## 2.1   Number properties

1.  $99999^2 - 1^2 =$

    (A)   $10^{10} - 2$
    (B)   $(10^5 - 2)^2$
    (C)   $10^4(10^5 - 2)$
    (D)   $10^5(10^4 - 2)$
    (E)   $10^5(10^5 - 2)$

2.  If the greatest integer $k$ for which $3^k$ is a factor of $n!$ is 8, what is the largest possible value of $p$ so that $5^p$ is a factor of $n!$?

    (A)   2
    (B)   3
    (C)   4
    (D)   5
    (E)   6

3.  If $r = 0.345$, $s = (0.345)^2$ and $t = \sqrt{0.345}$, which of the following is the correct ordering of $r, s$ and $t$?

    (A)   $r < s < t$
    (B)   $r < t < s$
    (C)   $s < t < r$
    (D)   $s < r < t$
    (E)   $t < r < s$

4.  If $s$ is the product of the integers from 100 to 200, inclusive, and $t$ is the product of the integers from 100 to 201, inclusive, what is $\left(\dfrac{1}{s} + \dfrac{1}{t}\right)$ in terms of $t$?

    (A)   $\dfrac{(201)^2}{t}$
    (B)   $\dfrac{(201)\,(202)}{t}$
    (C)   $\dfrac{201}{t}$
    (D)   $\dfrac{202}{t}$
    (E)   $\dfrac{(201)\,(202)}{t^2}$

5.  If $s$ is the sum of all integers from 1 to 30, inclusive, what is the sum of all the factors of $s$?

    (A)   303
    (B)   613
    (C)   675
    (D)   737

    **(E)**  768

6.  If $s$ is the sum of the reciprocals of the consecutive integers from 91 to 100, inclusive, which of the following is less than $s$?

    **I.**  $\dfrac{1}{8}$

    **II.**  $\dfrac{1}{9}$

    **III.**  $\dfrac{1}{10}$

    **(A)**  Only I

    **(B)**  Only II

    **(C)**  Only III

    **(D)**  Only II and III

    **(E)**  I, II and III

7.  If the number $5m15n$, where $m$ and $n$ represent the thousands' and unit digits, is divisible by 36, what is the maximum value of $|m - n|$?

    **(A)**  1

    **(B)**  3

    **(C)**  5

    **(D)**  6

    **(E)**  8

8.  A positive integer $n$ is said to be "prime-saturated" if the product of all the different positive prime factors of $n$ is less than the square root of $n$. What is the greatest two-digit prime-saturated integer?

    **(A)**  99

    **(B)**  98

    **(C)**  97

    **(D)**  96

    **(E)**  95

9.  A set of numbers has the property that for any number $t$ in the set, $(t + 2)$ is also in the set. If $-1$ is in the set, which of the following is also in the set?

    **I.**  $-3$

    **II.**  1

    **III.**  5

    **(A)**  Only I

    **(B)**  Only II

    **(C)**  Only I and II

    **(D)**  Only II and III

**(E)**  I, II and III

10. If the sequence $x_1, x_2, x_3, \ldots x_n$, is such that $x_1 = 3$ and $x_{n+1} = 2x_n - 1$ for $n \geq 1$, then $x_{20} - x_{19} =$

   **(A)**  $2^{19}$
   **(B)**  $2^{20} - 1$
   **(C)**  $2^{20}$
   **(D)**  $2^{21} - 1$
   **(E)**  $2^{21}$

11. If $w, x, y$ and $z$ are integers such that $1 < w \leq x \leq y \leq z$ and $w * x * y * z = 924$, then how many possible values exist for $z$?

   **(A)**  Three
   **(B)**  Four
   **(C)**  Five
   **(D)**  Six
   **(E)**  Seven

12. If $0 < x < 1$ and $y > 1$, $\left(\sqrt{x + y - 2\sqrt{xy}} + \sqrt{x + y + 2\sqrt{xy}}\right) =$

   **(A)**  $\sqrt{x}$
   **(B)**  $2\sqrt{x}$
   **(C)**  $\sqrt{y} + \sqrt{x}$
   **(D)**  $\sqrt{y}$
   **(E)**  $2\sqrt{y}$

13. If $x \geq 0.9$, which of the following could be the value of $\left(\dfrac{1}{\sqrt{x}}\right)$?

   **(A)**  1.02
   **(B)**  1.12
   **(C)**  1.23
   **(D)**  1.45
   **(E)**  2.10

14. If $x$ and $y$ are positive integers and $180x = y^3$, which of the following must be an integer?

   **I.**  $\dfrac{x}{2^2 * 3 * 5}$
   **II.**  $\dfrac{x}{2 * 3^2 * 5}$
   **III.**  $\dfrac{x}{2 * 3 * 5^2}$

   **(A)**  Only I
   **(B)**  Only II
   **(C)**  Only III

**(D)**   Only I and II

**(E)**   I, II and III

**15.**   In the correctly worked addition problem shown below, where the sum of the two-digit positive integers $AB$ and $BA$ is the three-digit integer $AAC$, and $A$, $B$, and $C$ are different digits, what is the unit digit of the integer $AAC$?

$$\begin{array}{r} A\ B \\ +\ B\ A \\ \hline A\ A\ C \end{array}$$

**(A)**  9

**(B)**  6

**(C)**  3

**(D)**  2

**(E)**  0

16.  In the first week of the year, Nancy saved \$1. In each of the next 51 weeks, she saved \$1 more than she had saved in the previous week. What was the total amount that Nancy saved during the 52 weeks?

**(A)**  \$1326

**(B)**  \$1352

**(C)**  \$1378

**(D)**  \$2652

**(E)**  \$2756

## 2.2  Percents

17. A certain pair of used shoes can be repaired for $12.50 and will last for one year. A pair of the same kind of shoes can be purchased new for $28.00 and will last for two years. The average cost per year of the new shoes is what percent greater than the cost of repairing the used shoes?

   **(A)**  3%
   **(B)**  5%
   **(C)**  12%
   **(D)**  15%
   **(E)**  24%

18. A certain state has a sales tax of 5 percent on the portion of a purchase price that is greater than $100. If a customer paid a sales tax of $4 on a particular item, what was the purchase price of the item?

   **(A)**  $120
   **(B)**  $124
   **(C)**  $180
   **(D)**  $184
   **(E)**  $220

19. A certain sales tax rate is $0.82 per $50. What is the rate, as a percent, which is thrice as much as the rate mentioned?

   **(A)**  492%
   **(B)**  49.2%
   **(C)**  4.92%
   **(D)**  1.23%
   **(E)**  0.055%

20. A certain telescope X increases the visual range of a particular location from 90 kilometers to 270 kilometers. Another telescope Y increases the visual range of another location from 45 kilometers to 180 kilometers. By what percent is the percent increase in visual range using Y more than that obtained using X?

   **(A)**  33
   **(B)**  50
   **(C)**  75
   **(D)**  100
   **(E)**  150

21. The population of a certain country X is 120,108,000 and its land area is 2,998,000 square kilometers. The population of another country Y is 200,323,000 and its land area is 7,899,000 square kilometers. The population density is defined as the population per square kilometer of land area. The population density of country X is approximately what percent greater or lesser than that of country Y?

   **(A)**  60%

(B)  50%

(C)  45%

(D)  37%

(E)  15%

22.  A coat's original price of \$112 was reduced by 20 percent for a sale. If the sale price was then increased by 20 percent, which of the following, expresses the single percent change, which when applied to the original price of the coat, would result in the same final price of the coat now?

(A)  $100(1 - 0.2)^2$

(B)  $100(1 - 0.4)$

(C)  $100(1 - 0.4)^2$

(D)  $100(1 - 0.8)$

(E)  $100(1 - 0.96)$

23.  A doctor prescribed 18 cubic centimeters of a certain drug to a patient whose body weight was 120 pounds. If the typical dosage is 2 cubic centimeters per 15 pounds of body weight, by what percent should the prescribed dosage be reduced to bring it down to the typical dosage?

(A)  7.5

(B)  9.0

(C)  11.1

(D)  12.5

(E)  14.8

24.  A factory that employs 100 assembly-line workers pays each of these workers \$5 per hour for the first 40 hours worked during a week and $1\frac{1}{2}$ times that rate for hours worked in excess of 40. What was the total payroll for the assembly-line workers for a week in which 30 percent of them worked 20 hours, 50 percent worked 40 hours, and the rest worked 50 hours?

(A)  \$18000

(B)  \$18500

(C)  \$19000

(D)  \$20000

(E)  \$20500

25.  A pharmaceutical company received \$3 million in royalties on the first \$20 million in sales of the generic equivalent of one of its products and then \$9 million in royalties on the next \$108 million in sales. By approximately what percent did the ratio of royalties to sales decrease from the first \$20 million in sales to the next \$108 million in sales?

(A)  8%

(B)  15%

(C)  44%

(D)  52%

(E)  56%

**26.** A salesperson received 6 percent commission on the amount of total sales up to and including $10,000, and $r$ percent commission on the amount of total sales above $10,000. If the salesperson received a total commission of $920 on total sales of $14,000, what was the value of $r$?

    **(A)** 3.2

    **(B)** 4.3

    **(C)** 6.6

    **(D)** 8.0

    **(E)** 9.2

**27.** A shipment of 1,500 heads of cabbage, each of which was approximately the same size, was purchased for $600. The day the shipment arrived, $\frac{2}{3}$ of the heads were sold, each at 25 percent above the cost per head. The following day the rest were sold at a price per head equal to 10 percent less than the cost per head. What was the percent profit on this shipment?

    **(A)** 7.5%

    **(B)** 13.3%

    **(C)** 17.5%

    **(D)** 22.5%

    **(E)** 25.0%

**28.** Due to a 25% increase in the price of diesel, a person got 10 liters less quantity for $50 than he was getting before the increase. What was the initial price per liter of diesel?

    **(A)** $1.00

    **(B)** $1.50

    **(C)** $2.25

    **(D)** $2.50

    **(E)** $3.00

**29.** Company K has an annual budget for a certain project, and $\frac{1}{5}$ of this budget was spent during the first quarter of the year. If $\frac{1}{8}$ of the remainder of the budget was spent during the second quarter, by what percent is the budget that was left at the end of the second quarter more than that spent in the previous two quarters?

    **(A)** 80.0%

    **(B)** 120.0%

    **(C)** 125.0%

    **(D)** 133.3%

    **(E)** 250.0%

**30.** Dick and Jane each saved $3,000 in 2006. In 2007 Dick saved 8 percent more than he did in 2006, and together he and Jane saved a total of $5,000. Approximately, what percent less did Jane save in 2007 than he did in 2006?

    **(A)** 8%

**(B)** 25%

**(C)** 41%

**(D)** 59%

**(E)** 70%

31. The price of each share of stock K, when traded at a certain stock exchange, first goes up by $p$ percent and then falls down by $p$ percent every alternate day. After one such up-down cycle, the price of the stock fell by $2. If, after another such up-down cycle, the price per share of stock K comes to $196.02, what was the original price per share of stock K?

   **(A)** $300

   **(B)** $270

   **(C)** $250

   **(D)** $200

   **(E)** $150

32. Based on this year's costs, an orchard grower budgets $p$ dollars for planting $n$ new trees. If the average cost of planting each tree were to increase 25 percent from this year's cost, then the number of trees that the orchard grower could plant next year using $2p$ dollars would be

   **(A)** 12% less than $n$

   **(B)** 20% less than $n$

   **(C)** 33% greater than $n$

   **(D)** 60% greater than $n$

   **(E)** 75% greater than $n$

33. Before a certain tire is used, 40 percent of its total weight consists of tread. If during a lifetime of use, 50 percent, by weight, of the tire's tread is lost and no other parts of the tire is lost, what per cent of the tire's total remaining weight consists of the remaining tread?

   **(A)** 55%

   **(B)** 35%

   **(C)** 30%

   **(D)** 25%

   **(E)** 20%

34. A nut mix contains, by weight, 20 percent peanuts and 80 percent cashews. If this mixture costs 10 percent more than the cost of an equal quantity of pure peanuts, by what percent are cashews more expensive than peanuts?

   **(A)** 10.0%

   **(B)** 12.5%

   **(C)** 15.0%

   **(D)** 22.5%

   **(E)** 25.0%

35. At Company X, senior sales representatives visit the home office once every 30 days, and junior sales representatives visit the home office once every 20 days. The number of visits that a junior sales representative makes in a 2-year period is approximately what percent greater than the number of visits that a senior representative makes in the same period?

    **(A)** 10%

    **(B)** 25%

    **(C)** 33%

    **(D)** 50%

    **(E)** 67%

36. Anne bought a computer for $2,000 and then paid a 5 percent sales tax, and Henry bought a computer for $1,800 and then paid a 12 percent sales tax. The total amount that Henry paid, including sales tax, was what percent less than the total amount Anne paid, including sales tax?

    **(A)** 3%

    **(B)** 4%

    **(C)** 7%

    **(D)** 10%

    **(E)** 12%

37. In a corporation, 50 percent of the male employees and 40 percent of the female employees are at least 35 years old. If 42 percent of all the employees are at least 35 years old, what fraction of the employees in the corporation are females?

    **(A)** $\dfrac{3}{5}$

    **(B)** $\dfrac{2}{3}$

    **(C)** $\dfrac{3}{4}$

    **(D)** $\dfrac{4}{5}$

    **(E)** $\dfrac{5}{6}$

38. In a recent election, Ms. Robbins received 8,000 votes cast by independent voters, that is, voters not registered with a specific political party. She also received 10 percent of the votes cast by those voters registered with a political party. If $N$ is the total number of votes cast in the election and 40 percent of the votes were cast by independent voters, which of the following represents the number of votes that Ms. Robbins received?

    **(A)** $0.06N + 3200$

    **(B)** $0.1N + 7200$

    **(C)** $0.4N + 7200$

    **(D)** $0.06N + 8000$

    **(E)** $0.1N + 8000$

39. In Company X, 30 percent of the employees live over ten miles from work and 60 percent of the employees who live over ten miles from work use car pools. If 40 percent of the employees of Company X use car pools, what percent of the employees of Company X live ten miles or less from work and use car pools?

    **(A)** 12%

    **(B)** 20%

(C)   22%

(D)   28%

(E)   32%

40.   A total of 30 percent of the geese included in a certain migration study were male. If some of
      the geese migrated during the study and 20 percent of the migrating geese were male, what was
      the ratio of the migration rate for the male geese to the migration rate for the female geese?

(A)   $\dfrac{1}{4}$

(B)   $\dfrac{7}{12}$

(C)   $\dfrac{2}{3}$

(D)   $\dfrac{7}{8}$

(E)   $\dfrac{8}{9}$

41.   In 2006, the book value of a certain car was $\dfrac{2}{3}$ of the original purchase price, and in 2008 its
      book value was $\dfrac{1}{2}$ of the original purchase price. By what percent did the book value of this car
      decrease from 2006 to 2008?

(A)   16.6%

(B)   25.0%

(C)   33.3%

(D)   50.0%

(E)   75.0%

42.   In a certain city, 60 percent of the registered voters are Democrats and the rest are Republicans.
      In a mayoral race, if 75 percent of the registered voters who are Democrats and 20 percent of
      the registered voters who are Republicans are expected to vote for Candidate A, what percent of
      the registered voters are expected to vote for Candidate A?

(A)   50%

(B)   53%

(C)   54%

(D)   55%

(E)   57%

43.   In 2005, 45 percent of a document storage facility's 60 customers were banks, and in 2007, 25
      percent of its 144 customers were banks. What was the simple annual percent growth rate in
      the number of bank customers the facility had?

(A)   11.1%

(B)   16.6%

(C)   25.0%

(D)   33.3%

(E)  58.3%

44.  In 2006, the book value of a certain car was $\frac{2}{3}$ of the original purchase price, and in 2008 its book value was $\frac{1}{2}$ of the original purchase price. By what percent did the book value of this car decrease from 2006 to 2008?

   (A)  16.6%
   (B)  25.0%
   (C)  33.3%
   (D)  50.0%
   (E)  75.0%

45.  In a certain city, 60 percent of the registered voters are Democrats and the rest are Republicans. In a mayoral race, if 75 percent of the registered voters who are Democrats and 20 percent of the registered voters who are Republicans are expected to vote for Candidate A, what percent of the registered voters are expected to vote for Candidate A?

   (A)  50%
   (B)  53%
   (C)  54%
   (D)  55%
   (E)  57%

## 2.3   Profit & Loss

46.   A collection of books went on sale, and $\frac{2}{3}$ of them were sold for $2.50 each. If none of the 36 remaining books were sold, what was the total amount received for the books that were sold?

   **(A)**   $180

   **(B)**   $135

   **(C)**   $90

   **(D)**   $60

   **(E)**   $54

47.   A farmer produced 750 bushels of a certain crop at a cost of $20 per bushel. If the farmer sold $\frac{2}{3}$ of the bushels for double their production cost and sold the remaining bushels at 25 percent above their production cost, what was the farmer's gross profit on the sale of the crop?

   **(A)**   $11250

   **(B)**   $13375

   **(C)**   $15000

   **(D)**   $18750

   **(E)**   $26250

48.   A furniture store sells only two models of desks, model A and model B. The selling price of a model A desk is $120, which is 30 percent of the selling price of a model B desk. If the furniture store sells 2,000 desks, $\frac{3}{4}$ of which are model B, what is the furniture store's total revenue from the sale of desks?

   **(A)**   $114000

   **(B)**   $186000

   **(C)**   $294000

   **(D)**   $380000

   **(E)**   $660000

49.   A retailer bought a machine at a wholesale price of $90 and later on sold it for 10% less than the suggested retail price. If the retailer made a profit equivalent to 20% of the wholesale price, what is the suggested retail price of the machine?

   **(A)**   $81

   **(B)**   $100

   **(C)**   $120

   **(D)**   $135

   **(E)**   $160

50.   A small business invests $9,900 in equipment to produce a product. Each unit of the product costs $0.65 to produce and is sold for $1.20. How many units of the product must be sold before the revenue received equals the total expense of production, including the initial investment in equipment?

(A) 12000

(B) 14500

(C) 15230

(D) 18000

(E) 20000

51. A store's selling price for a certain computer would yield a profit of 40 percent of the store's cost for the computer. If the price were increased by $200, it would yield a profit of 50 percent of the computer's cost. What was the initial selling price of the computer?

(A) $2000

(B) $2400

(C) $2800

(D) $3000

(E) $3500

52. Company C produces toy trucks at a cost of $5.00 each for the first 100 trucks and $3.50 for each additional truck. If 500 toy trucks were produced by Company C and sold for $10.00 each, what was Company C's gross profit?

(A) $2250

(B) $2500

(C) $3100

(D) $3250

(E) $3500

53. A toy store's gross profit on a computer game was 10 percent of the cost of the game. If the store increased the selling price of the game from $44 to $46 and the cost of the game remained the same, then the store's gross profit on the game after the price increase was what percent of the cost of the game?

(A) 10.5%

(B) 11.0%

(C) 12.5%

(D) 13.0%

(E) 15.0%

54. A wholesaler bought 1200 radios for $18 each. He then sold 60 percent of the radios for $30 each and the rest for $15 each. What was the wholesaler's average (arithmetic mean) profit per radio?

(A) $2

(B) $3

(C) $4

(D) $5

(E) $6

**55.** A man sold an article at $k$ percent profit after offering $k$ percent discount on the listed price. Had he sold the article at $(k + 15)$ percent discount on the listed price, his profit would have been $(k - 20)$ percent. What would have been his percent profit had he sold the article without offering any discount?

    **(A)**   5.0%

    **(B)**   10.0%

    **(C)**   25.0%

    **(D)**   33.3%

    **(E)**   38.0%

## 2.4  Averages

**56.**  A certain college has a student-to-teacher ratio of 11 to 1. The average (arithmetic mean) annual salary for teachers is $52,000. If the college pays a total of $6,760,000 in annual salaries to its teachers, how many students does the college have?

  **(A)**  130
  **(B)**  169
  **(C)**  1300
  **(D)**  1430
  **(E)**  1560

**57.**  A club sold an average (arithmetic mean) of 92 raffle tickets per member. Among the female members, average number sold was 84, and among the male members, the average number sold was 96. What was the ratio of the number of male members to the number of female members in the club?

  **(A)**  1 : 1
  **(B)**  1 : 2
  **(C)**  1 : 3
  **(D)**  2 : 1
  **(E)**  3 : 1

**58.**  A college chemistry course is divided into two sections. In section A, the average score in the final examination was 92. In section B, the average score in the final examination was 84. If the average score of all 40 students in the course was 89, how many students are in section A?

  **(A)**  15
  **(B)**  18
  **(C)**  20
  **(D)**  22
  **(E)**  25

**59.**  A grocer has 400 pounds of coffee in stock, 20 percent of which is decaffeinated. If the grocer buys another 100 pounds of coffee of which 60 percent is decaffeinated, what percent, by weight, of the grocer's stock of coffee is decaffeinated?

  **(A)**  28%
  **(B)**  30%
  **(C)**  32%
  **(D)**  34%
  **(E)**  40%

**60.**  A class has 4 sections P, Q, R and S and the average weights of the students in the sections are 45lb, 50lb, 55lb and 65lb respectively. What is the maximum possible number of students in section R if there are 40 students in all sections combined and the average weight of the all students across all the sections is 55lb? It is known that each section has at least one student.

  **(A)**  18

**(B)**   20

**(C)**   25

**(D)**   35

**(E)**   37

61.   A set S consists of the integers $\{1,\ 2,\ 3,\ 4\ldots(2n+1)\}$, where $n$ is a positive integer. If $X$ is the average of the odd integers in set S and $Y$ is the average of the even integers in set S, what is the value of $(X - Y)$?

**(A)**   0

**(B)**   $\dfrac{1}{2}$

**(C)**   1

**(D)**   $\dfrac{3}{2}$

**(E)**   2

62.   The average of seven numbers is 20. The average of the first four numbers is 19 and that of the last four is 24. What is the value of the fourth number?

**(A)**   23

**(B)**   25

**(C)**   32

**(D)**   43

**(E)**   63

63.   Box W and Box V each contain several blue sticks and red sticks, and all of the red sticks have the same length. The length of each red stick is 18 inches less than the average length of the sticks in Box Wand 6 inches greater than the average length of the sticks in Box V. What is the difference between average (arithmetic mean) length, in inches, of the sticks in Box W and of the sticks in Box V?

**(A)**   3

**(B)**   6

**(C)**   12

**(D)**   18

**(E)**   24

64.   At a certain company, the average (arithmetic mean) salary of 10 of the employees is $30,000, the average salary of 30 other employees is $40,000, and the average salary of the remaining 20 employees is $60,000. What is the average salary of the 60 employees at the company?

**(A)**   $40,000

**(B)**   $43,000

**(C)**   $45,000

**(D)**   $50,000

**(E)**   $55,000

65. At a certain food stand, the price of each apple is 40 cents and the price of each orange is 60 cents. Mary selects a total of 10 apples and oranges from the food stand, and the average (arithmetic mean) price of the 10 pieces of fruit comes to 56 cents. How many oranges must Mary put back so that the average price of the pieces of fruit that she keeps with her is 52 cents?

   (A)   1
   (B)   2
   (C)   3
   (D)   4
   (E)   5

66. A student's average (arithmetic mean) test score on four tests is 78. If each test is scored out of 100, which of the following can be the student's score on the fifth test so that the student's average score on the five tests increases by an integer value?

   (A)   82
   (B)   87
   (C)   89
   (D)   93
   (E)   95

67. A teacher gave the same test to three history classes: A, B, and C. The average (arithmetic mean) scores for the three classes were 65, 80, and 77, respectively. The ratio of the numbers of students in each class who took the test was 4 : 6 : 5, respectively. What was the average score for the three classes combined?

   (A)   74
   (B)   75
   (C)   76
   (D)   77
   (E)   78

68. A total of 22 men and 26 women were at a party. The average (arithmetic mean) age of all of the people at the party was exactly 35 years. If the average age of the men was exactly 38 years, which of the following was closest to the average age, in years, of the women?

   (A)   31.0
   (B)   31.5
   (C)   32.0
   (D)   32.5
   (E)   33.0

69. This is a modified question of the above question.

   A total of 22 men and 26 women were at a party. The average (arithmetic mean) age of all of the people at the party was exactly 66.74 years. If the average age of the men was exactly 69.74 years, which of the following was closest to the average age, in years, of the women?

   (A)   61.24

**(B)** 63.74

**(C)** 64.24

**(D)** 64.74

**(E)** 69.24

## 2.5 Ratio & Proportion

**70.** The total expenses of organizing a party has a fixed expense of $250 as the rent of the place where the party is to be organized and a variable expense depending on the number of guests attending the party. For 10 guests the total expense was estimated to be $650. What is the estimated total expense for 20 guests?

**(A)** $800

**(B)** $900

**(C)** $1050

**(D)** $1250

**(E)** $1300

**71.** A glass was filled with 10 ounces of water and spirit mixture with the components in the ratio 2 : 3 respectively. If 1 percent of the initial quantity of water and 3 percent of the initial quantity of spirit evaporated each day during a twenty-day period, what percent of the original amount of mixture evaporated during this period?

**(A)** 4.4%

**(B)** 24.4%

**(C)** 44.0%

**(D)** 50.0%

**(E)** 80.0%

**72.** In Diana's stamp collection, $\frac{4}{5}$ of the stamps are Canadian, and $\frac{3}{7}$ of the Canadian stamps were issued before 1940. If 192 stamps in Diana's collection are Canadian stamps that were issued in 1940 or later, how many stamps in her collection are not Canadian?

**(A)** 84

**(B)** 88

**(C)** 96

**(D)** 104

**(E)** 112

**73.** The ratio of the ages of A and B is 7 : 11. Which of the following cannot be the ratio of their ages after 5 years?

**(A)** 1 : 3

**(B)** 9 : 20

**(C)** 4 : 15

**(D)** 3 : 5

**(E)** 2 : 3

**74.** Company S produces two kinds of stereos: basic and deluxe. Of the stereos produced by Company S last month, $\frac{2}{3}$ were basic and the rest were deluxe. If it takes $\frac{7}{5}$ as many hours to produce a deluxe stereo as it does to produce a basic stereo, then the number of hours it took to produce the deluxe stereos last month was what fraction of the total number of hours it took to produce all the stereos?

(A) $\dfrac{7}{17}$

(B) $\dfrac{14}{31}$

(C) $\dfrac{7}{15}$

(D) $\dfrac{17}{35}$

(E) $\dfrac{1}{2}$

75. At a certain school, the ratio of the number of second graders to the number of fourth graders is 8 to 5, and the ratio of the number of first graders to the number of second graders is 3 to 4. If the ratio of the number of third graders to the number of fourth graders is 3 to 2, what is the ratio of the number of first graders to the number of third graders?

(A) 5 to 4

(B) 9 to 5

(C) 16 to 15

(D) 4 to 5

(E) 5 to 16

76. At a monthly meeting, $\dfrac{2}{5}$ of the attendees were males and $\dfrac{7}{8}$ of the male attendees arrived on time. If $\dfrac{9}{10}$ of the female attendees arrived on time, what fraction of the attendees at the monthly meeting who did not arrive on time are males?

(A) $\dfrac{11}{100}$

(B) $\dfrac{3}{25}$

(C) $\dfrac{11}{50}$

(D) $\dfrac{9}{20}$

(E) $\dfrac{5}{11}$

77. Ann, Carol, and Judy paid a total of \$45 for their dinner at a restaurant. If Ann paid $\dfrac{2}{5}$ of what Judy paid, Carol paid \$17 and Judy paid the rest, what fraction of the total amount did Judy pay?

(A) $\dfrac{2}{9}$

(B) $\dfrac{14}{45}$

(C) $\dfrac{1}{3}$

(D) $\dfrac{2}{5}$

(E) $\dfrac{4}{9}$

**78.** A total of $n$ trucks and cars are parked in a lot. If the number of cars is $\frac{1}{4}$ the number of trucks, and $\frac{2}{3}$ of the trucks are pickups, how many pickups, in terms of $n$, are parked in the lot?

(A)  $\dfrac{n}{12}$

(B)  $\dfrac{n}{6}$

(C)  $\dfrac{5n}{12}$

(D)  $\dfrac{8n}{15}$

(E)  $\dfrac{11n}{12}$

**79.** A wire that weighs 20 pounds is cut into two pieces so that one of the pieces weighs 16 pounds and is 36 feet long. If the weight of each piece is directly proportional to the square of its length, how many feet long is the other piece of wire?

(A)  9

(B)  12

(C)  18

(D)  24

(E)  27

**80.** A sum of money was divided between John and Bob so that the ratio of John's share to Bob's share was 5 : 3. If John's share exceeded $\frac{5}{9}$ of the total sum of money by \$50, what was Bob's share?

(A)  \$180

(B)  \$270

(C)  \$340

(D)  \$450

(E)  \$720

**81.** In a certain English class, $\frac{1}{4}$ of the number of girls is equal to $\frac{1}{6}$ of the total number of students. What is the ratio of the number of boys to the number of girls in the class?

(A)  1 : 4

(B)  1 : 3

(C)  1 : 2

(D)  2 : 3

(E)  2 : 1

**82.** In a certain quiz that consists of 10 questions, each question after the first is worth 4 points more than the preceding question. If the 10 questions on the quiz are worth a total of 360 points, how many points is the third question worth?

(A)  18

36

(B)   24

(C)   26

(D)   32

(E)   44

83.  In a certain school, 40 more than $\frac{1}{3}$ of all the students are taking a science course and $\frac{1}{4}$ of those taking a science course are taking physics. If $\frac{1}{8}$ of all the students in the school are taking physics, how many students are in the school?

(A)   240

(B)   300

(C)   480

(D)   720

(E)   960

84.  In a certain class containing 36 students, some boys and some girls, exactly $\frac{1}{3}$ of the boys and exactly $\frac{1}{4}$ of the girls walk to school. What is the greatest possible number of students in this class who walk to school?

(A)   9

(B)   10

(C)   11

(D)   12

(E)   13

85.  In a certain English class, $\frac{1}{4}$ of the number of girls is equal to $\frac{1}{6}$ of the total number of students. What is the ratio of the number of boys to the number of girls in the class?

(A)   1 : 4

(B)   1 : 3

(C)   1 : 2

(D)   2 : 3

(E)   2 : 1

86.  In a certain shipment, there are 30 boxes which weigh either 10 pounds or 20 pounds, and the average (arithmetic mean) weight of the boxes in the shipment is 18 pounds. If the average weight of the boxes in the shipment is to be reduced to 16 pounds by including few extra 10-pound boxes, how many extra 10-pound boxes must be included?

(A)   4

(B)   6

(C)   10

(D)   20

(E)   24

87. How many liters of pure alcohol must be added to a 90-liter solution that is 20 percent alcohol in order to produce a solution that is 25 percent alcohol?

   **(A)** 4.5

   **(B)** 5.0

   **(C)** 5.5

   **(D)** 6.0

   **(E)** 6.5

## 2.6   Speed, Time, & Distance

88.   A bus trip of 450 miles would have taken one hour less if the average speed $S$ for the trip had been greater by five miles per hour. What was the average speed $S$, in miles per hour, for the trip?

   **(A)**   10
   **(B)**   40
   **(C)**   45
   **(D)**   50
   **(E)**   55

89.   A car traveled 462 miles per full tank of gasoline on the highway and 336 miles per full tank of gasoline in the city. If the car traveled six fewer miles per gallon in the city than on the highway, how many miles per gallon did the car travel in the city?

   **(A)**   14
   **(B)**   16
   **(C)**   21
   **(D)**   22
   **(E)**   27

90.   A car traveling at a certain constant speed takes two seconds longer to travel one kilometer than it would take to travel one kilometer at 75 kilometers per hour. At what speed, in kilometers per hour, is the car traveling?

   **(A)**   71.5
   **(B)**   72
   **(C)**   72.5
   **(D)**   73
   **(E)**   73.5

91.   A certain car increased its average speed by 5 miles per hour in each successive 5-minute interval after the first interval. If in the first 5-minute interval, its average speed was 20 miles per hour, how many miles did the car travel in the third 5-minute interval?

   **(A)**   1.0
   **(B)**   1.5
   **(C)**   2.0
   **(D)**   2.5
   **(E)**   3.0

92.   A certain pilot flew 400 miles to City K at an average speed of 350 miles per hour with the wind and made the trip back at an average speed of 250 miles per hour against the wind. Which of the following is closest to the pilot's average speed, in miles per hour, for the round-trip?

   **(A)**   280
   **(B)**   290

(C) 300

(D) 310

(E) 320

93. A driver completed the first 20 miles of a 40-mile trip at an average speed of 50 miles per hour. At what average speed (in miles per hour) did the driver complete the remaining 20 miles to achieve an average speed of 60 miles per hour for the entire 40-mile trip? It is known that the driver did not make any stops during the 40-mile trip.

(A) 65

(B) 68

(C) 70

(D) 75

(E) 80

94. A hiker walked for two days. On the second day the hiker walked at an average speed of 1 mile per hour faster than he walked on the first day. If during the two days he walked a total of 64 miles and spent a total of 18 hours walking, which of the following could be his average speed (in miles per hour) on the first day?

(A) 2

(B) 3

(C) 4

(D) 5

(E) 6

95. If two trains are 120 miles apart and are traveling toward each other on parallel tracks at constant rates of 30 miles per hour and 40 miles per hour, how far apart will they be one hour before they meet?

(A) 10

(B) 30

(C) 40

(D) 50

(E) 70

96. Because of construction, the speed limit along an 8-mile section of highway is reduced from 55 miles per hour to 35 miles per hour. Approximately how many minutes more will it take to travel along this section of highway at the new speed limit than it would have taken at the old speed limit?

(A) 5

(B) 8

(C) 10

(D) 15

(E) 24

**97.** Cars X and Y traveled the same 80-mile route. If car X took 2 hours and car Y traveled at an average speed which was 50 percent faster than the average speed of car X, how many hours did it take car Y to travel the route?

   **(A)** $\dfrac{2}{3}$

   **(B)** 1

   **(C)** $1\dfrac{1}{3}$

   **(D)** $1\dfrac{3}{5}$

   **(E)** 3

**98.** Joe drives five times farther in 50 minutes than what Bob drives in 40 minutes. If Joe drives at a speed of 36 miles per hour, at what speed, in miles per hour, does Bob drive?

   **(A)** 6.0

   **(B)** 9.0

   **(C)** 20.0

   **(D)** 32.5

   **(E)** 64.8

**99.** A train left a station P at 6 am and reached another station Q at 11 am. Another train left station Q at 7 am and reached P at 10 am. At what time did the two trains pass one another?

   **(A)** 7:50 am

   **(B)** 8:13 am

   **(C)** 8:30 am

   **(D)** 8:42 am

   **(E)** 9:03 am

## 2.7 Time & Work

**100.** A certain machine produces 1,000 units of product P per hour. Working 12 hours each day, another machine, twice as efficient, will produce how many units of product P in seven days?

**(A)** 7,000

**(B)** 24,000

**(C)** 40,000

**(D)** 100,000

**(E)** 168,000

**101.** A pump started filling an empty pool with water and continued at a constant rate until the pool was full. At noon, the pool was $\frac{1}{3}$ full, and $1\frac{1}{4}$ hours later, it was $\frac{3}{4}$ full. What would be the total number of hours that another pump thrice as efficient would take to completely fill a pool twice as large?

**(A)** 2

**(B)** $2\frac{2}{3}$

**(C)** 3

**(D)** $3\frac{1}{2}$

**(E)** $3\frac{2}{3}$

**102.** Two taps can fill a cistern in 20 minutes and 30 minutes. The first tap was opened initially for $x$ minutes after which the second tap was opened. If it took a total of 15 minutes for the tank to be filled, what is the value of $x$?

**(A)** 5.0

**(B)** 7.5

**(C)** 9.0

**(D)** 10.0

**(E)** 12.5

**103.** An empty swimming pool with a capacity of 5,760 gallons is filled by a pipe at the rate of 12 gallons per minute. There is an emptying pipe which can empty the pool which is $\frac{3}{4}$ full in 9 hours. How many hours does it take to fill the entire pool which is already half filled, if both pipes are kept open?

**(A)** 6

**(B)** 12

**(C)** 24

**(D)** 36

**(E)** 72

**104.** Machine A produces parts twice as fast as machine B does. Machine B produces 100 parts of product X in 40 minutes. If each machine produces parts at a constant rate, how many parts of product Y does machine A produce in 6 minutes, if each part of product Y takes $\frac{3}{2}$ times of the time taken to produce each part of product X?

(A)  45

(B)  30

(C)  25

(D)  20

(E)  15

**105.** Machine A, operating alone at its constant rate, produces 500 feet of a particular fiber in 2 hours. Machine B, operating alone at its constant rate, produces 500 feet of the same fiber in 3 hours. Machine C, operating alone at its constant rate, produces 500 feet of the same fiber in 6 hours. How many hours will it take machines A, B, and C, operating together at their respective constant rates, to produce 1,000 feet of the fiber?

(A)  1.0

(B)  1.5

(C)  2.0

(D)  2.5

(E)  3.0

**106.** On a 3-day fishing trip, 4 adults consumed food costing $60. If it is known that one child consumes half the amount of food consumed by an adult in the same time, for the same food costs per person per day, what would be the cost of food consumed by 6 adults and 3 children during a 4-day fishing trip?

(A)  $180

(B)  $150

(C)  $125

(D)  $90

(E)  $75

**107.** Mark and Kate individually take 12 hours more and 27 hours more, respectively, to complete a certain project than what they would have taken to complete the same project working together. How many hours do Mark and Kate take to complete the project, working together?

(A)  12

(B)  16

(C)  18

(D)  24

(E)  39

## 2.8 Computational

**108.** A certain liquid leaks out of a container at the rate of $k$ liters for every $x$ hours. If the liquid costs 6 dollars per liter, what is the cost, in dollars, of the amount of the liquid that will leak out in $y$ hours?

(A) $\dfrac{ky}{6x}$

(B) $\dfrac{6x}{ky}$

(C) $\dfrac{6k}{xy}$

(D) $\dfrac{6ky}{x}$

(E) $\dfrac{6xy}{k}$

**109.** A certain quantity is measured on two different scales, the R-scale and the S-scale, that are related linearly. Measurements on the R-scale of 6 and 24 correspond to measurements on the S-scale of 30 and 60, respectively. What measurement on the R-scale corresponds to a measurement of 100 on the S-scale?

(A) 20

(B) 36

(C) 48

(D) 60

(E) 84

**110.** If Jack had twice the amount of money that he has, he would have exactly the amount necessary to buy three hamburgers at $0.96 a piece and two milk shakes at $1.28 a piece. How much money does Jack have?

(A) $1.60

(B) $2.24

(C) $2.72

(D) $3.36

(E) $5.44

**111.** The population of a certain country increases at the rate of 30,000 people every month. The population of the country in 2012 was 360 million. In which year would the population of the country be 378 million?

(A) 2060

(B) 2061

(C) 2062

(D) 2063

(E) 2064

**112.** A restaurant buys fruit in cans, each containing $3\frac{1}{2}$ cups of fruit. If the restaurant uses $\frac{1}{2}$ cup of the fruit in each serving of its fruit compote, what is the least number of cans needed to prepare 60 servings of the compote?

    **(A)**   7

    **(B)**   8

    **(C)**   9

    **(D)**   10

    **(E)**   12

**113.** Coins are to be put into 7 pockets so that each pocket contains at least one coin. At most 3 of the pockets are to contain the same number of coins, and no two of the remaining pockets are to contain an equal number of coins. What is the least possible number of coins needed for the pockets?

    **(A)**   7

    **(B)**   13

    **(C)**   17

    **(D)**   22

    **(E)**   28

**114.** During a spring season, a certain glacier surged at the rate of $\frac{1}{4}$ mile per 25 days. How many hours does it take the glacier to cover one foot? (1 mile = 5,280 feet)

    **(A)**   $\dfrac{5}{264}$

    **(B)**   $\dfrac{6}{25}$

    **(C)**   $\dfrac{5}{11}$

    **(D)**   $\dfrac{11}{5}$

    **(E)**   $\dfrac{25}{6}$

**115.** At a certain carpet factory, if carpeting of width 10 feet is moving continuously through a dryer at a constant speed of 2160 feet per hour, how many SECONDS does it take for an area of 1 square foot of carpeting to move through the dryer?

    **(A)**   $\dfrac{1}{6}$

    **(B)**   $\dfrac{1}{3}$

    **(C)**   6

    **(D)**   36

    **(E)**   60

**116.** At a certain company, each employee has a salary grade $s$ that is at least 1 and at most 5. Each employee receives an hourly wage $p$, in dollars, determined by the formula $p = 950 + 0.25(s - 1)$. An employee with a salary grade of 5 receives how many more dollars per hour than an employee with a salary grade of 1?

   **(A)** $0.50
   **(B)** $1.00
   **(C)** $1.25
   **(D)** $1.50
   **(E)** $1.75

**117.** At a garage sale, the prices of all the items sold were different. The items sold were radios and DVD players. If the price of a radio sold at the garage sale was the 15$^{\text{th}}$ highest price as well as the 20$^{\text{th}}$ lowest price among the prices of the radios sold, and the price of a DVD player sold was the 29$^{\text{th}}$ highest price as well as the 37$^{\text{th}}$ lowest price among all the prices of all the items sold, how many DVD players were sold at the garage sale?

   **(A)** 30
   **(B)** 31
   **(C)** 32
   **(D)** 64
   **(E)** 65

**118.** An author received $0.80 in royalties for each of the first 100,000 copies of her book sold, and $0.60 in royalties for each additional copy sold. If she received a total of $260,000 in royalties, how many copies of her book were sold?

   **(A)** 130,000
   **(B)** 300,000
   **(C)** 380,000
   **(D)** 400,000
   **(E)** 420,000

**119.** A tourist purchased a total of $1,500 worth of traveler's checks in $10 and $50 denominations. During the trip, the tourist cashed only seven checks and then lost all the rest. If the number of $10 checks cashed was one more or one less than the number of $50 checks cashed, what is the minimum possible value of the checks that were lost?

   **(A)** $1430
   **(B)** $1310
   **(C)** $1290
   **(D)** $1270
   **(E)** $1150

## 2.9   Interest

**120.**   A sum of money invested under simple interest, amounts to $1200 in three years and $1500 in five years. What is the rate at which the sum of money was invested?

   **(A)**   10%
   **(B)**   15%
   **(C)**   20%
   **(D)**   25%
   **(E)**   45%

**121.**   The difference, after two years, between compound interest and simple interest on a certain sum of money invested at the same rate of interest, is $18. If the simple interest accumulated on the sum after two years is $180, what is the rate of interest at which the sum of money was invested?

   **(A)**   36%
   **(B)**   30%
   **(C)**   25%
   **(D)**   20%
   **(E)**   10%

**122.**   Andrew borrows equal sums of money under simple interest at 5% and 4% rate of interest. He finds that if he repays the former sum on a certain date six months before the latter, he will have to pay the same amount of $1100 in each case. What is the total sum that he had borrowed?

   **(A)**   $750
   **(B)**   $1000
   **(C)**   $1500
   **(D)**   $2000
   **(E)**   $4000

**123.**   A total of $10,000 was invested in two certificates of deposit at simple annual interest rates of 6 percent and 8 percent, respectively. If the total interest on the two certificates was $720 at the end of one year, what fractional part of the 10,000 was invested at the higher rate?

   **(A)**   $\dfrac{3}{8}$
   **(B)**   $\dfrac{2}{5}$
   **(C)**   $\dfrac{1}{2}$
   **(D)**   $\dfrac{3}{5}$
   **(E)**   $\dfrac{3}{4}$

**124.**   In 2005, 45 percent of a document storage facility's 60 customers were banks, and in 2007, 25 percent of its 144 customers were banks. What was the simple annual percent growth rate in the number of bank customers the facility had?

(A) 11.1%

(B) 16.6%

(C) 25.0%

(D) 33.3%

(E) 58.3%

**125.** A basket contains five apples, of which one is spoiled and the rest are good. If Henry is to select two apples from the basket simultaneously and at random, what is the probability that the two apples selected will include the spoiled apple?

(A) $\dfrac{1}{20}$

(B) $\dfrac{1}{10}$

(C) $\dfrac{1}{5}$

(D) $\dfrac{2}{5}$

(E) $\dfrac{3}{5}$

**126.** At the start of an experiment, a certain population consisted of $x$ organisms. At the end of each month after the start of the experiment, the population size increased by twice of its size at the beginning of that month. If the total population at the end of five months is greater than 1000, what is the minimum possible value of $x$?

(A) 2

(B) 3

(C) 4

(D) 5

(E) 6

**127.** At the end of each year, the value of a certain antique watch is $c$ percent more than its value one year earlier, where $c$ has the same value each year. If the value of the watch was $k$ dollars on January 1, 1992, and $m$ dollars on January 1, 1994, then in terms of $m$ and $k$, what was the value of the watch, in dollars, on January 1, 1995?

(A) $m + \dfrac{1}{2}(m - k)$

(B) $m + \dfrac{1}{2}\left(\dfrac{m - k}{k}\right)m$

(C) $\dfrac{m\sqrt{m}}{\sqrt{k}}$

(D) $\dfrac{m^2}{2k}$

(E) $km^2$

**128.** Alex deposited $x$ dollars into a new account that earned 8 percent annual interest compounded annually. One year later Alex deposited additional $x$ dollars in the account. If there were no other transactions and if the account contained $w$ dollars at the end of the two years, which of the following expresses $x$ in terms of $w$?

(A) $\dfrac{w}{1 + 1.08}$

(B) $\dfrac{w}{1.08 + 1.16}$

(C) $\dfrac{w}{1.16 + 1.24}$

(D) $\dfrac{w}{1.08 + 1.08^2}$

(E) $\dfrac{w}{1.08^2 + 1.08^3}$

129. The compound interest on a certain sum of money invested at a certain rate of interest in the 2$^{nd}$ year and in the 3$^{rd}$ year was \$600 and \$720 respectively. What was the rate of interest at which the sum of money was invested?

(A) 12.0%

(B) 12.5%

(C) 15.0%

(D) 20.0%

(E) 25.0%

## 2.10  Functions

**130.** If the function $f$ is defined by $f(x) = x^2 + \dfrac{1}{x^2}$ for all non-zero numbers $x$, then $\left(f\left(-\dfrac{1}{\sqrt{x}}\right)\right)^2 =$

(A)  $\dfrac{2}{f(x^2)}$

(B)  $\left(\dfrac{1}{f(\sqrt{x})}\right)^2$

(C)  $1 - (f(\sqrt{x}))^2$

(D)  $f(x) - 2$

(E)  $f(x) + 2$

**131.** The function $f$ is defined by $f(x) = -\dfrac{1}{x}$ for all non-zero numbers $x$. If $f(a) = -\dfrac{1}{2}$ and $f(ab) = \dfrac{1}{6}$, then $b =$

(A)  3

(B)  $\dfrac{1}{3}$

(C)  $-\dfrac{1}{3}$

(D)  $-3$

(E)  $-12$

**132.** The function $f$ is defined by $f(x) = \sqrt{x} - 10$ for all positive numbers $x$. If $u = f(t)$ for some positive numbers $t$ and $u$, what is $t$ in terms of $u$?

(A)  $\sqrt{u + 10}$

(B)  $(\sqrt{u} + 10)^2$

(C)  $\sqrt{u^2 + 10}$

(D)  $(u + 10)^2$

(E)  $(u^2 + 10)^2$

**133.** The function $f$ is defined for each positive three-digit integer $n$ by $f(n) = 2^x 3^y 5^z$, where $x$, $y$ and $z$ are the hundreds', tens and unit digits of $n$, respectively. If $m$ and $v$ are three-digit positive integers such that $f(m) = 9f(v)$, then $m - v =$

(A)  8

(B)  9

(C)  18

(D)  20

(E)  80

**134.** For which of the following functions $f$, is $f(x) = f(1 - x)$ for all $x$?

(A)  $f(x) = 1 - x$

(B)  $f(x) = 1 - x^2$

**(C)**   $f(x) = x^2 - (1-x)^2$

**(D)**   $f(x) = x^2(1-x)^2$

**(E)**   $f(x) = \dfrac{x}{1-x}$

135.   If $f(x) = \dfrac{1}{x}$ and $g(x) = \dfrac{x}{x^2 + 1}$, for all $x > 0$, what is the minimum value of $f(g(x))$?

**(A)**   0

**(B)**   $\dfrac{1}{2}$

**(C)**   1

**(D)**   $\dfrac{3}{2}$

**(E)**   2

136.   If $P(r) = \dfrac{8r}{1-r}$, for what value of $r$ does $P(r) = \dfrac{1}{2}P(3)$?

**(A)**   6

**(B)**   3

**(C)**   0

**(D)**   $-3$

**(E)**   $-6$

137.   If $3f(x) + 2f(-x) = 5x - 10$, what is the value of $f(1)$?

**(A)**   0

**(B)**   1

**(C)**   2

**(D)**   3

**(E)**   4

## 2.11   Permutation & Combination & Probability

**138.**   $C_n^m = \dfrac{m!}{(m-n)!.n!}$ for non-negative integers $m$ and $n$, $m \geq n$. If $C_3^5 = C_x^5$ and $x \neq 3$, what is the value of $x$?

   **(A)**   0
   **(B)**   1
   **(C)**   2
   **(D)**   4
   **(E)**   5

**139.**   A "code" is defined as a sequence of three dots arranged in a row. Each dot is colored either "yellow" or "blue". How many distinct codes can be formed?

   **(A)**   3
   **(B)**   5
   **(C)**   6
   **(D)**   8
   **(E)**   9

**140.**   A certain office supply store stocks two sizes of self-stick notepads, each in four colors: blue, green, yellow and pink. The store packs the notepads in packages that contain either three notepads of the same size and the same color or three notepads of the same size and of three different colors. If the order in which the colors are packed is not considered, how many different packages of the types described above are possible?

   **(A)**   6
   **(B)**   8
   **(C)**   16
   **(D)**   24
   **(E)**   32

**141.**   A certain restaurant offers six kinds of cheese and two kinds of fruit for its dessert platter. If each dessert platter contains an equal number of kinds of cheese and an equal number of kinds of fruits, how many different dessert platters could the restaurant offer?

   **(A)**   8
   **(B)**   12
   **(C)**   15
   **(D)**   21
   **(E)**   27

**142.**   A certain stock exchange designates each stock with a one, two or three-letter code, where each letter is selected from the 26 letters of the alphabet. If the letters may be repeated and if the same letters used in a different order constitute a different code, how many different stocks is it possible to uniquely designate with these codes?

   **(A)**   2951

   **(B)** 8125

   **(C)** 15600

   **(D)** 16302

   **(E)** 18278

143.   A certain university will select one of seven candidates eligible to fill a position in the Mathematics department and two of ten candidates eligible to fill two identical positions in the Computer Science department. If none of the candidates is eligible for a position in both departments, how many different sets of three candidates are there to fill the three positions?

   **(A)** 42

   **(B)** 70

   **(C)** 140

   **(D)** 165

   **(E)** 315

144.   A company has assigned a distinct three-digit code number to each of its 330 employees. Each code number was formed from the digits 2, 3, 4, 5, 6, 7, 8, 9 and no digit appears more than once in any one code number. How many unassigned code numbers are there?

   **(A)** 6

   **(B)** 58

   **(C)** 174

   **(D)** 182

   **(E)** 399

145.   A company plans to assign identification numbers to its employees. Each number is to consist of four different digits from 0 to 9, inclusive, except that the first digit cannot be 0. If any digit can be repeated any number of times in a particular code, how many different identification numbers are possible that are odd numbers?

   **(A)** 2520

   **(B)** 2268

   **(C)** 3240

   **(D)** 4500

   **(E)** 9000

146.   A fast-food company plans to build four new restaurants. If there are six sites A, B, C, D, E and F, that satisfy the company's criteria for location of the new restaurants, in how many different ways can the company select the four sites if the order of selection does not matter, given that both the sites A and B cannot be selected simultaneously?

   **(A)** 4

   **(B)** 5

   **(C)** 6

   **(D)** 9

   **(E)** 15

**147.** A photographer wants to arrange 6 men of 6 different heights for a photograph by placing them in two rows of three so that each man in the first row is standing in front of someone in the second row. The heights of the men within each row must increase from left to right, and each man in the second row must be taller than the man standing in front of him. How many such arrangements of the 6 men are possible?

- **(A)** 5
- **(B)** 6
- **(C)** 9
- **(D)** 24
- **(E)** 36

**148.** A researcher plans to identify each participant in a certain medical experiment with a code consisting of either a single letter or a pair of distinct letters written in alphabetic order. What is the least number of letters that can be used if there are 12 participants, and each participant is to receive a different code?

- **(A)** 4
- **(B)** 5
- **(C)** 6
- **(D)** 7
- **(E)** 8

**149.** Departments A, B, and C have 10 employees each, and department D has 20 employees. Departments A, B, C, and D have no employees in common. A task force is to be formed by selecting 1 employee from each of departments A, B, and C and 2 employees from department D. How many different task forces are possible?

- **(A)** 19,000
- **(B)** 40,000
- **(C)** 100,000
- **(D)** 190,000
- **(E)** 400,000

**150.** An analyst will recommend a combination of 3 industrial stocks, 2 transportation stocks, and 2 utility stocks. If the analyst can choose from 5 industrial stocks, 4 transportation stocks, and 3 utility stocks, how many different combinations of 7 stocks are possible?

- **(A)** 12
- **(B)** 19
- **(C)** 60
- **(D)** 180
- **(E)** 720

**151.** In a meeting of 3 representatives from each of 6 different companies, each representative shook hands with every person other than those from his or her own company. How many handshakes took place in the meeting?

- **(A)** 45

(B)   135

(C)   144

(D)   270

(E)   288

152.  A three-digit code for certain logs uses the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 according to the following constraints: the first digit cannot be 0 or 1, the second digit must be 0 or 1, and the second and third digits cannot both be 0 in the same code. If the digits may be repeated in the same code, how many different codes are possible?

(A)   144

(B)   152

(C)   160

(D)   168

(E)   176

153.  A box contains exactly 24 balls, of which 12 are red and 12 are blue. If two balls are to be picked from this box at random and without replacement, what is the probability that both balls will be red?

(A)   $\dfrac{11}{46}$

(B)   $\dfrac{1}{4}$

(C)   $\dfrac{5}{12}$

(D)   $\dfrac{17}{40}$

(E)   $\dfrac{19}{40}$

154.  A certain basket contains 10 apples, seven of which are red and three of which are green. If three different apples are to be selected at random from the basket, what is the probability that two of the apples selected will be red and one will be green?

(A)   $\dfrac{7}{40}$

(B)   $\dfrac{7}{20}$

(C)   $\dfrac{49}{100}$

(D)   $\dfrac{21}{40}$

(E)   $\dfrac{7}{10}$

155.  A certain characteristic in a large population has a distribution that is symmetric about the mean $m$. If 68 percent of the distribution lies within one standard deviation $d$ of the mean, what percent of the distribution is less than $(m + d)$?

(A)   16%

(B)   32%

   **(C)**   48

   **(D)**   84%

   **(E)**   92%

**156.** A certain club has 20 members. What is the ratio of number of 5-member committees that can be formed from the members of the club to the number of 4-member committees that can be formed from the members of the club?

   **(A)**   16 to 1

   **(B)**   15 to 1

   **(C)**   16 to 5

   **(D)**   15 to 6

   **(E)**   5 to 4

**157.** A certain company assigns employees to offices in such a way that some of the offices can be empty and more than one employee can be assigned to an office. In how many ways can the company assign three employees to two different offices?

   **(A)**   5

   **(B)**   6

   **(C)**   7

   **(D)**   8

   **(E)**   9

**158.** A certain company employs six senior officers and four junior officers. If a committee is to be created that is made up of three senior officers and one junior officer, how many different committees are possible?

   **(A)**   8

   **(B)**   24

   **(C)**   58

   **(D)**   80

   **(E)**   210

**159.** A certain company expects quarterly earnings of $0.80 per share of stock, half of which will be distributed as dividends to shareholders while the rest will be used for research and development. If earnings are greater than expected, shareholders will receive an additional $0.04 per share for each additional $0.10 of per share earnings. If quarterly earnings are $1.10 per share, what will be the dividend paid to a person who owns 200 shares of the company's stock?

   **(A)**   $92

   **(B)**   $96

   **(C)**   $104

   **(D)**   $120

   **(E)**   $240

**160.** A certain company sold 800 units of its product for $8 each and 1,000 units of its product for $5 each. If the company's cost of producing each unit of its product was $6, what was the company's profit or loss on the 1,800 units of its product?

(A)  $1,600

(B)  $600 loss

(C)  No profit or loss

(D)  $600 profit

(E)  $1,600 profit

161.  A certain company that sells only cars and trucks reported that revenues from car sales in 1997 were down 11 percent from 1996 and revenues from truck sales in 1997 were up 7 percent from 1996. If total revenues from car sales and truck sales in 1997 were up 1 percent from 1996, what is the ratio of revenue from car sales in 1996 to revenue from truck sales in 1996?

(A)  1:2

(B)  4:5

(C)  1:1

(D)  3:2

(E)  5:3

162.  A certain company's profit in 1996 was 15 percent greater than its profit in 1995, and its profit in 1997 was 20 percent greater than its profit in 1996. The company's profit in 1997 was what percent greater than its profit in 1995?

(A)  5%

(B)  18%

(C)  33%

(D)  35%

(E)  38%

163.  A certain computer program generates a sequence of numbers $a_1, a_2, \ldots a_n$ such that $a_1 = a_2 = 1$ and $a_k = a_{(k-1)} + 2a_{(k-2)}$ for all integers $k$ such that $3 \le k \le n$. If $n > 6$, then $a_7 =$

(A)  32

(B)  43

(C)  64

(D)  100

(E)  128

164.  If the probability that stock A will increase in value during the next month is 0.54 and the probability that stock B will increase in value during the next month is 0.38, what is the approximate probability that exactly one of stock A and stock B would increase in value during the next month? It is known that price fluctuations of stock A in no way affect the price fluctuations of stock B.

(A)  0.21

(B)  0.29

(C)  0.51

(D)  0.73

(E)  0.92

**165.** A coin that is tossed will land heads or tails, and each outcome has equal probability. What is the probability that the coin will land heads at least once on two tosses?

(A) $\dfrac{1}{4}$

(B) $\dfrac{1}{3}$

(C) $\dfrac{1}{2}$

(D) $\dfrac{2}{3}$

(E) $\dfrac{3}{4}$

**166.** A contest will consist of $n$ questions, each of which is to be answered either "True" or "False." Anyone who answers all $n$ questions correctly will be a winner. What is the least value of $n$ for which the probability is less than $\dfrac{1}{1000}$, that a person who randomly guesses the answer to each question will be a winner?

(A) 5

(B) 10

(C) 50

(D) 100

(E) 1000

**167.** A gum ball dispenser has 24 gum balls – 12 white and 12 black, which are dispensed at random. If the first three gum balls dispensed are black, what is the probability that the next two gum balls dispensed will also be black?

(A) $\dfrac{6}{35}$

(B) $\dfrac{1}{3}$

(C) $\dfrac{4}{15}$

(D) $\dfrac{3}{7}$

(E) $\dfrac{1}{2}$

**168.** A jar contains 16 marbles, of which 4 are red, 3 are blue, and the rest are yellow. If 2 marbles are to be selected at random from the jar, one at a time without being replaced, what is the probability that one marble selected will be red and the other marble selected will be blue?

(A) $\dfrac{3}{64}$

(B) $\dfrac{1}{20}$

(C) $\dfrac{1}{10}$

(D) $\dfrac{1}{8}$

(E) $\dfrac{1}{6}$

169. A shipment of eight television sets contains two LCD sets and six LED sets. If two television sets are to be chosen at random from this shipment, what is the probability that at least one of the two sets chosen will be a LCD set?

(A) $\dfrac{1}{7}$

(B) $\dfrac{1}{4}$

(C) $\dfrac{5}{14}$

(D) $\dfrac{13}{28}$

(E) $\dfrac{15}{28}$

170. In a stack of cards, 9 cards are blue and the rest are red. If 2 cards are to be chosen at random from the stack without replacement, the probability that the cards chosen will both be blue is $\dfrac{6}{11}$. What is the number of cards in the stack?

(A) 10

(B) 11

(C) 12

(D) 15

(E) 18

171. A string of 10 light bulbs is wired in such a way that if any individual light bulb fails, the entire string fails. If for each individual light bulb the probability of failing during time period T is 0.06, what is the probability that the string of light bulbs will fail during time period T?

(A) $0.06^{10}$

(B) $0.06$

(C) $1 - 0.94^{10}$

(D) $0.94^{10}$

(E) $1 - 0.06^{10}$

172. In a box of 12 pens, a total of 3 are defective. If a customer buys 2 pens, selected at random from the box, what is the probability that neither pen will be defective?

(A) $\dfrac{1}{6}$

(B) $\dfrac{2}{9}$

(C) $\dfrac{6}{11}$

(D) $\dfrac{9}{16}$

(E) $\dfrac{3}{4}$

**173.** In a box of 12 pens, a total of 3 are defective. If a customer buys 2 pens, selected at random from the box, what is the probability that neither pen will be defective?

(A) $\dfrac{1}{6}$

(B) $\dfrac{2}{9}$

(C) $\dfrac{6}{11}$

(D) $\dfrac{9}{16}$

(E) $\dfrac{3}{4}$

## 2.12   Sets

**174.** A club with a total membership of 30 has formed committees, M, S, and R, which have 8, 12, and 5 members, respectively. If no member of the committee M is on either of the other two committees, what is the greatest possible number of members in the club who are on none of the committees?

(A)  5

(B)  7

(C)  8

(D)  10

(E)  12

**175.** In each production lot for a certain toy, 25 percent of the toys are red and 75 percent of the toys are blue. Half the toys are size A and half are size B. If 10 out of a lot of 100 toys are red and size A, how many of the toys are blue and size B?

(A)  15

(B)  25

(C)  30

(D)  35

(E)  40

**176.** In an isosceles triangle PQR, if the measure of angle P is 80º, which of the following could be the measure of angle R ?

   I.  20º

   II.  50º

   III.  80º

(A)  Only I

(B)  Only III

(C)  Only I and II

(D)  Only II and III

(E)  I, II and III

**177.** According to a survey, 7 percent of teenagers have not used a computer to play games, 11 percent have not used a computer to write reports, and 95 percent have used a computer for at least one of the above purposes. What percent of the teenagers in the survey have used a computer both to play games and to write reports?

(A)  13%

(B)  56%

(C)  77%

(D)  87%

(E)  91%

**178.** In a survey, 2000 executives were each asked whether they read newsletter A or newsletter B. According to the survey, 55 percent of the executives read newsletter A,

62 percent read newsletter B, and 37 percent read both newsletter A and newsletter B. How many of the executives surveyed read at most one among newsletter A and newsletter B?

  **(A)** 1600

  **(B)** 1260

  **(C)** 900

  **(D)** 860

  **(E)** 760

**179.** In a certain region, the number of children who have been vaccinated against rubella is twice the number of children who have been vaccinated against mumps. The number of children who have been vaccinated against both is twice the number of children who have been vaccinated only against mumps. If 5,000 have been vaccinated against both, how many have been vaccinated only against rubella?

  **(A)** 2500

  **(B)** 7500

  **(C)** 10000

  **(D)** 15000

  **(E)** 17500

## 2.13   Statistics & Data Interpretation

**180.**                150, 200, 250, $n$: (not in order)

Which of the following could be the median of the four integers listed above (not in order)?

   **I.**   175

  **II.**   215

 **III.**   235

- **(A)** I only
- **(B)** II only
- **(C)** I and II only
- **(D)** II and III only
- **(E)** All of them

**181.**                40, 45, 50, 55, 60, 75, 75, 100, 100, 100

The list above shows the scores of ten schoolchildren on a certain test. If the standard deviation of the ten scores is 22.4, rounded to the nearest tenth, how many of the scores are more than 1 standard deviation below the mean of the ten scores?

- **(A)** One
- **(B)** Two
- **(C)** Three
- **(D)** Four
- **(E)** Five

**182.** A certain list consists of 21 different numbers. If $n$ is a number in the list and is four times the average (arithmetic mean) of the other 20 numbers in the list, then $n$ is what fraction of the sum of the 21 numbers in the list?

- **(A)** $\dfrac{1}{20}$
- **(B)** $\dfrac{1}{6}$
- **(C)** $\dfrac{4}{21}$
- **(D)** $\dfrac{1}{5}$
- **(E)** $\dfrac{5}{21}$

**183.** If the average (arithmetic mean) of 3, 8 and $w$ is greater than or equal to $w$ and smaller than or equal to $3w$, how many integer values of $w$ exist?

- **(A)** 5
- **(B)** 4
- **(C)** 3

**(D)**   2

**(E)**   1

184.   If the average (arithmetic mean) of five distinct positive integers is 10, what is the least possible value of the greatest of the five numbers?

**(A)**   11

**(B)**   12

**(C)**   24

**(D)**   40

**(E)**   46

185.   If the average (arithmetic mean) of $x$, $y$ and 20 is 10 greater than the average of $x$, $y$, 20 and 30, what is the average of $x$ and $y$?

**(A)**   40

**(B)**   45

**(C)**   60

**(D)**   75

**(E)**   95

186.   A set of 15 different integers has a median of 30 and a range of 30. What is the greatest possible integer that could be in this set?

**(A)**   42

**(B)**   47

**(C)**   50

**(D)**   53

**(E)**   60

187.   The mean of the set of the positive integers $\{4, 4, 5, 5, 6, x\}$ is $\dfrac{x^2}{2}$. What is the range of the above set of integers?

**(A)**   1

**(B)**   2

**(C)**   3

**(D)**   4

**(E)**   5

188.   Company A has a total of $n$ employees, where $n$ is an odd integer, and no two employees have the same annual salary. The annual salaries of the $n$ employees are listed in increasing order, and the 16$^{\text{th}}$ salary in the list is the median of the annual salaries. If the sum of the annual salaries of Company A's employees is \$942,400, what is the average (arithmetic mean) of the annual salaries of Company A's employees?

**(A)**   \$29450

**(B)**   \$30400

**(C)**   \$32500

**(D)** $47120

**(E)** $58900

**189.**

| Time | Amount of bacteria |
|------|--------------------|
| 1:00 pm | 10.0 grams |
| 4:00 pm | $x$ grams |
| 7:00 pm | 14.4 grams |

Data for a certain biology experiment are given in the table above. If the amount of bacteria present increased by the same fraction during each of the two 3-hour periods shown, how many grams of bacteria were present at 4:00 pm?

**(A)**  12.0

**(B)**  12.1

**(C)**  12.2

**(D)**  12.3

**(E)**  12.4

**190.** According to the table given below, the number of fellows was approximately what percent of the total membership of organization X?

| Membership of an Organization X, 2008 | |
|---------------------------------------|-------|
| Honorary members | 78 |
| Fellows | 9209 |
| Members | 35509 |
| Associate members | 27909 |
| Affiliates | 2372 |

**(A)**  9%

**(B)**  12%

**(C)**  18%

**(D)**  25%

**(E)**  35%

**191.** According to the table below, what was the approximate average number of watts of electricity used per hour per appliance in the household on May 1?

| Electricity usage in a certain household on May 1 | | |
|-----------|----------------------|------------------------------|
| Appliance | Number of hours in use | Number of watts of electricity used per hour |
| TV | 4 | 145 |
| Computer | 3 | 155 |
| VCR | 2 | 45 |
| Stereo | 2 | 109 |

**(A)** 31
**(B)** 74
**(C)** 123
**(D)** 281
**(E)** 338

## 2.14  Linear Equations

**192.** A cashier mentally reversed the digits of one customer's correct amount of change and thus gave the customer an incorrect amount of change. If the cash register contained 45 cents more than it should have as a result of this error, which of the following could have been the correct amount of change in cents?

    **(A)**   14

    **(B)**   45

    **(C)**   54

    **(D)**   65

    **(E)**   83

**193.** A certain business produced $x$ rakes each month from November through February and shipped $\dfrac{x}{2}$ rakes at the beginning of each month from March through October. The business paid no storage costs for the rakes from November through February, but it paid storage costs of $0.10 per rake each month from March through October for the rakes that had not been shipped. In terms of $x$, what was the total storage cost, in dollars, that the business paid for the rakes for the 12 months from November through October?

    **(A)**   $0.4x$

    **(B)**   $1.2x$

    **(C)**   $1.4x$

    **(D)**   $1.6x$

    **(E)**   $3.2x$

**194.** A certain fruit stand sold apples for $0.70 each and bananas for $0.50 each. If a customer purchased both apples and bananas from the stand for a total of $6.30, what is the total number of apples and bananas did the customer purchase? The customer purchased at least one of both the fruits.

    **(A)**   10

    **(B)**   11

    **(C)**   12

    **(D)**   13

    **(E)**   14

**195.** If $x + y + z = 2$, and $x + 2y + 3z = 6$ and $y \neq 0$, then what is the value of $\left(\dfrac{x}{y}\right)$?

    **(A)**   $-\dfrac{1}{2}$

    **(B)**   $-\dfrac{1}{3}$

    **(C)**   $-\dfrac{1}{6}$

    **(D)**   $\dfrac{1}{3}$

    **(E)**   $\dfrac{1}{2}$

**196.** An optometrist charges $150 per pair for soft contact lenses and $85 per pair for hard contact lenses. Last week she sold five more pairs of soft lenses than hard lenses. If her total sales for pairs of contact lenses last week were $1690, what was the total number of pairs of contact lenses that she sold?

(A)  11

(B)  13

(C)  15

(D)  17

(E)  19

## 2.15  Quadratic Equations & Polynomials

**197.**  If $x \geq 0$ and $x = \sqrt{8xy - 16y^2}$, then in terms of $y$, $x =$

  **(A)**  $-4y$

  **(B)**  $\dfrac{y}{4}$

  **(C)**  $y$

  **(D)**  $4y$

  **(E)**  $4y^2$

**198.**  What is the difference between the maximum and the minimum value of $\left(\dfrac{x}{y}\right)$ for which $(x - 2)^2 = 9$ and $(y - 3)^2 = 25$?

  **(A)**  $-\dfrac{15}{8}$

  **(B)**  $\dfrac{3}{4}$

  **(C)**  $\dfrac{9}{8}$

  **(D)**  $\dfrac{19}{8}$

  **(E)**  $\dfrac{25}{8}$

**199.**  If $x$ and $y$ are positive integers and $2x + 3y + xy = 12$, what is the value of $(x + y)$?

  **(A)**  2

  **(B)**  4

  **(C)**  5

  **(D)**  6

  **(E)**  8

**200.**  An object thrown directly upward is at a height of $h$ feet, $t$ seconds after it was thrown, where $h = -16(t - 3)^2 + 150$. What is the height of the object now once it reached its maximum height and descended for 2 seconds?

  **(A)**  6 feet

  **(B)**  86 feet

  **(C)**  134 feet

  **(D)**  150 feet

  **(E)**  214 feet

**201.**  According to a certain estimate, the depth $N(t)$, in centimeters, of the water in a certain tank at $t$ hours past 2:00 in the morning is given by $N(t) = -20(t - 5)^2 + 500$, for $0 \leq t \leq 10$. According to this estimate, at what time in the morning does the depth of the water in the tank reach its maximum?

  **(A)**  5:30

    **(B)**   7:00

    **(C)**   7:30

    **(D)**   8:00

    **(E)**   9:00

## 2.16  Inequalities

202.  Bill's school is 10 miles from his home. He travels 4 miles from school to football practice, and then 2 miles to a friend's house. If he is then $x$ miles from home, what is the range of possible values for $x$?

(A)  $2 \le x \le 10$

(B)  $4 \le x \le 10$

(C)  $4 \le x \le 12$

(D)  $4 \le x \le 16$

(E)  $6 \le x \le 16$

203.  $2x + y = 12 \ |y| \le 12$

For how many ordered pairs $(x, \ y)$ that are solutions of the above system such that $x$ and $y$ both are integers?

(A)  7

(B)  10

(C)  12

(D)  13

(E)  14

204.  If the cost of 12 eggs varies between $0.90 and $1.20, and the cost of 5 sandwiches varies between $10 and $15, then the cost of 4 eggs and 3 sandwiches varies between

(A)  $2.15 and $3.20

(B)  $2.30 and $3.40

(C)  $6.40 and $9.30

(D)  $6.30 and $9.40

(E)  $9.30 and $12.40

205.  If $x < 0$ and $0 < y < 1$, which of the following has the greatest value?

(A)  $x^2$

(B)  $(xy)^2$

(C)  $\left(\dfrac{x}{y}\right)^2$

(D)  $\dfrac{x^2}{y}$

(E)  $x^2 y$

206.  Anne traveled from City A to City B in 4 hours, and her speed was between 25 miles per hour and 45 miles per hour. John also traveled from City A to City B along the same route in 2 hours, and his speed was between 45 miles per hour and 60 miles per hour. Which of the following could be the distance, in miles, from City A to City B?

(A)  95

   **(B)**   115

   **(C)**   125

   **(D)**   160

   **(E)**   180

## 2.17   Geometry–Lines & Triangles

**207.**   If each of the two lines $l$ and $m$ are parallel to line $n$, which of the following MUST be correct?

   **I.**   Lines $l, m$ and $n$ lie in the same plane.
   **II.**   Lines $l$ and $m$ are parallel to one another.
   **III.**   Line $l$ is the same as line $m$.

   **(A)**   Only I
   **(B)**   Only II
   **(C)**   Only III
   **(D)**   Only I and II
   **(E)**   Only II and III

**208.**   On the line segment AD shown below, AB $= \frac{1}{2}$CD and BD $= \frac{3}{2}$AC. If BC = 24, then AD =
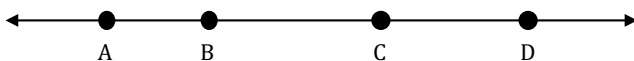


   **(A)**   24
   **(B)**   48
   **(C)**   72
   **(D)**   96
   **(E)**   120

**209.**   R, S, T, and U are points on a line, and U is the midpoint of line segment ST. If the lengths of line segments RS, RT, and ST are 20, 4, and 16, respectively, what is the length of line segment RU?

   **(A)**   6
   **(B)**   8
   **(C)**   12
   **(D)**   14
   **(E)**   16

**210.**   A cash register in a certain clothing store is the same distance from two dressing rooms in the store. The distance between the two dressing rooms is 16 feet, which of the following could be the distance between the cash register and either dressing room?

   **I.**   6 feet
   **II.**   12 feet
   **III.**   24 feet

   **(A)**   I only
   **(B)**   II only
   **(C)**   III only

**(D)** I and II

**(E)** II and III

**211.** A certain right triangle has sides of length $x$, $y$ and $z$, where $x < y < z$. If the area of this triangular region is 1, which of the following indicates all of the possible values of $y$?

**(A)** $y > \sqrt{2}$

**(B)** $\dfrac{\sqrt{3}}{2} < y < \sqrt{2}$

**(C)** $\dfrac{\sqrt{2}}{3} < y < \dfrac{\sqrt{3}}{2}$

**(D)** $\dfrac{\sqrt{3}}{4} < y < \dfrac{\sqrt{2}}{3}$

**(E)** $y < \dfrac{\sqrt{3}}{4}$

**212.** A certain right triangle has sides of length $x$, $y$ and $z$, where $x < y < z$. If the area of this triangular region is 1, which of the following indicates all of the possible values of $z$?

**(A)** $z > 2$

**(B)** $\sqrt{2} < z < 2$

**(C)** $\sqrt{2} < z < \sqrt{3}$

**(D)** $1 < z < \sqrt{2}$

**(E)** $z < 1$

**213.** In the figure below, DA = DB = DC. What is the value of $x$?
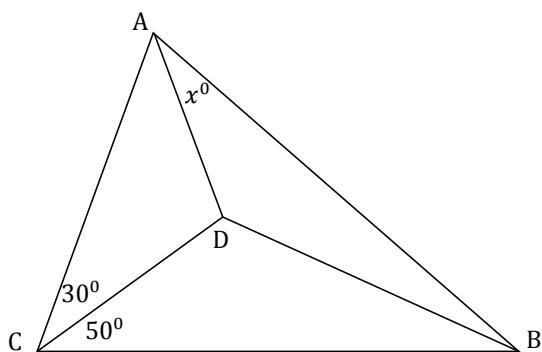
**(A)** 10

**(B)** 20

**(C)** 30

**(D)** 40

**(E)** 50

**214.** In the figure below, each side of square ABCD has length 1, the length of line segment CE is 1, and the length of line segment BE is equal to the length of line segment DE. What is the area of the triangular region BCE?
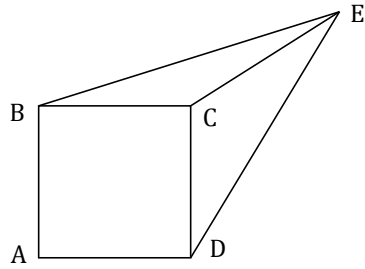
(A) $\dfrac{1}{3}$

(B) $\dfrac{\sqrt{2}}{4}$

(C) $\dfrac{1}{2}$

(D) $\dfrac{\sqrt{2}}{2}$

(E) $\dfrac{3}{4}$

**215.** In the figure shown below, what is the value of $x$?
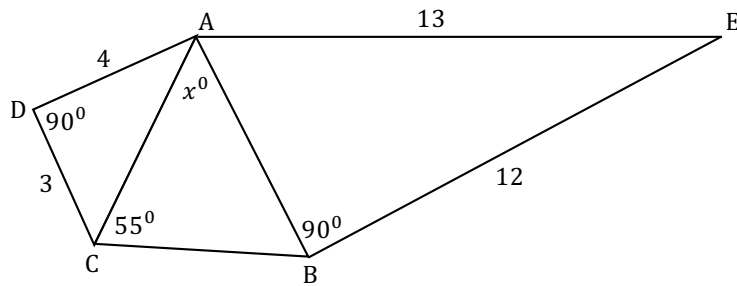


(A) 55

(B) 60

(C) 65

(D) 70

(E) 75

**216.** In the figure below, what is the perimeter of triangle BCD?
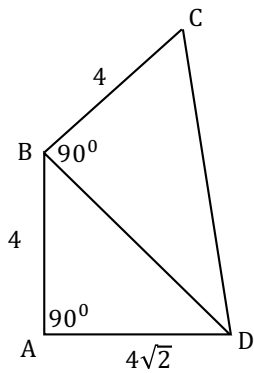
**(A)** $4 + 4\sqrt{3}$

**(B)** 12

**(C)** $12 + 4\sqrt{3}$

**(D)** $8 + 8\sqrt{3}$

**(E)** $16\sqrt{2}$

## 2.18   Geometry–Circles

**217.** If the circle below has centre O and length of the arc RST is $18\pi$, what is the perimeter of the region RSTU?
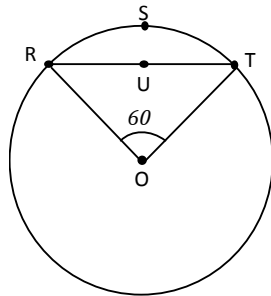


(A)   $12\pi + 18$

(B)   $12\pi + 27$

(C)   $18\pi + 27$

(D)   $18\pi + 54$

(E)   $18\pi + 108$

**218.** In the figure below, O is the center of the circle. If the area of the sector containing the angle $x^o$ is $2\pi$, what is the value of $x$?
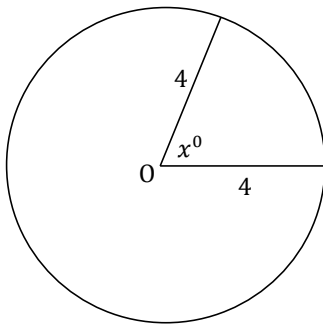
**(A)**   22.5

**(B)**   30.0

**(C)**   45.0

**(D)**   60.0

**(E)**   90.0

219.   In the figure shown below, if the area of the shaded region is 3 times the area of the smaller circular region, then the circumference of the larger circle is how many times the circumference of the smaller circle?
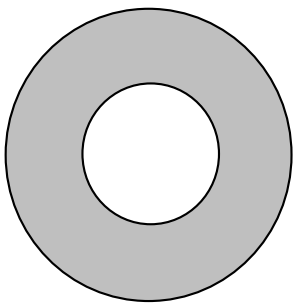


**(A)**   4

**(B)**   3

**(C)**   2

**(D)**   $\sqrt{3}$

**(E)**   $\sqrt{2}$

220.   In the figure shown below, line segments QS and RT are diameters of the circle. If the distance between Q and R is $\dfrac{8}{\sqrt{2}}$, what is the area of the circle?
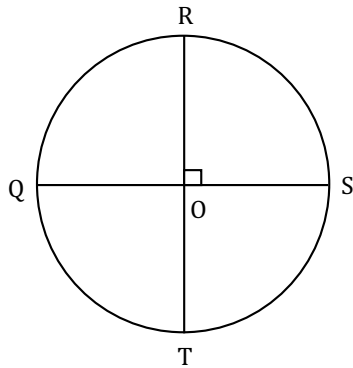
(A) $4\pi$

(B) $8\pi$

(C) $16\pi$

(D) $32\pi$

(E) $64\pi$

221. In the figure shown below, the triangle ABC is inscribed in a semicircle. If the length of line segment AB is 8 and the length of line segment BC is 6, what is the length of arc ABC?
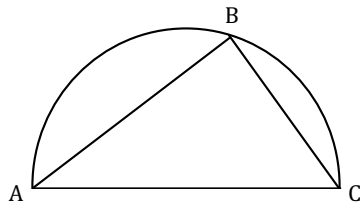


(A) $15\pi$

(B) $12\pi$

(C) $10\pi$

(D) $7\pi$

(E) $5\pi$

222. An equilateral triangle that has an area of $9\sqrt{3}$ is inscribed in a circle. What is the area of the circle?

(A) $6\pi$

(B) $9\pi$

(C) $12\pi$

(D) $9\sqrt{3}\pi$

(E) $18\sqrt{3}\pi$

## 2.19  Geometry–Polygon

223.  A circular mat with diameter 20 inches is placed on a square tabletop, having its sides equal to 24 inches. Which of the following is closest to the fraction of the tabletop NOT covered by the mat?

(A)  $\dfrac{1}{2}$

(B)  $\dfrac{3}{5}$

(C)  $\dfrac{2}{3}$

(D)  $\dfrac{1}{4}$

(E)  $\dfrac{9}{20}$

224.  Rectangular floors having perimeter of 16 meters are to be covered with carpet squares that measure 1 meter by 1 meter each, costing $6 apiece. What is the maximum possible cost for the number of carpet squares needed to cover any such rectangular floor if the sides of the floors are integers?

(A)  $42

(B)  $72

(C)  $90

(D)  $96

(E)  $120

225.  A rectangular photograph is surrounded by a border that is 1 inch wide on each side. The total area of the photograph and the border is $m$ square inches. If the border had been 2 inches wide on each side, the total area would have been $(m + 52)$ square inches. What is the perimeter of the photograph, in inches?

(A)  34

(B)  36

(C)  38

(D)  40

(E)  42

226.  A rectangular picture is surrounded by a border, as shown in the figure below. Without the border, the length of the picture is twice its width. If the area of the border is 196 square inches, what is the length, in inches, of the picture, excluding the border?
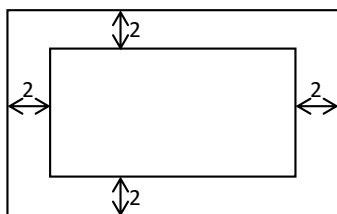
(A) 10

(B) 15

(C) 30

(D) 40

(E) 60

227. Two brothers inherited a rectangular field of dimension 80 feet by 120 feet. If they decide to split the land into two equal rectangles, then what is the minimum cost required to fence one such half at the rate of $2 per feet?

(A) $240

(B) $280

(C) $320

(D) $560

(E) $640

228. A rectangular park has a perimeter of 560 feet and a diagonal measurement of 200 feet. What is its area, in square feet?

(A) 19200

(B) 19600

(C) 20000

(D) 20400

(E) 20800

229. A solid yellow stripe is to be painted in the middle of a certain highway. If 1 gallon of paint covers an area of $p$ square feet of highway, how many gallons of paint will be needed to paint a stripe $t$ inches wide on a stretch of highway $m$ miles long? (1 mile = 5,280 feet, and 1 foot = 12 inches)

(A) $\dfrac{5280mt}{12p}$

(B) $\dfrac{5280pt}{12m}$

(C) $\dfrac{5280mpt}{12}$

(D) $\dfrac{5280*12m}{pt}$

(E) $\dfrac{5280*12p}{mt}$

230. In the parallelogram PQRS shown below, if PQ = 4 and QR = 6, what is the area of PQRS?
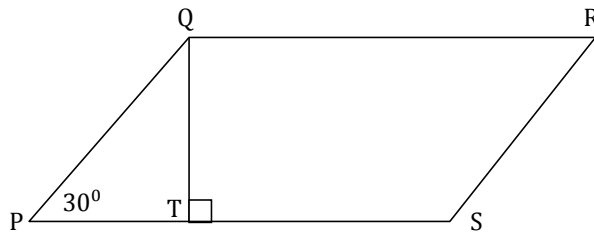
**(A)**  8

**(B)**  12

**(C)**  24

**(D)**  $8\sqrt{3}$

**(E)**  $12\sqrt{3}$

**231.**
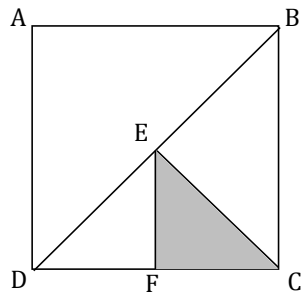
In square ABCD above, if DE = EB and DF = FC, then the area of the shaded region is what fraction of the area of square region ABCD?
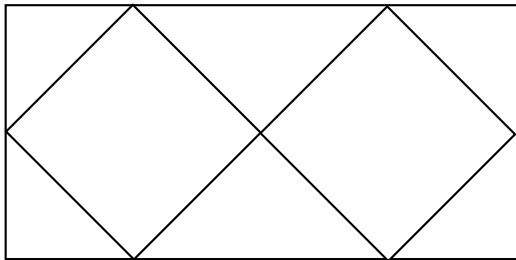
(A) $\dfrac{1}{16}$

(B) $\dfrac{1}{8}$

(C) $\dfrac{1}{6}$

(D) $\dfrac{1}{4}$

(E) $\dfrac{1}{3}$

232. In the figure shown below, the area of square region PRTV is 81, and the ratio of the area of square region XSTU to the area of square region PQXW is 1 to 4. What is the length of segment RS?
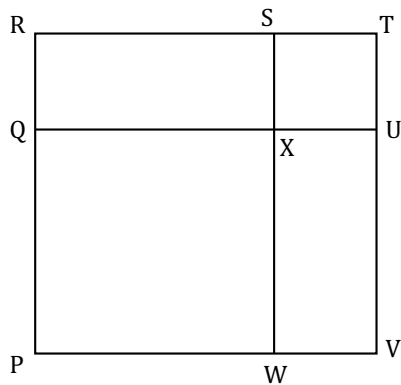


(A) 5.0

(B) 5.5

(C) 6.0

(D) 6.5

(E) 7.0

233.

In the figure above, two identical squares are inscribed in the rectangle. If the perimeter of the rectangle is $18\sqrt{2}$, then what is the perimeter of each square?

(A)  $8\sqrt{2}$

(B)  12

(C)  16

(D)  $12\sqrt{2}$

(E)  18

234.  A certain number of desks and bookshelves, at least one each, are to be placed along a library wall that is 16 meters long. Each desk is 2 meters long, and each bookshelf is 1.5 meters long. If the maximum possible number of desks and bookshelves are to be placed along the wall, then the space along the wall that is left over will be how many meters long?

(A)  0.5

(B)  1.0

(C)  1.5

(D)  2.0

(E)  3.0

235.  A thin piece of wire 40 meters long is cut into two pieces. One piece is used to form a circle with radius $r$, and the other is used to form a square. If no wire is left over, which of the following represents the total area, in square meters, of the circular and the square regions in terms of $r$?

(A)  $\pi r^2$

(B)  $\pi r^2 + 10$

(C)  $\pi r^2 + \dfrac{1}{4}\pi^2 r^2$

(D)  $\pi r^2 + (40 - 2\pi r)^2$

(E)  $\pi r^2 + \left(10 - \dfrac{1}{2}\pi r\right)^2$

## 2.20   Geometry–3 Dimensional

236.   A certain right circular cylinder has a radius of 5 inches. A certain quantity of liquid fills this cylinder to a height of 9 inches. When all of this liquid is poured into a second right circular cylinder, the liquid fills the second cylinder to a height of 4 inches. What is the radius of the second cylinder, in inches?

   **(A)**   6.0
   **(B)**   6.5
   **(C)**   7.0
   **(D)**   7.5
   **(E)**   8.0

237.   A circular rim 28 inches in diameter rotates the same number of inches per second as a circular rim 35 inches in diameter. If the smaller rim makes $x$ revolutions per second, how many revolutions per minute does the larger rim make in terms of $x$?

   **(A)**   $\dfrac{48\pi}{x}$
   **(B)**   $75x$
   **(C)**   $48x$
   **(D)**   $24x$
   **(E)**   $\dfrac{x}{75\pi}$

238.   In the rectangular solid below, the three faces shown have areas 12, 15, and 20. What is the volume of the solid?
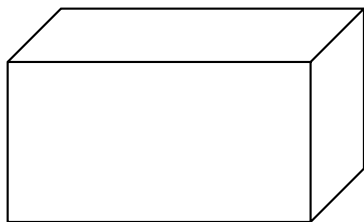


   **(A)**   60
   **(B)**   120
   **(C)**   450
   **(D)**   1800
   **(E)**   3600

239.   The interior of a rectangular carton is designed by a certain manufacturer to have a volume of $x$ cubic feet and a ratio of length to width to height of $3 : 2 : 2$. In terms of $x$, which of the following equals the height of the carton, in feet?

   **(A)**   $\sqrt[3]{x}$
   **(B)**   $\sqrt[3]{\dfrac{2}{3}x}$
   **(C)**   $\sqrt[3]{\dfrac{3}{2}x}$

**(D)**   $\dfrac{2}{3}\sqrt[3]{x}$

**(E)**   $\dfrac{3}{2}\sqrt[3]{x}$

240.  Two oil cans, X and Y, are right circular cylinders, and the height and the radius of Y are each twice those of X. If the oil in can X, which is filled to capacity, sells for \$2, then at the same rate, how much does the oil in can Y sell for, if Y is filled to only half its capacity?

**(A)**   \$1

**(B)**   \$2

**(C)**   \$4

**(D)**   \$8

**(E)**   \$16

241.  For the cube shown below, what is the degree measure of ∠PQR?



**(A)**   30º

**(B)**   45º

**(C)**   60º

**(D)**   75º

**(E)**   90º
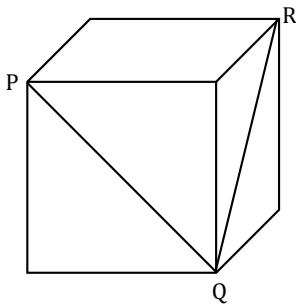
242.  A solid cube is placed in a cylindrical container. Which of the following percent values COULD possibly represent the ratio of the volume of the cylinder not occupied by the cube to the volume of the cylinder? (Assume the value of $\pi$ to be 3)

**(A)**   16%

**(B)**   25%

**(C)**   28%

**(D)**   32%

**(E)**   36%

## 2.21   Co-ordinate geometry

243.  In the coordinate plane, a diameter of a circle has the end points $(-3, -6)$ and $(5, 0)$. What is the area of the circle?

(A)  $5\pi$

(B)  $10\sqrt{2}\pi$

(C)  $25\pi$

(D)  $50\pi$

(E)  $100\pi$

244.  A straight line in the XY-plane has a slope of 2 and a Y-intercept of 2. On this line, what is the X-coordinate of the point whose Y-coordinate is 500?

(A)  249

(B)  498

(C)  676

(D)  823

(E)  1002

245.  In the XY-plane, a line $n$ passes through the origin and has a slope 4. If points $(1, c)$ and $(d, 2)$ are on the line $n$, what is the value of $\dfrac{c}{d}$?

(A)  $\dfrac{1}{4}$

(B)  $\dfrac{1}{2}$

(C)  2

(D)  4

(E)  8

246.  In the XY-plane, the point $(-2, -3)$ is the center of a circle. The point $(-2, 1)$ lies inside the circle and the point $(4, -3)$ lies outside the circle. If the radius of the circle is an integer, then what is the value of $r$?

(A)  6

(B)  5

(C)  4

(D)  3

(E)  2

247.  In the XY-plane, the points $(c, d)$, $(c, -d)$ and $(-c, -d)$ are three vertices of a certain square. If $c < 0$ and $d > 0$, which of the following points is in the same quadrant as the fourth vertex of the square?

(A)  $(-5, -3)$

(B)  $(-5, 3)$

(C)  $(5, -3)$

   **(D)**   $(3, -5)$

   **(E)**   $(3, \ 5)$

248.   In the XY-plane, the vertices of a triangle have coordinates $(0, \ 0)$, $(3, \ 3)$ and $(7, \ 0)$. What is the perimeter of the triangle?

   **(A)**   $\sqrt{34}$

   **(B)**   $\sqrt{43}$

   **(C)**   $13$

   **(D)**   $7 + 6\sqrt{2}$

   **(E)**   $12 + 3\sqrt{2}$

249.   If the points $(a, 0)$, $(0, b)$ and $(1, \ 1)$ are collinear, what is the value of $\left( \dfrac{1}{a} + \dfrac{1}{b} \right)$?

   **(A)**   $-1$

   **(B)**   $0$

   **(C)**   $1$

   **(D)**   $2$

   **(E)**   $3$

250.   In the XY-plane, what is the area of the triangle formed by the line $3y - 4x = 24$ and the X and Y axes?

   **(A)**   $6$

   **(B)**   $14$

   **(C)**   $24$

   **(D)**   $36$

   **(E)**   $48$

**Chapter 3**

# Data Sufficiency Question Bank

## Data Sufficiency

For most of you, Data Sufficiency (DS) may be a new format. The DS format is very unique to the GMAT exam. The format is as follows: There is a question stem followed by two statements, labeled statement (1) and statement (2). These statements contain additional information.

Your task is to use the additional information from each statement alone to answer the question. If none of the statements alone helps you answer the question, you must use the information from both the statements together. There may be questions which cannot be answered even after combining the additional information given in both the statements. Based on this, the question always follows standard five options which are always in a fixed order.

**(A)** Statement (1) ALONE is sufficient, but statement (2) ALONE is not sufficient to answer the question asked.

**(B)** Statement (2) ALONE is sufficient, but statement (1) ALONE is not sufficient to answer the question asked.

**(C)** BOTH statements (1) and (2) TOGETHER are sufficient to answer the question asked, but NEITHER statement ALONE is sufficient to answer the question asked.

**(D)** EACH statement ALONE is sufficient to answer the question asked.

**(E)** Statements (1) and (2) TOGETHER are NOT sufficient to answer the question asked, and additional data specific to the problem are needed.

## 3.1 Numbers

**251.** For any positive integer $x$, the 2-height of $x$ is defined to be the greatest non-negative integer $n$ such that $2^n$ is factor of $x$. For example, the 2-height of 24 is 3 as 3 is the greatest exponent of 2 which is also a factor of 24. If $k$ and $m$ are positive integers, is the 2-height of $k$ greater than the 2-height of $m$?

   (1)  $k > m$

   (2)  $\dfrac{k}{m}$ is an even integer

**252.** For each positive integer $n$, the integer $n^{\#}$ is defined by $n^{\#} = n^2 + 1$. What is the value of the positive integer $k$?

   (1)  When $k$ is divided by 4, the remainder is 1

   (2)  $18 \le k^{\#} \le 36$

**253.** Harvey teaches a certain number of biology students in two classes, K and L. He can divide the students in class K into seven groups of $n$ students each. However, if he divides the students in class L into six groups of $p$ students each; one student will be left over. How many students are in class L?

   (1)  $n = p$

   (2)  There are five more students in class K than in class L

**254.** How many different positive factors does the integer $n$ have?

   (1)  $n = a^4 b^3$, where $a$ and $b$ are different positive prime numbers.

   (2)  The only positive prime numbers that are factors of $n$ are 5 and 7.

**255.** If $\sqrt{x}$ is an integer, what is the value of $\sqrt{x}$?

   (1)  $11 < x < 17$

   (2)  $2 < \sqrt{x} < 5$

**256.** If $xy^{\left(\frac{4}{3}\right)} = \sqrt[3]{432}$, is $x + y = 5$?

   (1)  $y$ is a positive integer.

   (2)  $x$ is an integer.

**257.** If $xy \ne 0$, what is the value of $\dfrac{25x^2}{y^2}$?

   (1)  $x = 3$

   (2)  $5x - 2y = 0$

**258.** If $|m + 4| = 2$, what is the value of $m$?

   (1)  $m < 0$

   (2)  $m^2 + 8m + 12 = 0$

**259.** If $|n + 5| = 5$, what is the value of $n$?

    (1)   $n^2 \neq 0$

    (2)   $n^2 + 10n = 0$

**260.**   If $1 < d < 2$, is the tenth's digit of the decimal representation of $d$ equal to 9?

    (1)   $d + 0.01 < 2$

    (2)   $d + 0.05 > 2$

**261.**   If $a$ and $b$ are integers, is $b$ even?

    (1)   $3a + 4b$ is even.

    (2)   $3a + 5b$ is even.

**262.**   If $a, b, k$ and $m$ are positive integers, is $a^k$ a factor of $b^m$?

    (1)   $a$ is a factor of $b$.

    (2)   $k \leq m$

**263.**   If four of the five integers in a list are 10, $-2$, $-8$, and 0, what is the fifth integer?

    (1)   The product of the five integers is 0.

    (2)   The sum of the given four integers divided by the fifth integer is 0.

**264.**   If $J, S$ and $V$ are points on the number line, what is the distance between $S$ and $V$?

    (1)   The distance between $J$ and $S$ is 20.

    (2)   The distance between $J$ and $V$ is 25.

**265.**   If $k$ is a positive integer, what is the remainder when $2^k$ is divided by 10?

    (1)   $k$ is divisible by 10.

    (2)   $k$ is divisible by 4.

**266.**   If $k$, $m$, and $p$ are integers, is $(k - m - p)$ odd?

    (1)   $k$ and $m$ are even and $p$ is odd.

    (2)   $k$, $m$ and $p$ are consecutive integers.

**267.**   If $k$, $m$ and $t$ are positive integers and $\dfrac{k}{6} + \dfrac{m}{4} = \dfrac{t}{12}$, do $t$ and 12 have a common factor greater than 1?

    (1)   $k$ is a multiple of 3.

    (2)   $m$ is a multiple of 3.

**268.**   If $m$ and $v$ are integers, what is the value of $(m + v)$?

    (1)   $mv = 6$

    (2)   $(m + v)^2 = 25$

**269.**   If $m$ is a positive integer, then what is the number of digits of $m^3$?

    (1)   $m$ has three digits.

    (2)   $m^2$ has five digits.

**270.**  If $m, p$ and $t$ are positive integers and $m < p < t$, is the product $mpt$ an even integer?

    (1)   $t - p = p - m$

    (2)   $t - m = 16$

**271.**  If $n = 3k$, is $k$ an integer?

    (1)   $n$ is an integer.

    (2)   $\dfrac{n}{6}$ is an integer.

**272.**  If $n$ and $k$ are positive integers, is $\dfrac{n}{k}$ an even integer?

    (1)   $n$ is divisible by 8.

    (2)   $k$ is divisible by 4.

**273.**  If $n$ and $k$ are positive integers, is $n$ divisible by 6?

    (1)   $n = k\,(k + 1)\,(k - 1)$

    (2)   $(k - 1)$ is a multiple of 3.

**274.**  If $n$ is a positive integer and $r$ is the remainder when $(n - 1)\,(n + 1)$ is divided by 24, what is the value of $r$?

    (1)   2 is not a factor of $n$.

    (2)   3 is not a factor of $n$.

**275.**  If $n$ is a positive integer, is $(n^3 - n)$ divisible by 4?

    (1)   $n = 2k + 1$, where $k$ is an integer.

    (2)   $(n^2 + n)$ is divisible by 6.

**276.**  If $n$ is a positive integer, is $n$ odd?

    (1)   $3n$ is odd.

    (2)   $(n + 3)$ is even.

**277.**  If $n$ is a positive integer, what is the value of $n$?

    (1)   When $n$ is divided by 3, the remainder is 2.

    (2)   When $n^2$ is divided by 3, the remainder is 1.

**278.**  If $n$ is a positive integer, what is the value of the hundreds' digit of $30^n$?

    (1)   $30^n > 1000$.

    (2)   $n$ is a multiple of 3.

**279.**  If $n$ is an integer and $100 < n < 200$, what is the value of $n$?

(1)  $\dfrac{n}{36}$ is an odd integer.

(2)  $\dfrac{n}{45}$ is an even integer.

280.  If $n$ is an integer and $2 < n < 6$, what is the value of $n$?

(1)   $n$ is a factor of 15.

(2)   $n$ is a factor of 21.

281.  If $n$ is an integer and $x^n - x^{-n} = 0$, what is the value of $x$?

(1)   $x$ is an integer.

(2)   $n \neq 0$

282.  If $n$ is an integer between 10 and 99, is $n < 80$?

(1)   The sum of the two digits of $n$ is a prime number.

(2)   Each of the two digits of $n$ is a prime number.

283.  If $n$ is an integer, is $\dfrac{n}{7}$ an integer?

(1)  $\dfrac{3n}{7}$ is an integer.

(2)  $\dfrac{5n}{7}$ is an integer.

284.  If $n$ is an integer, is $10^n \leq 0.001$?

(1)   $n \leq -2$

(2)   $n > -5$

285.  If $p, r, s$ and $t$ are non-zero integers, is $\dfrac{p}{r} = \dfrac{s}{t}$?

(1)   $s = 3p$ and $t = 3r$

(2)   $3p = 2r$ and $3s = 2t$

286.  If $p, s$ and $t$ are positive prime numbers, what is the value of $p^3 s^3 t^3$?

(1)   $p^3 st = 728$

(2)   $t = 13$

287.  If the positive integer $x$ is a multiple of 12 and the positive integer $y$ is a multiple of 10, is $x^2 y$ a multiple of 216?

(1)   $x$ is a multiple of 8.

(2)   $y$ is a multiple of 6.

288.  If $q$ is a positive integer less than 17 and $r$ is the remainder when 17 is divided by $q$, what is the value of $r$?

    (1)   $q > 10$

    (2)   $q = 2^k$, where $k$ is a positive integer.

**289.**  If $r > 0$, is $rs > 0$?

    (1)   $s \leq r$

    (2)   $s \geq r$

**290.**  If $r$ and $s$ are integers, is $r$ divisible by 7?

    (1)   The product $rs$ is divisible by 49.

    (2)   $s$ is divisible by 7.

**291.**  If $r$ and $s$ are non-zero integers, is $\dfrac{r}{s}$ an integer?

    (1)   $r - 1 = (s + 1)(s - 1)$

    (2)   $r - s = 20$

**292.**  If $r$ and $t$ are integers, what is the value of $t$?

    (1)   $t^{r-1} = 1$

    (2)   $r \neq 1$

**293.**  If $p$ is a constant and $a_{n-1} + a_n = pn(n - 1)$ for all positive integers $n$, what is the value of ?

    (1)   $a_{31} - a_{29} = 120$

    (2)   $a_2 = 6$

**294.**  If $R$, $S$, &$T$ are numbers on the number line, not necessarily in that order, is the value of $|R - T|$ at least 9?

    (1)   $|R - S| = 50$.

    (2)   $|S - T| = 41$.

**295.**  If $r, s$, &$t$ are positive integers, is $(r + s + t)$ even?

    (1)   $(r + s)$ is even.

    (2)   $(s + t)$ is even.

**296.**  If $r, s, w$ are positive numbers such that $w = 60r + 80s$ and $r + s = 1$, is $w > 70$?

    (1)   $r > \dfrac{1}{2}$

    (2)   $r > s$

**297.**  If $S$ is a set of 10 consecutive integers, is the integer 5 present in $S$?

    (1)   The integer $-3$ is present in $S$.

    (2)   The integer 4 is present in $S$.

**298.**  If the sequence $S$ has 250 terms, what is the $243^{rd}$ term of $S$?

  (1)   The $242^{nd}$ term of $S$ is $-494$.

  (2)   The first term of $S$ is $-12$ and each term of $S$ after the first term is 2 less than the preceding term.

**299.** If the digit $h$ is the hundredths' digit in the decimal $d = 0.2h6$, what is the value of $d$ rounded to the nearest tenth?

  (1)   $d < \dfrac{1}{4}$

  (2)   $h < 5$

**300.** If the integer $n$ is greater than 1, is $n$ equal to 2?

  (1)   $n$ has exactly two distinct positive factors.

  (2)   The difference of any two distinct positive factors of $n$ is odd.

**301.** If the product of the digits of the two-digit positive integer $n$ is 12, what is the value of $n$?

  (1)   $n$ can be expressed as the sum of two perfect squares in exactly one way.

  (2)   $n$ is smaller than 40.

**302.** If the sum of three integers is even, is the product of the three integers a multiple of 4?

  (1)   All three integers are equal.

  (2)   All three integers are not even.

**303.** If the tens digit of the three-digit positive number $k$ is non-zero, what is the tens' digit of $k$?

  (1)   The tens' digit of $(k + 9)$ is 3

  (2)   The tens' digit of $(k + 4)$ is 2

**304.** If $v$ and $w$ are different integers, does $v = 0$?

  (1)   $vw = v^2$

  (2)   $w = 0$

**305.** If $vmt \neq 0$, is $v^2 m^3 t^4 > 0$?

  (1)   $m > v^2$

  (2)   $m > t^3$

**306.** If $x$ and $y$ are integers, is $y$ an even integer?

  (1)   $2y - x = x^2 - y^2$

  (2)   $x$ is an odd integer.

**307.** If $x$ and $y$ are integers, what is the value of $(2x^{6y} - 4)$?

  (1)   $x^{2y} = 16$

  (2)   $xy = 4$

**308.** If $x$ and $y$ are positive integers and 18 is a multiple of $xy^2$, what is the value of $y$?

   (1)   $x$ is a factor of 54 and is less than half of 54.

   (2)   $y$ is a multiple of 3.

**309.** If $x$ and $y$ are positive integers and $x^y = x^{2y-3}$, what is the value of $y^x$?

   (1)   $x = 2$

   (2)   $x^2 < 9$

**310.** If $x$ and $y$ belong to the set {2, 4}, and $x^{ky} = x^{(ly^2-8)}$, is $kl > 2$?

   (1)   $k = -6$

   (2)   $3l - k = 3$

**311.** If $x$ and $y$ are non-zero integers, what is the value of $(x^{2y} - 1)$?

   (1)   $|x| + |y| = 5$, where $1 < |x| < y$

   (2)   $|x^2 - 4| + |y - 3| = 0$

**312.** If $x$ and $y$ are positive integers and $r$ is the remainder when $(3^{4x+2} + y)$ is divided by 10, what is the value of $r$?

   (1)   $x = 25$

   (2)   $y = 1$

**313.** If $x$ and $y$ are positive integers, what is the value of $(x + y)^2$?

   (1)   $x = y - 3$

   (2)   $x$ and $y$ are prime numbers.

**314.** If $x$ and $y$ are positive integers, what is the value of $x$?

   (1)   $3^x + 5^y = 134$

   (2)   $y = 3$

**315.** If $x$ and $y$ are distinct positive integers, is $|x - y|$ a factor of 12?

   (1)   $x^2 - 6x + y^2 - 4y = 0$

   (2)   $x = 1$

**316.** If $x$ and $z$ are positive integers, is at least one of them a prime number?

   (1)   $x^2 = 15 + z^2$

   (2)   $(x - z)$ is a prime number.

**317.** If $x$ is a positive integer, does the remainder, when $(7^x + 1)$ is divided by 100, have 0 as the tens digit?

   (1)   $x = 4n + 2$, where $n$ is a positive integer.

   (2)   $x > 5$

**318.** If $x, y$ and $z$ are positive integers, is $xz$ even?

    (1)   $(2xy - x)$ is even

    (2)   $(x^2 + xz)$ is even

**319.** If $x, y$ and $z$ are positive integers, is $y > x$?

    (1)   $y^2 = xz$

    (2)   $z - x > 0$

**320.** If $z$ is positive, is $|x - y| > 0$?

    (1)   $xy + 2z = z$

    (2)   $x^2 - 2x = 0$

**321.** If $y$ is an integer and $y = |x| + x^3$, is $y = 0$?

    (1)   $x < 0$

    (2)   $y < 1$

**322.** In the decimal representation of $x$, where $0 < x < 1$, is the tenths' digit of $x$ non-zero?

    (1)   $16x$ is an integer.

    (2)   $8x$ is an integer.

**323.** In the sequence of non-zero numbers $t_1, t_2, t_3, \ldots t_n, \ldots$, the value of $t_{(n+1)} = \dfrac{t_n}{2}$, for all positive integers $n$. What is the value of $t_5$?

    (1)   $t_3 = \dfrac{1}{4}$

    (2)   $t_1 - t_5 = \dfrac{15}{16}$

**324.** Is $2^x$ greater than 100?

    (1)   $2^{\sqrt{x}} = 8$

    (2)   $\dfrac{1}{2^x} < 0.01$

**325.** Is $|x| < 1$?

    (1)   $|x + 1| = 2|x - 1|$

    (2)   $|x - 3| \neq 0$

**326.** Is $\sqrt{(x - 5)^2} = (5 - x)$?

    (1)   $--x|x| > 0$

    (2)   $5 - x > 0$

                 

**327.** Is $\dfrac{x}{y} < xy$?

  (1) $xy > 0$
  (2) $y < -1$

## 3.2 Percents

**328.** An attorney charged a fee for estate planning services for a certain estate. The attorney's fee was what percent of the assessed value of the estate?

(1) The assessed value of the estate was $1.2 million.

(2) The attorney charged $2,400 for the estate planning services.

**329.** Are at least 10 percent of Country X's citizens who are 65 years old or older employed?

(1) In Country X, 11.3 percent of the population is 65 years old or older.

(2) In Country X, of the population 65 years old or older, 20 percent of the men and 10 percent of the women are employed.

**330.** By what percent was the price of a certain candy bar increased?

(1) The price of the candy bar was increased by 5 cents.

(2) The price of the candy bar after the increase was 45 cents.

**331.** Did Sally pay less than $x$ dollars, including sales tax, for her bicycle?

(1) The price Sally paid for her bicycle was $0.9x$ dollars, excluding the 10 percent sales tax

(2) The price Sally paid for her bicycle was $170, excluding the 10 percent sales tax

**332.** Does Joe weigh more than Tim?

(1) Tim's weight is 80 percent of Joe's weight.

(2) Joe's weight is 125 percent of Tim's weight.

**333.** Each week a certain salesman is paid a fixed amount equal to $300 plus a commission equal to 5 percent of the amount of total sales that week over $1,000. What was the total amount paid to the salesman last week?

(1) The total amount the salesman was paid last week is equal to 10 percent of the amount of total sales last week.

(2) The salesman's total sales last week was $5,000

**334.** Each week Connie receives a base salary of $500, plus a 20 percent commission on the total amount of her sales that week in excess of $1,500. What was the total amount of Connie's sales last week?

(1) Last week Connie's base salary and commission totaled $1,200

(2) Last week Connie's commission was $700

**335.** For a certain car repair, the total charge consisted of a charge for parts, a charge for labor, and a 6 percent sales tax on both the charge for parts and the charge for labor. If the charge for parts, excluding sales tax, was $50.00, what was the total charge for the repair?

(1) The sales tax on the charge for labor was $9.60

(2) The total sales tax was $12.60

**336.** For what percent of those tested for a certain infection was the test accurate; that is, positive for those who had the infection and negative for those who did not have the infection?

    (1)    Of those who tested positive for the infection, 8 did not have the infection.

    (2)    Of those tested for the infection, 90 percent tested negative.

**337.** From 1985 to 1994, what was the percent increase in total trade of the United States?

    (1)    Total trade of the United States in 1985 was 17 percent of gross domestic product in 1985.

    (2)    Total trade of the United States in 1994 was 23 percent of gross domestic product in 1994.

**338.** From 2004 to 2007, the value of foreign goods consumed annually in the United States increased by what percent?

    (1)    In both 2004 and 2007, the value of foreign goods consumed constituted 20 percent of the total value of goods consumed in the United States that year.

    (2)    In 2007 the total value of goods consumed in the United States was 20 percent higher than that in 2004.

**339.** From May 1 to May 30 in the same year, the balance in a checking account had increased. What was the balance in the checking account on May 30?

    (1)    If, from May 1 to May 30, the increase in the balance in the checking account had been 12 percent, then the balance in the account on May 30 would have been $ 504.

    (2)    From May 1 to May 30, the increase in the balance in the checking account was 8 percent.

**340.** Guy's net income equals his gross income minus his deductions. By what percent did Guy's net income change on January 1, 1989, when both his gross income and his deductions increased?

    (1)    Guy's gross income increased by 4 percent on January 1, 1989.

    (2)    Guy's deductions increased by 15 percent on January 1, 1989.

**341.** How many of the boys in a group of 100 children have brown hair?

    (1)    Of the children in the group, 60 percent have brown hair.

    (2)    Of the children in the group, 40 are boys.

**342.** If Jack's and Kate's annual salaries in 2005 were each 10 percent higher than their respective annual salaries in 2004, what was Jack's annual salary in 2004?

    (1)    The sum of Jack's and Kate's annual salaries in 2004 was $80,000.

    (2)    The sum of Jack's and Kate's annual salaries in 2005 was $88,000.

**343.** If $n > 0$, is 20% of $n$ greater than 10% of the sum of $n$ and 0.5?

    (1)    $n < 0.1$

    (2)    $n > 0.01$

**344.** If $p$ and $r$ are positive, is 25 percent of $p$ equal to 10 percent of $r$?

    (1)    $r$ is 300 percent greater than $p$.

    (2)    $p$ is 80 percent less than $(r + p)$.

**345.** If the Lincoln Library's total expenditure for books, periodicals, and newspapers last year was $35,000, how much of the expenditure was on books?

(1) The expenditures for newspapers were 40 percent greater than the expenditures for periodicals.

(2) The total of the expenditures for periodicals and newspapers was 25 percent less than the expenditures for books.

**346.** In 1993, Mr. Jacobs paid 4.8 percent of his income in state taxes. In 1994, what percent of Mr. Jacobs' income did he pay in state taxes?

(1) In 1993, Mr. Jacobs' taxable income was $42,500.

(2) In 1994 Mr. Jacobs paid $232 more in state tax than he did in 1993.

**347.** In 2001, Joe paid 5.1 percent of his income in taxes. In 2002, did Joe pay less than 5.1 percent of his income in taxes?

(1) From 2001 to 2002, Joe's income increased by 10 percent.

(2) Taxes paid in 2002 are 3.4 percent of Joe's income in 2001.

**348.** In 1997, there were 300 female employees at Company C. If the number of female employees at Company C increased by 60 percent from 1977 to 1987, by what percent did the number of female employees at Company C increase from 1987 to 1997?

(1) From 1977 to 1997, the number of female employees increased by 200 percent at Company C.

(2) In 1977, there were 100 female employees at Company C.

**349.** In June 1989, what was the ratio of the number of sales transactions made by salesperson X to the number of sales transactions made by salesperson Y?

(1) In June 1989, salesperson X made 50 percent more sales transactions than salesperson Y did in May 1989.

(2) In June 1989, salesperson Y made 25 percent more sales transactions than in May 1989.

## 3.3 Profit & Loss

**350.** A clothing store acquired an item at a cost of $x$ dollars and sold the item for $y$ dollars. The store's gross profit from the item was what percent of its cost for the item?

(1) $y - x = 20$

(2) $\dfrac{y}{x} = \dfrac{5}{4}$

**351.** A construction company was paid a total of $500,000 for a construction project. The company's only costs for the project were for labor and materials. Was the company's profit from the project greater than $150,000?

(1) The company's total cost was three times its cost for materials

(2) The company's profit was greater than its cost for labor

**352.** A merchant discounted the sale price of a coat and the sale price of a sweater. Was the discount in dollar on coat greater than that on sweater?

(1) The percent discount on the coat was 2 percentage points greater than the percent discount on the sweater

(2) Before the discounts, the sale price of the coat was $10 less than the sale price of the sweater

**353.** A store purchased a Brand C computer for the same amount that it paid for a Brand D computer and then sold them both at higher prices. The store's gross profit on the Brand C computer was what percent greater than its gross profit on the Brand D computer?

(1) The price at which the store sold the Brand C computer was 15 percent greater than the price at which the store sold the Brand D computer.

(2) The store's gross profit on the Brand D computer was $300.

**354.** If the list price of a new car was $12,300, what was the cost of the car to the dealer?

(1) The cost price, when raised by 25 percent was equal to the list price.

(2) The car was sold for $11,070, which was 12.5 percent more than the cost to the dealer.

## 3.4   Averages (including weighted averages)

**355.** A total of 20 amounts are entered on a spreadsheet that has 5 rows and 4 columns; each of the 20 positions in the spreadsheet contains one amount. The average (arithmetic mean) of the amounts in row $i$ is $R_i (1 \leq i \leq 5)$. The average of the amounts in column $j$ is $C_j (1 \leq j \leq 4)$. What is the average of all 20 amounts on the spreadsheet?

(1)   $R_1 + R_2 + R_3 + R_4 + R_5 = 550$

(2)   $C_1 + C_2 + C_3 + C_4 = 440$

**356.** All 48 seniors in a certain high school take one of the two English classes. What is the average (arithmetic mean) height of the seniors in this school?

(1)   In the school, the average height of the seniors in the English class with the larger number of students is 70 inches.

(2)   In the school, the average height of the seniors in the English class with the smaller number of students is $\frac{4}{5}$ of the average height of the seniors in the other English class.

**357.** Division R of Company Q has 1,000 employees. What is the average (arithmetic mean) annual salary of the employees at Company Q?

(1)   The average annual salary of the employees in Division R is $30,000

(2)   The average annual salary of the employees at Company Q who are <u>not</u> in Division R is $35,000

**358.** If every car sold last week at a certain used-car dealership was either a Coupe or a Sedan, what was the average (arithmetic mean) sale price for all the cars that were sold at the dealership last week?

(1)   The average sale price for the Sedans that were sold at the dealership last week was $10,600.

(2)   The average sale price for the Coupes that were sold at the dealership last week was $8,400.

**359.** If Jill's average (arithmetic mean) score for three games of bowling was 168, what was her lowest score?

(1)   Jill's highest score was 204.

(2)   The sum of Jill's two highest scores was 364.

**360.** A group of 20 friends went out for lunch. Five of them spent $21 each and the rest spent $x less than the average of all of them. Is the value of the average amount spent by all the friends $12?

(1)   $x = 3$

(2)   The total amount spent by all the friends is $240.

## 3.5 Ratio & Proportion

**361.** A department manager distributed a number of pens, pencils, and pads among the staff in the department, with each staff member receiving $x$ pens, $y$ pencils, and $z$ pads. How many staff members were in the department?

   (1) The numbers of pens, pencils, and pads that each staff member received were in the ratio 2 : 3 : 4 respectively

   (2) The manager distributed a total of 18 pens, 27 pencils, and 36 pads

**362.** At the beginning of the year, the Finance Committee and the Planning Committee of a certain company each had $n$ members, and no one was a member of both the committees. At the end of the year, 5 members left the Finance Committee and 3 members left the Planning Committee. How many members did the Finance Committee have at the beginning of the year?

   (1) The ratio of the total number of members who left at the end of the year to the total number of members at the beginning of the year was 1 : 6

   (2) At the end of the year, 21 members remained on the Planning Committee

**363.** Bucket $X$ and bucket $Y$ contain only water and bucket $Y$ was $\frac{1}{2}$ full. If all of the water in bucket $X$ was poured into bucket $Y$, then what fraction of the capacity of $Y$ was filled with water?

   (1) Before the water from $X$ was poured, $X$ was $\frac{1}{3}$ full.

   (2) $X$ and $Y$ have the same capacity.

**364.** Color X ink is created by blending red, blue, green, and yellow inks in the ratio 6 : 5 : 2 : 2. What is the number of liters of green ink that was used to create a certain batch of color X ink?

   (1) The amount of red ink used to create the batch is 2 liters more than the amount of blue ink used to create the batch

   (2) The batch consists of 30 liters of color X ink

**365.** How many liters of apple juice were added to the cranberry juice in a certain container?

   (1) The amount of apple juice that was added was $\frac{3}{2}$ times the amount of cranberry juice in the container.

   (2) There was 5 liters of cranberry juice in the container.

**366.** If all the employees of Company K who worked there last January are still there, how many employees does Company K have now?

   (1) Last January the ratio of the number of male employees to the number of female employees was 2 to 3.

   (2) Since last January, Company K has employed 400 new male employees and no new female employees, raising the ratio of the number of male employees to the number of female employees to 3 to 4.

**367.** If, on a fishing trip, Jim and Tom each caught some fish, did Jim catch more fish than Tom?

   (1) Jim caught $\frac{2}{3}$ of the total number of fish they caught together.

(2)   After Tom stopped fishing, Jim continued fishing until he had caught 12 more fish.

**368.**   The ratio of the number of male and female workers in a company in 2002 was 3 : 4. Was the percent increase in the number of men more than that in the number of women from 2002 to 2003?

(1)   The ratio of the number of male workers in 2002 to 2003 was 3 : 5.

(2)   The ratio of the number of male and female workers in 2003 was 10 : 7.

**369.**   In a certain senior citizens' club, are more than $\frac{1}{4}$ of the members over 75 years of age?

(1)   Exactly 60 percent of the female members are over 60 years of age, and, of them, $\frac{1}{3}$ are over 75 years of age.

(2)   Exactly 10 male members are over 75 years of age.

**370.**   In a certain professionals' club, are more than $\frac{1}{3}$ of the members mechanical engineers? Only those who are engineers can be mechanical engineers.

(1)   Exactly 75 percent of the female members are engineers, and, of them, $\frac{1}{3}$ are mechanical engineers.

(2)   Exactly 30 percent of the male members are engineers.

**371.**   What is the length of the line AD?
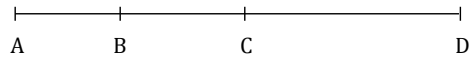
(1)  AC = 10, BD = 15

(2)  $\dfrac{AB}{BC} = \dfrac{BC}{CD}$

## 3.6 Mixtures

**372.** Two containers contain milk and water solutions of volume $x$ liters and $y$ liters, respectively. What would be the minimum concentration of milk in either container so that when the entire contents of both containers are mixed, 30 liters of 80 percent milk solution is obtained?

(1)   $x = 2y$

(2)   $x = y + 10$

**373.** From a cask containing $y$ liters of milk, $x$ liters of milk is drawn out and $z$ liters of water are then added to the cask. This process is repeated one more time. What is the fraction of milk finally present in the mixture in the cask?

(1)   $x = 20, y = 100$

(2)   $x$ and $z$ form 20% and 10% of $y$, respectively

**374.** Two containers contain milk and water solutions of volume $x$ liters and $y$ liters, respectively. What would be the minimum concentration of milk in either container so that when the entire contents of both containers are mixed, 30 liters of 80 percent milk solution is obtained?

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**375.** From a cask containing $y$ liters of milk, $x$ liters of milk is drawn out and $z$ liters of water are then added to the cask. This process is repeated one more time. What is the fraction of milk finally present in the mixture in the cask?

(1)   $x = 20, y = 100$

(2)   $x$ and $z$ form 20% and 10% of $y$, respectively

## 3.7 Speed, Time, & Distance

**376.** Chan and Mieko drove separate cars along the entire length of a certain route. If Chan made the trip in 15 minutes, how many minutes did it take Mieko to make the same trip?

(1) Mieko's average speed for the trip was $\frac{3}{4}$ of Chan's average speed.

(2) The route is 14 miles long.

**377.** How many miles long is the route from Houghton to Callahan?

(1) It will take one hour less time to travel the entire route at an average rate of 55 miles per hour than at an average rate of 50 miles per hour.

(2) It will take 11 hours to travel the first half of the route at an average rate of 25 miles per hour.

**378.** In planning for a trip, Joan estimated both the distance of the trip, in miles, and her average speed, in miles per hour. She accurately divided her estimated distance by her estimated average speed to obtain an estimate for the time, in hours, that the trip would take. Was her estimated time within 0.5 hour of the actual time that the trip took?

(1) Joan's estimate for the distance was within 5 miles of the actual distance.

(2) Joan's estimate for her average speed was within 10 miles per hour of her actual average speed.

**379.** Is the number of seconds required to travel $d$ feet at $r$ feet per second greater than the number of seconds required to travel $D$ feet at $R$ feet per second?

(1) $d$ is 30 greater than $D$

(2) $r$ is 30 greater than $R$

## 3.8  Time & Work

**380.**  If a certain machine produces screws and bolts at a constant rate, how many seconds will it take the machine to produce 300 bolts?

(1)   It takes the machine 56 seconds to produce 40 screws.

(2)   It takes the machine 1.5 times more time to produce 1 bolt than to produce one screw.

**381.**  If two copying machines work simultaneously at their respective constant rates, how many copies do they produce in 5 minutes?

(1)   One of the machines produces copies at the constant rate of 250 copies per minute.

(2)   One of the machines produces copies at twice the constant rate of the other machine.

**382.**  A group of 5 equally efficient skilled workers together take 18 hours to finish a job. How long will it take for a group of 4 skilled workers and 3 apprentices to do the same job, if each skilled worker works at an identical rate and each apprentice works at an identical rate?

(1)   An apprentice works at $\frac{2}{3}$ the rate of a skilled worker.

(2)   6 apprentices and 5 skilled workers take 10 hours to complete the same job.

### 3.9 Computational

**383.** A certain dealership has a number of cars to be sold by its salespeople. How many cars are to be sold?

   (1) If each of the salespeople sells 4 of the cars, 23 cars will remain unsold

   (2) If each of the salespeople sells 6 of the cars, 5 cars will remain unsold

**384.** A certain employee is paid \$9 per hour for an 8-hour workday. If the employee is paid $1\frac{1}{2}$ times this rate for time worked in excess of 8 hours during a single day, how many hours did the employee work today?

   (1) The employee was paid \$27 more for the hours worked today than for the hours worked yesterday

   (2) Yesterday the employee worked 8 hours

**385.** A family-size box of cereal contains more cereal and costs more than the regular-size box of cereal. What is the cost per ounce of the family-size box of cereal?

   (1) The family-size box of cereal contains 10 ounces more than the regular-size box of cereal.

   (2) The family-size box of cereal costs \$5.40.

**386.** A total of 100 customers purchased books at a certain bookstore last week. If these customers purchased a total of 200 books, how many of the customers purchased only one book each?

   (1) None of the customers purchased more than three books

   (2) 20 of the customers purchased only two books each

**387.** At a certain company, 25 percent of the employees are male and 50 percent of the employees are sales staff. What is the number of employees at this company?

   (1) Exactly seven of the employees at the company are males who are sales staff.

   (2) There are 16 more female employees than male employees at the company.

**388.** At a fruit stand yesterday, the price of each apple was \$0.10 more than the price of each orange. What was the total revenue from the sale of oranges at the fruit stand yesterday?

   (1) The number of oranges sold at the fruit stand yesterday was 5 more than the number of apples.

   (2) The total revenue from the sale of apples at the fruit stand yesterday was \$15.00

**389.** At the beginning of last month, a stationery store had in stock 250 writing pads, which had cost the store \$0.75 each. During the same month, the store made only one purchase of writing pads. What was the total amount of inventory, in dollar, of the writing pads it had in stock at the end of the last month?

   (1) Last month, the store purchased 150 writing pads for \$0.80 each.

   (2) Last month, the total revenue from the sale of writing pads was \$180

**390.** Development planners determined the number of new housing units needed in a certain area by using the formula $H = kJ$, where $H$ is the number of new housing units needed in the area, $J$ is the number of new jobs to be created in the area, and $k$ is a constant. How many new housing units did the planners determine were needed?

   (1)   The number of new jobs to be created was 60,000

   (2)   According to the formula used by the planners, if 37,500 jobs were to be created, then 7,500 new housing units would be needed

**391.** During week W, how much did it cost, per mile, for the gasoline used by car X?

   (1)   During week W, car X used gasoline that cost $3.10 per gallon.

   (2)   During week W, car X was driven 270 miles.

**392.** Each of 20 parents chose one of five days from Monday through Friday to attend parent-teacher conferences. If more parents chose Monday than Tuesday, did at least one of the parents choose Friday?

   (1)   None of the five days was chosen by more than 5 parents

   (2)   More parents chose Monday than Wednesday

**393.**

| $r$ | $s$ | $t$ |
|-----|-----|-----|
| $u$ | $v$ | $w$ |
| $x$ | $y$ | $z$ |

   Each of the letters in the table above represents one of the numbers 1, 2, or 3, and each of these numbers occurs exactly once in each row and exactly once in each column. What is the value of $r$?

   (1)   $v + z = 6$

   (2)   $s + t + u + x = 6$

**394.** For all integers $x$ and $y$, the operation $\triangle$ is defined by $x \triangle y = (x + 2)^2 + (y + 3)^2$. What is the value of integer $t$?

   (1)   $t \triangle 2 = 74$

   (2)   $2 \triangle t = 80$

**395.** From Leland's gross pay of $p$ dollars last week, $t$ percent was deducted for taxes and then $s$ dollars was deducted for savings. What amount of Leland's gross pay last week remained after these two deductions?

   (1)   $p - s = 244$

   (2)   $pt = 7,552$

**396.** If a certain city loses 12 percent of its daily water supply each day because of water-main breaks, what is the cost in dollars to the city per day for this loss?

   (1)   The city's daily water supply is 350 million gallons.

   (2)   The cost to the city for each 12,000 gallons of water loss is $2.

**397.** If Ann saves $x$ dollars each week and Beth saves $y$ dollars each week, what is the total amount that they together save per week?

(1)  Beth saves $ 5 more per week than Ann saves per week.

(2)  It takes Ann six weeks to save the same amount that Beth saves in five weeks.

**398.** If Antonio bought two half-liter cartons of same ice cream during a special sale, what percent of the total regular price of the two cartons did he save?

(1)  Antonio paid the regular price for the first carton and received the second carton for half the regular price.

(2)  The regular price of the ice cream Antonio bought was $4.00 per half-liter carton.

**399.** If the symbol '$\nabla$' represents either of addition, subtraction, multiplication or division, what is the value of $6 \nabla 2$?

(1)  $10 \nabla 5 = 2$

(2)  $4 \nabla 2 = 2$

**400.** In 2004, Mr. John bought a total of $n$ shares of stock X and Mrs. John bought a total of 300 shares of stock X. If the couple held all of their respective shares throughout 2005, and Mr. John's dividends on his $n$ shares totaled $150 in 2005, what was Mrs. John's total dividend on her 300 shares in 2005?

(1)  In 2005, the annual dividend on each share of stock X was $0.75

(2)  In 2004, Mr. John bought a total of 200 shares of stock X.

**401.** In a demographic study, the population and total income of a certain region were estimated, and both estimates had lower and upper limits. At the time of the estimates, was the average income per person for the region greater than $16,500?

(1)  The lower limit for the estimate of the population was 330,000 people.

(2)  The lower limit for the estimate of the total income was $5,500,000,000.

**402.**

$$\blacksquare + \triangle = \forall$$

In the addition problem above, each of the symbols $\blacksquare$, $\triangle$ and $\forall$ represents a positive digit. If $\blacksquare < \triangle$, what is the value of $\triangle$?

(1)  $\forall = 4$

(2)  $\blacksquare = 1$

## 3.10   Simple Interest

**403.**   A total of $60,000 was invested for one year. Part of this amount earned simple annual interest at the rate of $x$ percent per year, and the rest earned simple annual interest at the rate of $y$ percent per year. If the total interest earned on investment of $60,000 for that year was $4,080, what is the value of $x$?

(1)   $x = \dfrac{3}{4}y$

(2)   The ratio of the amount that earned interest at the rate of $x$ percent per year to the amount that earned interest at the rate of $y$ percent per year was 3 to 2

**404.**   John lent one part of an amount of money at 10 percent rate of simple interest and the remaining at 22 percent rate of simple interest, both for one year. At what rate was the larger part lent?

(1)   The total amount lent was $2400.

(2)   The average rate of simple interest he received on the total amount was 15 percent.

### 3.11   Compound Interest

**405.**   $10,000 is deposited in a certain account that pays $r$ percent annual interest compounded annually. The amount $D(t)$, in dollars, that the deposit will grow to in $t$ years is given by $D(t) = 10,000 \left(1 + \dfrac{r}{100}\right)^t$. What amount will the deposit grow to in 3 years?

(1)   $D(1) = 11,000$

(2)   $r = 10$

## 3.12   Functions

**406.**   For all integers $n$, the function $f$ is defined by $f(n) = a^n$, where $a$ is a constant. What is the value of $f(1)$?

   (1)   $f(2) = 100$

   (2)   $f(3) = -1000$

**407.**   For all numbers $x$, the function $f$ is defined by $f(x) = 3x + 1$ , and the function $g$ is defined by $g(x) = \dfrac{x-1}{3}$. If $c$ is a positive number, what is the value of $g(c)$?

   (1)   $f(c) = 13$

   (2)   $f(1) = c$

**408.**   If $f$ is the function defined by $f(x) = 2x$ for $x \geq 0$ and $f(x) = x^2$ for $x < 0$, what is the value of $f(c)$?

   (1)   $|c| = 2$

   (2)   $c < 0$

## 3.13   Permutation & Combination

**409.**   A box contains 10 light bulbs, fewer than half of which are defective. Two bulbs are to be drawn simultaneously from the box. If $n$ of the bulbs in box are defective, what is the value of $n$?

(1)   The probability that the two bulbs to be drawn will be defective is $\dfrac{1}{15}$

(2)   The probability that one of the bulbs to be drawn will be defective and the other will not be defective is $\dfrac{7}{15}$

**410.**   A certain jar contains only $b$ black marbles, $w$ white marbles, and $r$ red marbles If one marble is to be chosen at random from the jar, is the probability that the marble chosen will be red greater than the probability that the marble chosen will be white?

(1)   $\dfrac{r}{b+w} > \dfrac{w}{b+r}$

(2)   $b - w > r$

**411.**   In a 21 apartment building, there are in total 12 men and 9 women residing in one apartment each. If a poll taken is to select one of the apartments at random, what is the probability that the resident of the apartment selected will be a woman who is a student?

(1)   Of the women, four are students.

(2)   Of the women, five are not students.

**412.**   Each of the eggs in a bowl is dyed red, or green, or blue. If one egg is to be removed at random, what is the probability that the egg will be green?

(1)   There are 5 red eggs in the bowl.

(2)   The probability that the egg will be blue is $\dfrac{1}{3}$

**413.**   If two different representatives are to be selected at random from a group of 10 employees and if $p$ is the probability that both the representatives selected will be women, is $p > \dfrac{1}{2}$ ?

(1)   More than half of the 10 employees are women.

(2)   The probability that both representatives selected will be men is less than $\dfrac{1}{10}$.

**414.**   If each of the students in a certain mathematics class is either a junior or a senior, how many students are in the class?

(1)   If one student is to be chosen at random from the class to attend a conference, the probability that the student chosen will be a senior is $\dfrac{4}{7}$.

(2)   There are five more seniors in the class than juniors.

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## 3.14   Sets

**415.** In a school election, if each of the 900 voters voted for either Edith or Jose (but not both), what percent of the female voters in this election voted for Jose?

   (1)   80 percent of the female voters voted for Edith.

   (2)   60 percent of the male voters voted for Jose.

**416.** In a survey of 200 college graduates, 30 percent said that they had received student loans during their college careers, and 40 percent said that they had received scholarships. What percent of those surveyed said that they had received neither student loans nor scholarships during their college careers?

   (1)   25 percent of those surveyed said that they had received scholarships but no loans.

   (2)   50 percent of those surveyed who said that they had received loans also said that they had received scholarships.

**417.** Is the number of members of Club X greater than the number of members of Club Y?

   (1)   Of the members of Club X, 20 percent are also members of Club Y.

   (2)   Of the members of Club Y, 30 percent are also members of Club X.

## 3.15   Statistics & Data Interpretation

**418.**   A scientist recorded the number of eggs in each of 10 birds' nests.  What was the standard deviation of the numbers of eggs in the 10 nests?

    (1)   The average (arithmetic mean) number of eggs for the 10 nests was 4

    (2)   Each of the 10 nests contained the same number of eggs

**419.**   Each of the 45 boxes on shelf J weighs less than each of the 44 boxes on shelf K. What is the median weight of the 89 boxes on these shelves?

    (1)   The heaviest box on shelf J weighs 15 pounds

    (2)   The lightest box on shelf K weighs 20 pounds

**420.**   If each of the eight employees working on a certain project received an award, was the amount of each award the same?

    (1)   The standard deviation of the amounts of the eight awards was 0.

    (2)   The total amount of the eight awards was $ 10,000.

**421.**   If the average (arithmetic mean) of five different numbers is 12, what is the median of the five numbers?

    (1)   The median of the five numbers is equal to $\frac{1}{3}$ of the sum of the four numbers other than the median.

    (2)   The sum of the four numbers other than the median is equal to 45.

**422.**   If the average (arithmetic mean) of four different numbers is 30, how many of the numbers are greater than 30?

    (1)   None of the four numbers is greater than 60.

    (2)   Two of the four numbers are 9 and 10.

**423.**   If the average (arithmetic mean) of the assessed values of $x$ houses is $ 212,000 and the average of the assessed values of $y$ other houses is $ 194,000, what is the average of the assessed values of the $x + y$ houses?

    (1)   $x + y = 36$

    (2)   $x = 2y$

**424.**   Is the standard deviation of the salaries of Company Y's employees greater than the standard deviation of the salaries of Company Z's employees?

    (1)   The average (arithmetic mean) salary of Company Y's employees is greater than the average salary of Company Z's employees.

    (2)   The median salary of Company Y's employees is greater than the median salary of Company Z's employees.

## 3.16   Linear Equations

**425.** A certain bakery sells rye bread in 16-ounce loaves and 24-ounce loaves, and all loaves of the same size sell for the same price per loaf regardless of the number of loaves purchased. What is the price of a 24-ounce loaf of rye bread?

    (1)   The total price of a 16-ounce loaf and a 24-ounce loaf of this bread is $2.40

    (2)   The total price of two 16-ounce loaves and one 24-ounce loaf of this bread is $3.40

**426.** A certain database charges users a registration fee of $x$ dollars, and it charges registered users $y$ dollars per file downloaded. If there are no other charges for users of this database, what is the amount of the registration fee?

    (1)   The total charge to download 50 files is $150, including the registration fee.

    (2)   The total charge to download 100 files is $225, including the registration fee.

**427.** A shirt and a pair of gloves cost a total of $ 41.70. How much does the pair of gloves cost?

    (1)   The shirt costs twice as much as the gloves

    (2)   The shirt costs $27.80

**428.** A swim club sold only individual and family memberships. It charged $300 for an individual membership. If the club's total revenue from memberships was $480,000, what was the charge for a family membership?

    (1)   The revenue from individual memberships was $\frac{1}{4}$ of the total revenue from memberships

    (2)   The club sold 1.5 times as many family memberships as individual memberships

**429.** At a sale, all books were priced equally and all magazines were priced equally. What was the price of 3 books and 4 magazines at the sale?

    (1)   At the sale, the price of a book was $1.45 more than the price of a magazine.

    (2)   At the sale, the price of 6 books and 8 magazines was $43.70

**430.** Currently there are 50 picture books on each shelf in the children's section of a library. If these books were to be placed on smaller shelves with 30 picture books on each shelf, how many of the smaller shelves would be needed to hold all of these books?

    (1)   The number of smaller shelves needed is 6 more than the current number of shelves

    (2)   Currently there are 9 shelves in the children's section

**431.** Is $2m - 3n = 0$?

    (1)   $m \neq 0$

    (2)   $6m = 9n$

**432.** Each week John earns $x$ dollars an hour for the first 40 hours he works a week and $y$ dollars for each additional hour. How many dollars an hour does John earn for the first 40 hours?

    (1)   $y = 1.5x$

    (2)   If John works 45 hours in a week, he earns a total of $570 that week.

**433.** For a convention, a hotel charges a daily room rate of $120 for one person and $x$ dollars for each additional person. What is the charge for each additional person?

   (1)   The daily cost per person for 4 people sharing the cost of a room equally is $45.

   (2)   The daily cost per person for 2 people sharing the cost of a room equally is $25 more than the corresponding cost for 4 people.

**434.** For a recent play performance, the ticket prices were $25 per adult and $15 per child. A total of 500 tickets were sold for the performance. How many of the tickets were sold to adults?

   (1)   Revenue from ticket sales for this performance totaled $10,500

   (2)   The average (arithmetic mean) price per ticket sold was $21

**435.** For a week Raymond is paid at the rate of $x$ dollars per hour for the first $t$ hours ($t > 4$) he works and $ 2 per hour for the hours worked in excess of $t$ hours. If $x$ and $t$ are integers, what is the value of $t$?

   (1)   If Raymond works ($t - 3$) hours in one week, he will earn $14.

   (2)   If Raymond works ($t + 3$) hours in one week, he will earn $23.

**436.** From May 1, 1980, to May 1, 1995, the closing price of a share of stock X doubled. What was the closing price of a share of stock on May 1, 1980?

   (1)   From May 1, 1995, to May 1, 2004, the closing price of a share of stock X doubled.

   (2)   From May 1, 1995, to May 1, 2004, the closing price of a share of stock X increased by $ 4.50

**437.** How many books does Ricardo have?

   (1)   If Ricardo had 15 fewer books, he would have only half as many books as he actually has.

   (2)   Ricardo has twice as many fiction books as non-fiction books.

**438.** How many years did Dr. Jones live?

   (1)   If Dr. Jones had become a doctor 10 years earlier than he actually did, he would have been a doctor for exactly $\frac{2}{3}$ of his life.

   (2)   If Dr. Jones had become a doctor 10 years later than he actually did, he would have been a doctor for exactly $\frac{1}{3}$ of his life.

**439.** If $r = \dfrac{x + y}{2}$ and $s = \dfrac{x - y}{2}$, what is the value of ($r + s$)?

   (1)   $y = 4$.

   (2)   $x = 6$.

**440.** If $\dfrac{x}{600} = \dfrac{y}{300}$, is $y = 1000$?

   (1)   $x + y = 3000$

   (2)   $3x = 6000$

**441.** In what year was Ellen born?

    (1)   Ellen's brother, Pete, who is 2 years older than Ellen, was born in 1986.

    (2)   In 2005, Pete turned 18 years old.

## 3.17  Quadratic Equations & Polynomials

**442.**  How many more men than women are in the room?

    (1)  There are a total of 20 men and women in the room.

    (2)  The number of men in the room equals the square of the number of women in the room.

**443.**  If $x^2 + y^2 = 1$, is $(x + y) = 1$?

    (1)  $xy = 0$.

    (2)  $y = 0$.

**444.**  If $x \neq y$, is $x + y = xy$?

    (1)  $(1 - x)(1 - y) = 1$

    (2)  $x^2 - y^2 = x^2 y - xy^2$

**445.**  If $x(x - 5)(x + 2) = 0$, is $x < 0$?

    (1)  $x^2 - 7x \neq 0$

    (2)  $x^2 - 2x - 15 \neq 0$

**446.**  If $xy \neq 0$, what is the value of $\left( \dfrac{1}{x} + \dfrac{1}{y} \right)$?

    (1)  $\dfrac{1}{x + y} = -1$

    (2)  $xy = 6(x + y)$

**447.**  If $x^2 - y = w$, what is the value of $x$?

    (1)  $w + y = 4$

    (2)  $y = 1$

**448.**  If $(y + 3)(y - 1) - (y - 2)(y - 1) = r(y - 1)$, what is the value of $y$?

    (1)  $r^2 = 25$

    (2)  $r = 5$

**449.**  If $b, c$ and $d$ are constants and $x^2 + bx + c = (x + d)^2$ for all values of $x$, what is the value of $c$?

    (1)  $d = 3$

    (2)  $b = 6$

**450.**  If $x^2 + 3x + c = (x + a)(x + b)$ for all $x$, what is the value of $c$?

    (1)  $a = 1$

    (2)  $a$ and $b$ are positive integers.

## 3.18  Inequalities

**451.**  During a summer vacation, was the average (arithmetic mean) number of books that Carolyn read per week greater than the average number of books that Jacob read per week?

(1)   Twice the average number of books that Carolyn read per week was greater than 5 less than twice the average number of books that Jacob read per week.

(2)   During the last 5 weeks of the vacation, Carolyn read a total of 3 books more than Jacob.

**452.**  If $\dfrac{1}{4}$ of the larger of two positive numbers is greater than five times the smaller of the same two numbers, is the smaller number less than four?

(1)   The larger number is greater than 70.

(2)   The larger number is less than 80.

**453.**  If $xy \neq 0$, is $\dfrac{x}{y} = 1$?

(1)   $x^2 = y^2$

(2)   $xy > 0$

**454.**  If $xyz \neq 0$, is $x\,(y + z) \geq 0$?

(1)   $|y + z| = |y| + |z|$

(2)   $|x + y| = |x| + |y|$

**455.**  If $R = \dfrac{P}{Q}$, is $R \leq P$?

(1)   $P > 50$

(2)   $0 < Q \leq 20$

**456.**  If $s^4 v^3 x^7 < 0$, is $svx < 0$?

(1)   $v < 0$

(2)   $x > 0$

**457.**  If $\dfrac{x}{2} = \dfrac{3}{y}$, is $x < y$?

(1)   $y \geq 3$

(2)   $y \leq 4$

**458.**  If $-2x > 3y$, is $x < 0$?

(1)   $y > 0$

(2)   $2x + 5y - 20 = 0$

**459.**  If $a$ and $b$ are positive, is $\left(a^{-1} + b^{-1}\right)^{-1} < \left(a^{-1}b^{-1}\right)^{-1}$?

(1)   $a = 2b$

(2)   $a + b > 1$

**460.** If $a$, $b$, $c$ and $d$ are positive integers, is $\left(\dfrac{a}{b}\right) * \left(\dfrac{c}{d}\right) > \dfrac{c}{b}$?

(1)   $c > b$

(2)   $a > d$

**461.** If $w$ and $c$ are integers, is $w > 0$?

(1)   $w + c > 50$

(2)   $c > 48$

**462.** If $wz < 2$, is $z < 1$?

(1)   $w > 2$

(2)   $z < 2$

**463.** If $x > 0$, is $x^2 < x$?

(1)   $0.1 < x < 0.4$

(2)   $x^3 < x^2$

**464.** If $x > 1$ and $y > 1$, is $x < y$?

(1)   $\dfrac{x^2}{xy + x} < 1$

(2)   $\dfrac{xy}{y^2 - y} < 1$

**465.** If $x \neq 0$, is $\dfrac{x^2}{|x|} < 1$?

(1)   $x < 1$

(2)   $x > -1$

**466.** If $x$ and $y$ are integers and $y = |x + 3| + |4 - x|$, does $y$ equal 7?

(1)   $x < 4$

(2)   $x > -3$

**467.** If $x$ and $y$ are integers and $x > 0$, is $y > 0$?

(1)   $7x - 2y > 0$

(2)   $- - y < x$

**468.** If $x$ and $y$ are integers, is $(x + y) > 2$?

(1)   $x^2 < 1$

(2)   $y < 1$

**469.** If $x$ and $y$ are positive integers and $y = \sqrt{9 - x}$, what is the value of $y$?

(1)  $x < 8$

(2)  $y > 1$

**470.**  If $x$ and $y$ are positive, is $3x > 7y$?

(1)  $x > y + 4$

(2)  $-5x < -14y$

**471.**  If $x$ and $y$ are positive, is $4x > 3y$?

(1)  $x > y - x$

(2)  $\frac{x}{y} < 1$

**472.**  If $x$ is a negative integer, is $x < -3$?

(1)  $x^2 + 6x < 7$

(2)  $x^2 + |x| \leq 2$

**473.**  If $x + y > 0$, is $xy < 0$?

(1)  $x^{2y} < 1$

(2)  $x + 2y < 0$

### 3.19 Geometry–Lines

**474.** If $l_1 || l_2$ in the figure given below, is $x = y$?
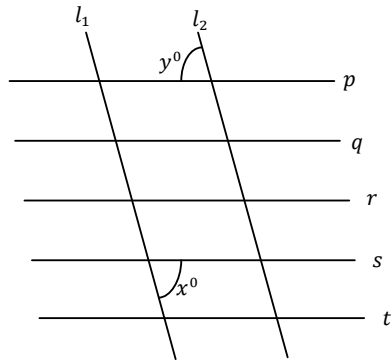


(1) $p || r$ and $r || t$

(2) $q || s$

## 3.20  Geometry–Triangles

**475.**  In the triangle below, is $x > 90$?
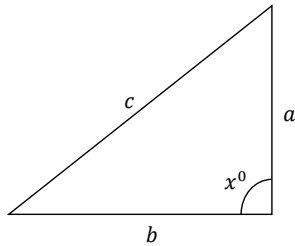


(1)  $a^2 + b^2 < 15$

(2)  $c > 4$

**476.**  In triangle ABC, point X is the midpoint of side AC and point Y is the midpoint of side BC. If point R is the midpoint of line segment XC and if point S is the midpoint of line segment YC, what is the area of the triangular region CRS ?

(1)  The area of the triangular region ABX is 32.

(2)  The length of one of the altitudes of triangle ABC is 8.

**477.**  In triangle PQR, the measure of angle P is $30^0$ greater than twice the measure of angle Q. What is the measure of angle R?

(1)  PQ = QR

(2)  The measure of angle P is $78^0$.

**478.**  In triangle PQR below, what is the value of $y$?
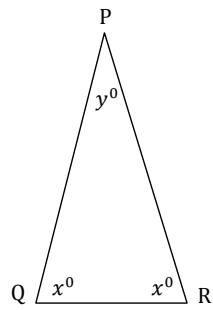
(1) $\dfrac{3}{2}x = 120$

(2) $x + y = 100$

## 3.21   Geometry–Circles

**479.**   In the figure shown, triangle ABC is inscribed in the circle.  What is the circumference of the circle?
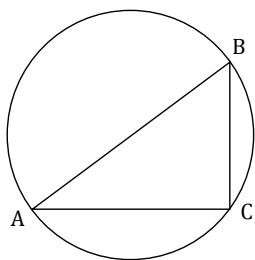


(1)   The perimeter of the triangle ABC is 48.

(2)   The ratio of the lengths of BC, AC, and AB respectively, is 3 : 4 : 5.

**480.**   In the figure below, ABCD is a rectangle. What is the area of the semi-circular region with centre O and diameter BC?
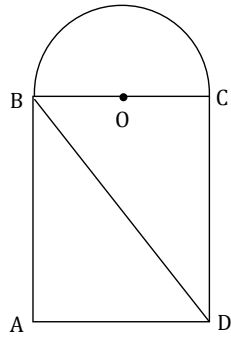
(1)  $\dfrac{BC}{AB} = \dfrac{3}{4}$

(2)  BD = 25

**481.**  In the figure, points A, B, C, D, and E lie on a line. A is the point of contact of the two circles, B is the center of the smaller circle, C is the center of the larger circle, D is a point on the smaller circle, and E is a point on the larger circle. What is the area of the region inside the larger circle but outside the smaller circle?
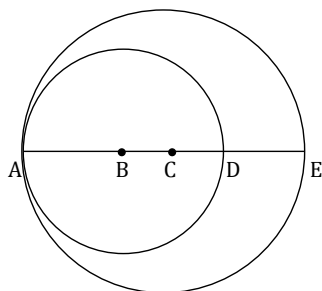
(1)  AB = 3 and BC = 2
(2)  CD = 1 and DE = 4

## 3.22   Geometry–Polygon

**482.**   Can a certain rectangular sheet of glass be positioned on a rectangular tabletop so that it covers the entire tabletop and its edges are parallel to the edges of the tabletop?

    (1)   The tabletop is 36 inches wide by 60 inches long.

    (2)   The area of one face of the sheet of glass is 2,400 square inches.

**483.**   If the length of a certain rectangle is 2 greater than the width of the rectangle, what is the perimeter of the rectangle?

    (1)   The length of the diagonal of the rectangle is 10.

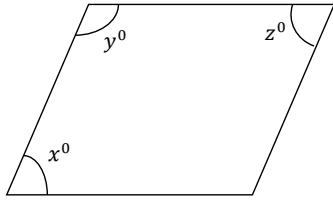    (2)   The area of the rectangular region is 48.

**484.**   In the figure shown below, the line segment AD is parallel to the line segment BC. Is AC the shortest side of triangle ACD?
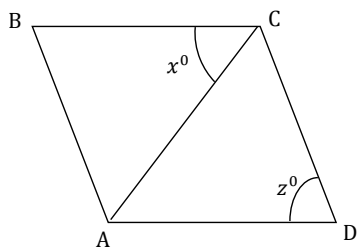
(1)   $x = 50$

(2)   $z = 70$

**485.**   In the parallelogram shown below, what is the value of $x$?

(1)  $y = 2x$

(2)  $x + z = 120$

## 3.24   Co-ordinate geometry

**486.**   A certain circle in the XY-plane has its center at the origin. If P is a point on the circle, what is the sum of the squares of the coordinates of P?

   (1)   The radius of the circle is 4.

   (2)   The sum of the coordinates of P is 0.

**487.**   If line $k$ in the XY-plane has equation $y = mx + b$, where $m$ and $b$ are constants, what is the slope of $k$?

   (1)   $k$ is parallel to the line with equation $y = (1 - m) x + b + 1$.

   (2)   $k$ intersects the line with equation $y = 2x + 3$ at the point (2, 7).
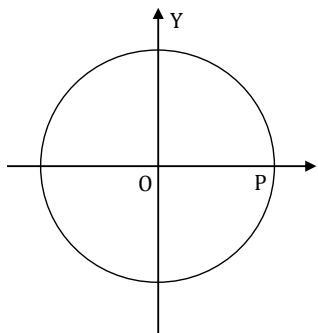
**488.**   In the figure below, ST and TU are parallel to the X-axis and Y-axis respectively. What is the sum of the coordinates of point T?
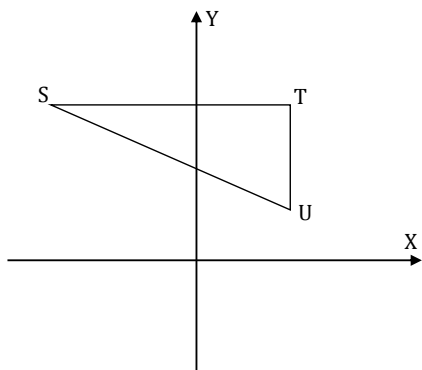
(1)   The Y-coordinate of point U is 1.

(2)   The X-coordinate of point S is −5.

**489.**  In the figure shown, the circle has center O and radius 50, and point P has coordinates (50, 0). If point Q (not shown) is on the circle, what is the length of line segment PQ?

    (1)    The X-coordinate of point Q is $-30$.

    (2)    The Y-coordinate of point Q is $-40$.


**490.** In the rectangular coordinate system, are the points $(r, s)$ and $(u, v)$ equidistant from the origin?

    (1)    $r + s = 1$

    (2)    $u = 1 - r$ and $v = 1 - s$

**491.** In the XY-plane, does the point $(a, b)$ lie above the line $y = x$?

    (1)    $a = 2$

    (2)    $b = a + 2$

**492.** In the XY-plane, is the slope of the line $k$ positive?

    (1)    Line $k$ is perpendicular to the line passing though the points $(1,\ 1)$ and $(-2,\ 5)$.

    (2)    Line $k$ makes a negative intercept on the X-axis and a positive intercept on the Y-axis.

**493.** In the XY-plane, lines $l$ and $k$ intersect at the point $\left( \dfrac{16}{5}, \dfrac{12}{5} \right)$. What is the slope of line $l$?

    (1)    The product of the slopes of lines $l$ and $k$ is $-1$.

    (2)    Line $k$ passes through the origin.

**494.** In the XY-plane, lines $a$ and $b$ are parallel. If the Y-intercept of line $a$ is $-1$, what is the Y-intercept of line $b$?

    (1)    The X-intercept of line $a$ is $-1$.

    (2)    Line $b$ passes through the point $(10,\ 20)$.

**495.** In the XY-plane, the point $(r, s)$ lies on a circle with centre at the origin. What is the value of $(r^2 + s^2)$?

    (1)    The circle has radius 2.

    (2)    The point $\left( \sqrt{2},\ -\sqrt{2} \right)$ lies on the circle.

**496.** In the XY-plane, region R consists of all the points $(x, y)$ such that $2x + 3y \leq 6$. Is the point $(r, s)$ in region R?

(1)   $3r + 2s = 6$

(2)   $r \leq 3$ and $s \leq 2$

**497.**   In the XY-plane, the line $k$ passes through the origin and through the point $(a, b)$, where $ab \neq 0$. Is $b > 0$?

(1)   The slope of line $k$ is negative.

(2)   $a < b$

**498.**   In the XY-plane, the line with equation $ax + by + c = 0$, where $abc \neq 0$, has slope $\dfrac{2}{3}$. What is the value of $b$?

(1)   $a = 4$

(2)   $c = -6$

**499.**   In the XY-plane, the sides of a certain rectangle are parallel to the X and Y axes. If one of the vertices of the rectangle is $(-1, -2)$, what is the perimeter of the rectangle?

(1)   One of the vertices of the rectangle is $(2, -2)$.

(2)   One of the vertices of the rectangle is $(2,\ 3)$.

**500.**   In the XY-plane, what is the slope of line $l$?

(1)   The line $l$ does not intersect with the line having equation $y = 1 - x$

(2)   The line $l$ intersects with the line having equation $y = x - 1$