Percents

A1- What percent of 112 is 14?

(A) .125 %
(B) 8 %
(C) 12.5 %
(D) 125%
(E) 800 %

A2- What is 45 percent of $\frac{7}{12}$ of 240?

(A) 63
(B) 90
(C) 108
(D) 140
(E) 311

A3- 18 is 15 % of 30 % of what number?

(A) 9
(B) 36
(C) 40
(D) 81
(E) 400

A4- What is the quotient when .25% of 600 is divided by .25 of 600?
(A) 10
(B) 1
(C) .1
(D) .01
(E) .001

A5- If a 10 % deposit that has been paid towards the purchase of a certain product is $ 110, what amount of money would still need to be paid?

(A) $ 880
(B) $ 990
(C) $ 1,000
(D) $ 1,100
(E) $ 1,210

A6- If a compact disk that usually sells for $ 12.95 is on sale for $ 9.95, then the percent of decrease in its price is approximately

(A) 38 %
(B) 31 %
(C) 30 %
(D) 29 %
(E) 23 %

A7- Increasing the original price of an article by 15 % and then increasing the resulting price by 15 % is equivalent to increasing the original price by

(A) 32.25 %
(B) 31.00 %
(C) 30.25 %
(D) 30.00 %
(E) 22.50 %

A8- If the length and width of a rectangular garden plot were each increased by 20 %, what would be the percent increase in the area of the garden?

(A) 20 %
(B) 24 %
(C) 36 %
(D) 40 %
(E) 44 %

A9- Last year's receipts from the sale of candy on Valentine's Day totaled 385 million dollars, which represented 7 % of the total candy sales for that year. What was the total amount of money earned from candy sale last year, in millions of dollars?

(A) 55
(B) 550
(C) 2,695
(D) 5,500
(E) 26,950

A10- In a shipment of 120 machine parts, 5 % were defective. In a shipment of 80 machine parts, 10 % were defective. What was the percentage of defective parts in the two shipments combined?

(A) 6.5 %
(B) 7.0 %
(C) 7.5 %
(D) 8.0 %
(E) 8.5 %

A11- Lucy invested $ 10,000 in a new mutual fund account exactly 3 years ago. The value of the account increased by 10 % during the first year, by 5 % during the second year, and then decreased by 10 % during the third year. What is currently the value of the account?

(A) $ 10,350
(B) $ 10, 395
(C) $ 10,500
(D) $ 11,500
(E) $ 12,705

A12- Chris's convertible gets gas mileage that is 40 percent higher than that of Stan's SUV. If Harry's hatchback gets gas mileage that is 15% higher than that of Chris's convertible, then Harry's hatchback gets gas mileage that is what percent greater than that of Stan's SUV?

    (A)   25 %
    (B)   46 %
    (C)   55 %
    (D)   61 %
    (E)   66 %

A13- A store sells a six-pack of soda for $2.70. If this represents a savings of 10 percent of the individual price of cans of soda, then what is the price of a single can of soda?

    (A) $0.35
    (B) $0.40
    (C) $0.45
    (D) $0.50
    (E) $0.55

A14- At apartment complex Z, 30 percent of the residents are men over the age of 18, and 40 percent are women over the age of 18. If there are 24 children living in the complex, how many total residents live in apartment complex Z?

    (A)   32
    (B)   80
    (C)   94
    (D)   112
    (E)   124

A15- A discount electronics store normally sells all merchandise at a discount of 10 percent to 30 percent off the suggested retail price. If, during a special sale, an additional 20 percent were to be deducted from the discount price, what would be the lowest possible price of an item costing $260 before any discount?

(A) $130.00
(B) $145.60
(C) $163.80
(D) $182.00
(E) $210.00

Ratios and proportions

A22- A collection of books went on sale, and $\frac{2}{3}$ of the books were sold for $ 2.50 each. If none of the 36 remaining books were sold, what was the total amount received from the selling of the books?

(A) $ 180
(B) $ 135
(C) $ 90
(D) $ 60
(E) $ 54

A23- Of the final grades received by the students in a certain math course, $\frac{1}{5}$ are A's, $\frac{1}{4}$ are B's, $\frac{1}{2}$ are C's, and the remaining 10 grades are D's. What is the number of students in the course?

(A) 80
(B) 110
(C) 160
(D) 200
(E) 400

A24- Three business partners Q, R and S agreed to divide their profit for a certain year in the ratio of $2 : 5 : 8$ respectively. If Q's share was $\$\,4,000$ for that year, what was the profit of all of them together for that year?

(A) $\$\,26,000$
(B) $\$\,30,000$
(C) $\$\,52,000$
(D) $\$\,60,000$
(E) $\$\,300,000$

A25- A fruit salad mixture consists of apples, peaches and grapes in the ratio of $6 : 5 : 2$ respectively, by weight. If 39 pounds of the mixture is prepared, how many more pounds of apples than grapes would the mixture include?

(A) 15
(B) 12
(C) 9
(D) 6
(E) 4

A26- Andre has already saved $\frac{3}{7}$ of the cost of a new car, and he has calculated that he will be able to save $\frac{2}{5}$ of the remaining amount before the end of the summer. If his calculations are correct, what fraction of the cost of the new car will he still need to save at the end of summer vacation?

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

(B) $\frac{8}{35}$

(C) $\frac{12}{35}$

(D) $\frac{23}{35}$

(E) $\frac{29}{35}$

A27- A group of 20 friends formed an investment club, with each member contributing an equal amount to the general fund. The club then invested the entire fund, which amounted to d dollars, in Stock X. The value of the stock subsequently increased 40 percent, at which point the stock was sold and the proceeds divided evenly among the members. In terms of d, how much money did each member of the club receive from the sale? (Assume that transaction fees and other associated costs were negligible.)

(A) $800d$

(B) $\dfrac{7d}{5}$

(C) $\dfrac{d}{20} + 40$

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

(E) $\dfrac{7d}{100}$

A28- On Monday, a certain animal shelter housed 55 cats and dogs. By Friday, exactly $\frac{1}{5}$ of the cats and $\frac{1}{4}$ of the dogs had been adopted; no new cats or dogs were brought to the shelter during this period. What is the greatest possible number of pets that could have been adopted from the animal shelter between Monday and Friday?

(A) 11
(B) 12
(C) 13
(D) 14
(E) 20

Statistics

A33- The arithmetic mean of 4 positive integers is 10. What is the largest possible value of the largest integer?

A34- 18 is the median of the following list of numbers: 5, 18, 43, 67 and x; what should be the value of x so that the mean of this set of numbers is at its maximum?

A35- The ratio of males to females in a certain group is $1:2$. The average IQ of the males is 120 and that of the females is 135. Find the average IQ of the entire group.

A36- The range of a set of numbers is 20. What is the new range of the set if each number is
a) Increased by 20?

b) Divided by 4?

c) Multiplied by −2?

A37- Which of the following sets has the greatest standard deviation?
(A) $\{-8, -6, -4, -2\}$
(B) $\{12, 13, 14, 15\}$
(C) $\{1, 4, 7, 10\}$
(D) $\{20, 30, 40, 50\}$
(E) $\{2, 4, 6, 8\}$

A38- Find the difference between the median and the mode of the GPAs of 40 students listed in the table below.

Grade	Number of students
4	2
3.8	3
3.7	4
3.5	6
3.2	8
2.9	10
2.7	5
2.4	2

A39- The average of 6 numbers is 8.5. When one number is discarded, the average of the remaining numbers becomes 7.2. What is the discarded number?
(A) 7.8
(B) 9.8
(C) 10
(D) 12.4
(E) 15

A40- If $S = \{0, 4, 5, 2, 11, 8\}$, what is the difference between the arithmetic mean of the numbers in set S and their median?
(A) 0.5
(B) 1
(C) 1.5
(D) 2
(E) 2.5

A41- $\{1, 4, 6, y\}$
If the average (arithmetic mean) of the set of numbers above is 6, then what is the median?
(A) 5
(B) 6
(C) 7
(D) 13
(E) 24

A42- $\{3, 5, 9, 13, y\}$

If the average (arithmetic mean) of the set of numbers above is equal to the median of the same set of numbers, then what is the value of y?

(A) 7
(B) 8
(C) 10
(D) 15
(E) 17

Probability and counting

A49- A six-sided die, with faces numbered one through six is rolled once. What is the probability that the face numbered 2 is facing upward?

A50- A number is picked from a set $\{1, 2, 3, 4, 5, 6\}$. What is the probability that it is a multiple of 3?

A51- A six-sided die with faces numbered one through six is rolled once. What is the probability that either the face numbered two or the face numbered three is facing up?

A52- A ball is picked from a bag containing 3 red, 4 blue and 5 green balls, then what is the probability that the ball is either red or green?

A53- What is the probability of getting two heads when a fair coin is tossed twice?

A54- Two marbles are picked from a bag containing 4 red, 5 green and 6 blue marbles. What is the probability that:
a) Both are red?

b) Both are not blue?

A55- Sally and Sam are watching a magician perform with 16 of their friends. If the magician chooses one child at random to assist with a trick, what is the probability that either Sally or Sam is chosen?

A56- Sally and Sam are watching a magician perform with 16 of their friends. If one child is chosen at random to assist with a trick, what is the probability that neither Sally nor Sam is chosen?

A57- Nine boys and nine girls are watching a magician perform. Four times during the performance a child is chosen at random to assist with a trick. If any of the children can be chosen to assist with each of the four tricks, what is the probability that at least one girl is chosen?

A58- Three basketball teams play in a league against each other. At the end of the season, how many different ways could the 3 teams end up ranked against each other?

A59- Seven basketball teams play in a league against each other. At the end of the season, how many different arrangements are there for the top 3 teams in the rankings?

A60- A cricket team consisting of 11 players must be formed out of 16 players available. How many different teams can be formed?

A61- In how many ways can a committee of 3 men and 2 women be formed from a group of 8 men and 6 women?

A62- In how many ways can a team of 3 people be selected from a group of 14 people so that Jack would be in the team? (Given that Jack is among the 14 people)

A63- In how many ways can 3 people out of 14 be awarded 3 prizes (Gold, silver and bronze) so that Jack would be awarded? (Given that Jack is among the 14 people)

A64- In how many ways can 5 people sit in a circle?

A65- At a restaurant, you must choose an appetizer, a main course, and a dessert. If there are 2 possible appetizers, 3 possible main courses, and 5 possible desserts, how many different meals could you order?

A66- A menu contains 4 appetizers, 3 main courses and 4 desserts. In how many ways can Ron order a complete meal consisting of 2 appetizers, one main course and 1 dessert?

A67- You have 10 pairs of socks, 5 black pairs and 5 blue pairs, but they are not paired up. Instead, they are all mixed up in a drawer. It's early in the morning and you don't want to turn on the lights in your dark room.
a) How many socks must you pull out to guarantee that you have a pair of one color?

b) How many must you pull out to have two good pairs (each pair is the same color)?

c) How many must you pull out to be certain that you have a pair of black socks?

A68- A circle has 7 points on its circumference. What is the ratio of the number of triangles to the number of quadrilaterals that could be drawn having some of these points as their vertices?

A69- How many arrangements of 5 people (A, B, C, D and E) are possible if A and B cannot be next to each other?

A70- How many arrangements of the letters of the word MASSACHUSETTS are possible?

A71- A book contains 732 pages numbered 1, 2, ..., 732. If a student randomly opens the book, what is the probability that the page number contains digit 1?

A72- $X = \{9, 10, 11, 12\}$

   $Y = \{2, 3, 4, 5\}$
One number will be chosen randomly from each of the sets above. If x represents the chosen member of set X and y represents the chosen member of set Y, what is the probability that $\frac{x}{y}$ will be an integer?

(A) $\frac{1}{16}$

(B) $\frac{3}{8}$

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

(D) $\frac{3}{4}$

(E) $\frac{15}{16}$

A73- Sam and Jessica are invited to a dance. If there are 7 men and 7 women in total at the dance and one woman and one man are chosen for the dance, what is the probability that Sam and Jessica will NOT be the pair chosen to lead the dance?

(A) $\dfrac{1}{49}$

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

(C) $\dfrac{6}{7}$

(D) $\dfrac{47}{49}$

(E) $\dfrac{48}{49}$

A74- To fill a number of vacancies, an employer must hire 3 programmers from among 6 applicants and 2 managers from among 4 applicants. What is the total number of ways in which she can make her selection?

(A) 1,490
(B) 132
(C) 120
(D) 60
(E) 23

A75- In a workshop there are 4 kinds of beds, 3 kinds of closets, 2 kinds of shelves and 7 kinds of chairs. In how many ways can a person decorate his room if he wants to buy in the workshop one shelf, one bed and one of the following: a chair or a closet?

(A) 168
(B) 16
(C) 80
(D) 48
(E) 56

A76- In a jar, there are 15 white balls, 25 red balls, 10 blue balls and 20 green balls. How many must be taken out in order to make sure to obtain 8 of the same color?

(A) 8
(B) 23
(C) 29
(D) 32
(E) 53

A77- Suppose the heights of a population of 3,000 adult penguins are approximately normally distributed with a mean of 65 cm and a standard deviation of 5 cm.

a) Approximately how many of the adult penguins are between 65 cm and 75 cm tall?

b) If an adult is chosen at random from the population, approximately what is the probability that the penguin's height will be less than 60 cm?

Solids

A80- What is the radius of the largest sphere that could fit inside a right circular cylinder of radius 10 units and height 40 units?

A81- What is the radius of the largest sphere that could fit inside a right circular cylinder of radius 10 units and height 10 units?

A82- A perfectly spherical satellite with a radius of 4 feet is being packed for shipment to its launch site. If the inside dimensions of the rectangular crates available for shipment, when measured in feet, are consecutive even integers, then what is the volume of the smallest available crate that can be used?

(A)   48
(B)   192
(C)   480
(D)   960
(E)   1,680

Intersecting lines and angles

A84- In the figure above, what is the value of y?

(A) 6
(B) 12
(C) 24
(D) 36
(E) 42

$(3x)°$
$(2x)°$ $(y + 30)°$
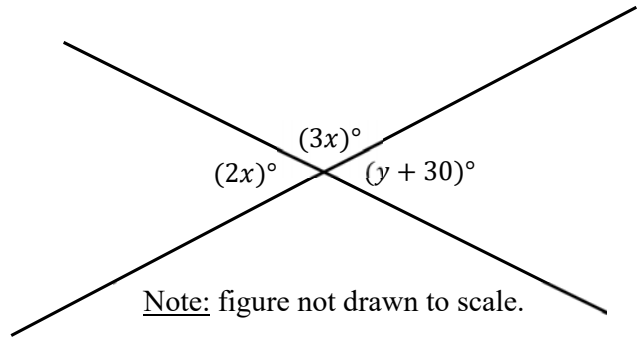
<u>Note:</u> figure not drawn to scale.

Radicals

A85- $\sqrt{\sqrt{1 + \frac{17}{64}}} =$

(A) $\dfrac{\sqrt{34}}{8}$

(B) $\dfrac{3\sqrt{2}}{4}$

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

(D) $\dfrac{\sqrt{68}}{4}$

(E) $\dfrac{3\sqrt{2}}{2}$

A86- The value of $\sqrt[3]{-89}$ is

(A) Between -9 and -10
(B) Between -8 and -9
(C) Between -4 and -5
(D) Between -3 and -4
(E) Undefined

A87- $\sqrt{(16)(20) + (8)(32)} =$

(A) $4\sqrt{20}$
(B) 24
(C) 25
(D) $4\sqrt{20} + 8\sqrt{2}$
(E) 32

A88- If $x = \dfrac{\frac{5}{9} + \frac{15}{27} + \frac{45}{81}}{3}$, then $\sqrt{1-x} =$

(A) $\quad \dfrac{\sqrt{5}}{9}$

(B) $\quad \dfrac{5}{9}$

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

(D) $\quad \dfrac{\sqrt{5}}{3}$

(E) $\quad \dfrac{15}{9}$

A89- If $M = \sqrt{4} + \sqrt[3]{4} + \sqrt[4]{4}$, then the value of M is

(A) less than 3
(B) equal to 3
(C) between 3 and 4
(D) equal to 4
(E) greater than 4

Properties of numbers

A90- X is the product of all the integers from 1 to 10, inclusive. If 3^N is a factor of X, what is the greatest possible value of N?

A91- If a is divided by 5 or 15, the answer is an integer. Is $\dfrac{a}{20}$ an integer?

a) yes   b) no   c) maybe

A92- 40 is a divisor of b. Is 5 a divisor of b?

c) yes   b) no   c) maybe

A93- Given that 5 is a factor of n and 7 is a factor of q, is 70 a factor of nq?

a) yes   b) no   c) maybe

A94- Given that n is not divisible by 5, is $3n$ divisible by 10?

a) yes   b) no   c) maybe

A95- If p is divisible by 10 and 15, then is p divisible by 6?

a) yes   b) no   c) maybe

A96- If p is divisible by 15, and q is divisible by 20, then is pq divisible by 12?

a) yes   b) no   c) maybe

A97- If the sum of 3 consecutive integers is odd, then the first and last integers must be:

a) Both odd   b) both even   c) one even, one odd

A98- A person has n chocolates. If he keeps 3 chocolates with him, and divides the remaining equally among 5 children. If n is between 30 and 35, find n.

A99- Let a be the sum of the integers from 1 to 30, and b the sum of the integers from 31 to 60. What is the value of $b - a$?

A100- If $\frac{1}{7} = 0.142857142857$ ... find the 100th digit to the right of the decimal point.

A101- Which of the following is the least positive integer that is divisible by 2, 3, 4, 5, 6, 7, 8 and 9?
(A) 15,120
(B) 3,024
(C) 2,520
(D) 1,890
(E) 1,680

A102- If p is an even integer and q is an odd integer, which of the following must be an odd integer?
(A) $\frac{p}{q}$
(B) pq
(C) $2p + q$
(D) $2(p + q)$
(E) $\frac{3p}{q}$

A103- What is the units digit of $(13)^4(17)^2(29)^3$?
(A) 9
(B) 7
(C) 5
(D) 3
(E) 1

A104- If x is an integer, then which of the following statements about $x^2 - x - 1$ is true?
(A)   It is always odd
(B)   It is always even
(C)   It is always positive
(D)   It is even when x is even and odd when x is odd
(E)   It is even when x is odd and odd when x is even

A105- x, y and z are consecutive positive integers such that $x < y < z$. If the units' digit of x^2 is 6 and the units' digit of y^2 is 9, what is the units' digit of z^2?
(A)   0
(B)   1
(C)   2
(D)   4
(E)   5

Algebra - Simplifying algebraic expressions and solving equations & inequalities

A120- $200^2 - 2(200)(199) + 199^2 =$
(A) $-79{,}201$
(B) -200
(C)   1
(D)   200
(E) $79{,}999$

A121- If $x \neq \frac{1}{2}$, then $\frac{6x^2 + 11x - 7}{2x - 1} =$
(A) $3x + 7$
(B) $3x - 7$
(C) $3x + 1$
(D) $x + 7$
(E) $x - 7$

A122- If $(t - 8)$ is a factor of $t^2 - kt - 48$, then $k =$

(A) -6
(B) -2
(C) 2
(D) 6
(E) 14

Triangles

A125- Two sides of a triangle are 4 and 10. If all the side measures are integers, find the largest and the smallest possible values of the measure of the third side.

A126- If 2 sides of a triangle are of 6 and 8 units respectively, which of the following cannot be the area of the triangle?

(A) 0.01
(B) 5
(C) 10
(D) 20
(E) 25

A127- Given two triangles ABC and PQR such that $m\angle A = m\angle Q = 50°$ and $m\angle B = m\angle P = 60°$. The ratio of the area of $\triangle ABC$ to that of $\triangle PQR$ is $4:25$. If $AB = 16, BC = 10$ and $AC = 12$, find the length of sides PQ, QR and PR.

A130- If P is the perimeter of an equilateral triangle, which of the following represents the height of the triangle?

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

(B) $\dfrac{P\sqrt{3}}{3}$

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

(D) $\dfrac{p\sqrt{3}}{6}$

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

Quadrilaterals
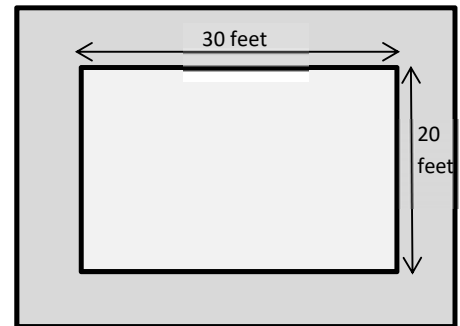
A133- Martin planted a rectangular garden with dimensions 20 feet by 30 feet and then surrounded the garden with a rectangular brick walkway of uniform width (represented by the shaded area in the drawing above). If the area of the walkway equals the area of the garden, what is the width of the walkway?

(A)   1 foot
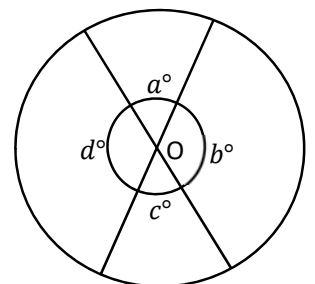(B)   3 feet
(C)   5 feet
(D)   8 feet
(E)   10 feet

Circles

A134- If A is the center of the circle shown below and $AB = BC = CD$, what is the value of x?

(A)   15
(B)   30
(C)   45
(D)   60
(E)   75
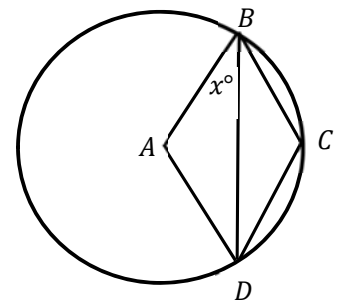
A135- In the circle above, with center O intersected by 2 straight lines, $3a = b$. What is the value of $b - a$?

(A)   2
(B)   30
(C)   45
(D)   90
(E)   135
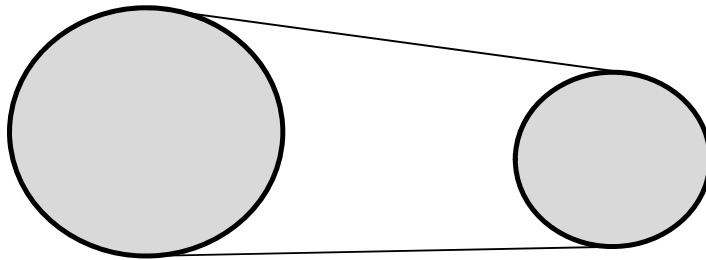
A136- The diagram above shows two wheels that drive a conveyor belt. The larger wheel has a diameter of $40\ cm$; the smaller wheel has a diameter of $32\ cm$. In order for the conveyor belt to run smoothly, each wheel must rotate the exact same number of cm per minute. If the larger wheel makes r revolutions per minute, how many revolutions does the smaller wheel make per hour, in terms of r?

(A) $\dfrac{1,280\pi}{3}$

(B) $75\ r$

(C) $48\ r$

(D) $24\ r$

(E) $\dfrac{64\pi}{3}$

Coordinate geometry

A139- Find the slope of a line having an $x-$intercept equal to 4 and passing through $(1,2)$.

A140- Find the slope of a line that does not intersect the line $3x + 6y = 9$

A141- Find the slope of a line perpendicular to the line $2y + 4x = 2$

A142- Find the $y-$intercept of a line passing through $(3,4)$ and having a slope equal to 1.

A143- Find the equation of the line passing through $(2,5)$ and $(4,8)$.

Powers and exponents

A145- What is the value of x^2 if $2^x - 2^{x-2} = 3 \times 2^{13}$

A146- Find m if $\dfrac{1}{5^m} \times \dfrac{1}{2^{36}} = \dfrac{1}{2 \times 10^{35}}$

A147- If $(2^x)(2^y) = 8$ and $(9^x)(3^y) = 81$, then $(x, y) =$
(A) $(1, 2)$
(B) $(2, 1)$
(C) $(1, 1)$
(D) $(2, 2)$
(E) $(1, 3)$

A148- If $x = m - 1$, which of the following is true when $m = \frac{1}{2}$?
(A) $x^0 > x^2 > x^3 > x^1$
(B) $x^0 > x^2 > x^1 > x^3$
(C) $x^0 > x^1 > x^2 > x^3$
(D) $x^2 > x^0 > x^3 > x^1$
(E) $x^3 > x^2 > x^1 > x^0$

A149- If $\frac{1}{y} = 2\frac{2}{3}$, then $\left(\frac{1}{y+1}\right)^2 =$

(A) $\frac{9}{64}$

(B) $\frac{3}{8}$

(C) $\frac{64}{121}$

(D) $\frac{121}{64}$

(E) $\frac{64}{9}$

A150- An operation $\sim$ is defined by the equation $a\sim b = \frac{a+b}{(ab)^2}$ for all numbers a and b such that $ab \neq 0$. If $c \neq 0$ and $a\sim c = 0$, then $c =$

(A) $-a$
(B) 0
(C) $\sqrt{a}$
(D) a
(E) a^2

Operations with rational numbers

A154- $\frac{(-1.5)(1.2)-(4.5)(0.4)}{30} =$

(A) -1.2
(B) -0.12
(C) 0
(D) 0.12
(E) 1.2

Sequences

A155- In a certain brick wall, each row contains one brick less than the row just below it. If there are 5 rows in all and a total of 75 bricks in the wall, how many bricks does the bottom row contain?
(A) 14
(B) 15
(C) 16
(D) 17
(E) 18

A156- In an increasing sequence of 10 consecutive integers, the sum of the first 5 integers is 560. What is the sum of the last 5 integers in the sequence?

(A) 585
(B) 580
(C) 575
(D) 570
(E) 565

A157- $p, \ r, \ s, \ t, \ u$

An arithmetic sequence is a sequence in which each term is equal to the preceding one added to a constant. If the list of numbers shown above is an arithmetic sequence, which of the following must also be an arithmetic sequence?

I- $2p, \ 2r, \ 2s, \ 2t, \ 2u$

II- $p - 3, \ r - 3, \ s - 3, \ t - 3, \ u - 3$

III- $p^2, \ r^2, \ s^2, t^2, \ u^2$

(A) I only
(B) II only
(C) III only
(D) I and II
(E) II and III

Sets and Venn diagrams

A158- Out of 50 professors in a university, 30 teach math and 25 teach literature. If 10 professors teach subjects other than math and literature, how many professors teach only math?

A159- In a community, 60% of people own a car and 40% of car owners live in a villa. If 80% of people who live in a villa own a car too, then what percentage of people of the community:

a) Live in a villa?

b) Own a car but do not live in a villa?

c) Live in a villa but do not own a car?

d) Neither live in a villa nor own a car?

A160- 80 % of the people present at a certain party drink coffee, 10 % of them also drink tea; 10 % do not drink coffee nor tea. Find the percentage of people at the party who drink

a) Only coffee

b) Only tea

c) Tea

A161- Of the 65 cars in a parking lot, 45 have air conditioning, 30 have power windows, and 12 have both air conditioning and power windows. How many of the cars in the parking lot have neither air conditioning nor power windows?

(A) 2
(B) 8
(C) 10
(D) 15
(E) 18

A162- Of the 30 applicants for a job, 14 had at least 4 years of experience, 18 had degrees, and 3 had less than 4 years of experience and did not have a degree. How many of the applicants had at least 4 years of experience and a degree?
(A) 14
(B) 13
(C) 9
(D) 7
(E) 5

A163- In a particular state, 70 percent of the counties received some rain on Monday, and 65 percent of the counties received some rain on Tuesday. No rain fell either day in 25 percent of the counties in the state. What percent of the counties received some rain on Monday and Tuesday?
(A) 12.5%
(B) 40%
(C) 50%
(D) 60%
(E) 67.5%

Club	Number of students
Chess	40
Drama	30
Math	25

A164- The table above shows the number of students in 3 clubs of a school. Given that no student belongs to all 3 clubs, 10 students are in both the chess and the drama clubs, 5 students are in both the chess and the math club, and 6 are in both the drama and the math club, how many students are in the 3 clubs altogether?

(A) 68
(B) 69
(C) 74
(D) 79
(E) 84

A165- On a particular night, a motel rented $\frac{3}{4}$ of its rooms, including $\frac{2}{3}$ of its air-conditioned rooms. If $\frac{3}{5}$ of its rooms were air-conditioned, what percent of the rooms that were not rented were air-conditioned?

(A) 20 %
(B) 33$\frac{1}{3}$ %
(C) 35 %
(D) 40 %
(E) 80 %

Time, Speed and rate problems

A166- A rope of length 200 m is lit on both sides. Its first end burns at a rate of $2\ m/s$ and its other end burns at a rate of $3\ m/s$. If both ends were lit at the same time, how many seconds will it take for the entire rope to burn?

A167- Tony was at a distance of 50 miles from Robert when Robert started chasing him at a speed of 100 mph. if tony can run at a maximum speed of 80 mph, then what is the maximum time taken by Robert to catch Tony?

A168- Three workers, each working alone, can paint a house in 4, 5, and 6 days, respectively. How long will it take them to paint the house together?

S169- 3 identical machines can print 600 books in 4 hours. In how many hours, 9 such identical machines will produce 1350 books?

A170- Paul travels first 40% of his trip at the speed of 20 mph and the remaining distance at the speed of 90 mph. Find his average speed for the entire trip.

A171- Machine A produces 120 bolts every 40 seconds, and Machine B produces 100 bolts every 20 seconds. How many seconds will it take them both to produce a total of 200 bolts if they run simultaneously, each working at its constant rate?

(A) 22
(B) 25
(C) 28
(D) 32
(E) 56

A172- Working at a constant rate, Sam can finish a job in 3 hours. Mark, also working at a constant rate, can finish the same job in 12 hours. How many hours does it take Mark and Sam to finish the job if they work together at their respective constant rate?

(A) 1

(B) $2\frac{2}{5}$

(C) $2\frac{5}{8}$

(D) $3\frac{1}{4}$

(E) 4

A173- Machine A prints 50 pages in 30 minutes; machine B can print 100 pages in 40 minutes. How much time will it take both machines A and B to print 100 pages, each working at its respective constant rate?

(A) 20 minutes
(B) 22 minutes
(C) 24 minutes
(D) 26 minutes
(E) 28 minutes

Applied problems

A174- A certain family has 3 sons: Richard is 6 years older than David, and David is 8 years older than Scott. If in 8 years, Richard will be twice as old as Scott, then how old was David 4 years ago?

(A)   8
(B)   10
(C)   12
(D)   14
(E)   16

A175- The number of flights leaving a certain airport doubles every one-hour period between its $9\ A.M.$ opening and noon; after noon, the number of flights leaving from the airport doubles every two-hour period. If 4 flights left from the airport between 9 and $10\ A.M.$, how many flights left the airport between 2 and $4\ P.M.$?

(A)   32
(B)   48
(C)   64
(D)   128
(E)   258

$$FGF$$
$$\times \; G$$
$$\overline{HGG}$$

A176- In the multiplication problem above, F, G and H represent unique odd digits. What is the value of the three-digit number FGF?

(A) 151
(B) 161
(C) 171
(D) 313
(E) 353

A177- Jolene began building a picket fence by planting stakes in a row; the stakes were evenly spaced. After planting the first 10 stakes, Jolene measured the length of the row and found that the row was 27 feet long. She continued the row by planting another 10 stakes, then measured the length of the entire row. How many feet long was the row of stakes Jolene had planted?

(A) 37
(B)   54
(C)   57
(D)   60
(E)   81

Lines and Angles

1) Angles are classified according to their degree measures.

    • An *acute* angle measures less than 90°.
    • A *right* angle measures 90°.
    • An *obtuse* angle measures more than 90° but less
      than 180°.
    • A *straight* angle measures 180°.

$x < 90$

$x = 90$

$90 < x < 180$

$x = 180$
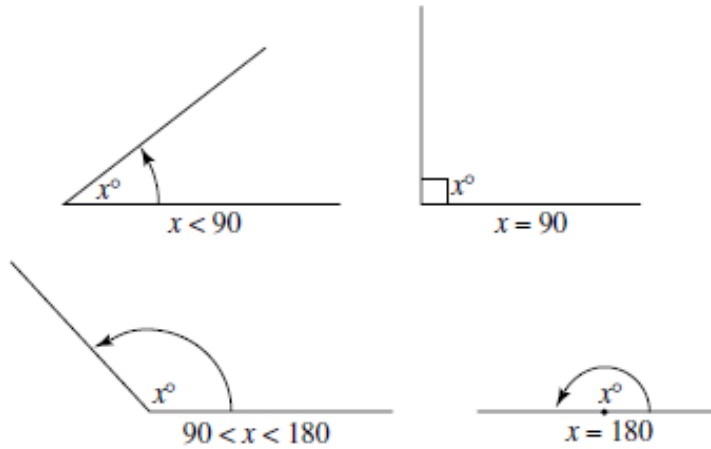
2) If a pair of parallel lines is cut by a transversal that is
not perpendicular to the parallel lines:

    • Four of the angles are
      acute, and four are obtuse.
    • All four acute angles are
      congruent: $a = c = e = g$.
    • All four obtuse angles are
      congruent: $b = d = f = h$.
    • The sum of any acute
      angle and any obtuse angle
      is 180°: for example, $d + e$
      $= 180$, $c + f = 180$, $b + g =$
      180, ...
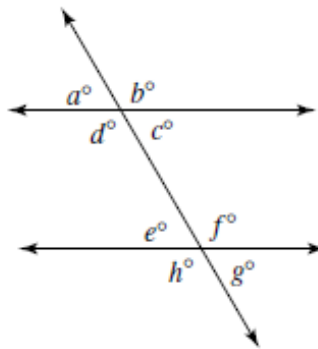
Triangles

1) In any triangle, the sum of the measures of the three angles is 180°.

$x + y + z = 180.$
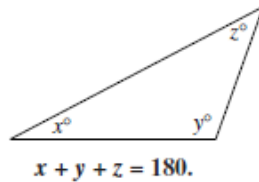
2) The measure of an exterior angle of a triangle is equal to the sum of the measures of the two opposite interior angles.

3) The area of a triangle is given by $A = \frac{1}{2}bh$, where b = base and h = height.

4) Let a, b, and c be the sides of $\triangle ABC$, with $a \leq b \leq c$.

- If $\triangle ABC$ is a right triangle, $a^2 + b^2 = c^2$;
- If $a^2 + b^2 = c^2$, then $\triangle ABC$ is a right triangle.

$a^2 + b^2 = c^2$
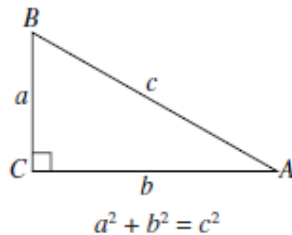
5) 3, 4, 5 and 5, 12, 13 are Pythagorean triples, as well as 3k, 4k, 5k and 5k, 12k, 13k for any positive integer k. (they are the measures of the sides of right triangles)

6) In any triangle:

- the longest side is opposite the largest angle;
- the shortest side is opposite the smallest angle;
- sides with the same length are opposite angles with the same measure.

7) The Triangle Inequality Theorem
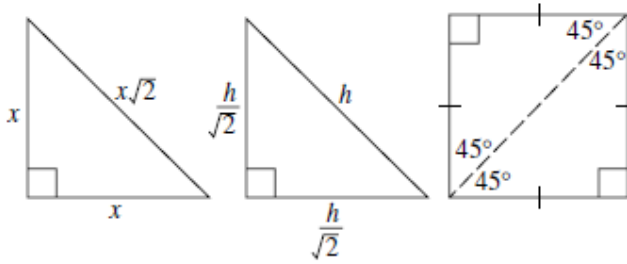$$|x - y| < z < x + y$$
$$|z - y| < x < z + y$$
$$|x - z| < y < x + z$$
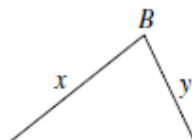
8) The diagonal of a square divides the square into two isosceles right triangles.

9) In a 45-45-90 right triangle, the sides are x, x, and $x\sqrt{2}$. Therefore:

- By multiplying the length of a leg by $\sqrt{2}$, you get the hypotenuse.
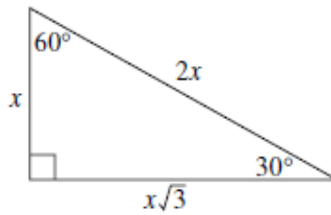- By dividing the hypotenuse by $\sqrt{2}$, you get the length of each leg.

10) An altitude divides an equilateral triangle into two 30-60-90 right triangles.

11) In a 30-60-90 right triangle the sides are x, $x\sqrt{3}$, and $2x$.

If you know the length of the shorter leg (x):

- multiply it by $\sqrt{3}$ to get the length of the longer leg;
- multiply it by 2 to get the length of the hypotenuse.

12) Two triangles are *similar* provided that the following two conditions are satisfied.

1. The three angles in the first triangle are congruent to the three angles in the second triangle.

$$m\angle A = m\angle D, \quad m\angle B = m\angle E, \quad m\angle C = m\angle F.$$

2. The lengths of the corresponding sides of the two triangles are in proportion:

$$\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}.$$

13) If the measures of two angles of one triangle are equal to the measures of two angles of a second triangle, the triangles are similar.

14) If two triangles are similar, and if k is the ratio of similitude, then:

- The ratio of all the linear measurements of the triangles is k.
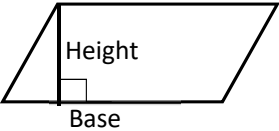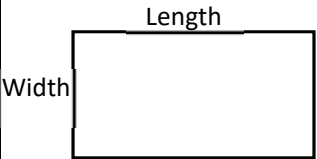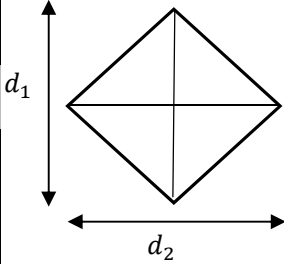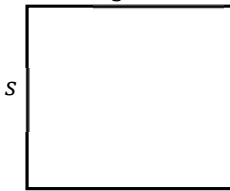- The ratio of the areas of the triangles is k^2.

Polygons

1)   A polygon is a closed figure, with straight sides that meet only at the vertices.

| Number of sides	Name
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon

2)   The sum of the measures of the n angles in a polygon with n sides is $(n-2) \times 180°$.

3)   In any polygon, the sum of the measures of the exterior angles, taking one at each vertex, is $360°$.

Quadrilaterals

Shape	Area	Properties
Parallelogram Height Base	**Area = Base × Height**	Opposite sides are parallel and congruent Opposite angles are congruent Adjacent angles are supplementary Diagonals bisect each other
Rectangle Length Width	**Area = Length × Width**	All properties of a parallelogram All angles are right Diagonals are congruent and bisect each other
Rhombus d_1 d_2	**Area = $\frac{1}{2} d_1 \times d_2$**	- All properties of a parallelogram All sides are congruent Diagonals are perpendicular, they bisect each other and they are the angle bisectors
Square s s	**Area = s^2**	- All properties of a parallelogram All sides are congruent All angles are right Diagonals are congruent, perpendicular, they bisect each other and they are the angle bisectors

Trapezoid: A trapezoid has exactly one pair of parallel sides and 1 pair of non-parallel sides. The parallel sides are called the bases and the non-parallel sides are called the legs. The angles adjacent to the same leg are supplementary.

$$Area = \frac{Small\ base + Large\ base}{2} \times Height$$

Small Base

Leg   Height   Leg

Large Base
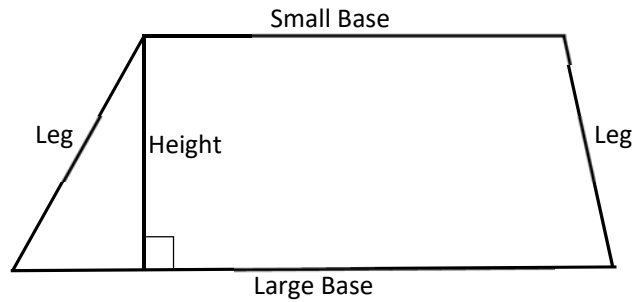
Isosceles trapezoid: A trapezoid that has congruent legs is isosceles.
In an isosceles trapezoid, base angles are equal.

Circles

1) A **circle** consists of all the points that are the same distance from one fixed point, called the **center**. That distance is called the **radius** of the circle. The figure at the right is a circle of radius 1 unit whose center is at point O. A, B, C, D, and E, which are each 1 unit from O, are all points on circle O. The word **radius** is also used to represent any of the line segments joining the center and a point on the circle. The plural of *radius* is **radii**. In circle O, above, $\overline{OA}$, $\overline{OB}$, $\overline{OC}$, $\overline{OD}$, and $\overline{OE}$ are all radii. If a circle has radius r, each of the radii is r units long.
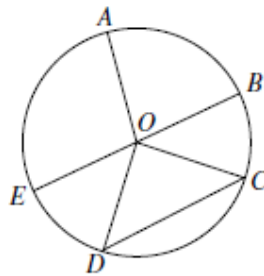
2) If d is the diameter and r the radius of a circle, then $d = 2r$.

3) For every circle:

$$\pi = \frac{circumference}{diameter} = \frac{C}{d} \quad or \quad C = \pi d \quad or \quad C = 2\pi r.$$

4) The formula for the area of a circle of radius r is $A = \pi r^2$.

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5) An *arc* consists of two points on a circle and all the points between them. If two points, such as P and Q in circle O, are the endpoints of a diameter, they divide the circle into two arcs called *semicircles*. On the SAT, *arc AB* always refers to the small arc joining A and B.
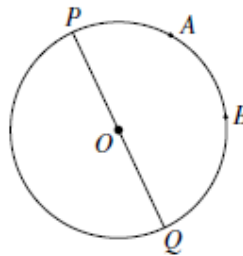
To refer to the large arc going from A to B through P and Q, we would say *arc APB* or *arc AQB*.

An angle whose vertex is at the center of a circle is called a *central angle*.

6) The degree measure of an arc equals the degree measure of the central angle that intercepts it.

7) If an arc measures $x°$, the length of the arc is $\frac{x}{360}(2\pi r)$; and the area of the sector formed by the arc and two radii is $\frac{x}{360}(\pi r^2)$.

8) A line tangent to a circle is perpendicular to the radius drawn to the point of contact.

Solid Geometry

### 1) Rectangular Solids and Cubes

RECTANGULAR SOLID
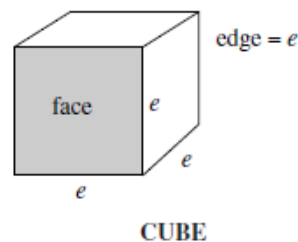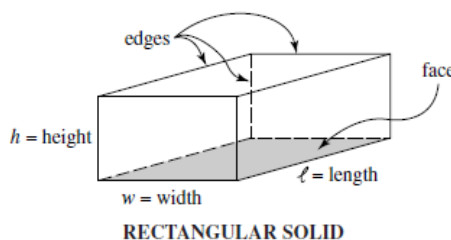
CUBE

The formula for the volume of a rectangular solid is $V = \ell wh$.

In a cube, all the edges are equal. Therefore, if e is the length of an edge, the formula for the volume is $V = e^3$.

The formula for the surface area of a rectangular solid is $A = 2(\ell w + \ell h + wh)$. The formula for the surface area of a cube is $A = 6e^2$.

2) Cylinders

A *cylinder* is similar to a rectangular solid except that the base is a circle instead of a rectangle. The volume of a cylinder is the area of its circular base (πr^2) times its height (h). The surface area of a cylinder depends on whether you are envisioning a tube, such as a straw, without a top or bottom, or a can, which has both a top and a bottom.
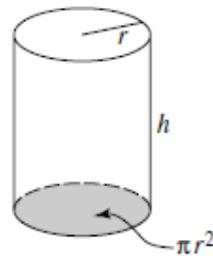
- The volume, V, of a cylinder whose circular base has radius r and whose height is h is the area of the base times the height:

$$V = \pi r^2 h.$$

- The surface area, A, of the side of the cylinder is the circumference of the circular base times the height:

$$A = 2\pi r h.$$