $36x^6y^{12}$
239. The product of  $(5ab)$  and  $(-2a^2b)^3$  is  
 [A]  $-30a^7b^4$  [B]  $-40a^6b^4$   
 [C]  $-30a^6b^4$  [D]  $-40a^7b^4$
240. When  $-9x^5$  is divided by  $-3x^3$ ,  $x \neq 0$ , the quotient is  
 [A]  $27x^8$  [B]  $-27x^{15}$   
 [C]  $3x^2$  [D]  $-3x^2$
241. The quotient of  $-\frac{15x^8}{5x^2}$ ,  $x \neq 0$ , is  
 [A]  $-10x^6$  [B]  $-3x^4$   
 [C]  $-10x^4$  [D]  $-3x^6$
242. The expression  $\frac{-32x^8}{4x^2}$ ,  $x \neq 0$ , is equivalent to  
 [A]  $8x^4$  [B]  $-8x^4$   
 [C]  $8x^6$  [D]  $-8x^6$
243. If  $x \neq 0$ , then  $\frac{(x^2)^3}{x^5} \cdot 1000$  is equivalent to  
 [A] 0 [B] 1000  
 [C]  $1000x$  [D]  $1000 + x$
244. The expression  $\frac{5x^6y^2}{x^8y}$  is equivalent to  
 [A]  $5x^{14}y^3$  [B]  $\frac{5y}{x^2}$   
 [C]  $5x^2y$  [D]  $\frac{5y^3}{x^{14}}$
245. The expression  $\frac{(b^{2n+1})^3}{b^n \cdot b^{4n+3}}$  is equivalent to  
 [A]  $b^n$  [B]  $\frac{b^n}{2}$  [C]  $b^{-3n}$  [D]  $b^{-3n+1}$

A.A.13: Add, subtract, and multiply monomials and polynomials.

246. The sum of  $3x^2 + x + 8$  and  $x^2 - 9$  can be expressed as  
 [A]  $4x^2 + x - 1$  [B]  $4x^2 + x - 17$   
 [C]  $4x^4 + x - 1$  [D]  $3x^4 + x - 1$

247. The sum of  $3x^2 + 4x - 2$  and  $x^2 - 5x + 3$  is  
 [A]  $4x^2 - x + 1$  [B]  $4x^2 + x - 1$   
 [C]  $4x^2 - x - 1$  [D]  $4x^2 + x + 1$
248. If  $2x^2 - 4x + 6$  is subtracted from  $5x^2 + 8x - 2$ , the difference is  
 [A]  $-3x^2 - 12x + 8$  [B]  $-3x^2 + 4x + 4$   
 [C]  $3x^2 + 4x + 4$  [D]  $3x^2 + 12x - 8$
249. The expression  $(3x^2 + 2xy + 7) - (6x^2 - 4xy + 3)$  is equivalent to  
 [A]  $3x^2 - 6xy - 4$  [B]  $3x^2 - 2xy + 4$   
 [C]  $-3x^2 - 2xy + 4$  [D]  $-3x^2 + 6xy + 4$
250. The expression  $(2x^2 + 6x + 5) - (6x^2 + 3x + 5)$  is equivalent to  
 [A]  $4x^2 + 3x - 10$  [B]  $4x^2 - 3x$   
 [C]  $-4x^2 + 3x$  [D]  $-4x^2 - 3x + 10$
251. When  $3a^2 - 2a + 5$  is subtracted from  $a^2 + a - 1$ , the result is  
 [A]  $2a^2 - 3a - 6$  [B]  $2a^2 - 3a + 6$   
 [C]  $-2a^2 + 3a - 6$  [D]  $-2a^2 + 3a + 6$
252. When  $3x^2 - 2x + 1$  is subtracted from  $2x^2 + 7x + 5$ , the result will be  
 [A]  $-x^2 + 5x + 6$  [B]  $-x^2 + 9x + 4$   
 [C]  $x^2 - 9x - 4$  [D]  $x^2 + 5x + 6$
253. When  $-2x^2 + 4x + 2$  is subtracted from  $x^2 + 6x - 4$ , the result is  
 [A]  $3x^2 + 2x - 6$  [B]  $-3x^2 - 2x + 6$   
 [C]  $-x^2 + 10x - 2$  [D]  $2x^2 - 2x - 6$
254. If  $2x^2 - x + 6$  is subtracted from  $x^2 + 3x - 2$ , the result is  
 [A]  $x^2 + 2x - 8$  [B]  $x^2 - 4x + 8$   
 [C]  $-x^2 + 4x - 8$  [D]  $-x^2 + 2x - 8$
255. When  $3x^2 - 8x$  is subtracted from  $2x^2 + 3x$ , the difference is  
 [A]  $-x^2 - 11x$  [B]  $-x^2 + 11x$   
 [C]  $-x^2 - 5x$  [D]  $x^2 - 5x$
256. Subtract  $5x^2 - 7x - 6$  from  $9x^2 + 3x - 4$ .
257. The expression  $(x^2 - 5x - 2) - (-6x^2 - 7x - 3)$  is equivalent to  
 [A]  $7x^2 + 2x + 1$  [B]  $7x^2 - 2x + 1$   
 [C]  $7x^2 - 12x - 5$  [D]  $7x^2 + 2x - 5$
258. When  $3a^2 - 7a + 6$  is subtracted from  $4a^2 - 3a + 4$ , the result is  
 [A]  $a^2 - 10a - 2$  [B]  $a^2 + 4a - 2$   
 [C]  $-a^2 - 4a + 2$  [D]  $7a^2 - 10a + 10$
259. What is the product of  $(c + 8)$  and  $(c - 5)$ ?  
 [A]  $c^2 - 3c - 40$  [B]  $c^2 + 13c - 40$   
 [C]  $c^2 + 3c - 40$  [D]  $c^2 - 40$
260. The expression  $(a^2 + b^2)^2$  is equivalent to  
 [A]  $a^4 + b^4$  [B]  $a^4 + a^2b^2 + b^4$   
 [C]  $a^4 + 2a^2b^2 + b^4$  [D]  $a^4 + 4a^2b^2 + b^4$
261. The expression  $(x - 6)^2$  is equivalent to  
 [A]  $x^2 - 36$  [B]  $x^2 - 12x + 36$   
 [C]  $x^2 + 36$  [D]  $x^2 + 12x + 36$
- A.A.14: Divide a polynomial by a monomial or binomial, where the quotient has no remainder.
262. If  $x \neq 0$ , the expression  $\frac{x^2 + 2x}{x}$  is equivalent to  
 [A] 4 [B] 2 [C]  $3x$  [D]  $x + 2$

263. Which polynomial is the quotient of

$$\frac{6x^3 + 9x^2 + 3x}{3x} ?$$

- [A]  $2x^2 + 3x$       [B]  $6x^2 + 9x$   
[C]  $2x + 3$       [D]  $2x^2 + 3x + 1$

A.A.15: Find values of a variable for which an algebraic fraction is undefined.

264. For which value of  $x$  is the expression  $\frac{x-7}{x+2}$  undefined?

- [A] 0      [B] 7      [C] 2      [D] -2

265. For which value of  $x$  is the expression  $\frac{3x-6}{x-4}$  undefined?

- [A] -4      [B] 2      [C] 4      [D] 0

266. For which value of  $x$  will the fraction  $\frac{3}{2x+4}$  be undefined?

- [A] -4      [B] 2      [C] 0      [D] -2

267. For which value of  $x$  is the expression  $\frac{3}{x-2}$  undefined?

- [A] -2      [B] 0      [C] 3      [D] 2

268. Which expression is undefined when  $w = 3$ ?

- [A]  $\frac{w^2 + 2w}{5w}$       [B]  $\frac{3w}{3w^2}$   
[C]  $\frac{w+1}{w^2 - 3w}$       [D]  $\frac{w-3}{w+1}$

A.A.16: Simplify fractions with polynomials in the numerator and denominator by factoring both and renaming them to lowest terms.

269. Simplify:  $\frac{9x^2 - 15xy}{9x^2 - 25y^2}$

270. Simplify:  $\frac{x^2 + 6x + 5}{x^2 - 25}$

271. Which expression is in simplest form?

- [A]  $\frac{9}{x^2 + 9}$       [B]  $\frac{x}{x^2}$   
[C]  $\frac{x^2 - 4}{x + 2}$       [D]  $\frac{x^2 - 6x + 9}{x^2 - x - 6}$

272. Written in simplest form, the expression  $\frac{x^2y^2 - 9}{3 - xy}$  is equivalent to

- [A]  $-(3 + xy)$       [B]  $\frac{1}{3 + xy}$   
[C]  $3 + xy$       [D]  $-1$

273. Express the following rational expression in simplest form:

$$\frac{9 - x^2}{10x^2 - 28x - 6}$$

274. For all values of  $x$  for which the expression is defined,  $\frac{2x + x^2}{x^2 + 5x + 6}$  is equivalent to

- [A]  $\frac{1}{x+2}$       [B]  $\frac{x}{x+2}$   
[C]  $\frac{1}{x+3}$       [D]  $\frac{x}{x+3}$

275. Written in simplest form, the expression  $\frac{x^2 - 9x}{45x - 5x^2}$  is equivalent to

- [A] 5      [B] -5      [C]  $-\frac{1}{5}$       [D]  $\frac{1}{5}$

276. The expression  $\frac{3y^2 - 12y}{4y^2 - y^3}$  is equivalent to

- [A]  $\frac{3}{4} - \frac{12}{y^2}$       [B]  $-\frac{3}{y}$       [C]  $-\frac{9}{4}$       [D]  $\frac{3}{y}$



A.A.17: Add or subtract fractional expressions with monomial or like binomial denominators.

277. What is the least common denominator of  $\frac{1}{2}$ ,

$$\frac{2}{7x}, \text{ and } \frac{5}{x}?$$

- [A]  $9x$  [B]  $14x^2$  [C]  $2x$  [D]  $14x$

278. Which expression is equivalent to  $\frac{a}{x} + \frac{b}{2x}$ ?

[A]  $\frac{a+b}{2x}$  [B]  $\frac{a+b}{3x}$

[C]  $\frac{2a+b}{2x}$  [D]  $\frac{2a+b}{x}$

279. The sum of  $\frac{3}{x} + \frac{2}{5}$ ,  $x \neq 0$ , is

[A]  $\frac{2x+15}{x+5}$  [B]  $\frac{2x+15}{5x}$

[C]  $\frac{5}{x+5}$  [D]  $\frac{1}{x}$

280. What is the sum of  $\frac{2}{x}$  and  $\frac{x}{2}$ ?

[A]  $\frac{4+x^2}{2x}$  [B]  $\frac{2+x}{2x}$

[C]  $1$  [D]  $\frac{4+x}{2x}$

281. What is the sum of  $\frac{3}{7n}$  and  $\frac{7}{3n}$ ?

[A]  $\frac{10}{21n}$  [B]  $\frac{58}{21n}$  [C]  $\frac{42}{21n}$  [D]  $\frac{1}{n}$

282. The expression  $\frac{y}{x} - \frac{1}{2}$  is equivalent to

[A]  $\frac{2y-x}{2x}$  [B]  $\frac{1-y}{2x}$

[C]  $\frac{x-2y}{2x}$  [D]  $\frac{y-1}{x-2}$

A.A.18: Multiply and divide algebraic fractions and express the product or quotient in simplest form.

283. Perform the indicated operation and express the result in simplest terms:

$$\frac{x}{x+3} \div \frac{3x}{x^2-9}$$

284. A rectangular prism has a length of  $\frac{2x^2+2x-24}{4x^2+x}$ , a width of  $\frac{x^2+x-6}{x+4}$ , and a

height of  $\frac{8x^2+2x}{x^2-9}$ . For all values of  $x$  for which it is defined, express, in terms of  $x$ , the volume of the prism in simplest form.

285. If the length of a rectangular garden is represented by  $\frac{x^2+2x}{x^2+2x-15}$  and its width is

represented by  $\frac{2x-6}{2x+4}$ , which expression represents the area of the garden?

[A]  $x$  [B]  $x+5$

[C]  $\frac{x^2+2x}{2(x+5)}$  [D]  $\frac{x}{x+5}$

286. If  $f(x) = \frac{3x^2-27}{18x+30}$  and  $g(x) = \frac{x^2-7x+12}{3x^2-7x-20}$ , find  $f(x) \div g(x)$  for all values of  $x$  for which the expression is defined and express your answer in simplest form.

287. Express in simplest form:

$$\frac{4x+8}{x+1} \cdot \frac{2-x}{3x-15} \div \frac{x^2-4}{2x^2-8x-10}$$

288. Perform the indicated operations and simplify completely:

$$\frac{x^2-9}{x^2-5x} \cdot \frac{5x-x^2}{x^2-x-12} \div \frac{x-4}{x^2-8x+16}$$

A.A.19: Identify and factor the difference of two perfect squares.

289. What is a common factor of  $x^2 - 9$  and  $x^2 - 5x + 6$ ?

- [A]  $x - 2$  [B]  $x^2$   
[C]  $x - 3$  [D]  $x + 3$

290. Expressed in factored form, the binomial  $4a^2 - 9b^2$  is equivalent to

- [A]  $(4a - 3b)(a + 3b)$   
[B]  $(2a + 3b)(2a - 3b)$   
[C]  $(2a - 3b)(2a - 3b)$   
[D]  $(2a - 9b)(2a + b)$

291. One of the factors of  $4x^2 - 9$  is

- [A]  $(2x + 3)$  [B]  $(4x - 3)$   
[C]  $(x - 3)$  [D]  $(x + 3)$

A.A.20: Factor algebraic expressions completely, including trinomials with a lead coefficient of one (after factoring a GCF).

292. If  $3x$  is one factor of  $3x^2 - 9x$ , what is the other factor?

- [A]  $x^2 - 6x$  [B]  $x - 3$   
[C]  $x + 3$  [D]  $3x$

293. If one factor of  $56x^4y^3 - 42x^2y^6$  is  $14x^2y^3$ , what is the other factor?

- [A]  $4x^2 - 3y^2$  [B]  $4x^2y - 3xy^3$   
[C]  $4x^2y - 3xy^2$  [D]  $4x^2 - 3y^3$

294. When  $3x^2 - 6x$  is divided by  $3x$ , the result is

- [A]  $2x$  [B]  $-2x$   
[C]  $x - 2$  [D]  $x + 2$

295. The expression  $(50x^3 - 60x^2 + 10x) \div 10x$  is equivalent to

- [A]  $5x^2 - 60x^2 + 10x$  [B]  $5x^3 - 6x^2 + x$   
[C]  $5x^2 - 6x$  [D]  $5x^2 - 6x + 1$

296. Which expression is a factor of  $n^2 + 3n - 54$ ?

- [A]  $n + 6$  [B]  $n^2 + 9$   
[C]  $n + 9$  [D]  $n - 9$

297. What are the factors of  $x^2 - 10x - 24$ ?

- [A]  $(x - 4)(x - 6)$  [B]  $(x - 4)(x + 6)$   
[C]  $(x - 12)(x + 2)$  [D]  $(x + 12)(x - 2)$

298. Factored completely, the expression  $2y^2 + 12y - 54$  is equivalent to

- [A]  $2(y - 3)(y - 9)$  [B]  $2(y + 9)(y - 3)$   
[C]  $(2y + 6)(y - 9)$  [D]  $(y + 6)(2y - 9)$

299. Factor completely:  $3x^2 + 15x - 42$

A.A.21: Determine whether a given value is a solution to a given linear equation in one variable or linear inequality in one variable.

300. In the set of positive integers, what is the solution set of the inequality  $2x - 3 < 5$ ?

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

301. Which number is in the solution set of the inequality  $5x + 3 > 38$ ?

- [A] 5 [B] 7 [C] 6 [D] 8

302. Find all negative odd integers that satisfy the following inequality:  
 $-3x + 1 \leq 17$

A.A.23: Solve literal equations for a given variable.

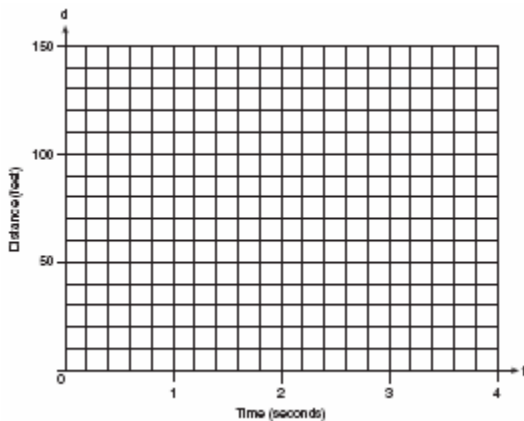
303. The equation  $P = 2L + 2W$  is equivalent to

- [A]  $2L = \frac{P}{2W}$  [B]  $L = \frac{P + 2W}{2}$   
[C]  $L = P - W$  [D]  $L = \frac{P - 2W}{2}$

304. In the equation  $A = p + prt$ ,  $t$  is equivalent to
- [A]  $\frac{A - pr}{p}$       [B]  $\frac{A}{pr} - p$   
 [C]  $\frac{A}{p} - pr$       [D]  $\frac{A - p}{pr}$
305. The formula for the volume of a right circular cylinder is  $V = \pi r^2 h$ . The value of  $h$  can be expressed as
- [A]  $\frac{\pi r^2}{V}$       [B]  $\frac{V}{\pi r^2}$   
 [C]  $\frac{V}{\pi r^2}$       [D]  $V - \pi r^2$
306. The formula for potential energy is  $P = mgh$ , where  $P$  is potential energy,  $m$  is mass,  $g$  is gravity, and  $h$  is height. Which expression can be used to represent  $g$ ?
- [A]  $P - mh$       [B]  $\frac{P}{mh}$   
 [C]  $P - m - h$       [D]  $\frac{P}{m} - h$
307. Shoe sizes and foot length are related by the formula  $S = 3F - 24$ , where  $S$  represents the shoe size and  $F$  represents the length of the foot, in inches.
- a* Solve the formula for  $F$ .  
*b* To the *nearest tenth of an inch*, how long is the foot of a person who wears a size  $10\frac{1}{2}$  shoe?
308. The volume of any spherical balloon can be found by using the formula  $V = \frac{4}{3}\pi r^3$ .  
 Write an equation for  $r$  in terms of  $V$  and  $\pi$ .
309. If  $2m + 2p = 16$ ,  $p$  equals
- [A]  $8 - m$       [B]  $16 - m$   
 [C]  $16 + 2m$       [D]  $9m$
310. If  $bx - 2 = K$ , then  $x$  equals
- [A]  $\frac{K + 2}{b}$       [B]  $\frac{K}{b} + 2$   
 [C]  $\frac{K - 2}{b}$       [D]  $\frac{2 - K}{b}$
311. If  $c = 2m + d$ , then  $m$  is equal to
- [A]  $\frac{c - d}{2}$       [B]  $c - \frac{d}{2}$   
 [C]  $d - 2c$       [D]  $\frac{c}{2} - d$
312. If  $x = 2a - b^2$ , then  $a$  equals
- [A]  $\frac{x - b^2}{2}$       [B]  $x + b^2$   
 [C]  $\frac{b^2 - x}{2}$       [D]  $\frac{x + b^2}{2}$
313. If  $2ax - 5x = 2$ , then  $x$  is equivalent to
- [A]  $7 - 2a$       [B]  $\frac{1}{a - 5}$   
 [C]  $\frac{2}{2a - 5}$       [D]  $\frac{2 + 5a}{2a}$
314. If  $\frac{x}{4} - \frac{a}{b} = 0$ ,  $b \neq 0$ , then  $x$  is equal to
- [A]  $-\frac{4a}{b}$       [B]  $\frac{4a}{b}$       [C]  $-\frac{a}{4b}$       [D]  $\frac{a}{4b}$
315. If  $\sqrt{x - a} = b$ ,  $x > a$ , which expression is equivalent to  $x$ ?
- [A]  $b^2 - a$       [B]  $b - a$   
 [C]  $b + a$       [D]  $b^2 + a$
- A.A.26: Solve algebraic proportions in one variable which result in linear or quadratic equations.
316. A cake recipe calls for 1.5 cups of milk and 3 cups of flour. Seth made a mistake and used 5 cups of flour. How many cups of milk should he use to keep the proportions correct?
- [A] 2      [B] 2.5      [C] 1.75      [D] 2.25

317. A total of \$450 is divided into equal shares. If Kate receives four shares, Kevin receives three shares, and Anna receives the remaining two shares, how much money did Kevin receive?
- [A] \$100 [B] \$200  
[C] \$150 [D] \$250
318. During a recent winter, the ratio of deer to foxes was 7 to 3 in one county of New York State. If there were 210 foxes in the county, what was the number of deer in the county?
- [A] 490 [B] 147 [C] 90 [D] 280
319. Sterling silver is made of an alloy of silver and copper in the ratio of 37:3. If the mass of a sterling silver ingot is 600 grams, how much silver does it contain?
- [A] 48.65 g [B] 450 g  
[C] 555 g [D] 200 g
320. There are 357 seniors in Harris High School. The ratio of boys to girls is 7:10. How many boys are in the senior class?
- [A] 117 [B] 210 [C] 147 [D] 107
321. The profits in a business are to be shared by the three partners in the ratio of 3 to 2 to 5. The profit for the year was \$176,500. Determine the number of dollars each partner is to receive.
322. At the Phoenix Surfboard Company, \$306,000 in profits was made last year. This profit was shared by the four partners in the ratio 3:3:5:7. How much *more* money did the partner with the largest share make than one of the partners with the smallest share?
323. Jordan and Missy are standing together in the schoolyard. Jordan, who is 6 feet tall, casts a shadow that is 54 inches long. At the same time, Missy casts a shadow that is 45 inches long. How tall is Missy?
- [A] 38 in [B] 5 ft 6 in  
[C] 86.4 in [D] 5 ft
324. An image of a building in a photograph is 6 centimeters wide and 11 centimeters tall. If the image is similar to the actual building and the actual building is 174 meters wide, how tall is the actual building, in meters?
325. If a girl 1.2 meters tall casts a shadow 2 meters long, how many meters tall is a tree that casts a shadow 75 meters long at the same time?
326. A 12-foot tree casts a 16-foot shadow. How many feet tall is a nearby tree that casts a 20-foot shadow at the same time?
327. What is the value of  $x$  in the equation  $\frac{x}{2x+1} = \frac{4}{3}$ ?
- [A] -5 [B]  $-\frac{4}{5}$  [C]  $-\frac{5}{4}$  [D]  $-\frac{1}{5}$
328. Solve for all values of  $x$  that satisfy the equation  $\frac{x}{x+3} = \frac{5}{x+7}$ .
329. Solve algebraically for  $x$ :  $\frac{1}{x} = \frac{x+1}{6}$
330. A rectangle is said to have a golden ratio when  $\frac{w}{h} = \frac{h}{w-h}$ , where  $w$  represents width and  $h$  represents height. When  $w = 3$ , between which two consecutive integers will  $h$  lie?
- A.A.27: Understand and apply the multiplication property of zero to solve quadratic equations with integral coefficients and integral roots.
331. What is the solution set of the equation  $3x^2 = 48$ ?
- [A] {4,-4} [B] {2,8}  
[C] {4,4} [D] {-2,-8}

332. Greg is in a car at the top of a roller-coaster ride. The distance,  $d$ , of the car from the ground as the car descends is determined by the equation  $d = 144 - 16t^2$ , where  $t$  is the number of seconds it takes the car to travel down to each point on the ride. How many seconds will it take Greg to reach the ground? For an algebraic solution show your work here.  
For a graphic solution show your work here.



333. What is the solution set of the equation  $x^2 - 5x = 0$ ?  
[A] {0,-5} [B] {5} [C] {0} [D] {0,5}
334. The solution set for the equation  $x^2 - 2x - 15 = 0$  is  
[A] {-5,-3} [B] {-5,3}  
[C] {5,-3} [D] {5,3}
335. The solution set of the equation  $x^2 - 4x - 12 = 0$  is  
[A] {-3,4} [B] {-6,2}  
[C] {-4,3} [D] {-2,6}
336. What is the solution set of  $m^2 - 3m - 10 = 0$ ?  
[A] {2,-5} [B] {3,-10}  
[C] {3,10} [D] {5,-2}
337. What is the solution set of the equation  $x^2 - 5x - 24 = 0$ ?  
[A] {3,8} [B] {-3,-8}  
[C] {-3,8} [D] {3,-8}

338. What is the solution set for the equation  $x^2 - 5x + 6 = 0$   
[A] {6,-1} [B] {2,3}  
[C] {-2,-3} [D] {-6,1}
339. What is the solution set of the equation  $x^2 + 11x + 28 = 0$ ?  
[A] {-7,4} [B] {3,4}  
[C] {-3,-4} [D] {-7,-4}
340. The solution set for the equation  $x^2 - 5x = 6$  is  
[A] {2,-3} [B] {-2,3}  
[C] {-1,6} [D] {1,-6}
341. One of the roots of the equation  $x^2 + 3x - 18 = 0$  is 3. What is the other root?  
[A] -21 [B] -6 [C] 6 [D] 15
342. Solve for  $x$ :  $x^2 + 3x - 40 = 0$
343. Solve for  $x$ :  $x^2 + 3x - 28 = 0$
344. Solve for  $x$ :  $x^2 + 2x - 24 = 0$
- A.A.28: Understand the difference and connection between roots of a quadratic equation and factors of a quadratic expression.
345. If  $(x - 4)$  is a factor of  $x^2 - x - w = 0$ , then the value of  $w$  is  
[A] -12 [B] 3 [C] 12 [D] -3
346. The larger root of the equation  $(x + 4)(x - 3) = 0$  is  
[A] 3 [B] -4 [C] 4 [D] -3

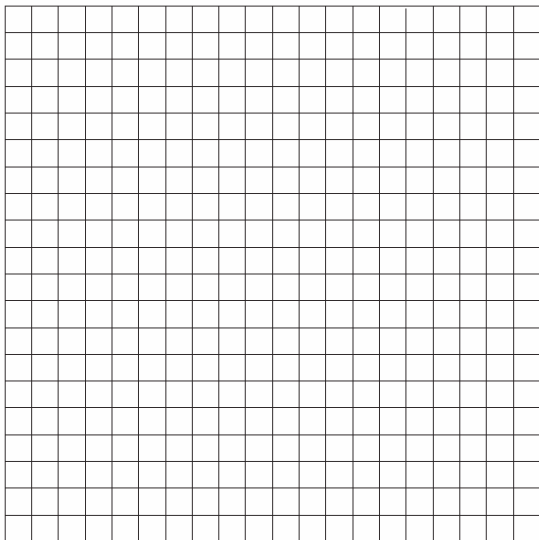
A.A.32: Explain slope as a rate of change between dependent and independent variables.

347. If the value of dependent variable  $y$  increases as the value of independent variable  $x$  increases, the graph of this relationship could be a

- [A] line with a positive slope
- [B] horizontal line      [C] vertical line
- [D] line with a negative slope

A.A.34: Write the equation of a line, given its slope and the coordinates of a point on the line.

348. A straight line with slope 5 contains the points  $(1,2)$  and  $(3,K)$ . Find the value of  $K$ . [The use of the accompanying grid is optional.]

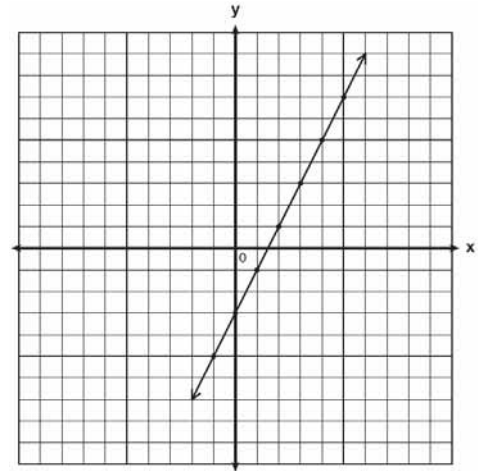


349. If point  $(-1,0)$  is on the line whose equation is  $y = 2x + b$ , what is the value of  $b$ ?

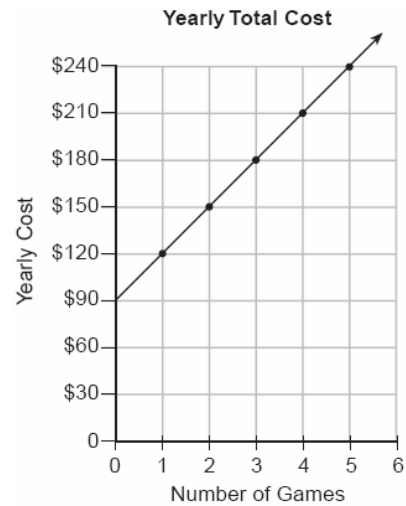
- [A] 3      [B] 1      [C] 0      [D] 2

A.A.35: Write the equation of a line, given the coordinates of two points on the line.

350. Write the equation for the line shown in the accompanying graph. Explain your answer.



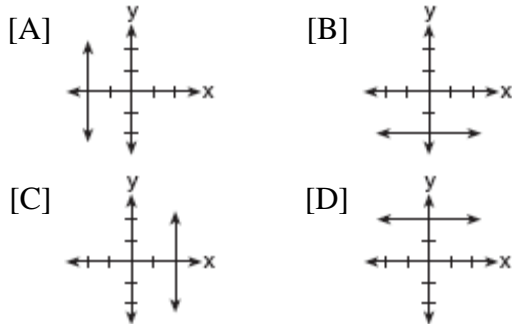
351. The accompanying graph represents the yearly cost of playing 0 to 5 games of golf at the Shadybrook Golf Course. What is the total cost of joining the club and playing 10 games during the year?



352. Line  $\ell$  contains the points  $(0,4)$  and  $(2,0)$ . Show that the point  $(-25,81)$  does or does not lie on line  $\ell$ .

A.A.36: Write the equation of a line parallel to the  $x$ - or  $y$ -axis.

353. Which graph represents the equation  $x = 2$ ?



354. Which statement describes the graph of  $x = 4$ ?

- [A] It has a slope of 4.
- [B] It is parallel to the  $y$ -axis.
- [C] It passes through the point  $(0, 4)$ .
- [D] It is parallel to the  $x$ -axis.

A.A.37: Determine the slope of a line, given its equation in any form.

355. The line  $3x - 2y = 12$  has

- [A] a slope of  $\frac{3}{2}$  and a  $y$ -intercept of  $-6$
- [B] a slope of 3 and a  $y$ -intercept of  $-2$
- [C] a slope of  $-\frac{3}{2}$  and a  $y$ -intercept of 6
- [D] a slope of  $-3$  and a  $y$ -intercept of  $-6$

356. What is the slope of the line whose equation is  $2y = 5x + 4$ ?

- [A]  $\frac{5}{2}$     [B] 2    [C]  $\frac{2}{5}$     [D] 5

357. What is the slope of the line whose equation is  $3x - 4y - 16 = 0$ ?

- [A]  $\frac{4}{3}$     [B]  $-4$     [C]  $\frac{3}{4}$     [D] 3

358. What is the slope of the linear equation  $5y - 10x = -15$ ?

- [A]  $-15$     [B] 2    [C] 10    [D]  $-10$

A.A.38: Determine if two lines are parallel, given their equations in any form.

359. Which equation represents a line parallel to the line  $y = 2x - 5$ ?

- [A]  $y = -\frac{1}{2}x - 5$     [B]  $y = 5x - 2$
- [C]  $y = 2x + 5$     [D]  $y = -2x - 5$

360. Which equation represents a line that is parallel to the line whose equation is  $2x + 3y = 12$ ?

- [A]  $6y - 4x = 2$     [B]  $6y + 4x = 2$
- [C]  $6x + 4y = -2$     [D]  $4x - 6y = 2$

A.A.39: Determine whether a given is on a line, given the equation of the line.

361. The graph of the equation  $x + 3y = 6$  intersects the  $y$ -axis at the point whose coordinates are

- [A]  $(0, 2)$     [B]  $(6, 0)$
- [C]  $(0, 6)$     [D]  $(0, 18)$

362. Point  $(k, -3)$  lies on the line whose equation is  $x - 2y = -2$ . What is the value of  $k$ ?

- [A] 8    [B]  $-6$     [C] 6    [D]  $-8$

363. The graph of the equation  $2x + 6y = 4$  passes through point  $(x, -2)$ . What is the value of  $x$ ?

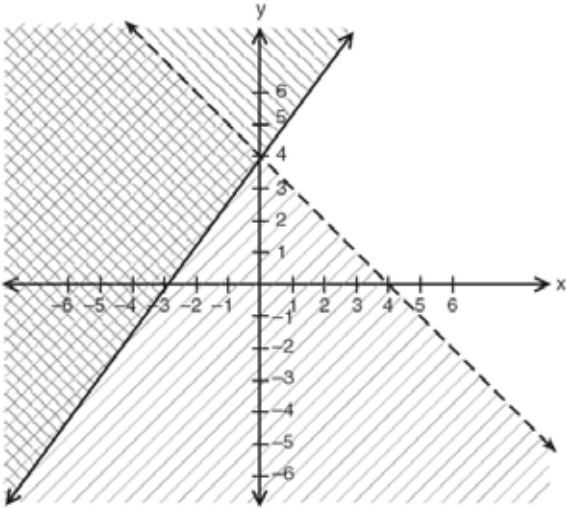
- [A]  $-4$     [B] 16    [C] 8    [D] 4

A.A.40: Determine whether a given point is in the solution set of a system of linear inequalities.

364. Which ordered pair is not in the solution set of  $y > 2x + 1$ ?

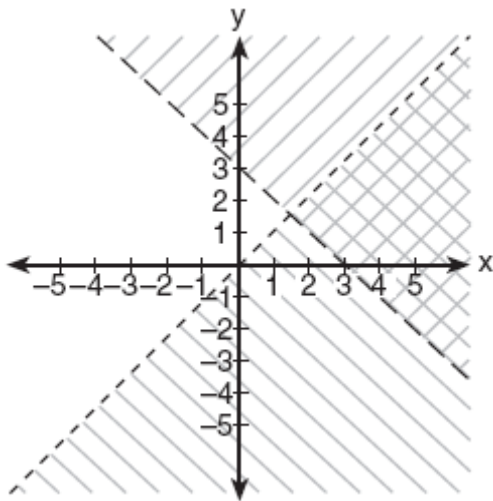
- [A]  $(1, 6)$     [B]  $(2, 5)$     [C]  $(1, 4)$     [D]  $(3, 8)$

365. Which point is in the solution set of the system of inequalities shown in the accompanying graph?



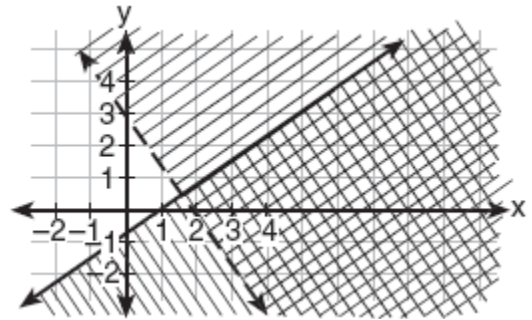
- [A] (-4, 1)                      [B] (0, 4)  
[C] (2, 4)                        [D] (4, -1)

366. Which ordered pair is in the solution set of the system of inequalities shown in the accompanying graph?



- [A] (0,0)    [B] (0,1)    [C] (3,2)    [D] (1,5)

367. Which coordinate point is in the solution set for the system of inequalities shown in the accompanying graph?



- [A] (3,1)                          [B] (1,-1)  
[C] (2,2)                        [D] (0,1)

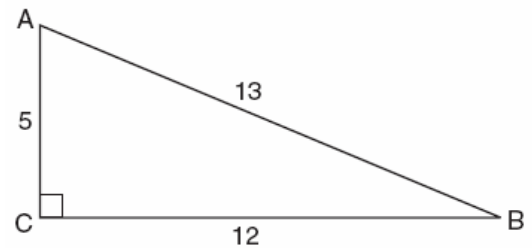
A.A.41: Determine the vertex and axis of symmetry of a parabola, given its equation.

368. What is the axis of symmetry of the graph of the equation  $x = y^2$ ?

- [A] y-axis                          [B] x-axis  
[C] line  $y = -x$                 [D] line  $y = x$

A.A.42: Find the sine, cosine, and tangent ratios of an angle of a right triangle, given the lengths of the sides.

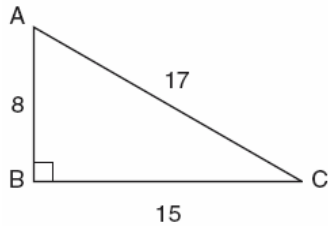
369. Which ratio represents  $\cos A$  in the accompanying diagram of  $\triangle ABC$ ?



- [A]  $\frac{12}{13}$     [B]  $\frac{12}{5}$     [C]  $\frac{5}{13}$     [D]  $\frac{13}{5}$



370. In the accompanying diagram of right triangle  $ABC$ ,  $AB = 8$ ,  $BC = 15$ ,  $AC = 17$ , and  $m\angle ABC = 90$ .

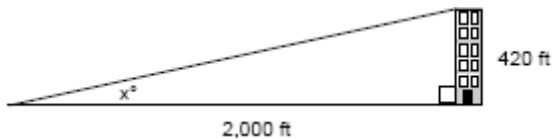


What is  $\tan \angle C$ ?

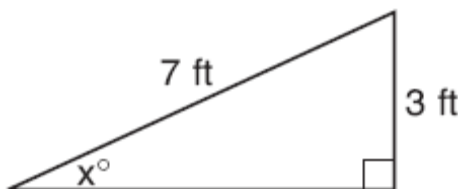
- [A]  $\frac{8}{17}$  [B]  $\frac{8}{15}$  [C]  $\frac{17}{15}$  [D]  $\frac{15}{17}$

A.A.43: Determine the measure of an angle of a right triangle, given an acute angle and the length of another side.

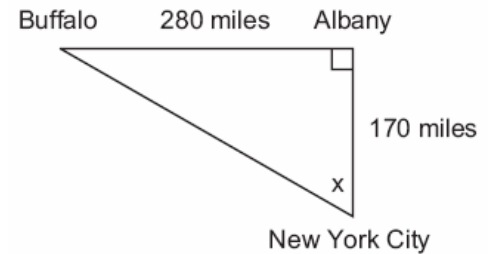
371. A person standing on level ground is 2,000 feet away from the foot of a 420-foot-tall building, as shown in the accompanying diagram. To the *nearest degree*, what is the value of  $x$ ?



372. Ron and Francine are building a ramp for performing skateboard stunts, as shown in the accompanying diagram. The ramp is 7 feet long and 3 feet high. What is the measure of the angle,  $x$ , that the ramp makes with the ground, to the *nearest tenth of a degree*?



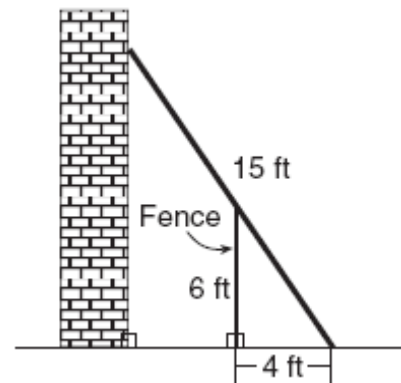
373. As seen in the accompanying diagram, a person can travel from New York City to Buffalo by going north 170 miles to Albany and then west 280 miles to Buffalo.



*a* If an engineer wants to design a highway to connect New York City directly to Buffalo, at what angle,  $x$ , would she need to build the highway? Find the angle to the *nearest degree*.

*b* To the *nearest mile*, how many miles would be saved by traveling directly from New York City to Buffalo rather than by traveling first to Albany and then to Buffalo?

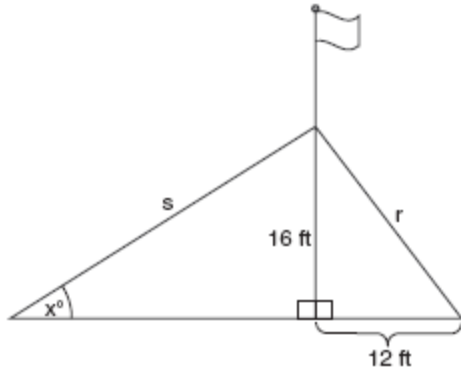
374. In the accompanying diagram, the base of a 15-foot ladder rests on the ground 4 feet from a 6-foot fence.



*a* If the ladder touches the top of the fence and the side of a building, what angle, to the *nearest degree*, does the ladder make with the ground?

*b* Using the angle found in part *a*, determine how far the top of the ladder reaches up the side of the building, to the *nearest foot*.

375. The accompanying diagram shows a flagpole that stands on level ground. Two cables,  $r$  and  $s$ , are attached to the pole at a point 16 feet above the ground. The combined length of the two cables is 50 feet. If cable  $r$  is attached to the ground 12 feet from the base of the pole, what is the measure of the angle,  $x$ , to the nearest degree, that cable  $s$  makes with the ground?



A.A.44: Find the measure of a side of a right triangle, given an acute angle and the length of another side.

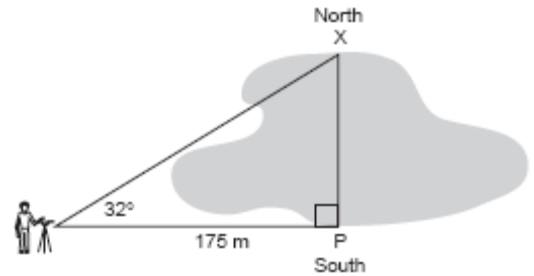
376. The angle of elevation from a point 25 feet from the base of a tree on level ground to the top of the tree is  $30^\circ$ . Which equation can be used to find the height of the tree?

[A]  $30^2 + 25^2 = x^2$       [B]  $\sin 30^\circ = \frac{x}{25}$

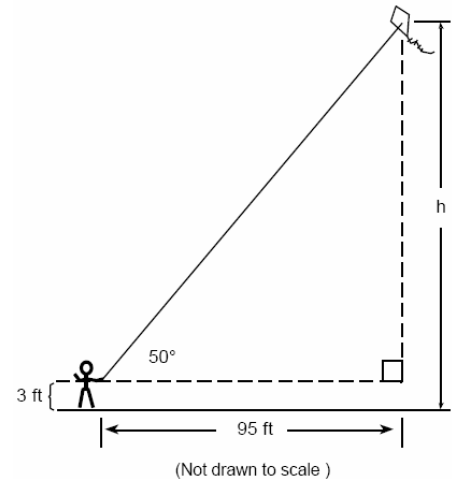
[C]  $\cos 30^\circ = \frac{x}{25}$       [D]  $\tan 30^\circ = \frac{x}{25}$

377. A person measures the angle of depression from the top of a wall to a point on the ground. The point is located on level ground 62 feet from the base of the wall and the angle of depression is  $52^\circ$ . How high is the wall, to the nearest tenth of a foot?

378. A surveyor needs to determine the distance across the pond shown in the accompanying diagram. She determines that the distance from her position to point  $P$  on the south shore of the pond is 175 meters and the angle from her position to point  $X$  on the north shore is  $32^\circ$ . Determine the distance,  $PX$ , across the pond, rounded to the nearest meter.

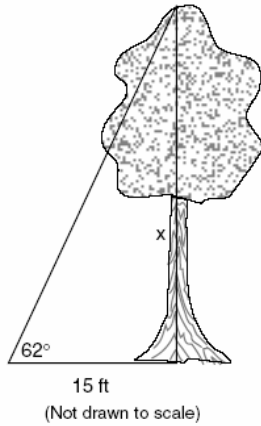


379. Joe is holding his kite string 3 feet above the ground, as shown in the accompanying diagram. The distance between his hand and a point directly under the kite is 95 feet. If the angle of elevation to the kite is  $50^\circ$ , find the height,  $h$ , of his kite, to the nearest foot.

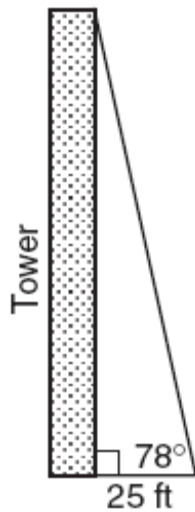


380. A 10-foot ladder is to be placed against the side of a building. The base of the ladder must be placed at an angle of  $72^\circ$  with the level ground for a secure footing. Find, to the nearest inch, how far the base of the ladder should be from the side of the building and how far up the side of the building the ladder will reach.

381. Find, to the *nearest tenth of a foot*, the height of the tree represented in the accompanying diagram.



382. From a point on level ground 25 feet from the base of a tower, the angle of elevation to the top of the tower is  $78^\circ$ , as shown in the accompanying diagram. Find the height of the tower, to the *nearest tenth of a foot*.

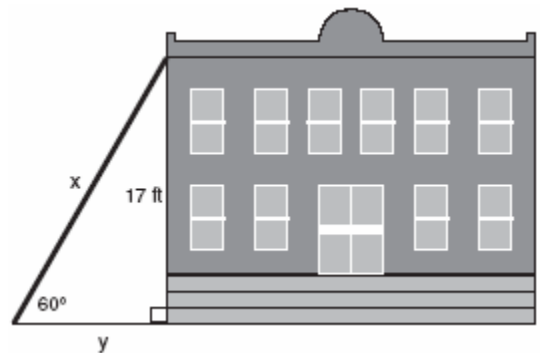


383. A ship on the ocean surface detects a sunken ship on the ocean floor at an angle of depression of  $50^\circ$ . The distance between the ship on the surface and the sunken ship on the ocean floor is 200 meters. If the ocean floor is level in this area, how far above the ocean floor, to the *nearest meter*, is the ship on the surface?

384. In the accompanying diagram, a ladder leaning against a building makes an angle of  $58^\circ$  with level ground. If the distance from the foot of the ladder to the building is 6 feet, find, to the *nearest foot*, how far up the building the ladder will reach.

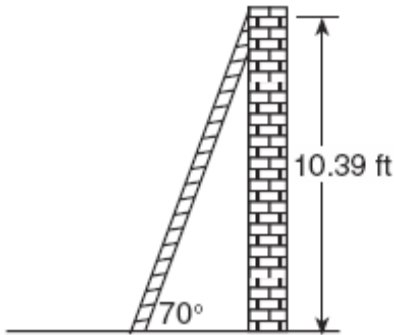


385. Draw and label a diagram of the path of an airplane climbing at an angle of  $11^\circ$  with the ground. Find, to the *nearest foot*, the ground distance the airplane has traveled when it has attained an altitude of 400 feet.
386. In the accompanying diagram,  $x$  represents the length of a ladder that is leaning against a wall of a building, and  $y$  represents the distance from the foot of the ladder to the base of the wall. The ladder makes a  $60^\circ$  angle with the ground and reaches a point on the wall 17 feet above the ground. Find the number of feet in  $x$  and  $y$ .



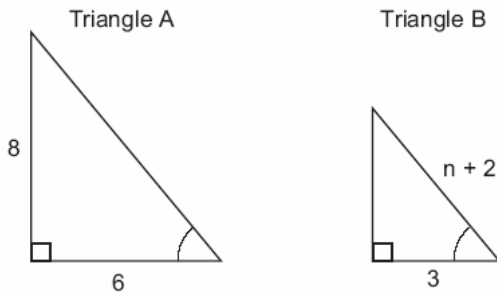
387. A tree casts a shadow that is 20 feet long. The angle of elevation from the end of the shadow to the top of the tree is  $66^\circ$ . Determine the height of the tree, to the *nearest foot*.

388. As shown in the accompanying diagram, a ladder is leaning against a vertical wall, making an angle of  $70^\circ$  with the ground and reaching a height of 10.39 feet on the wall. Find, to the *nearest foot*, the length of the ladder. Find, to the *nearest foot*, the distance from the base of the ladder to the wall.

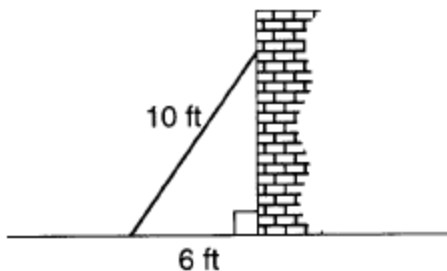


A.A.45: Determine the measure of a third side of a right triangle using the Pythagorean theorem, given the lengths of any two sides.

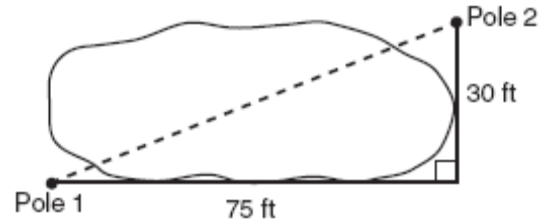
389. In the accompanying diagram, triangle A is similar to triangle B. Find the value of  $n$ .



390. A wall is supported by a brace 10 feet long, as shown in the diagram below. If one end of the brace is placed 6 feet from the base of the wall, how many feet up the wall does the brace reach?



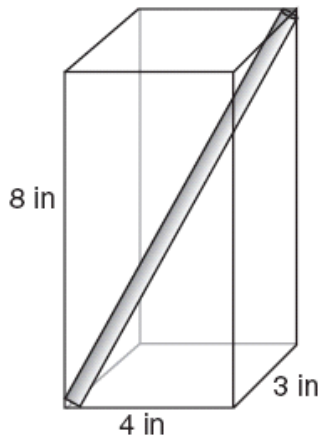
391. The NuFone Communications Company must run a telephone line between two poles at opposite ends of a lake, as shown in the accompanying diagram. The length and width of the lake are 75 feet and 30 feet, respectively.



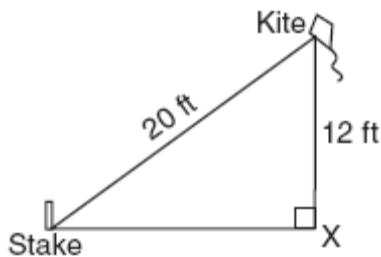
What is the distance between the two poles, to the *nearest foot*?

- [A] 81 [B] 69 [C] 105 [D] 45
392. How many feet from the base of a house must a 39-foot ladder be placed so that the top of the ladder will reach a point on the house 36 feet from the ground?
393. A woman has a ladder that is 13 feet long. If she sets the base of the ladder on level ground 5 feet from the side of a house, how many feet above the ground will the top of the ladder be when it rests against the house?
- [A] 8 [B] 12 [C] 9 [D] 11
394. If the length of the legs of a right triangle are 5 and 7, what is the length of the hypotenuse?
- [A]  $\sqrt{2}$  [B]  $\sqrt{74}$   
[C]  $2\sqrt{3}$  [D]  $2\sqrt{6}$
395. If the length of a rectangular television screen is 20 inches and its height is 15 inches, what is the length of its diagonal, in inches?
- [A] 25 [B] 13.2 [C] 5 [D] 35
396. The set of integers  $\{3,4,5\}$  is a Pythagorean triple. Another such set is
- [A]  $\{6,7,8\}$  [B]  $\{8,15,17\}$   
[C]  $\{6,8,12\}$  [D]  $\{6,12,13\}$

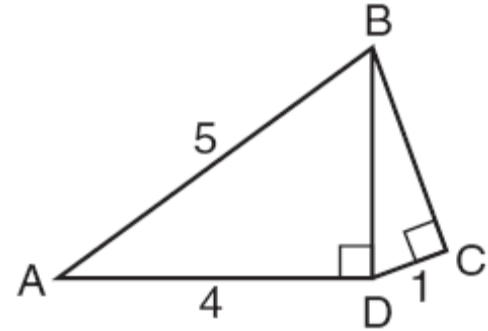
397. A straw is placed into a rectangular box that is 3 inches by 4 inches by 8 inches, as shown in the accompanying diagram. If the straw fits exactly into the box diagonally from the bottom left front corner to the top right back corner, how long is the straw, to the *nearest tenth of an inch*?



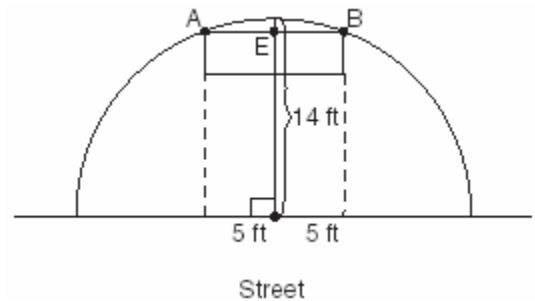
398. The accompanying diagram shows a kite that has been secured to a stake in the ground with a 20-foot string. The kite is located 12 feet from the ground, directly over point  $X$ . What is the distance, in feet, between the stake and point  $X$ ?



399. In the accompanying diagram of right triangles  $ABD$  and  $DBC$ ,  $AB = 5$ ,  $AD = 4$ , and  $CD = 1$ . Find the length of  $\overline{BC}$ , to the *nearest tenth*.



400. A builder is building a rectangular deck with dimensions of 16 feet by 30 feet. To ensure that the sides form  $90^\circ$  angles, what should each diagonal measure?  
 [A] 34 ft [B] 30 ft [C] 16 ft [D] 46 ft
401. The accompanying diagram shows a semicircular arch over a street that has a radius of 14 feet. A banner is attached to the arch at points  $A$  and  $B$ , such that  $AE = EB = 5$  feet. How many feet above the ground are these points of attachment for the banner?



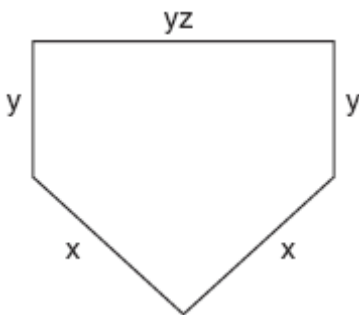
**GEOMETRY STRAND**  
(A.G.1-A.G.10)

*A.G.1: Find the area and/or perimeter of figures composed of polygons and circles or sectors of a circle. Note: Figures may include triangles, rectangles, squares, parallelograms, rhombuses, trapezoids, circles, semicircles, and regular polygons (perimeter area).*

402. The Pentagon building in Washington, D.C., is shaped like a regular pentagon. If the length of one side of the Pentagon is represented by  $n + 2$ , its perimeter would be represented by

[A]  $n + 10$                       [B]  $5n + 10$   
[C]  $5n + 2$                       [D]  $10n$

403. The lengths of the sides of home plate in a baseball field are represented by the expressions in the accompanying figure.



Which expression represents the perimeter of the figure?

[A]  $5xyz$                       [B]  $2x + 2y + yz$   
[C]  $2x + 3yz$                       [D]  $x^2 + y^3z$

404. The perimeter of a square is 56. Express the length of a diagonal of the square in simplest radical form.

405. If the area of a square garden is 48 square feet, what is the length, in feet, of one side of the garden?

[A]  $4\sqrt{6}$                       [B]  $4\sqrt{3}$   
[C]  $12\sqrt{2}$                       [D]  $16\sqrt{3}$

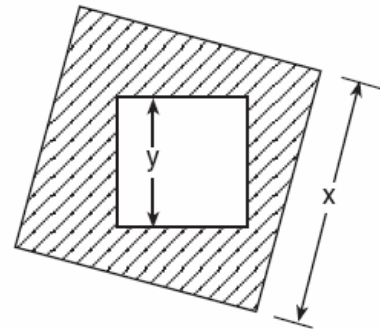
406. What is the area of a square whose perimeter is represented by  $12x$ ?

[A]  $6x\sqrt{2}$                       [B]  $12x^2$   
[C]  $144x^2$                       [D]  $9x^2$

407. The length of a side of a square window in Jessica's bedroom is represented by  $2x - 1$ . Which expression represents the area of the window?

[A]  $4x^2 + 4x - 1$                       [B]  $4x^2 - 4x + 1$   
[C]  $2x^2 + 1$                       [D]  $4x^2 + 1$

408. The accompanying diagram shows a square with side  $y$  inside a square with side  $x$ .



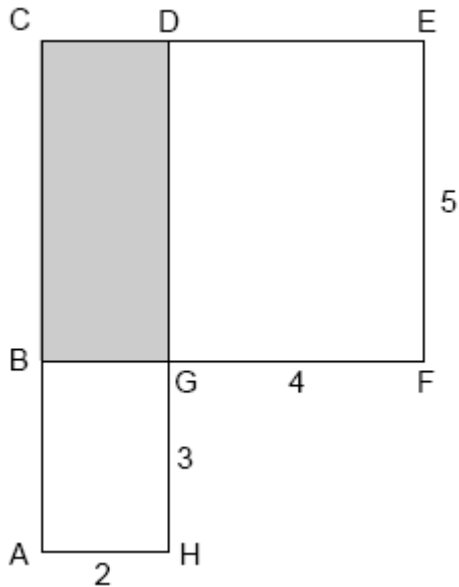
Which expression represents the area of the shaded region?

[A]  $x^2$                       [B]  $y^2 - x^2$   
[C]  $y^2$                       [D]  $x^2 - y^2$

409. A farmer has a rectangular field that measures 100 feet by 150 feet. He plans to increase the area of the field by 20%. He will do this by increasing the length and width by the same amount,  $x$ . Which equation represents the area of the new field?

[A]  $(100 + 2x)(150 + x) = 18,000$   
[B]  $(100 + x)(150 + x) = 18,000$   
[C]  $(100 + x)(150 + x) = 15,000$   
[D]  $2(100 + x) + 2(150 + x) = 15,000$

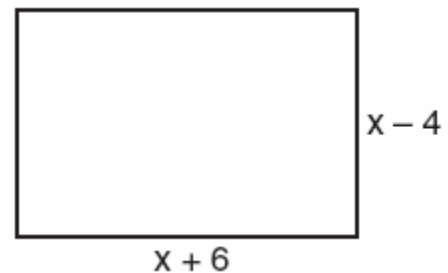
410. What is the length of one side of the square whose perimeter has the same numerical value as its area?  
[A] 5 [B] 3 [C] 4 [D] 6
411. In the accompanying figure,  $ACDH$  and  $BCEF$  are rectangles,  $AH = 2$ ,  $GH = 3$ ,  $GF = 4$ , and  $FE = 5$ .



What is the area of  $BCDG$ ?

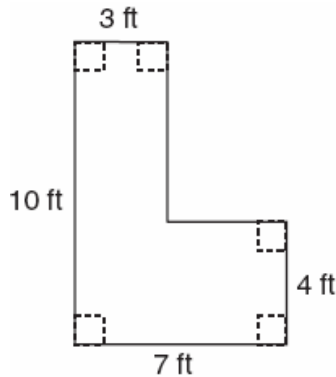
- [A] 8 [B] 20 [C] 10 [D] 6
412. An engineer measured the dimensions for a rectangular site by using a wooden pole of unknown length  $x$ . The length of the rectangular site is 2 pole measures increased by 3 feet, while the width is 1 pole measure decreased by 4 feet. Write an algebraic representation, in terms of  $x$ , for the perimeter of the site.
413. Jack is building a rectangular dog pen that he wishes to enclose. The width of the pen is 2 yards less than the length. If the area of the dog pen is 15 square yards, how many yards of fencing would he need to completely enclose the pen?

414. The area of the rectangular playground enclosure at South School is 500 square meters. The length of the playground is 5 meters longer than the width. Find the dimensions of the playground, in meters. [Only an algebraic solution will be accepted.]
415. Javon's homework is to determine the dimensions of his rectangular backyard. He knows that the length is 10 feet more than the width, and the total area is 144 square feet. Write an equation that Javon could use to solve this problem. Then find the dimensions, in feet, of his backyard.
416. A rectangular park is three blocks longer than it is wide. The area of the park is 40 square blocks. If  $w$  represents the width, write an equation in terms of  $w$  for the area of the park. Find the length and the width of the park.
417. Express both the perimeter and the area of the rectangle shown in the accompanying diagram as polynomials in simplest form.

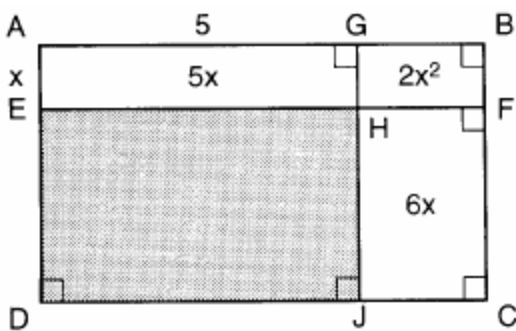


418. Mr. Santana wants to carpet exactly half of his rectangular living room. He knows that the perimeter of the room is 96 feet and that the length of the room is 6 feet longer than the width. How many square feet of carpeting does Mr. Santana need?
419. Kerry is planning a rectangular garden that has dimensions of 4 feet by 6 feet. Kerry wants one-half of the garden to have roses, and she says that the rose plot will have dimensions of 2 feet by 3 feet. Is she correct? Explain.

420. Determine the area, in square feet, of the *smallest* square that can contain a circle with a radius of 8 feet.
421. Keesha wants to tile the floor shown in the accompanying diagram. If each tile measures 1 foot by 1 foot and costs \$2.99, what will be the total cost, including an 8% sales tax, for tiling the floor?

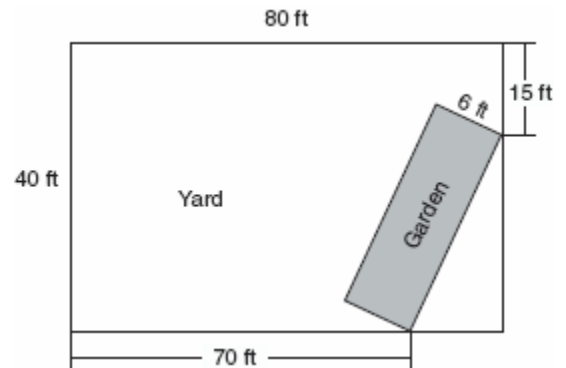


422. In the figure below, the large rectangle,  $ABCD$ , is divided into four smaller rectangles. The area of rectangle  $AEHG = 5x$ , the area of rectangle  $GHFB = 2x^2$ , the area of rectangle  $HJCF = 6x$ , segment  $AG = 5$ , and segment  $AE = x$ .

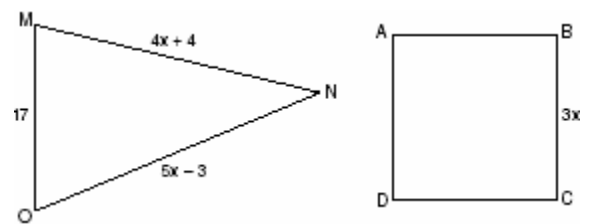


- a Find the area of the shaded region.  
b Write an expression for the area of the rectangle  $ABCD$  in terms of  $x$ .
423. Manuel plans to install a fence around the perimeter of his yard. His yard is shaped like a square and has an area of 40,000 square feet. The company that he hires charges \$2.50 per foot for the fencing and \$50.00 for the installation fee. What will be the cost of the fence, in dollars?

424. A rectangular garden is going to be planted in a person's rectangular backyard, as shown in the accompanying diagram. Some dimensions of the backyard and the width of the garden are given. Find the area of the garden to the *nearest square foot*.



425. Mr. James wanted to plant a garden that would be in the shape of a rectangle. He was given 80 feet of fencing to enclose his garden. He wants the length to be 10 feet more than twice the width. What are the dimensions, in feet, for a rectangular garden that will use exactly 80 feet of fencing?
426. In the accompanying diagram, the perimeter of  $\triangle MNO$  is equal to the perimeter of square  $ABCD$ . If the sides of the triangle are represented by  $4x + 4$ ,  $5x - 3$ , and 17, and one side of the square is represented by  $3x$ , find the length of a side of the square.



427. A homeowner wants to increase the size of a rectangular deck that now measures 15 feet by 20 feet, but building code laws state that a homeowner cannot have a deck larger than 900 square feet. If the length and the width are to be increased by the same amount, find, to the *nearest tenth*, the maximum number of feet that the length of the deck may be increased in size legally.



428. Chad had a garden that was in the shape of a rectangle. Its length was twice its width. He decided to make a new garden that was 2 feet longer and 2 feet wider than his first garden. If  $x$  represents the original width of the garden, which expression represents the difference between the area of his new garden and the area of the original garden?

- [A]  $2x^2$                       [B]  $x^2 + 3x + 2$   
[C]  $6x + 4$                       [D] 8

429. A small, open-top packing box, similar to a shoebox without a lid, is three times as long as it is wide, and half as high as it is long. Each square inch of the bottom of the box costs \$0.008 to produce, while each square inch of any side costs \$0.003 to produce. Write a function for the cost of the box described above. Using this function, determine the dimensions of a box that would cost \$0.69 to produce.

430. What is the perimeter of an equilateral triangle whose height is  $2\sqrt{3}$ ?

- [A] 12    [B]  $12\sqrt{3}$     [C] 6    [D]  $6\sqrt{3}$

431. The perimeter of an isosceles triangle is 71 centimeters. The measure of one of the sides is 22 centimeters. What are all the possible measures of the other two sides?

432. Sean knows the length of the base,  $b$ , and the area,  $A$ , of a triangular window in his bedroom. Which formula could he use to find the height,  $h$ , of this window?

- [A]  $h = \frac{2A}{b}$                       [B]  $h = 2A - b$   
[C]  $h = \frac{A}{2b}$                       [D]  $h = (2A)(b)$

433. If the midpoints of the sides of a triangle are connected, the area of the triangle formed is what part of the area of the original triangle?

- [A]  $\frac{1}{2}$     [B]  $\frac{1}{3}$     [C]  $\frac{1}{4}$     [D]  $\frac{3}{8}$

434. The second side of a triangle is two more than the first side, and the third side is three less than the first side. Which expression represents the perimeter of the triangle?

- [A]  $2x - 1$                       [B]  $x + 5$   
[C]  $3x - 1$                       [D]  $x^2 - x - 6$

435. If the base of a triangle is represented by  $x + 4$  and the height is represented by  $2x$ , which expression represents the area of the triangle?

- [A]  $(x + 4) + (2x)$                       [B]  $\frac{1}{2}(x + 4)(2x)$   
[C]  $\frac{1}{2}((x + 4) + (2x))$                       [D]  $(x + 4)(2x)$

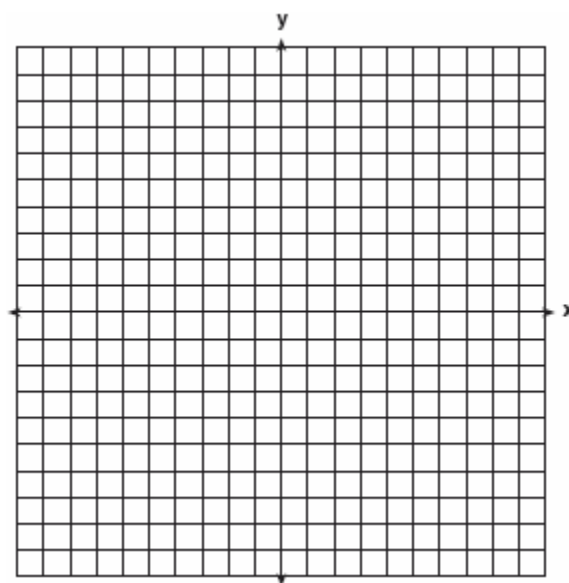
436. On the accompanying set of axes, graph and label the following lines:

$$y = 5$$

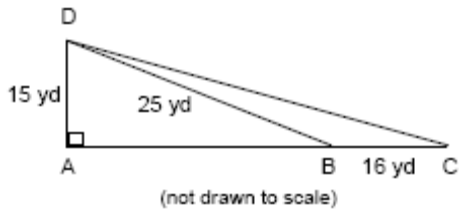
$$x = -4$$

$$y = \frac{5}{4}x + 5$$

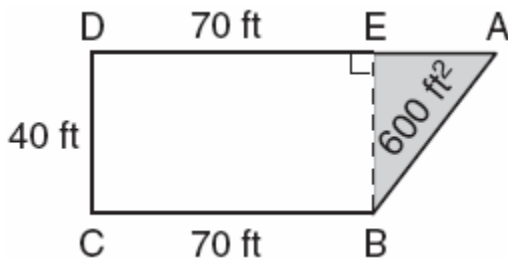
Calculate the area, in square units, of the triangle formed by the three points of intersection.



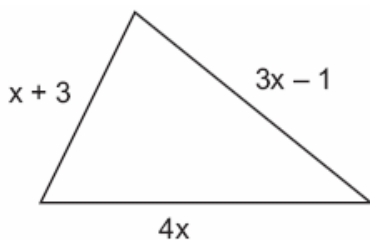
437. Mr. Gonzalez owns a triangular plot of land  $BCD$  with  $DB = 25$  yards and  $BC = 16$  yards. He wishes to purchase the adjacent plot of land in the shape of right triangle  $ABD$ , as shown in the accompanying diagram, with  $AD = 15$  yards. If the purchase is made, what will be the total number of square yards in the area of his plot of land,  $\triangle ACD$ ?



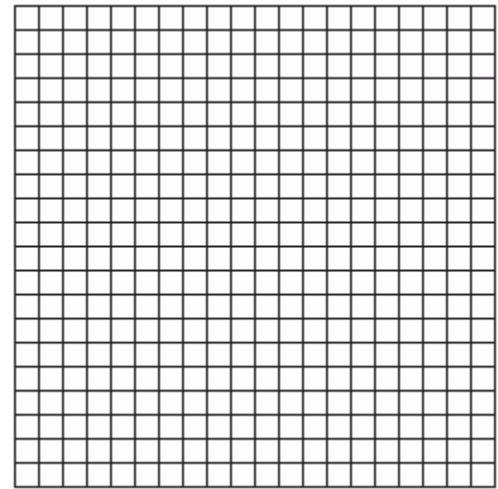
438. The plan of a parcel of land is represented by trapezoid  $ABCD$  in the accompanying diagram. If the area of  $\triangle ABE$  is 600 square feet, find the minimum number of feet of fence needed to completely enclose the entire parcel of land,  $ABCD$ .



439. The plot of land illustrated in the accompanying diagram has a perimeter of 34 yards. Find the length, in yards, of *each* side of the figure. Could these measures actually represent the measures of the sides of a triangle? Explain your answer.



440. On the accompanying grid, draw and label quadrilateral  $ABCD$  with points  $A(1,2)$ ,  $B(6,1)$ ,  $C(7,6)$ , and  $D(3,7)$ . On the same set of axes, plot and label quadrilateral  $A'B'C'D'$ , the reflection of quadrilateral  $ABCD$  in the  $y$ -axis. Determine the area, in square units, of quadrilateral  $A'B'C'D'$ .



441. A garden in the shape of an equilateral triangle has sides whose lengths are 10 meters. What is the area of the garden?
- [A]  $50\sqrt{3} m^2$       [B]  $50 m^2$   
 [C]  $25 m^2$       [D]  $25\sqrt{3} m^2$
442. If the perimeter of an equilateral triangle is 18, the length of the altitude of this triangle is
- [A]  $3\sqrt{3}$       [B] 3      [C]  $6\sqrt{3}$       [D] 6
443. The equation  $A = \frac{1}{2}(12)(3+7)$  is used to find the area of a trapezoid. Which calculation would *not* result in the correct area?
- [A]  $\frac{12}{2} \times \frac{10}{2}$       [B]  $\frac{12(3+7)}{2}$   
 [C]  $0.5(12)(10)$       [D]  $6(3+7)$
444. What is the approximate circumference of a circle with radius 3?
- [A] 28.27      [B] 7.07  
 [C] 18.85      [D] 9.42

445. What is the diameter of a circle whose circumference is 5?

- [A]  $\frac{5}{\pi}$  [B]  $\frac{5}{\pi^2}$  [C]  $\frac{2.5}{\pi^2}$  [D]  $\frac{2.5}{\pi}$

446. A wheel has a radius of 5 feet. What is the minimum number of *complete* revolutions that the wheel must make to roll at least 1,000 feet?

447. To measure the length of a hiking trail, a worker uses a device with a 2-foot-diameter wheel that counts the number of revolutions the wheel makes. If the device reads 1,100.5 revolutions at the end of the trail, how many miles long is the trail, to the *nearest tenth of a mile*?

448. Every time the pedals go through a  $360^\circ$  rotation on a certain bicycle, the tires rotate three times. If the tires are 24 inches in diameter, what is the minimum number of complete rotations of the pedals needed for the bicycle to travel at least 1 mile?

- [A] 12 [B] 281 [C] 561 [D] 5,280

449. If the circumference of a circle is  $10\pi$  inches, what is the area, in square inches, of the circle?

- [A]  $100\pi$  [B]  $25\pi$   
[C]  $10\pi$  [D]  $50\pi$

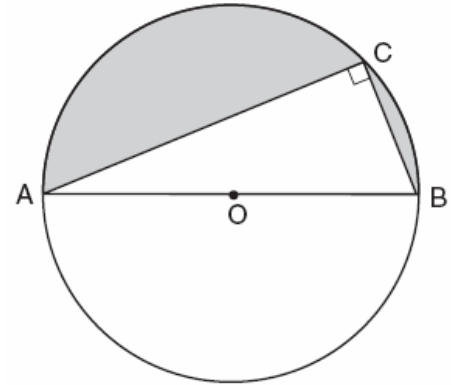
450. A dog is tied with a rope to a stake in the ground. The length of the rope is 5 yards. What is the area, in square yards, in which the dog can roam?

- [A]  $25\pi$  [B] 20 [C]  $10\pi$  [D] 25

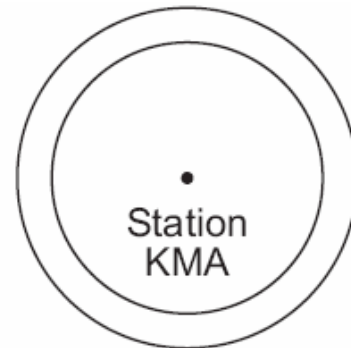
451. A circular garden has a diameter of 12 feet. How many bags of topsoil must Linda buy to cover the garden if one bag covers an area of 3 square feet?

- [A] 40 [B] 13 [C] 38 [D] 151

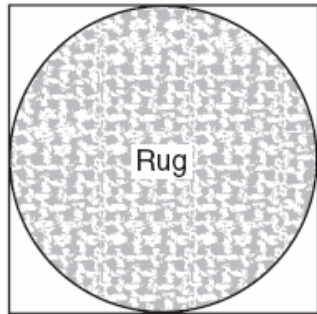
452. In the accompanying diagram, right triangle  $ABC$  is inscribed in circle  $O$ , diameter  $AB = 26$ , and  $CB = 10$ . Find, to the *nearest square unit*, the area of the shaded region.



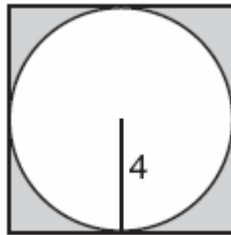
453. As shown in the accompanying diagram, radio station KMA is increasing its radio listening radius from 40 miles to 50 miles. How many additional square miles of listening area, to the *nearest tenth*, will the radio station gain?



454. Virginia has a circular rug on her square living room floor, as represented in the accompanying diagram. If her entire living room floor measures 100 square feet, what is the area of the part of the floor covered by the rug?

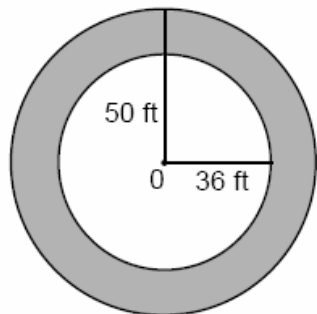


455. In the accompanying diagram, a circle with radius 4 is inscribed in a square.

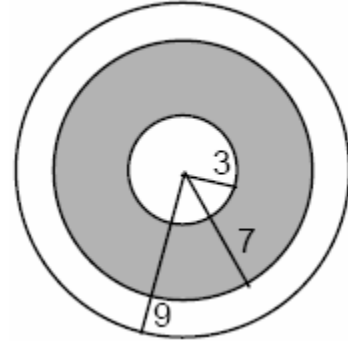


What is the area of the shaded region?

- [A]  $16 - 16\pi$                       [B]  $64\pi - 8\pi$   
[C]  $16 - 8\pi$                         [D]  $64 - 16\pi$
456. If asphalt pavement costs \$0.78 per square foot, determine, to the *nearest cent*, the cost of paving the shaded circular road with center O, an outside radius of 50 feet, and an inner radius of 36 feet, as shown in the accompanying diagram.

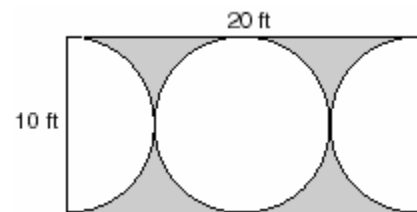


457. A target shown in the accompanying diagram consists of three circles with the same center. The radii of the circles have lengths of 3 inches, 7 inches, and 9 inches.



- a What is the area of the shaded region to the *nearest tenth of a square inch*?  
b To the *nearest percent*, what percent of the target is shaded?

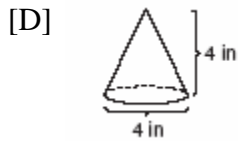
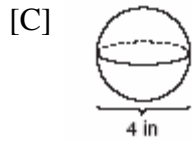
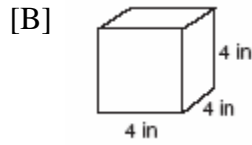
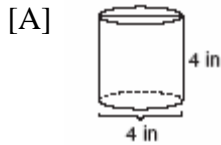
458. Mr. Petri has a rectangular plot of land with length = 20 feet and width = 10 feet. He wants to design a flower garden in the shape of a circle with two semicircles at each end of the center circle, as shown in the accompanying diagram. He will fill in the shaded area with wood chips. If one bag of wood chips covers 5 square feet, how many bags must he buy?



A.G.2: Use formulas to calculate volume and surface area of rectangular solids and cylinders.

459. A box in the shape of a cube has a volume of 64 cubic inches. What is the length of a side of the box?
- [A]  $21.\bar{3}$  in                              [B] 16 in  
[C] 4 in                                      [D] 8 in

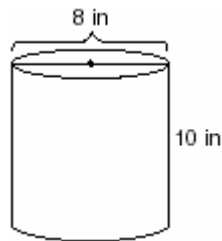
460. Which diagram represents the figure with the greatest volume?



461. The volume of a cube is 64 cubic inches. Its total surface area, in square inches, is

- [A] 96 [B] 16 [C] 48 [D] 576

462. A storage container in the shape of a right circular cylinder is shown in the accompanying diagram.



What is the volume of this container, to the nearest hundredth?

- [A]  $56.55 \text{ in}^3$  [B]  $502.65 \text{ in}^3$   
[C]  $251.33 \text{ in}^3$  [D]  $125.66 \text{ in}^3$

463. If the length of a rectangular prism is doubled, its width is tripled, and its height remains the same, what is the volume of the new rectangular prism?

- [A] six times the original volume  
[B] triple the original volume  
[C] double the original volume  
[D] nine times the original volume

464. A planned building was going to be 100 feet long, 75 feet deep, and 30 feet high. The owner decides to increase the volume of the building by 10% without changing the dimensions of the depth and the height. What will be the new length of this building?

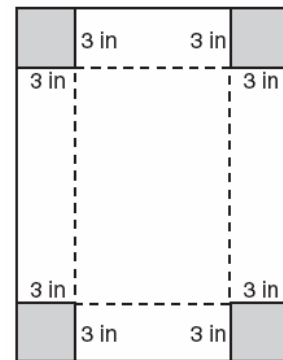
- [A] 108 ft [B] 110 ft  
[C] 112 ft [D] 106 ft

465. A cardboard box has length  $x - 2$ , width  $x + 1$ , and height  $2x$ .

a Write an expression, in terms of  $x$ , to represent the volume of the box.

b If  $x = 8$  centimeters, what is the number of cubic centimeters in the volume of the box?

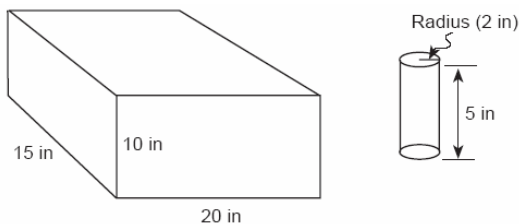
466. Deborah built a box by cutting 3-inch squares from the corners of a rectangular sheet of cardboard, as shown in the accompanying diagram, and then folding the sides up. The volume of the box is 150 cubic inches, and the longer side of the box is 5 inches more than the shorter side. Find the number of inches in the shorter side of the *original* sheet of cardboard.



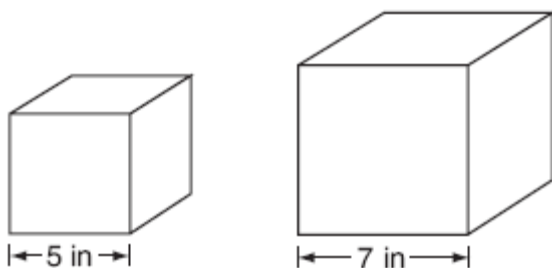
467. The volume of a rectangular pool is 1,080 cubic meters. Its length, width, and depth are in the ratio 10:4:1. Find the number of meters in each of the three dimensions of the pool.

468. A fish tank with a rectangular base has a volume of 3,360 cubic inches. The length and width of the tank are 14 inches and 12 inches, respectively. Find the height, in inches, of the tank.

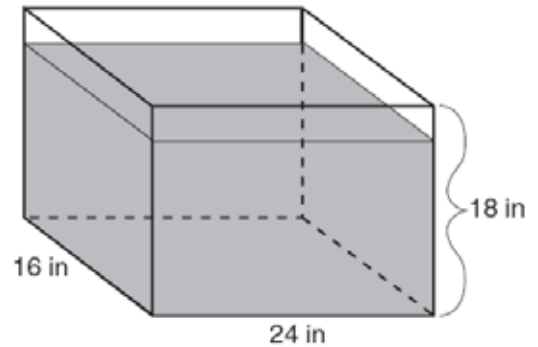
469. The dimensions of a brick, in inches, are 2 by 4 by 8. How many such bricks are needed to have a total volume of exactly 1 cubic foot?
470. Tina's preschool has a set of cardboard building blocks, each of which measures 9 inches by 9 inches by 4 inches. How many of these blocks will Tina need to build a wall 4 inches thick, 3 feet high, and 12 feet long?
471. Tamika has a hard rubber ball whose circumference measures 13 inches. She wants to box it for a gift but can only find cube-shaped boxes of sides 3 inches, 4 inches, 5 inches, or 6 inches. What is the *smallest* box that the ball will fit into with the top on?
472. In the accompanying diagram, a rectangular container with the dimensions 10 inches by 15 inches by 20 inches is to be filled with water, using a cylindrical cup whose radius is 2 inches and whose height is 5 inches. What is the maximum number of full cups of water that can be placed into the container without the water overflowing the container?



473. Tracey has two empty cube-shaped containers with sides of 5 inches and 7 inches, as shown in the accompanying diagram. She fills the smaller container completely with water and then pours all the water from the smaller container into the larger container. How deep, to the *nearest tenth of an inch*, will the water be in the larger container?



474. As shown in the accompanying diagram, the length, width, and height of Richard's fish tank are 24 inches, 16 inches, and 18 inches, respectively. Richard is filling his fish tank with water from a hose at the rate of 500 cubic inches per minute. How long will it take, to the *nearest minute*, to fill the tank to a depth of 15 inches?



(Not drawn to scale)

475. A rectangular piece of cardboard is to be formed into an uncovered box. The piece of cardboard is 2 centimeters longer than it is wide. A square that measures 3 centimeters on a side is cut from each corner. When the sides are turned up to form the box, its volume is 765 cubic centimeters. Find the dimensions, in centimeters, of the original piece of cardboard.
476. Denise is designing a storage box in the shape of a cube. Each side of the box has a length of 10 inches. She needs more room and decides to construct a larger box in the shape of a cube with a volume of 2,000 cubic inches. By how many inches, to the *nearest tenth*, should she *increase* the length of each side of the original box?

A.G.3: Determine whether a relation is a function, by examining ordered pairs and inspecting graphs of relations.

477. Which set of ordered pairs is *not* a function?

- [A]  $\{(4,1), (5,1), (6,1), (7,1)\}$
- [B]  $\{(3,1), (2,1), (1,2), (3,2)\}$
- [C]  $\{(1,2), (3,4), (4,5), (5,6)\}$
- [D]  $\{(0,0), (1,1), (2,2), (3,3)\}$

478. Which set of ordered pairs does *not* represent a function?

- [A]  $\{(3,-2), (3,-4), (4,-1), (4,-3)\}$
- [B]  $\{(3,-2), (-2,3), (4,-1), (-1,4)\}$
- [C]  $\{(3,-2), (4,-3), (5,-4), (6,-5)\}$
- [D]  $\{(3,-2), (5,-2), (4,-2), (-1,-2)\}$

479. Which graph is *not* a function?

- [A]
- [B]
- [C]
- [D]

480. Which graph does not represent a function of  $x$ ?

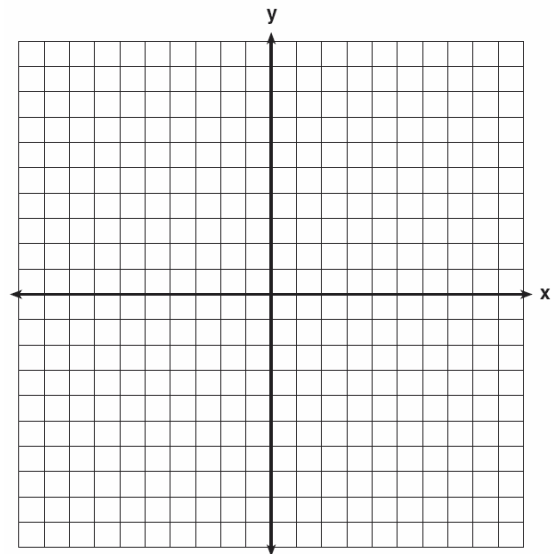
- [A]
- [B]
- [C]
- [D]

481. Each graph below represents a possible relationship between temperature and pressure. Which graph does *not* represent a function?

- [A]
- [B]
- [C]
- [D]

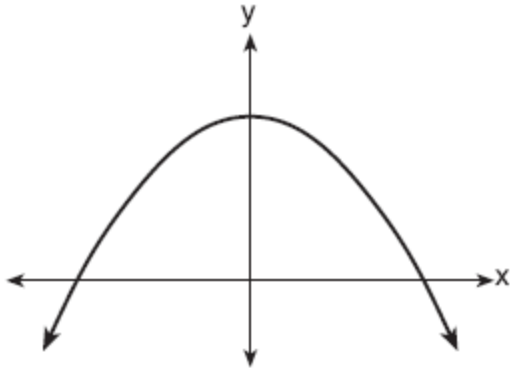
A.G.4: Identify and graph linear, quadratic (parabolic), absolute value, and exponential functions.

482. On the set of axes provided below, sketch a circle with a radius of 3 and center at  $(2,1)$  and also sketch the graph of the line  $2x + y = 8$ .



*b* What is the total number of points of intersection of the two graphs?

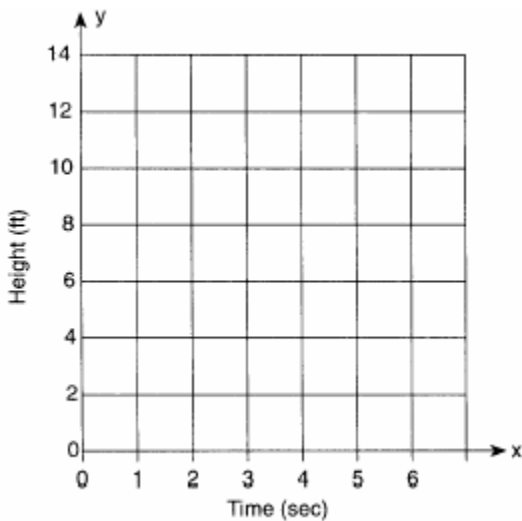
483. Which equation is best represented by the accompanying graph?



- [A]  $y = 6x + 1$       [B]  $y = 6x^2$   
 [C]  $y = 6^x$       [D]  $y = -x^2 + 1$

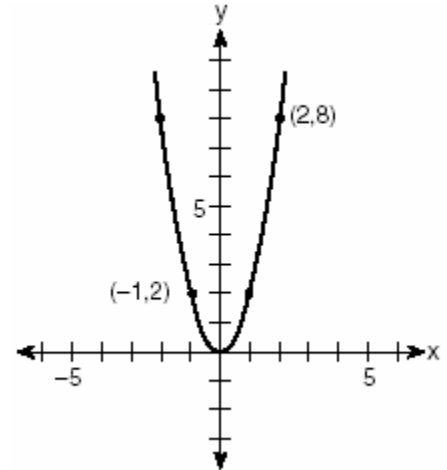
484. Amy tossed a ball in the air in such a way that the path of the ball was modeled by the equation  $y = -x^2 + 6x$ . In the equation,  $y$  represents the height of the ball in feet and  $x$  is the time in seconds.

a Graph  $y = -x^2 + 6x$  for  $0 \leq x \leq 6$  on the grid provided below.



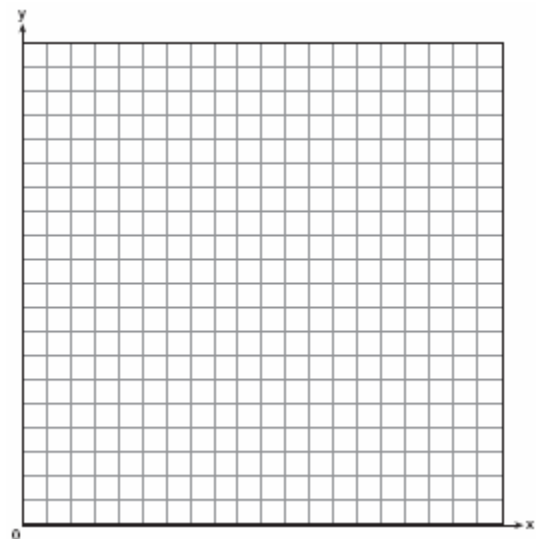
b At what time,  $x$ , is the ball at its highest point?

485. Which quadratic function is shown in the accompanying graph?



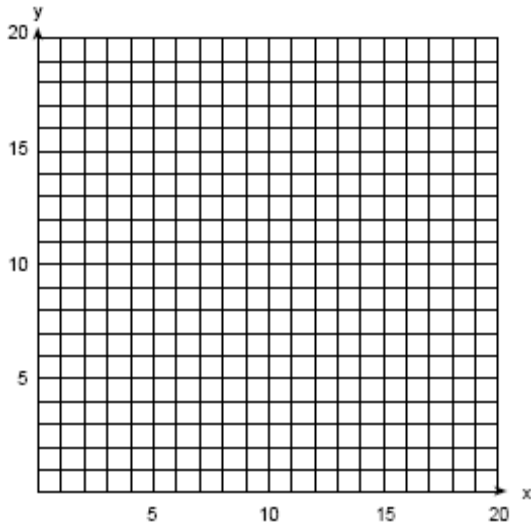
- [A]  $y = 2x^2$       [B]  $y = \frac{1}{2}x^2$   
 [C]  $y = -\frac{1}{2}x^2$       [D]  $y = -2x^2$

486. An architect is designing a museum entranceway in the shape of a parabolic arch represented by the equation  $y = -x^2 + 20x$ , where  $0 \leq x \leq 20$  and all dimensions are expressed in feet. On the accompanying set of axes, sketch a graph of the arch and determine its maximum height, in feet.



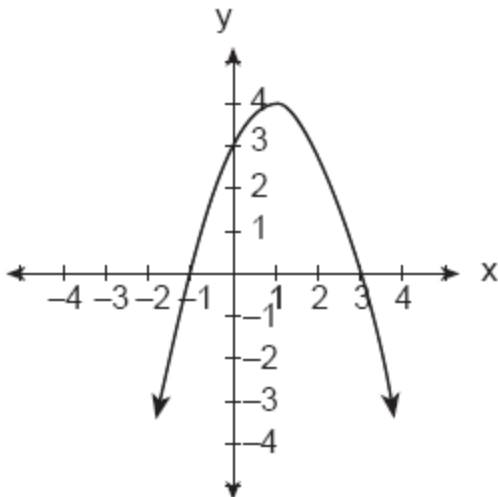


487. An arch is built so that it is 6 feet wide at the base. Its shape can be represented by a parabola with the equation  $y = -2x^2 + 12x$ , where  $y$  is the height of the arch.  
a Graph the parabola from  $x = 0$  to  $x = 6$  on the grid below.



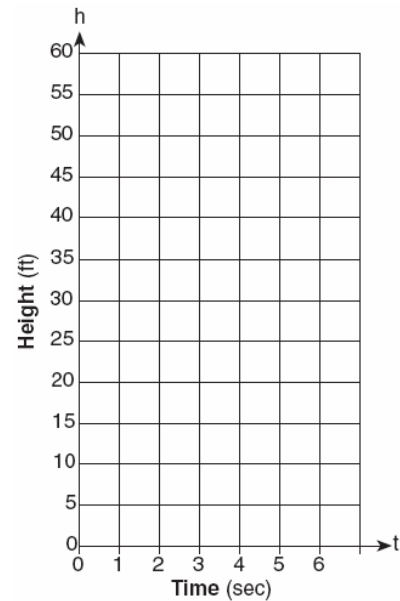
b Determine the maximum height,  $y$ , of the arch.

488. Which is an equation of the parabola shown in the accompanying diagram?



- [A]  $y = x^2 + 2x + 3$     [B]  $y = -x^2 + 2x + 3$   
[C]  $y = x^2 - 2x + 3$     [D]  $y = -x^2 - 2x + 3$

489. Tom throws a ball into the air. The ball travels on a parabolic path represented by the equation  $h = -8t^2 + 40t$ , where  $h$  is the height, in feet, and  $t$  is the time, in seconds.  
a On the accompanying set of axes, graph the equation from  $t = 0$  to  $t = 5$  seconds, including all integral values of  $t$  from 0 to 5.

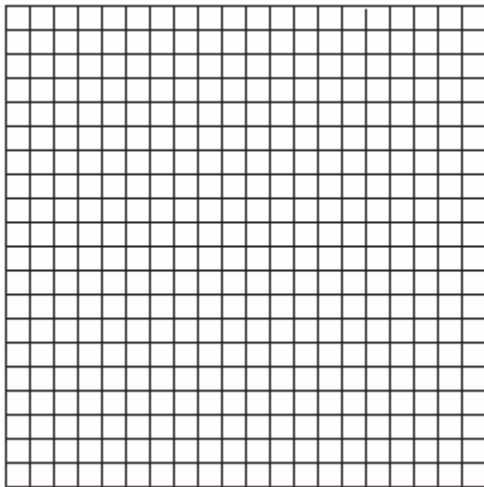


b What is the value of  $t$  at which  $h$  has its greatest value?

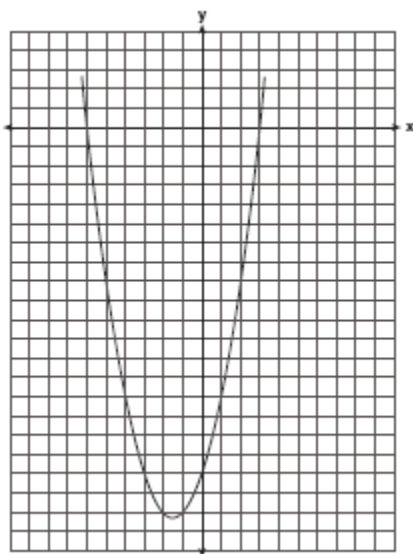
490. What is the equation of a parabola that goes through points  $(0,1)$ ,  $(-1,6)$ , and  $(2,3)$ ?

- [A]  $y = 2x^2 - 3x + 1$     [B]  $y = 2x^2 + 1$   
[C]  $y = x^2 - 3x + 1$     [D]  $y = x^2 + 1$

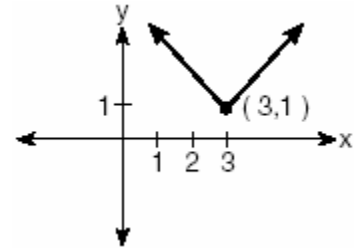
491. A small rocket is launched from a height of 72 feet. The height of the rocket in feet,  $h$ , is represented by the equation  $h(t) = -16t^2 + 64t + 72$ , where  $t =$  time, in seconds. Graph this equation on the accompanying grid. Use your graph to determine the number of seconds that the rocket will remain at or above 100 feet from the ground. [Only a graphic solution can receive full credit.]



492. The graph of a quadratic equation is shown in the accompanying diagram. The scale on the axes is a unit scale. Write an equation of this graph in standard form.

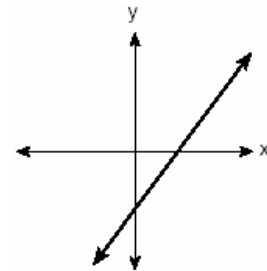


493. Which equation is represented by the accompanying graph?



- [A]  $y = |x| - 3$       [B]  $y = (x - 3)^2 + 1$   
 [C]  $y = |x + 3| - 1$       [D]  $y = |x - 3| + 1$

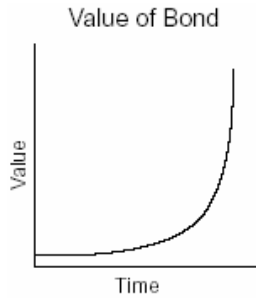
494. The graph below represents  $f(x)$ .



Which graph best represents  $|f(x)|$ ?

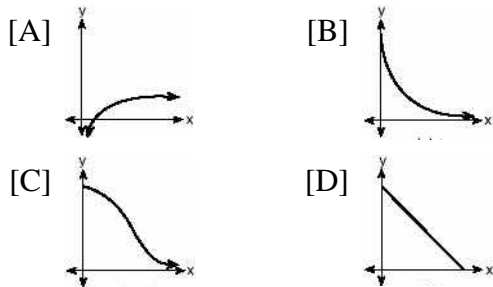
- [A] [B]   
 [C] [D]

495. The accompanying graph represents the value of a bond over time.

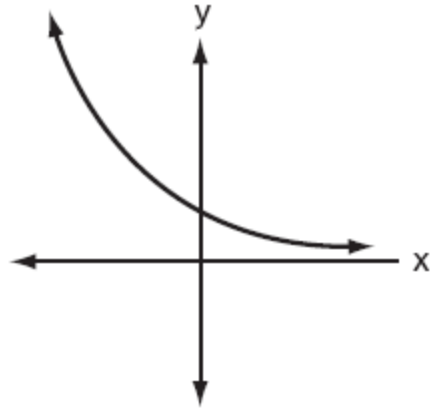


Which type of function does this graph best model?

- [A] quadratic                      [B] trigonometric  
 [C] exponential                  [D] logarithmic
496. The strength of a medication over time is represented by the equation  $y = 200(1.5)^{-x}$ , where  $x$  represents the number of hours since the medication was taken and  $y$  represents the number of micrograms per millimeter left in the blood. Which graph best represents this relationship?



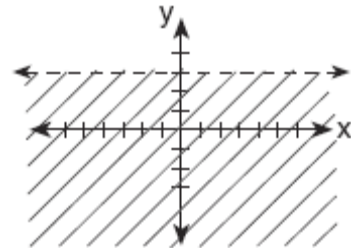
497. Which equation best represents the accompanying graph?



- [A]  $y = 2^{-x}$                       [B]  $y = -2^x$   
 [C]  $y = x^2 + 2$                   [D]  $y = 2^x$

A.G.6: Graph linear inequalities.

498. In the graph of  $y \leq -x$ , which quadrant is completely shaded?  
 [A] II            [B] I            [C] III            [D] IV
499. Which inequality is represented by the accompanying graph?



- [A]  $y > 3$                               [B]  $y < 3$   
 [C]  $y \geq 3$                               [D]  $y \leq 3$

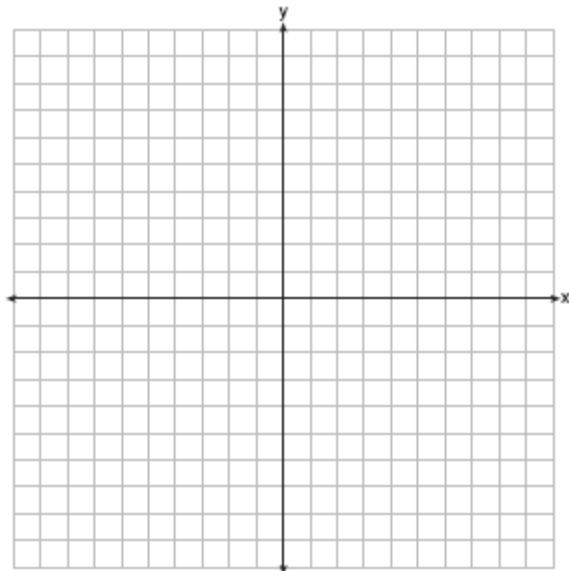
A.G.7: Graph and solve systems of linear equations and inequalities with rational coefficients in two variables.

500. Graph the following systems of inequalities on the accompanying set of axes and label the solution set  $S$ :

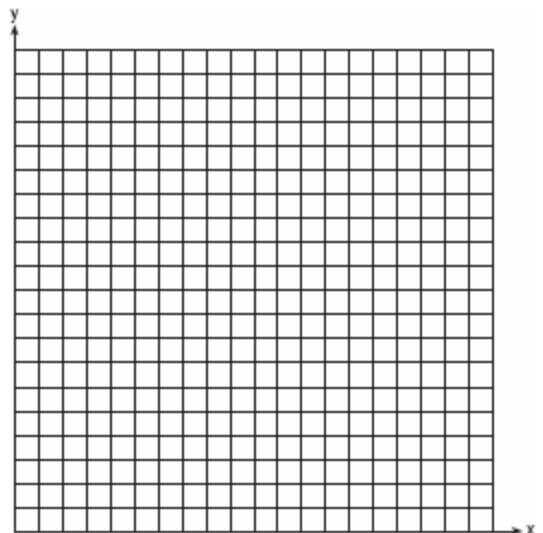
$$y > x - 4$$

$$y + x \geq 2$$

[Only a graphic solution can receive full credit.]

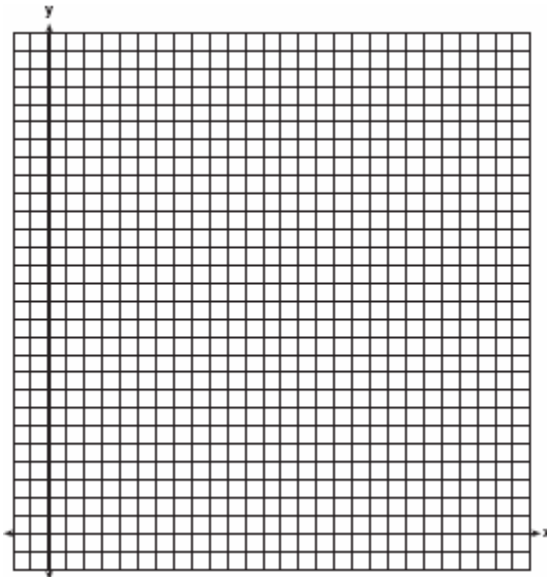


501. A company manufactures bicycles and skateboards. The company's daily production of bicycles cannot exceed 10, and its daily production of skateboards must be less than or equal to 12. The combined number of bicycles and skateboards cannot be more than 16. If  $x$  is the number of bicycles and  $y$  is the number of skateboards, graph on the accompanying set of axes the region that contains the number of bicycles and skateboards the company can manufacture daily.

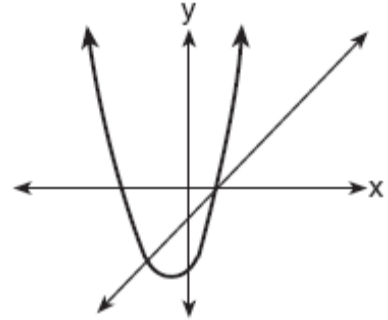


A.G.9: Solve systems of linear and quadratic equations graphically. *Note: Only use systems of linear and quadratic equations that lead to solutions whose coordinates are integers.*

502. A rocket is launched from the ground and follows a parabolic path represented by the equation  $y = -x^2 + 10x$ . At the same time, a flare is launched from a height of 10 feet and follows a straight path represented by the equation  $y = -x + 10$ . Using the accompanying set of axes, graph the equations that represent the paths of the rocket and the flare, and find the coordinates of the point or points where the paths intersect.



503. The accompanying diagram shows the graphs of a linear equation and a quadratic equation.



How many solutions are there to this system of equations?

- [A] 0 [B] 2 [C] 1 [D] 3

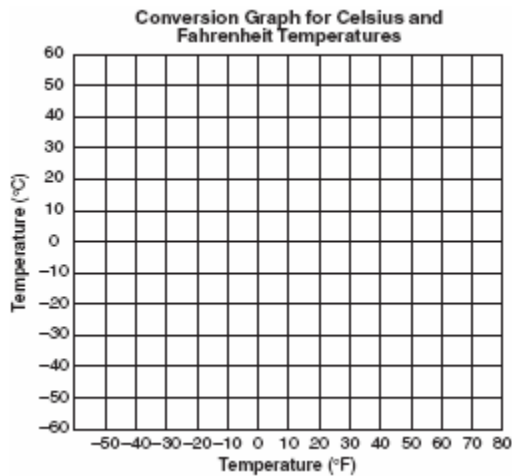
## MEASUREMENT STRAND

(A.M.1-A.M.3)

A.M.2: Solve problems involving conversions within measurement systems, given the relationship between the units.

504. If the temperature in Buffalo is  $23^\circ$  Fahrenheit, what is the temperature in degrees Celsius? [Use the formula  $C = \frac{5}{9}(F - 32)$ .]  
[A] 5 [B] -5 [C] -45 [D] 45
505. The formula  $C = \frac{5}{9}(F - 32)$  can be used to find the Celsius temperature ( $C$ ) for a given Fahrenheit temperature ( $F$ ). What Celsius temperature is equal to a Fahrenheit temperature of  $77^\circ$ ?  
[A]  $25^\circ$  [B]  $45^\circ$  [C]  $171^\circ$  [D]  $8^\circ$
506. The formula for changing Celsius ( $C$ ) temperature to Fahrenheit ( $F$ ) temperature is  $F = \frac{9}{5}C + 32$ . Calculate, to the nearest degree, the Fahrenheit temperature when the Celsius temperature is -8.

507. The formula  $C = \frac{5}{9}(F - 32)$  is used to convert Fahrenheit temperature,  $F$ , to Celsius temperature,  $C$ . What temperature, in degrees Fahrenheit, is equivalent to a temperature of  $10^\circ$  Celsius?
508. Connor wants to compare Celsius and Fahrenheit temperatures by drawing a conversion graph. He knows that  $-40^\circ C = -40^\circ F$  and that  $20^\circ C = 68^\circ F$ . On the accompanying grid, construct the conversion graph and, using the graph, determine the Celsius equivalent of  $25^\circ F$ .



509. Andy is 6 feet tall. If 1 inch equals 2.54 centimeters, how tall is Andy, to the *nearest centimeter*?
- [A] 15    [B] 30    [C] 183    [D] 213
510. If a United States dollar is worth \$1.41 in Canadian money, how much is \$100 in Canadian money worth in United States money, to the *nearest cent*?

## STATISTICS AND PROBABILITY STRAND

(A.S.1-A.S.23)

A.S.4: Compare and contrast the appropriateness of different measures of central tendency for a given data set.

511. The weights of all the students in grade 9 are arranged from least to greatest. Which statistical measure separates the top half of this set of data from the bottom half?
- [A] mean                      [B] mode  
[C] median                    [D] average

A.S.5: Construct a histogram, cumulative frequency histogram, and a box-and-whisker plot, given a set of data.

512. The following set of data represents the scores on a mathematics quiz:  
 58, 79, 81, 99, 68, 92, 76, 84, 53, 57, 81, 91, 77, 50, 65, 57, 51, 72, 84, 89  
 Complete the frequency table below and, on the accompanying grid, draw and label a frequency histogram of these scores.

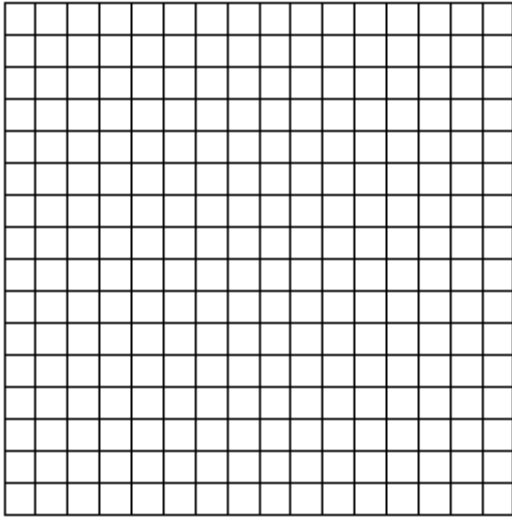
**Mathematics Quiz Scores**

| Interval | Tally | Frequency |
|----------|-------|-----------|
| 50–59    |       |           |
| 60–69    |       |           |
| 70–79    |       |           |
| 80–89    |       |           |
| 90–99    |       |           |

513. The scores on a mathematics test were 70, 55, 61, 80, 85, 72, 65, 40, 74, 68, and 84.  
 Complete the accompanying table, and use the table to construct a frequency histogram for these scores.

| Score | Tally | Frequency |
|-------|-------|-----------|
| 40–49 |       |           |
| 50–59 |       |           |
| 60–69 |       |           |
| 70–79 |       |           |
| 80–89 |       |           |

514. On a science quiz, 20 students received the following scores: 100, 95, 95, 90, 85, 85, 85, 80, 80, 80, 80, 75, 75, 75, 70, 70, 65, 65, 60, 55. Construct a statistical graph, such as a histogram or a stem-and-leaf plot, to display this data. *[Be sure to title the graph and label all axes or parts used.]*  
If your type of plot requires a grid, show your work here.

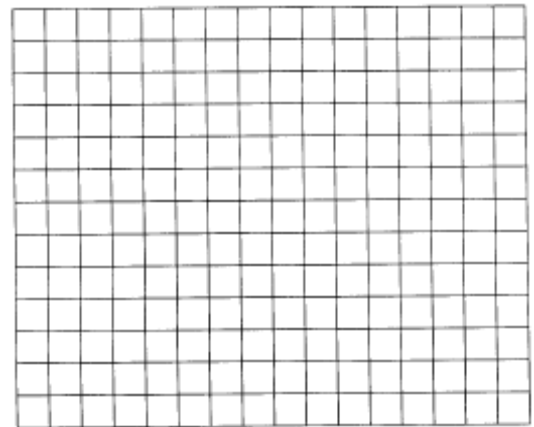


If no grid is necessary, show your work here.

515. In the time trials for the 400-meter run at the state sectionals, the 15 runners recorded the times shown in the table below.

| 400-Meter Run |           |
|---------------|-----------|
| Time (sec)    | Frequency |
| 50.0–50.9     |           |
| 51.0–51.9     |           |
| 52.0–52.9     |           |
| 53.0–53.9     |           |
| 54.0–54.9     |           |

- a Using the data from the frequency column, draw a frequency histogram on the grid provided below.



- b What percent of the runners completed the time trial between 52.0 and 53.9 seconds?

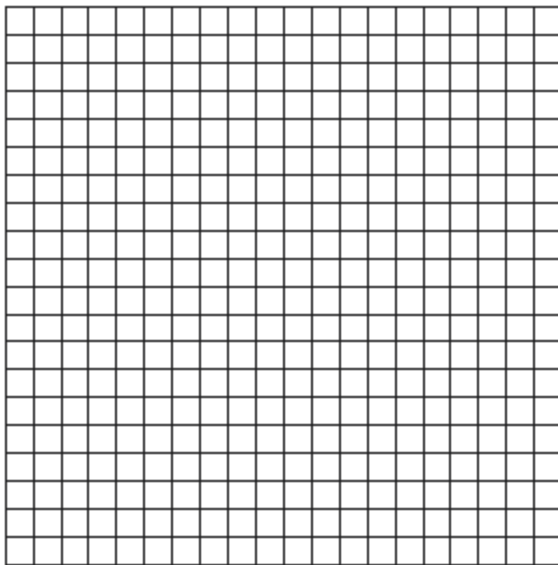


516. The following data consists of the weights, in pounds, of 30 adults:

195, 206, 100, 98, 150, 210, 195, 106, 195, 168, 180, 212, 104, 195, 100, 216, 195, 209, 112, 99, 206, 116, 195, 100, 142, 100, 135, 98, 160, 155

Using the data, complete the accompanying cumulative frequency table and construct a cumulative frequency histogram on the grid below.

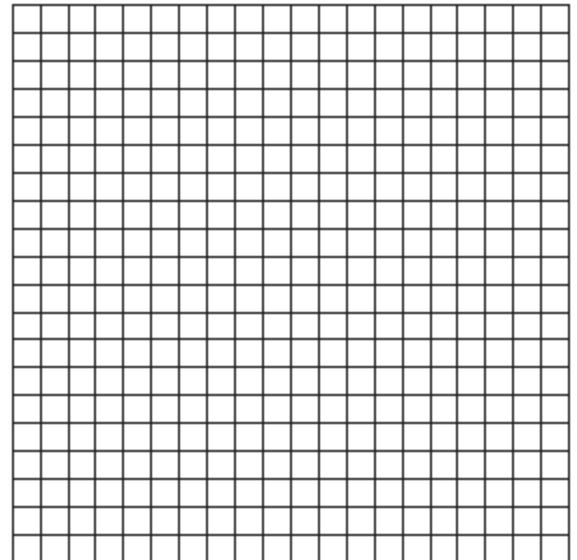
| Interval | Frequency | Cumulative Frequency |
|----------|-----------|----------------------|
| 51–100   |           |                      |
| 101–150  |           |                      |
| 151–200  |           |                      |
| 201–250  |           |                      |



517. The accompanying table shows the weights, in pounds, for the students in an algebra class.

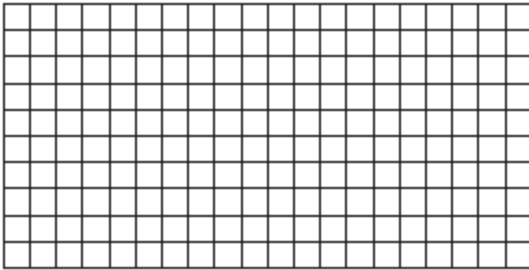
Using the data, complete the cumulative frequency table and construct a cumulative frequency histogram on the grid below.

| Interval | Frequency | Cumulative Frequency |
|----------|-----------|----------------------|
| 91–100   | 6         |                      |
| 101–110  | 3         |                      |
| 111–120  | 0         |                      |
| 121–130  | 3         |                      |
| 131–140  | 0         |                      |
| 141–150  | 2         |                      |
| 151–160  | 2         |                      |



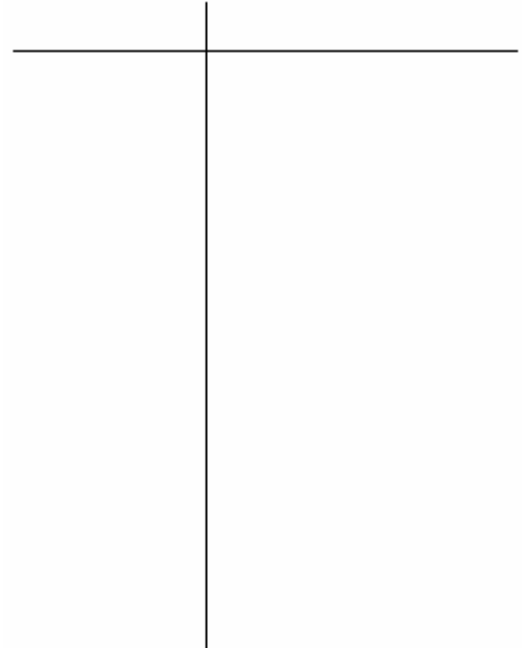
518. Sarah's mathematics grades for one marking period were 85, 72, 97, 81, 77, 93, 100, 75, 86, 70, 96, and 80.  
a Complete the tally sheet and frequency table below, and construct and label a frequency histogram for Sarah's grades using the accompanying grid.

| Interval (grades) | Tally | Frequency |
|-------------------|-------|-----------|
| 61–70             |       |           |
| 71–80             |       |           |
| 81–90             |       |           |
| 91–100            |       |           |



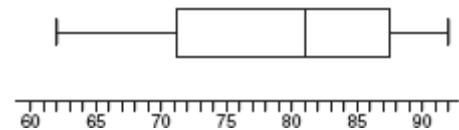
- b Which interval contains the 75th percentile (upper quartile)?

519. Construct a stem-and-leaf plot listing the scores below in order from lowest to highest.  
15, 25, 28, 32, 39, 40, 43, 26, 50, 75, 65, 19, 55, 72, 50



A.S.6: Understand how the five statistical summary (minimum, maximum, and the three quartiles) is used to construct a box-and-whisker plot.

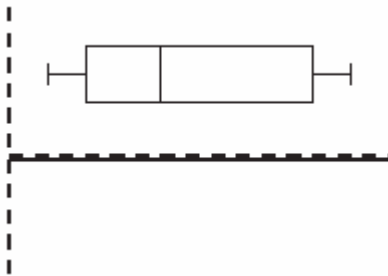
520. The accompanying diagram shows a box-and-whisker plot of student test scores on last year's Mathematics A midterm examination.



What is the median score?

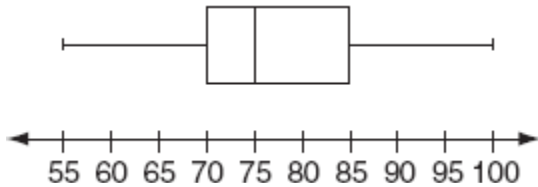
- [A] 92 [B] 71 [C] 81 [D] 62

521. The accompanying diagram is an example of which type of graph?



- [A] histogram      [B] box-and-whisker plot  
[C] stem-and-leaf plot      [D] bar graph

522. The accompanying box-and-whisker plot represents the scores earned on a science test.

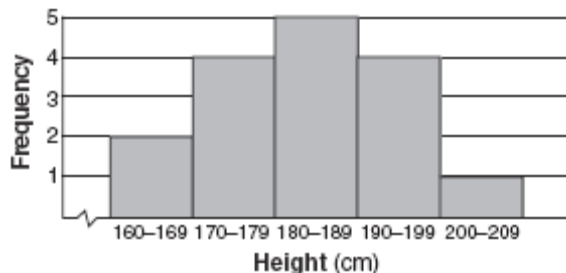


What is the median score?

- [A] 75      [B] 85      [C] 77      [D] 70

A.S.9: Analyze and interpret a frequency distribution table or histogram, a cumulative frequency distribution table or histogram, or a box-and-whisker plot.

523. The accompanying histogram shows the heights of the students in Kyra's health class.



What is the total number of students in the class?

- [A] 15      [B] 209      [C] 16      [D] 5

524. The test scores for 10 students in Ms. Sampson's homeroom were 61, 67, 81, 83, 87, 88, 89, 90, 98, and 100. Which frequency table is accurate for this set of data?

[A]

| Interval | Frequency |
|----------|-----------|
| 61-70    | 2         |
| 71-80    | 2         |
| 81-90    | 8         |
| 91-100   | 10        |

[B]

| Interval | Frequency |
|----------|-----------|
| 61-70    | 2         |
| 71-80    | 2         |
| 81-90    | 7         |
| 91-100   | 10        |

[C]

| Interval | Frequency |
|----------|-----------|
| 61-70    | 2         |
| 71-80    | 0         |
| 81-90    | 8         |
| 91-100   | 10        |

[D]

| Interval | Frequency |
|----------|-----------|
| 61-70    | 2         |
| 71-80    | 0         |
| 81-90    | 6         |
| 91-100   | 2         |

A.S.19: Determine the number of elements in a sample space and the number of favorable events.

525. If Laquisha can enter school by any one of three doors and the school has two staircases to the second floor, in how many different ways can Laquisha reach a room on the second floor? Justify your answer by drawing a tree diagram or listing a sample space.

526. The Grimaldis have three children born in different years.  
*a* Draw a tree diagram or list a sample space to show all the possible arrangements of boy and girl children in the Grimaldi family.  
*b* Using your information from part *a*, what is the probability that the Grimaldis have three boys?

527. Kimberly has three pair of pants: one black, one red, and one tan. She also has four shirts: one pink, one white, one yellow, and one green.  
Draw a tree diagram or list the sample space showing all possible outfits that she could wear, if an outfit consists of one pair of pants and one shirt.  
How many different outfits can Kimberly wear?

A.S.20: Calculate the probability of an event and its complement.

528. Which inequality represents the probability,  $x$ , of any event happening?  
[A]  $0 \leq x \leq 1$  [B]  $x < 1$   
[C]  $0 < x < 1$  [D]  $x \geq 0$
529. Mary chooses an integer at random from 1 to 6. What is the probability that the integer she chooses is a prime number?  
[A]  $\frac{2}{6}$  [B]  $\frac{5}{6}$  [C]  $\frac{4}{6}$  [D]  $\frac{3}{6}$
530. A box contains six black balls and four white balls. What is the probability of selecting a black ball at random from the box?  
[A]  $\frac{4}{6}$  [B]  $\frac{1}{10}$  [C]  $\frac{6}{10}$  [D]  $\frac{6}{4}$
531. A six-sided number cube has faces with the numbers 1 through 6 marked on it. What is the probability that a number less than 3 will occur on one toss of the number cube?  
[A]  $\frac{3}{6}$  [B]  $\frac{2}{6}$  [C]  $\frac{4}{6}$  [D]  $\frac{1}{6}$
532. The faces of a cube are numbered from 1 to 6. What is the probability of *not* rolling a 5 on a single toss of this cube?  
[A]  $\frac{5}{6}$  [B]  $\frac{4}{5}$  [C]  $\frac{1}{6}$  [D]  $\frac{1}{5}$

533. A fair coin is thrown in the air four times. If the coin lands with the head up on the first three tosses, what is the probability that the coin will land with the head up on the fourth toss?  
[A]  $\frac{1}{8}$  [B]  $\frac{1}{2}$  [C] 0 [D]  $\frac{1}{16}$
534. A fair coin is tossed three times. What is the probability that the coin will land tails up on the second toss?  
[A]  $\frac{1}{3}$  [B]  $\frac{2}{3}$  [C]  $\frac{3}{4}$  [D]  $\frac{1}{2}$
535. When a fair coin was tossed ten times, it landed heads up the first seven times. What is the probability that on the eighth toss the coin will land with tails up?  
[A]  $\frac{3}{10}$  [B]  $\frac{7}{10}$  [C]  $\frac{3}{7}$  [D]  $\frac{1}{2}$
536. Seth tossed a fair coin five times and got five heads. The probability that the next toss will be a tail is  
[A]  $\frac{1}{6}$  [B]  $\frac{5}{6}$  [C]  $\frac{1}{2}$  [D] 0
537. The party registration of the voters in Jonesville is shown in the table below.

| Registered Voters in Jonesville |                             |
|---------------------------------|-----------------------------|
| Party Registration              | Number of Voters Registered |
| Democrat                        | 6,000                       |
| Republican                      | 5,300                       |
| Independent                     | 3,700                       |

- If one of the registered Jonesville voters is selected at random, what is the probability that the person selected is *not* a Democrat?  
[A] 0.333 [B] 0.400  
[C] 0.667 [D] 0.600

538. If the probability that it will rain on Thursday is  $\frac{5}{6}$ , what is the probability that it will *not* rain on Thursday?

- [A]  $\frac{5}{6}$       [B] 1      [C] 0      [D]  $\frac{1}{6}$

A.S.23: Calculate the probability of a series of independent events, a series of dependent events, two mutually exclusive events, two events that are not mutually exclusive.

539. Selena and Tracey play on a softball team. Selena has 8 hits out of 20 times at bat, and Tracey has 6 hits out of 16 times at bat. Based on their past performance, what is the probability that both girls will get a hit next time at bat?

- [A]  $\frac{31}{40}$       [B]  $\frac{48}{320}$       [C] 1      [D]  $\frac{14}{36}$

540. Bob and Laquisha have volunteered to serve on the Junior Prom Committee. The names of twenty volunteers, including Bob and Laquisha, are put into a bowl. If two names are randomly drawn from the bowl without replacement, what is the probability that Bob's name will be drawn first and Laquisha's name will be drawn second?

- [A]  $\frac{1}{20} \cdot \frac{1}{19}$       [B]  $\frac{1}{20} \cdot \frac{1}{20}$

- [C]  $\frac{2}{20}$       [D]  $\frac{2}{20!}$

541. A student council has seven officers, of which five are girls and two are boys. If two officers are chosen at random to attend a meeting with the principal, what is the probability that the first officer chosen is a girl and the second is a boy?

- [A]  $\frac{10}{42}$       [B]  $\frac{2}{7}$       [C]  $\frac{7}{14}$       [D]  $\frac{7}{13}$

542. The probability that the Cubs win their first game is  $\frac{1}{3}$ . The probability that the Cubs win

their second game is  $\frac{3}{7}$ . What is the probability that the Cubs win both games?

- [A]  $\frac{1}{7}$       [B]  $\frac{6}{7}$       [C]  $\frac{16}{21}$       [D]  $\frac{2}{5}$

543. There are four students, all of different heights, who are to be randomly arranged in a line. What is the probability that the tallest student will be first in line and the shortest student will be last in line?

544. Mr. Yee has 10 boys and 15 girls in his mathematics class. If he chooses two students at random to work on the blackboard, what is the probability that both students chosen are girls?

# GRADE 8

**PROBLEM SOLVING STRAND**  
 (8.PS.1-8.PS.17)

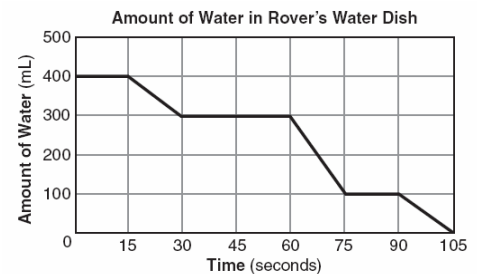
**ALGEBRA STRAND**  
 (A.A.1-A.A.45)

**REASONING AND PROOF STRAND**  
 (8.RP.1-8.RP.8)

8.A.3: Describe a situation involving relationships that matches a given graph.

- The accompanying graph shows the amount of water left in Rover's water dish over a period of time.

**COMMUNICATION STRAND**  
 (8.CM.1-8.CM.11)



**CONNECTIONS STRAND**  
 (8.CN.1-8.CN.9)

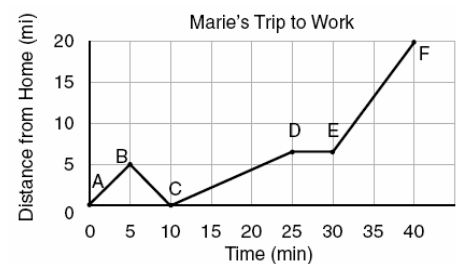
How long did Rover wait from the end of his first drink to the start of his second drink of water?

**REPRESENTATION STRAND**  
 (8.R.1-8.R.11)

- [A] 75 sec                      [B] 30 sec  
 [C] 10 sec                      [D] 60 sec

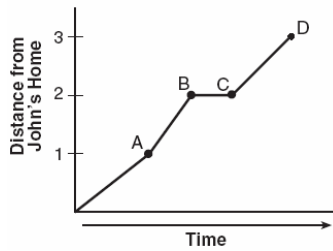
**NUMBER SENSE AND OPERATIONS STRAND**  
 (8.N.1-8.N.6)

- The accompanying graph shows Marie's distance from home (A) to work (F) at various times during her drive.



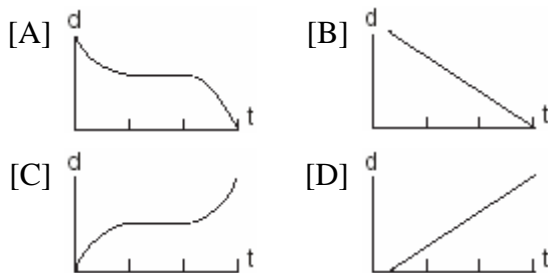
- Marie left her briefcase at home and had to return to get it. State which point represents when she turned back around to go home and explain how you arrived at that conclusion.
- Marie also had to wait at the railroad tracks for a train to pass. How long did she wait?

3. John left his home and walked 3 blocks to his school, as shown in the accompanying graph.



What is one possible interpretation of the section of the graph from point B to point C?

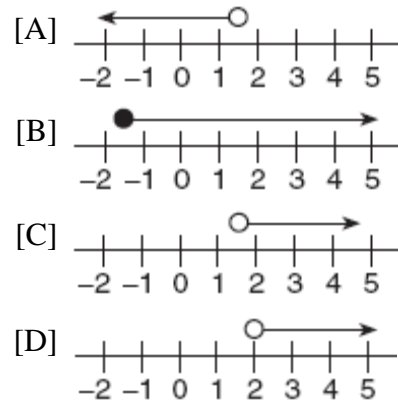
- [A] John arrived at school and stayed throughout the day.  
 [B] John returned home to get his mathematics homework.  
 [C] John reached the top of a hill and began walking on level ground.  
 [D] John waited before crossing a busy street.
4. A bug travels up a tree, from the ground, over a 30-second interval. It travels fast at first and then slows down. It stops for 10 seconds, then proceeds slowly, speeding up as it goes. Which sketch best illustrates the bug's distance ( $d$ ) from the ground over the 30-second interval ( $t$ )?



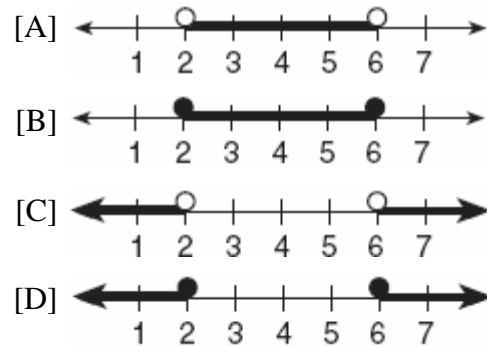
8.A.13: Solve multi-step inequalities and graph the solution set on a number line.

5. The inequality  $\frac{1}{2}x + 3 < 2x - 6$  is equivalent to
- [A]  $x < -\frac{5}{6}$                       [B]  $x < 6$   
 [C]  $x > 6$                           [D]  $x > -\frac{5}{6}$

6. Which graph best represents the solution set for the inequality  $x > \sqrt{2}$ ?



7. Which graph represents the solution set for  $2x - 4 \leq 8$  and  $x + 5 \geq 7$ ?



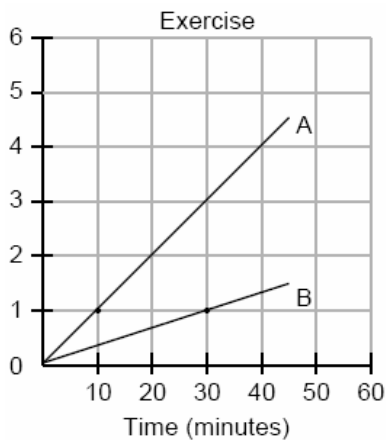
8.A.11: Factor a trinomial in the form  $ax^2 + bx + c = 0$ ;  $a = 1$  and  $c$  having no more than three set of factors.

8. Which expression is a factor of  $x^2 + 2x - 15$
- [A]  $(x + 3)$                           [B]  $(x - 5)$   
 [C]  $(x + 15)$                         [D]  $(x - 3)$

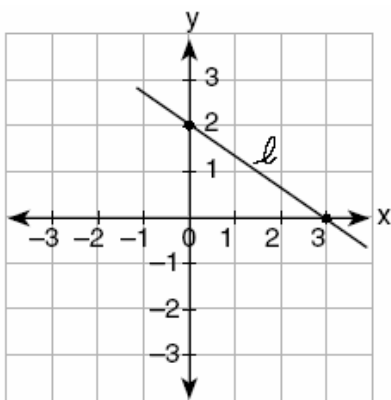
**GEOMETRY STRAND**  
(A.G.1-A.G.10)

8.G.13: Determine the slope of a line from a graph and explain the meaning of slope as a constant rate of change.

9. During a 45-minute lunch period, Albert (A) went running and Bill (B) walked for exercise. Their times and distances are shown in the accompanying graph. How much faster was Albert running than Bill was walking, in miles per hour?

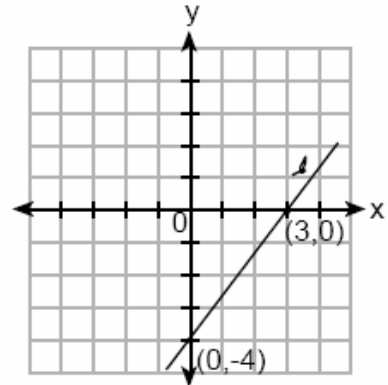


10. What is the slope of line  $l$  in the accompanying diagram?



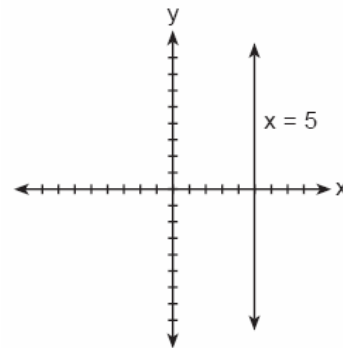
- [A]  $-\frac{2}{3}$  [B]  $\frac{2}{3}$  [C]  $-\frac{3}{2}$  [D]  $\frac{3}{2}$

11. What is the slope of line  $l$  shown in the accompanying diagram?



- [A]  $\frac{4}{3}$  [B]  $-\frac{3}{4}$  [C]  $-\frac{4}{3}$  [D]  $\frac{3}{4}$

12. The accompanying figure shows the graph of the equation  $x = 5$ .



What is the slope of the line  $x = 5$ ?

- [A] 5 [B] undefined [C] -5 [D] 0

13. If a line is horizontal, its slope is

- [A] negative [B] 0  
[C] 1 [D] undefined

8.G.16: Determine the equation of a line given the slope and the y-intercept.

14. An equation of the line that has a slope of 3 and a y-intercept of -2 is

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



15. What is the y-intercept of the graph of the line whose equation is  $y = -\frac{2}{5}x + 4$ ?

- [A]  $-\frac{2}{5}$       [B] 4      [C]  $-\frac{5}{2}$       [D] 0

8.G.19: Graph the solution set of an inequality on a number line.

16. Which inequality is represented in the graph below?



- [A]  $-4 \leq x \leq 2$       [B]  $-4 < x \leq 2$   
[C]  $-4 < x < 2$       [D]  $-4 \leq x < 2$

17. Which inequality is represented in the accompanying graph?



- [A]  $-3 \leq x < 4$       [B]  $-3 < x \leq 4$   
[C]  $-3 \leq x \leq 4$       [D]  $-3 < x < 4$

18. In order to be admitted for a certain ride at an amusement park, a child must be greater than or equal to 36 inches tall and less than 48 inches tall. Which graph represents these conditions?

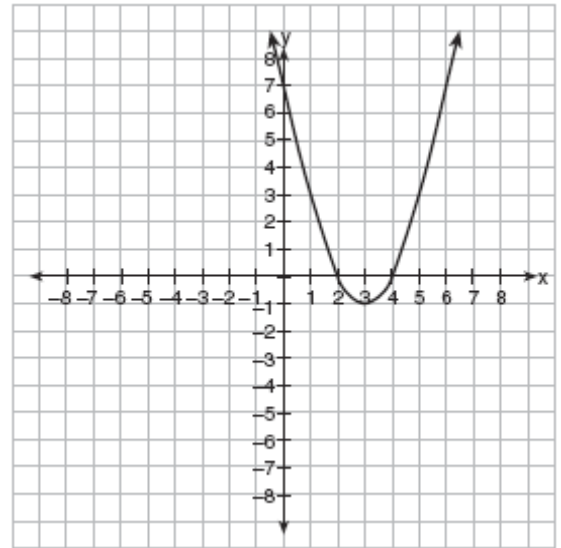
- [A] [B] [C] [D]

19. The manufacturer of Ron's car recommends that the tire pressure be at least 26 pounds per square inch and less than 35 pounds per square inch. On the accompanying number line, graph the inequality that represents the recommended tire pressure.



8.G.21: Recognize the characteristics of quadratics in tables, graphs, equations, and situations.

20. Which is an equation of the line of symmetry for the parabola in the accompanying diagram?



- [A]  $x = 3$       [B]  $y = 3$   
[C]  $x = 2$       [D]  $x = 4$

**MEASUREMENT STRAND**  
(8.M.1)

## GRADE 7

### PROBLEM SOLVING STRAND

(7.PS.1-7.PS.17)

### REASONING AND PROOF STRAND

(7.RP.1-7.RP.8)

### COMMUNICATION STRAND

(7.CM.1-7.CM.11)

### CONNECTIONS STRAND

(7.CN.1-7.CN.9)

### REPRESENTATION STRAND

(7.R.1-7.R.11)

### NUMBER SENSE AND OPERATIONS STRAND

(7.N.1-7.N.19)

7.N.2: Recognize the difference between rational and irrational numbers (e.g., explore different approximations of pi).

1. The number 0.14114111411114... is

[A] integral                      [B] whole  
[C] rational                      [D] irrational

2. Which number is rational?

[A]  $\pi$     [B]  $\frac{5}{4}$     [C]  $\sqrt{\frac{3}{2}}$     [D]  $\sqrt{7}$

3. Which number is irrational?

[A]  $\frac{2}{3}$     [B]  $\sqrt{9}$     [C] 0.3333    [D]  $\sqrt{8}$

4. Which expression represents an irrational number?

[A]  $\sqrt{2}$     [B]  $\frac{1}{2}$     [C] 0    [D] 0.17

5. Which is an irrational number?

[A]  $\frac{3}{4}$     [B]  $\sqrt{9}$     [C]  $\sqrt{3}$     [D] 3.14

6. Which is an irrational number?

[A]  $\pi$     [B] 0    [C]  $-\frac{1}{3}$     [D]  $\sqrt{9}$

7. Which is a rational number?

[A]  $6\sqrt{2}$     [B]  $\pi$     [C]  $\sqrt{8}$     [D]  $5\sqrt{9}$

8. Which expression is rational?

[A]  $\pi$     [B]  $\sqrt{\frac{1}{4}}$     [C]  $\sqrt{\frac{1}{2}}$     [D]  $\sqrt{3}$

9. Which is an irrational number?

[A]  $\sqrt{49}$     [B]  $\frac{3}{8}$     [C]  $\pi$     [D]  $0.\bar{3}$

10. Which number below is irrational?

$\sqrt{\frac{4}{9}}$ ,  $\sqrt{20}$ ,  $\sqrt{121}$

Why is the number you chose an irrational number?

11. Given:  $\frac{\sqrt{99}}{11}$ ,  $\sqrt{164}$ ,  $\sqrt{196}$

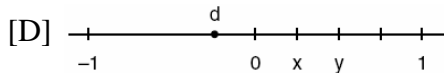
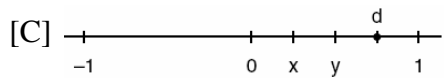
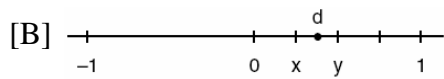
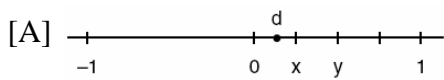
Identify the expression that is a rational number and explain why it is rational.

12. Write an irrational number and explain why it is irrational.

7.N.3: Place rational and irrational numbers (approximations) on a number line and justify the placement of the numbers.

13. If  $t^2 < t < \sqrt{t}$ , then  $t$  could be  
 [A]  $\frac{1}{4}$  [B]  $-\frac{1}{4}$  [C] 0 [D] 4

14. Let  $x$  and  $y$  be numbers such that  $0 < x < y < 1$ , and let  $d = x - y$ . Which graph could represent the location of  $d$  on the number line?



15. If  $a < b$ ,  $c < d$ , and  $a$ ,  $b$ ,  $c$ , and  $d$  are all greater than 0, which expression is always true?  
 [A]  $a + c > b + d$  [B]  $ac < bd$   
 [C]  $\frac{a}{d} > \frac{b}{c}$  [D]  $a - c + b - d = 0$

16. Kyoko's mathematics teacher gave her the accompanying cards and asked her to arrange the cards in order from least to greatest. In what order should Kyoko arrange the cards?

|       |            |             |             |                |
|-------|------------|-------------|-------------|----------------|
| $\pi$ | $\sqrt{8}$ | $3.\bar{1}$ | $2\sqrt{3}$ | $2\frac{4}{5}$ |
|-------|------------|-------------|-------------|----------------|

17. In which list are the numbers in order from least to greatest?  
 [A]  $\sqrt{3}$ , 3.2,  $\pi$ ,  $3\frac{1}{3}$  [B] 3.2,  $3\frac{1}{3}$ ,  $\sqrt{3}$ ,  $\pi$   
 [C]  $\sqrt{3}$ ,  $\pi$ , 3.2,  $3\frac{1}{3}$  [D] 3.2,  $\pi$ ,  $3\frac{1}{3}$ ,  $\sqrt{3}$

18. Which inequality is true if  $x = \frac{3.04}{1.48}$ ,  $y = 1.99 + 0.33$ , and  $z = (1.3)^3$ ?

- [A]  $y < z < x$  [B]  $x < y < z$   
 [C]  $x < z < y$  [D]  $y < x < z$

19. Which number has the greatest value?

- [A]  $\frac{\pi}{2}$  [B] 1.5 [C]  $1\frac{2}{3}$  [D]  $\sqrt{2}$

20. If  $x^3 < x < \frac{1}{x}$ , then  $x$  could be equal to

- [A] 5 [B]  $\frac{1}{5}$  [C] 1 [D]  $\frac{6}{5}$

21. Which expression has the *smallest* value?

- [A]  $-\sqrt{10}$  [B]  $-\frac{16}{5}$   
 [C]  $-\pi$  [D]  $-3.02$

22. Which numbers are arranged from smallest to largest?

- [A]  $\sqrt{9.1}$ ,  $\pi$ , 3.14,  $\frac{22}{7}$   
 [B]  $\sqrt{9.1}$ , 3.14,  $\frac{22}{7}$ ,  $\pi$   
 [C] 3.14,  $\frac{22}{7}$ ,  $\pi$ ,  $\sqrt{9.1}$   
 [D]  $\sqrt{9.1}$ , 3.14,  $\pi$ ,  $\frac{22}{7}$

23. Which list is in order from smallest value to largest value?

- [A]  $\sqrt{10}$ ,  $\frac{22}{7}$ ,  $\pi$ , 3.1 [B] 3.1,  $\pi$ ,  $\frac{22}{7}$ ,  $\sqrt{10}$   
 [C] 3.1,  $\frac{22}{7}$ ,  $\pi$ ,  $\sqrt{10}$  [D]  $\pi$ ,  $\frac{22}{7}$ , 3.1,  $\sqrt{10}$

24. Which list shows the numbers  $|-0.12|$ ,  $\sqrt{\frac{1}{82}}$ ,  $\frac{1}{8}$ ,  $\frac{1}{9}$  in order from smallest to largest?

[A]  $\sqrt{\frac{1}{82}}$ ,  $|-0.12|$ ,  $\frac{1}{9}$ ,  $\frac{1}{8}$

[B]  $\frac{1}{8}$ ,  $\frac{1}{9}$ ,  $\sqrt{\frac{1}{82}}$ ,  $|-0.12|$

[C]  $\sqrt{\frac{1}{82}}$ ,  $\frac{1}{9}$ ,  $|-0.12|$ ,  $\frac{1}{8}$

[D]  $|-0.12|$ ,  $\frac{1}{8}$ ,  $\frac{1}{9}$ ,  $\sqrt{\frac{1}{82}}$

7.N.5: Write numbers in scientific notation.

25. If 0.0347 is written by a scientist in the form  $3.47 \times 10^n$ , the value of  $n$  is  
[A] 2 [B] -3 [C] -2 [D] 3
26. According to the 2000 census, the population of New York State was approximately 18,900,000. How is this number expressed in scientific notation?  
[A]  $1890 \times 10^4$  [B]  $1.89 \times 10^7$   
[C]  $189 \times 10^5$  [D]  $18.9 \times 10^6$
27. The distance from Earth to the Sun is approximately 93 million miles. A scientist would write that number as  
[A]  $93 \times 10^{10}$  [B]  $9.3 \times 10^6$   
[C]  $93 \times 10^7$  [D]  $9.3 \times 10^7$
28. The approximate number of seconds in a year is 32,000,000. When this number is written in scientific notation, the numerical value of the exponent is  
[A] 7 [B] 6 [C] -7 [D] 8
29. The mass of an orchid seed is approximately 0.0000035 gram. Written in scientific notation, that mass is equivalent to  $3.5 \times 10^n$ . What is the value of  $n$ ?  
[A] -6 [B] -5 [C] -8 [D] -7

30. The size of a certain type of molecule is 0.00009078 inch. If this number is expressed as  $9.078 \times 10^n$ , what is the value of  $n$ ?

[A] 5 [B] 8 [C] -8 [D] -5

31. A micron is a unit used to measure specimens viewed with a microscope. One micron is equivalent to 0.00003937 inch. How is this number expressed in scientific notation?

[A]  $3937 \times 10^{-8}$  [B]  $3.937 \times 10^5$

[C]  $3.937 \times 10^{-5}$  [D]  $3937 \times 10^8$

7.N.6: Translate numbers from scientific notation into standard form.

32. Expressed in decimal notation,  $4.726 \times 10^{-3}$  is

[A] 0.04726 [B] 4,726

[C] 0.004726 [D] 472.6

33. The number  $8.375 \times 10^{-3}$  is equivalent to

[A] 0.0008375 [B] 8,375

[C] 0.08375 [D] 0.008375

34. The number  $156 \times 10^{-2}$  is equivalent to

[A] 156 [B] 0.156

[C] 0.0156 [D] 0.00156

7.N.7: Compare numbers written in scientific notation.

35. Which expression is equivalent to  $602 \times 10^{23}$ ?

[A]  $602 \times 10^{21}$  [B]  $6020 \times 10^{21}$

[C]  $60.2 \times 10^{21}$  [D]  $0.602 \times 10^{21}$

36. The expression  $0.62 \times 10^3$  is equivalent to

[A] 62,000 [B] 0.062

[C]  $6.2 \times 10^2$  [D]  $6.2 \times 10^4$

7.N.11: Simplify expressions using order of operations. *Note: Expressions may include absolute value and/or integral exponents greater than 0.*

37. If the expression  $3 - 4^2 + \frac{6}{2}$  is evaluated, what would be done *last*?
- [A] dividing                      [B] squaring  
[C] adding                        [D] subtracting
38. What is the first step in simplifying the expression  $(2 - 3 \times 4 + 5)^2$  ?
- [A] multiply 3 by 4    [B] subtract 3 from 2  
[C] add 4 and 5        [D] square 5
39. The expression  $15 - 3[2 + 6(-3)]$  simplifies to
- [A] -33    [B] 63    [C] -45    [D] 192
40. If  $n$  represents an odd number, which computation results in an answer that is an even number?
- [A]  $3 \times n - 2$                       [B]  $2 \times n - 1$   
[C]  $3 \times n + 1$                       [D]  $2 \times n + 1$
41. If  $a$  is an odd number,  $b$  an even number, and  $c$  an odd number, which expression will always be equivalent to an odd number?
- [A]  $ac(b)^1$                       [B]  $ac(b)^0$   
[C]  $a(bc)$                          [D]  $ac(b)^2$
42. If  $a$  and  $b$  are both odd integers, which expression must always equal an odd integer?
- [A]  $a - b$     [B]  $a \cdot b$     [C]  $\frac{a}{b}$     [D]  $a + b$
43. Tom scored 23 points in a basketball game. He attempted 15 field goals and 6 free throws. If each successful field goal is 2 points and each successful free throw is 1 point, is it possible he successfully made all 6 of his free throws? Justify your answer.

7.N.13: Add and subtract two integers (with and without the use of a number line).

44. On February 18, from 9 a.m. until 2 p.m., the temperature rose from  $-14^\circ\text{F}$  to  $36^\circ\text{F}$ . What was the total increase in temperature during this time period?
- [A]  $50^\circ$     [B]  $36^\circ$     [C]  $32^\circ$     [D]  $22^\circ$

7.N.16: Determine the square root of non-perfect squares using a calculator.

45. The amount of time,  $t$ , in seconds, it takes an object to fall a distance,  $d$ , in meters, is expressed by the formula  $t = \sqrt{\frac{d}{4.9}}$ .
- Approximately how long will it take an object to fall 75 meters?
- [A] 7.7 sec                              [B] 2.34 sec  
[C] 0.26 sec                            [D] 3.9 sec

7.N.18: Identify the two consecutive whole numbers between which the square root of a non-perfect square whole number less than 225 lies (with and without the use of a number line).

46. The expression  $\sqrt{93}$  is a number between
- [A] 3 and 9                              [B] 9 and 10  
[C] 46 and 47                         [D] 8 and 9
47. Which point on the accompanying number line best represents the position of  $\sqrt{5}$  ?



- [A] D    [B] A    [C] C    [D] B
48. The expression  $\sqrt{54 - b}$  is equivalent to a positive integer when  $b$  is equal to
- [A] -10    [B] 4    [C] 54    [D] 16

## ALGEBRA STRAND

(7.A.1-7.A.10)

7.A.4: Solve multi-step equations by combining like terms, using the distributive property, or moving variables to one side of the equation.

49. What is the solution of the equation  $3y - 5y + 10 = 36$ ?  
[A] 2 [B] -13 [C] 13 [D] 4.5
50. Solve for  $x$ :  $15x - 3(3x + 4) = 6$   
[A]  $-\frac{1}{2}$  [B] 3 [C] 1 [D]  $\frac{1}{3}$
51. What is the value of  $p$  in the equation  $2(3p - 4) = 10$ ?  
[A]  $\frac{1}{3}$  [B] 3 [C] 1 [D]  $2\frac{1}{3}$
52. If  $3(x - 2) = 2x + 6$ , the value of  $x$  is  
[A] 5 [B] 20 [C] 12 [D] 0
53. What is the value of  $x$  in the equation  $\frac{3}{4}x + 2 = \frac{5}{4}x - 6$ ?  
[A] -4 [B] 4 [C] -16 [D] 16
54. If  $2(x + 3) = x + 10$ , then  $x$  equals  
[A] 14 [B] 7 [C] 4 [D] 5
55. What is the value of  $n$  in the equation  $3n - 8 = 32 - n$ ?  
[A] 10 [B] 6 [C] -6 [D] -10
56. What is the value of  $x$  in the equation  $5(2x - 7) = 15x - 10$ ?  
[A] 1 [B] 0.6 [C] -9 [D] -5
57. What is the value of  $x$  in the equation  $6(x - 2) = 36 - 10x$ ?  
[A] 3 [B] -6 [C] 1.5 [D] 6
58. What is the value of  $w$  in the equation  $\frac{1}{2}w + 7 = 2w - 2$ ?  
[A] 3.6 [B]  $3\frac{1}{3}$  [C] 2 [D] 6
59. What is the value of  $w$  in the equation  $\frac{3}{4}w + 8 = \frac{1}{3}w - 7$ ?  
[A] -0.2 [B] 2.4 [C] -13.846 [D] -36
60. Solve for  $m$ :  $0.6m + 3 = 2m + 0.2$
61. Solve for  $x$ :  $2(x - 3) = 1.2 - x$
62. If  $x + y = 9x + y$ , then  $x$  is equal to  
[A]  $y$  [B]  $\frac{1}{5}y$  [C] 0 [D] 8
63. If  $9x + 2a = 3a - 4x$ , then  $x$  equals  
[A]  $a$  [B]  $\frac{5a}{12}$  [C]  $-a$  [D]  $\frac{a}{13}$
64. If  $7x + 2a = 3x + 5a$ , then  $x$  is equivalent to  
[A]  $\frac{7a}{10}$  [B]  $\frac{7a}{4}$  [C]  $\frac{3a}{10}$  [D]  $\frac{3a}{4}$
65. The number of people on the school board is represented by  $x$ . Two subcommittees with an equal number of members are formed, one with  $\frac{2}{3}x - 5$  members and the other with  $\frac{x}{4}$  members. How many people are on the school board?  
[A] 12 [B] 8 [C] 4 [D] 20
66. What is the value of  $x$  in the equation  $13x - 2(x + 4) = 8x + 1$ ?  
[A] 3 [B] 2 [C] 4 [D] 1
67. Solve for  $x$ :  $3.3 - x = 3(x - 1.7)$

7.A.10: Write an equation to represent a function from a table of values.

68. Which linear equation represents the data in the accompanying table?

| $c$ | $d$   |
|-----|-------|
| 0   | 20.00 |
| 1   | 21.50 |
| 2   | 23.00 |
| 3   | 24.50 |

- [A]  $d = 1.50c + 20.00$       [B]  $d = 1.50c$   
 [C]  $d = 21.50c$       [D]  $d = 20.00c + 1.50$

69. Which equation could represent the relationship between the  $x$  and  $y$  values shown in the accompanying table?

| $x$ | $y$ |
|-----|-----|
| 0   | 2   |
| 1   | 3   |
| 2   | 6   |
| 3   | 11  |
| 4   | 18  |

- [A]  $y = 2^x$       [B]  $y = x + 2$   
 [C]  $y = x^2 + 2$       [D]  $y = x^2$

70. If  $x$  and  $y$  are defined as indicated by the accompanying table, which equation correctly represents the relationship between  $x$  and  $y$ ?

| $x$ | $y$ |
|-----|-----|
| 2   | 1   |
| 3   | 3   |
| 5   | 7   |
| 7   | 11  |

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

**GEOMETRY STRAND**  
(7.G.1-7.G.10)

**MEASUREMENT STRAND**  
(7.M.1-7.M.13)

7.M.1: Calculate distance using a map scale.

71. On a map, 1 centimeter represents 40 kilometers. How many kilometers are represented by 8 centimeters?

- [A] 48      [B] 5      [C] 320      [D] 280

**STATISTICS AND PROBABILITY STRAND**  
(7.S.1-7.S.12)

## GRADE 6

### PROBLEM SOLVING STRAND

(6.PS.1-6.PS.23)

### REASONING AND PROOF STRAND

(6.RP.1-6.RP.9)

### COMMUNICATION STRAND

(6.CM.1-6.CM.11)

### CONNECTIONS STRAND

(6.CN.1-6.CN.9)

### REPRESENTATION STRAND

(6.R.1-6.R.9)

### NUMBER SENSE AND OPERATIONS STRAND

(6.N.1-6.N.27)

### ALGEBRA STRAND

(6.A.1-6.A.6)

6.A.2: Use substitution to evaluate algebraic expressions (may include exponents of one, two and three).

1. Brett was given the problem: "Evaluate  $2x^2 + 5$  when  $x = 3$ ." Brett wrote that the answer was 41. Was Brett correct? Explain your answer.

2. If  $x = -4$  and  $y = 3$ , what is the value of  $x - 3y^2$ ?

[A] -31 [B] -85 [C] -23 [D] -13

3. If  $t = -3$ , then  $3t^2 + 5t + 6$  equals

[A] -36 [B] 18 [C] -6 [D] 6

4. If  $a = 3$  and  $b = -1$ , what is the value of  $ab - b^2$ ?

[A] 4 [B] -4 [C] -2 [D] 2

5. What is the value of  $\frac{x^2 - 4y}{2}$ , if  $x = 4$  and  $y = -3$ ?

[A] 10 [B] 2 [C] 14 [D] -2

6. If  $x = 4$  and  $y = -2$ , the value of  $\frac{1}{2}xy^2$  is

[A] -4 [B] -8 [C] 32 [D] 8

### GEOMETRY STRAND

(6.G.1-6.G.11)

### MEASUREMENT STRAND

(6.M.1-6.M.9)

### STATISTICS AND PROBABILITY STRAND

(6.S.1-6.S.11)

6.S.5: Determine the mean, mode and median for a given set of data.

7. From January 3 to January 7, Buffalo recorded the following daily high temperatures:  $5^\circ$ ,  $7^\circ$ ,  $6^\circ$ ,  $5^\circ$ , and  $7^\circ$ . Which statement about the temperatures is true?

[A] median = mode [B] mean = mode  
[C] mean = median [D] mean < median



8. The ages of five children in a family are 3, 3, 5, 8, and 18. Which statement is true for this group of data?

- [A] mean > median [B] mode > mean  
 [C] median = mode [D] median > mean

9. Melissa's test scores are 75, 83, and 75. Which statement is true about this set of data?

- [A] mode < median [B] mean = median  
 [C] mean < mode [D] mode = median

10. Rosario and Enrique are in the same mathematics class. On the first five tests, Rosario received scores of 78, 77, 64, 86, and 70. Enrique received scores of 90, 61, 79, 73, and 87. How much higher was Enrique's average than Rosario's average?

- [A] 15 points [B] 2 points  
 [C] 4 points [D] 3 points

11. On an English examination, two students received scores of 90, five students received 85, seven students received 75, and one student received 55. The average score on this examination was

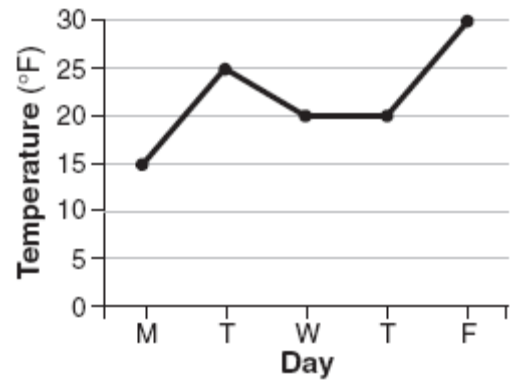
- [A] 79 [B] 76 [C] 75 [D] 77

12. What was the median high temperature in Middletown during the 7-day period shown in the table below?

| Daily High Temperature in Middletown |                  |
|--------------------------------------|------------------|
| Day                                  | Temperature (°F) |
| Sunday                               | 68               |
| Monday                               | 73               |
| Tuesday                              | 73               |
| Wednesday                            | 75               |
| Thursday                             | 69               |
| Friday                               | 67               |
| Saturday                             | 63               |

- [A] 69 [B] 75 [C] 70 [D] 73

13. The accompanying graph shows the high temperatures in Elmira, New York, for a 5-day period in January.



Which statement describes the data?

- [A] median = mean [B] mean = mode  
 [C] mean < mode [D] median = mode

14. Seth bought a used car that had been driven 20,000 miles. After he owned the car for 2 years, the total mileage of the car was 49,400. Find the average number of miles he drove *each month* during those 2 years.

15. Sara's test scores in mathematics were 64, 80, 88, 78, 60, 92, 84, 76, 86, 78, 72, and 90. Determine the mean, the median, and the mode of Sara's test scores.

16. Jorge made the accompanying stem-and-leaf plot of the weights, in pounds, of each member of the wrestling team he was coaching.

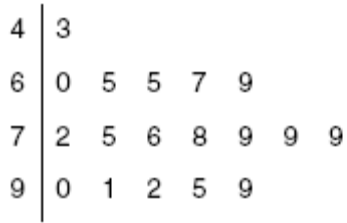
| Stem | Leaf          |
|------|---------------|
| 10   | 9             |
| 11   |               |
| 12   | 3 8           |
| 13   | 2 4 4 6 8     |
| 14   | 1 3 5 5 9     |
| 15   | 2 3 7 7 9     |
| 16   | 1 3 7 8 8 8 9 |
| 17   | 3 8           |

Key: 16 | 1 = 161

What is the mode of the weights?

- [A] 152 [B] 145 [C] 168 [D] 150

17. The student scores on Mrs. Frederick's mathematics test are shown on the stem-and-leaf plot below.



Key: 4 | 3 = 43 points

Find the median of these scores.