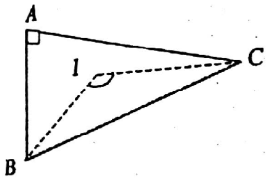
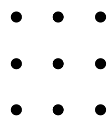
1. A four digit number of the form abaa (a's and b's are the digits of the four digit number) is divisible by 33. The number of such four digit numbers is
   (A) 36 (B) 6 (C) 3 (D) 1
2. If $a + 2a + 3a + ... + 1000a = 2b + 4b + 6b + ... + 2000b = 3c + 6c + 9c + ... + 3000c$ then a : b : c is as
   (A) 1 : 2 : 3 (B) 3 : 2 : 1 (C) 2 : 3 : 6 (D) 6 : 3 : 2
3. If $a* = a + 1$ and $*a = a - 1$, then $1 * - * 1 + 2 * - * 2 + 3 * - * 3 + ... + 1000 * - * 1000$ is equal to
   (A) 1000 (B) –1000 (C) 2000 (D) –2000
4. 'a' and 'b' are two natural numbers with $a + b = 8$. If $a \geq b$ and $a^2 + b^2$ has minimum value, then a and b are given by
   (A) 7, 1 (B) 6, 2 (C) 4, 4 (D) 5, 2
5. In the adjoining figure, ΔABC is right angled at A; $m\angle B = m\angle C$. The bisectors of angles B and C meet at I. Then $m\angle BIC$ is

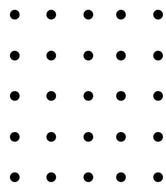


   (A) 135^0 (B) 115^0 (C) 100^0 (D) 90^0
6. The number of isosceles triangles in which one angle is 4 times another angle is
   (A) 2 (B) 1 (C) Infinitely many (D) 4
7. Nine dots are arranged such that they are equally spaced horizontally and vertically as in the figure. The number of triangles which are not right angled triangles that can be formed with the above dots as vertices is



   (A) 18 (B) 21 (C) 40 (D) 24
8. The number of non negative integers which are less than 1000 and end with only one zero is
   (A) 90 (B) 99 (C) 91 (D) 100
9. The tenth term of the sequence (2, 5), (3, 7), (5, 11), (7, 13), (11, 17), ... is
   (A) (23, 29) (B) (19, 13) (C) (20, 04) (D) (29, 31)
10. The sum of the digits of the number $10^n - 1$ is 3798. The value of n is
    (A) 431 (B) 673 (C) 422 (D) 501
11. The image of INMO when reflected in a mirror is
    (A) IWNO (B) OMNI (C) INWO (D) OWNI
12. A transport company's vans each carry a maximum load of 10 tonnes. 24 sealed boxes each weighing 5 tonnes have to be transported to a factory. The number of van loads needed to do this is
    (A) 9 (B) 10 (C) 11 (D) 12
13. The digits of the year 2000 add up to 2. In how many years has this happened since the year 1 till this year 2004 ?
    (A) 3 (B) 6 (C) 9 (D) 10
14. Ram is 7 years younger than Ravi. In four years time, Ram will be half of Ravi's age. The sum of their ages now is
    (A) 13 (B) 15 (C) 17 (D) 19

15. A circle is added to the equally spaced grid alongside. The largest number of dots that the circle can pass through is



(A) 4 (B) 6 (C) 18 (D) 10

16. A certain number has exactly eight factors including 1 and itself. Two of its factors are 21 and 35. The number is

(A) 105 (B) 210 (C) 420 (D) 525

17. In a magic square, each row and each column and both main diagonals have the same total. The number that should replace x in this partially completed magic square is

13		
5		15
x		

(A) more information needed (B) 9

(C) 10 (D) 12

18. In the triangle ABC, D is a point on the line segment BC such that AD = BD = CD. The measure of angle BAC is

(A) 60^0 (B) 75^0 (C) 190^0 (D) 120^0

19. The product of Hari's age in years on his last birthday and his age now in complete months is 1800. Hari's age on his last birthday was

(A) 9 (B) 10 (C) 12 (D) 15

20. One hundred and twenty students take an examination which is marked out of 100 (with no fractional marks). No three students are awarded the same mark. What is the smallest possible number of pairs of students who are awarded the same mark ?

(A) 9 (B) 10 (C) 19 (D) 20

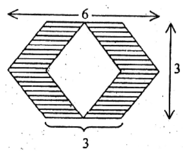
21. If all the diagonals of a regular hexagon are drawn, the numbe of points of intersection, not counting the corners of the hexagon is

(A) 6 (B) 13 (C) 7 (D) 12

22. Three people each think of a number, which is the product of two different primes. The product of the three numbers which are thought of is

(A) 120 (B) 12100 (C) 240 (D) 3000

23. The area of the shaded region in the diagram is



(A) 9 (B) $3\sqrt{2}$ (C) 18 (D) $6\sqrt{3}-3\sqrt{2}$

24. The largest positive integer which cannot be written in the form 5m + 7n where m and n are positive integers is

(A) 25 (B) 35

(C) geater than 100 (D) greater than 350

25. The last digit in the finite decimal representation of the number $\left(\frac{1}{5}\right)^{2004}$ is

(A) 2 (B) 4 (C) 6 (D) 8

- - - - - - - - - - - -

PART - A

1. Given 63.63 = $m\left(21+\frac{n}{100}\right), m, n$ positive integers with n < 100. The value of (m + n) is

(A) 21 (B) 24 (C) 104 (D) 101

2. n is a natural number and (n + 2) (n + 4) is odd. Then the biggest power of 2 that divides (n + 1) (n + 3) for any n is

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

3. Two squares 17 cm x 17 cm overlap to form a rectangle 17 cm x 30 cm. The area of the over lapping region is

(A) 289 (B) 68 (C) 510 (D) 85

4. Aruna and Baskar wrote the three digit number 888 and Aruna changed two of its digits and wrote the biggest three digit number divisible by 8. Bhaskar too changed two of the digits of 888 and wrote the smallest three digit number divisible by 8. The difference of the new numbers obtained is

(A) 848 (B) 856 (C) 864 (D) 872

5. n is a negative integer. The expression having the greatest value is

(A) $-2n^2 + 2n$ (B) $-2n^2 - 2n$ (C) $2n^2 + 2n$ (D) $2n^2 - 2n$

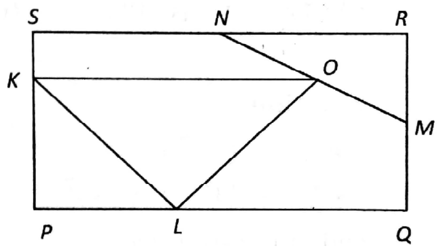
6. Five positive integers are written around a circle so that no two or three adjacent numbers have a sum divisible by 3. In this collection the number of numbers divisible by 3 is

(A) 0 (B) 1 (C) 2 (D) 3

7. A number is called a palindrome if it reads the same forward or backward. For example 13531 is a palindrome. The difference between the biggest 10 digit palindrome and the smallest 9 digit palindrome is

(A) 976666666 (B) 9888888888 (C) 9899999998 (D) 9777777777

8. In the figure, PQRS is a rectangle of area 2011 square units. K, L, M, N are the mid point of the respective sides. O is the midpoint of MN. The area of the triangle OKL is equal to (in square units)



(A) $\frac{2011}{5}$ (B) $\frac{2(2011)}{5}$ (C) $\frac{2011}{4}$ (D) $\frac{3(2011)}{8}$

9. A computer is printing a list of the seventh powers of all natural numbers, that is the sequence $1^7, 2^7, 3^7$, ... The number of terms (or numbers) between 5^{21} and 4^{28} are

(A) 12 (B) 130 (C) 14 (D) 150

10. A natural number n has exactly two divisors and (n + 1) has three divisors. The number of divisors of (n + 2) is

(A) 2 (B) 3

(C) 4 (D) depends on the value of n

11. $\frac{p}{9}+\frac{q}{10}=r$ where p, q, r are positive integers and p = q. The biggest value of r less than 100 is

(A) 19 (B) 57 (C) 76 (D) 95

12. In the grid shown in the diagram A and B erase 4 numbers each from the table. The sum of the numbers erased by them are in the ratio 10:11. After erasing the numbers, the number left out on the table is

13	14	15
20	21	22
27	28	29

(A) 21 (B) 14 (C) 22 (D) 13

13. The positive integers p, q. p – q and p + q are all prime numbers. The sum of all these numbers is

(A) divisible by 3 (B) divisible by 5
(C) divisible by 7 (D) prime

14. a, b, c are positive reals such that a(b + c) = 32, b(c + a) = 65 and c(a + b) = 77. Then abc =

(A) 100 (B) 110 (C) 220 (D) 130

15. 100th term of the sequence 1, 3, 3, 3, 5, 5, 5, 5, 5, 7, 7, 7, 7, 7, 7, 7 .... is

(A) 15 (B) 13 (C) 17 (D) 19

PART - B

1. When a barrel is 40 % empty it contains 80 litres more than when it is 20% full. The full capacity of the barrel (in litres) is _______.

2. a, b, c are the digits of a nine digit number abcabcabc. The quotient when this number is divided by 1001001 is _______

3. The first term of a sequence is $\left(\frac{2}{7}\right)$. Each new term is calculated using the formula $\left(\frac{1-x}{1+x}\right)$ where x is the preceding term. The sum of the first 2011 terms is ______.

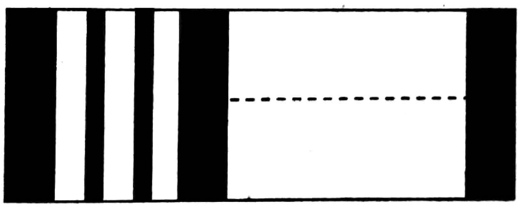
4. The number of integers n for which $\frac{n}{20-n}$ is the square of an integer is ______.

5. All sides of the convex pentagon ABCDE are equal in length. $\angle A = \angle B = 90^0$. Then $\angle E$ is equal to _____.

6. The units digit of the number 3^{2011} is _______.

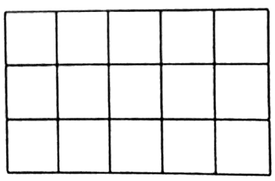
7. The number of digits used to write all page numbers in a book is 192. The total number of pages in the book is _______.

8. A bar code is formed using 25 black and certain white bars. White and black bars alternate. The first and the last are black bars. Some of the black bars are thin and others are wide.



The number of white bars is 15 more than the thin black bars. The number of thick black bars is ______.

9. By drawing 10 lines of which 4 are horizontal and 6 are vertical crossing each other as in the figure, one can get 15 cells. With the same 10 lines of which 3 are vertical and 7 horizontal we get 12 cells.



10. If $a^2 - b^2 = 2011$ where a, b are integers, then the most negative value of (a + b) is ____.

11. x and y are real numbers such that $xy = x + y = \frac{x}{y}$ $(x \neq 0, y \neq 0)$. Then the numerical value of (x – y) is _______.

12. When x = 2011, the value of $\dfrac{1}{1+\dfrac{1}{1+\dfrac{1}{1+\dfrac{1}{x}}}}$ is ______.

13. After the school final exams are over, all students in a class exchange their photographs. Each student gives his photograph to each of the remaining students and gets the photograph of all his friends. There are totally 870 exchanges of photos. The number of students in the class is ______.

14. The angles of a polygon are in the ratio 2:4:5:6:6:7. The difference between the greatest and least angle of the polygon is ________.

15. The perimeter of a right angled triangle is 132. The sum of the squares of all its sides is 6050. The sum of the legs of the triangle is ______.

PART - A

1. p is an odd prime. Then $\left(\frac{p+1}{2}\right)^2 - \left(\frac{p-1}{2}\right)^2$ is

(A) a fraction less than p. (B) a fraction greater than p.
(C) a natural number not equal to p. (D) a natural number equal to p.

2. PQRS is a parallelogram. MP and NP divide ∠SPQ into three equal parts (∠MPQ > ∠NPQ) and MQ and NQ divide ∠RQP into 3 equal parts (∠MQP > ∠NQP). If k(∠PNQ) = (∠PMQ) then k =

(A) $\frac{1}{2}$ (B) 1 (C) $\frac{3}{2}$ (D) $\frac{1}{3}$

3. In a foot ball league, a particular team played 50 games in a season. The team never lost three games consecutively and never won four games consecutively, in that season. If N is the number of games the team won in that season, then N satisfies

(A) $25 \le N \le 30$ (B) $25 \le N \le 36$ (C) $16 \le N \le 38$ (D) $16 \le N \le 30$

4. a, b, c, d, e are five integers such that a + b = b + c = c + d = d + e = 2012, a + b + c + d + e = 5024. Then the value of (d – a) is

(A) 8 (B) 12 (C) 10 (D) 4

5. The last two digits of 3^{2012}, when represented in decimal notation, will be

(A) 81 (B) 01 (C) 41 (D) 21

6. There exists positive integers x, y such that both the expressions (3x + 2y) and (4x – 3y) are exactly divisible by

(A) 11 (B) 7 (C) 23 (D) 17

7. The years of 20^{th} century and 21^{st} century are of 4 digits. The number of years which are divisible by the product of the four digits of the year is

(A) 7 (B) 8 (C) 9 (D) none of these

8. If $x + \frac{1}{x} = -1$, then the value of $x^3 - \frac{1}{x^3}$ is

(A) 0 (B) 1 (C) –1 (D) 2

9. The number of natural numbers a (< 100) such that $(a^3 - a^2)$ is a square of a natural number is

(A) 7 (B) 8 (C) 9 (D) 10

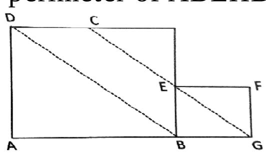
10. Let n be the smallest nonprime integer greater than 1 with no prime factor less than 10. Then

(A) $100 < n \le 100$ (B) $110 \le n \le 120$
(C) $120 < n \le 130$ (D) $130 < n \le 140$

11. A point P inside a rectangle ABCD is joined to the angular points. Then

(A) Sum of the areas of two of the triangles so formed is equal to the sum of the other two.
(B) The sum of the areas of the triangles so formed is a whole number whatever may be the dimensions of the rectangle.
(C) The sum of the areas of a pair of opposite triangles is greater than half the area of the rectangle.
(D) None of these

12. In the adjoining figure ABCD and BGFE are rhombuses. AB = 10 cm, GF = 3 cm. GE meets DC at H. ∠A = 60^0. The perimeter of ABEHD is (in cm)



(A) 47 (B) 40 (C) 39 (D) 33

13. If 3a + 1 = 2b – 1 = 5c + 3 = 7d + 1 = 15, then the value of (3a – b + 5c – 9d) is

(A) 0 (B) 1 (C) 2 (D) 3

14. The perimeter of an isosceles right angled triangle is 2012. Its area is

(A) $2012(3-\sqrt{2})$ (B) $(1006)^2(3-\sqrt{2})$

(C) $(2012)^2$ (D) $(1006)^2$

15. Five two digit numbers (none of the digits is zero) add up to 100. If each digit is replaced by its 9 complement, then the sum of these five new numbers is

(A) 295 (B) 195 (C) 380 (D) 395

PART - B

1. The sum of two natural numbers is 484. Their HCF is 11. The number of such possible pairs is _______.
2. ABCD is a trapezium with AB and CD parallel. If AB = 16 cm, BC = 17 cm, CD = 8 cm, DA = 15 cm then the area of the trapezium (in cm^2) is ______.
3. The number of multiples of 9 less than 2012 and having sum of the digits as 18 is ____.
4. AB, CD, EF, GH and IJ are five 2-digit numbers such that each letter stands for a different digit. The largest possible sum of these five numbers is _______.
5. Two consecutive natural numbers are respectively by 4 and 7. The sum of the their respective quotient is 8. Then the sum between the numbers is ______.
6. p is the difference between a real number and its reciprocal. q is the difference between the square of the same real number and the square of the reciprocal. Then the value of $p^4 + q^2 + 4p^2$ is _____.
7. A square is inscribed in another square each of whose four vertices lies on each side of the square. The area of the smaller square is $\frac{25}{49}$ times the area of the bigger one. Then the ratio with which each vertex of the smaller square divides the side of the bigger square is ______.
8. a, b, c are three positive numbers. The second number is greater than the first by the amount the third number is greater than the second. The product of the two smaller numbers is 85 and that of the two bigger numbers is 115. Then the value of (2012a – 1006c) is ______.
9. If $x = \frac{y}{y+1}$ and $y = \frac{a-2}{2}$ the value of $x(y+2) + \frac{x}{y} + \frac{y}{x}$ when a = 2012 is ______.
10. PSR is an isosceles triangle in which PS = PR. SP is produced to O such that PO = SP. Then ∠SRO is equal to _______.
11. a, b, c, d are five integers such that a + b = b + c = c + d = d + e = 2012 and a + b + c + d + e = 5024. Then the value of (d – a) = ______.
12. A class contains three girls and four boys. Every Saturday, five students go on a picnic, a different group is sent each week. During the picnic, each person (boy or girl) is given a Cake by the accompanying teacher. After all possible groups of five have gone once; the total number of cakes received by the girls during the picnic is _______.
13. CAB is an angle whose measure is 70^0. ACFG and ABDE are squares drawn outside the angle. The diagonal FA meets BE at H. Then the measure of the angle EAH is ______.
14. The number of prime numbers p for which p + 2 and are also prime number is _____.
15. The number of integers pairs (m, n) which satisfied $m(n^2 + 1) = 48$ is ______.

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PART - A

1. If a + b + c = 0 where a, b, c are non zero real numbers, then the value of $(a^2 - bc)^2 - (b^2 - ca)(c^2 - ab)$ is

(A) 1 (B) abc (C) $a^2 + b^2 + c^2$ (D) 0

2. In the adjoining incomplete magic square the sum of all numbers in any row or column or diagonals is a constant value. The value of x is

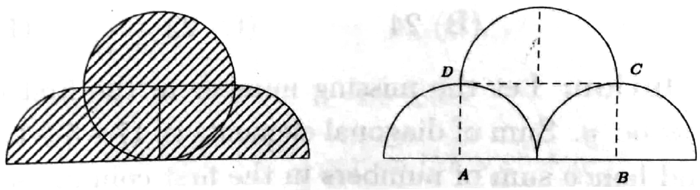
17				
23	5			
	6	13	20	x
10			21	
11				9

(A) 18 (B) 24 (C) 22 (D) 16

3. Aruna, Bhanu and Rita have some amount of money. The ratio of the money of Aruna to that of Bhanu is 7:15 and the ratio of the money of Bhanu and Rita is 7:16. If Aruna has Rs. 490, the amount of money Rita has is (in Rupees)

(A) 1500 (B) 1600 (C) 2400 (D) 3600

4. In the figure below, all the three semicircles have equal radius of 1 unit. The area of the shaded portion is



(A) π + 2 (B) 5 (C) $\frac{3\pi}{2}+1$ (D) 4

5. The sum of three different prime numbers is 40. What is the difference between the two biggest ones among them ?

(A) 8 (B) 12 (C) 20 (D) 24

6. Peter has written down four natural numbers. If the chooses three of his numbers at a time and adds up each triple, he obtains totals of 186, 206, 215 and 194. The largest number Peter has written is

(A) 93 (B) 103 (C) 81 (D) 73

7. There are four non-zero numbers x, y, z and u. If x = y – z, y = z – u, z = u – x, then the value of $\frac{x}{y}+\frac{y}{z}+\frac{z}{u}+\frac{u}{x}$ is equal to

(A) 1 (B) $\frac{1}{2}$ (C) 0 (D) $-\frac{1}{2}$

8. The natural numbers from 1 to 20 are listed below is such a way that the sum of each adjacent pair is a prime number. 20, A, 16, 15, 4, B, 12, C, 10, 7, 6, D, 2, 17, 14, 9, 8, 5, 18, E. The number D is

(A) 1 (B) 3 (C) 11 (D) 13

9. How many ordered pairs of natural numbers (a, b) satisfy a + 2b = 100 ?

(A) 33 (B) 49 (C) 50 (D) 99

10. The value of $(\sqrt{5}+\sqrt{6}+\sqrt{7})(\sqrt{5}+\sqrt{6}-\sqrt{7})\times(\sqrt{5}-\sqrt{6}+\sqrt{7})(\sqrt{6}+\sqrt{7}-\sqrt{5})$ is

(A) $3\sqrt{210}$ (B) 210 (C) $4\sqrt{210}$ (D) 104

11. The least number which, when divided by 52 leaves a remainder 33, when divided by 78 leaves a remainder 59 and when divided by 117 leaves a remainder 98 is

(A) 553 (B) 293 (C) 468 (D) 449

12. A sum of money is divided between two persons in the ratio 3:5. If the share of one person is Rs. 2000 more than that of the other, then the sum of money is (in rupees)

(A) 6000 (B) 8000 (C) 10,000 (D) 12,000

13. Two numbers are respectively 20% and 50% more than a third number. What percent of the second number is the first number ?

(A) 70 % (B) 30 % (C) 80 % (D) 60 %

14. There are some toys. One third of them are sold at a profit of 15%, one fourth of the total are sold at a profit of 20% and the rest for 24% profit. The total profit is Rs. 3200. The total price of the toys is (in rupees)

(A) 32000 (B) 64000 (C) 16000 (D) 48000

15. The radius of a circle is increased by 4 units and the ratio of the areas of the original and the increased circle is 4:9. The radius of the original circle is

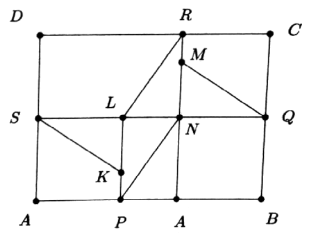
(A) 6 (B) 4 (C) 12 (D) 8

PART - B

16. A natural number less than 100 has remainder 2 when divided by 3, remainder 3 when divided by 4 and remainder 4 when divided by 5. The remainder when the number is divided by 7 is _______.

17. The units digit of $(2013)^{2013}$ is ______.

18. In the figure ABCD is a rectangle with sides 24 units, 32 units. SKL, PLN, QNM, RNL are congruent right angled triangles. The area of each triangle is ______.



19. The number of natural numbers n for which $\dfrac{(n+2)(n+2)}{(n-3)}$ is a natural number is ______.

20. The product of two natural numbers a and b divides 48. a, b are not relatively prime to each other. The number of pairs (a, b) where $1 < a + b < 48$, $(a \neq b)$ is ______.

21. The value of the expression $\left(\dfrac{a-a^{-2}}{a^{1/2}-a^{-1/2}}-\dfrac{1-a^{-2}}{a^{1/2}+a^{-1/2}}-a^{1/2}\right)$ is $\dfrac{2}{K^3}$ where $a = (2013)^2$. The value of K is _____.

22. AB and AC are two straight line segments enclosing an angle 70^0. Squares ABDE and ACFG are drawn outside the angle BAC. The diagonal FA is produced to meet the diagonal EB in H, then $\angle EAH$ = _______.

23. In the pentagon ABCDE, $\angle D = 2\angle B$ and the other angles are each equal to half the sum of the angles $\angle B$ and $\angle D$. The largest interior angle of the pentagon is _____.

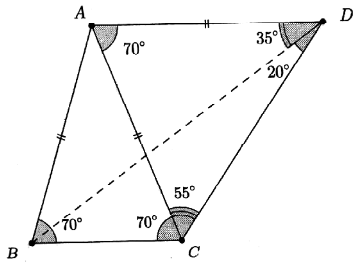
24. The ratio of a two digit number and the sum of its digits is 4:1. If the digit in the units place is 3 more than the digit in the tens place, then the number is _______.

25. There is a famine in a place. But there is sufficient food for 400 people for 31 days. After 28 days 280 of them left the place. Assuming that each person consumes the same amount of food per day, the number of days for which the rest of the food would last for the remaining people is ______.

26. A triangle whose sides are integers has a perimeter 8. The area of the triangle is _____.

27. If $(10^{2013}+25)^2-(10^{2013}-25)^2=(\sqrt{10})^n$ then the value of n is _______.

28. ABC and ADC are isosceles triangles with AB = AC = AD. ∠BAC = 40^0, ∠CAD = 70^0. The value of ∠BCD + ∠BDC = ________.



29. There are three persons Samrud, Saket and Vishwa. Samrud is twice the age of Saket and Saket is twice the age of Vishwa. Their total ages will be trebled in 28 years. The present age of Samrud is _______.

30. The number of three digit numbers of the form ab5 which are divisible by 9 is ______.

PART - A

1. If 150% of a certain number is 300, then 30% of the number is.
   (A) 50 (B) 60 (C) 70 (D) 65

2. The sum of five distinct non negative integers is 90. What can be the second largest number of the five at most ?
   (A) 82 (B) 43 (C) 34 (D) 73

3. The length of two sides of an isosceles triangle are 5 units and 16 units. The perimeter of the triangle (in the same units) is
   (A) 26 (B) 37 (C) 26 or 37 (D) none of these

4. ABCD is a rectangle. P is the mid-point of DC and Q is a point on AB such that $AQ = \frac{1}{3}AB$.
   What fraction of the area of ABCD is AQPD ?
   (A) $\frac{1}{2}$ (B) $\frac{3}{4}$ (C) $\frac{2}{7}$ (D) $\frac{5}{12}$

5. The number of digits when $(999999999999)^2$ is expanded is
   (A) 26 (B) 24 (C) 32 (D) 16

6. Three equal squares are kept as in the diagram. C, D being the mid points of the respective sides of the lower squares. If AB = 100 cm, area of each square is (in cm^2)
   (A) 1200 (B) 1500 (C) 900 (D) 1600

7. Samrud wrote 4 different natural numbers. He chose three numbers at a time and added them each time. He got the sums as 115, 153, 169, 181. The largest of the numbers Samrud first wrote is
   (A) 37 (B) 48 (C) 57 (D) 91

8. Saket wrote a two digit number. He added 5 to the tens digit and subtracted 3 from the units digit of the number. The resulting number is twice the original number. The original number is
   (A) 47 (B) 74 (C) 37 (D) 73

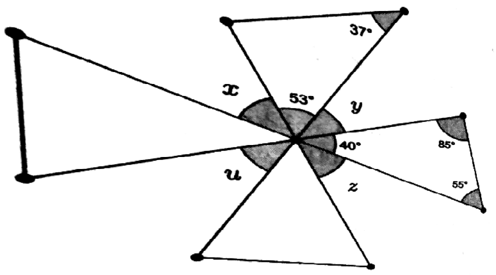
9. Five consecutive natural numbers cannot add up to
   (A) 225 (B) 222 (C) 220 (D) 200

10. In the adjoining figure the different numbers denote the area of the corresponding rectangle in which the number is there. The value of x is
    (A) 3014 (B) 1125 (C) 2139 (D) 250

11. What is the remainder when $2^{87} + 3$ is divided by ?
    (A) 2 (B) 3 (C) 4 (D) 5

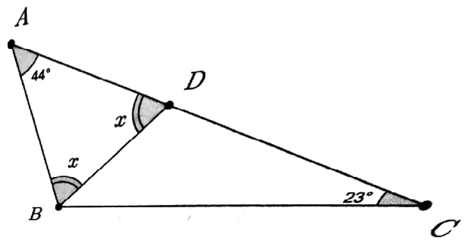
12. If Mahadevan gets 71 in his next examination, his average will be 83. If he gets 99, his average will be 87. How many exams Mahadevan has already taken ?
    (A) 3 (B) 4 (C) 5 (D) 6

13. In the adjoining figure, AB, CD, EF and GH are straight lines passing through a single point. The value of $\angle x + \angle y + \angle z + \angle u$ is



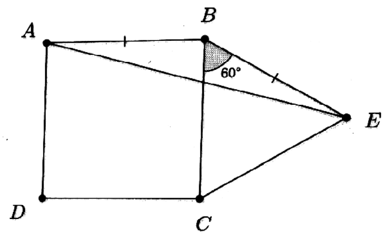
    (A) 155^0 (B) 164^0 (C) 174^0 (D) 148^0

14. In the adjoining diagram AB = AD. ∠DCB = 23^0. The measure of ∠DBC is



(A) 55^0 (B) 58^0 (C) 56^0 (D) 45^0

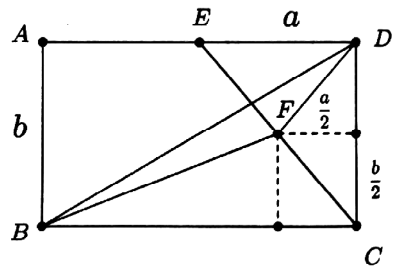
15. In the figure, ABCD is a square. BCE is an equilateral triangle. The measure of ∠BEA is



(A) 15^0 (B) 20^0 (C) 18^0 (D) 16^0

PART - B

16. The smallest multiple of 9 with no odd digits is _______.
17. The sum of the squares of the lengths of the three sides of a right triangle is 800. The length of the hypotenuse is _______.
18. In the adjoining figure, the biggest square of area 125 cm^2 is divided into 5 equal parts of same area. (4 squares and the L shaped figure). The shorter side of the L shape is $k(\sqrt{5}-2)$, where k is a natural number. Then k = ________.
19. Five years ago, the average age of A, B, C and D is 45 years. E joins them now. The average age of all the five now is 49 years. The present age of E is _______.
20. In the sequence 1, 1, 1, 2, 1, 3, 1, 4, 1, 5 ..... The 2014^{th} term is _______.
21. In the adjoining figure ABCD is a rectangle. E is the midpoint of AD. F is the midpoint of EC. The area of the rectangle ABCD is 120 cm^2.



22. Flag poles are installed along a road side on every 8 meters. Markings are made every 12 m as shown. The length of the road is 240 m. The number of markings made beside the flag poles are _______.
23. The number of different natural numbers n for which $n^2 - 440$ is a perfect square is ____.
24. Aruna, Bhavani and Christina each wear a saree of different colour (blue, yellow or green). It is known that, if Aruna wears blue then Bhavani wears green, if Aruna wears yellow Christina wears green and if Bhavani does not wear yellow, Christina wears blue. The saree Aruna is wearing has the color _______.
25. Arish found the value of 319 to be 11a2261467. He found all the digits correctly except the digit denoted by a. The value of a is _______.
26. The daily wages of two persons are in the ratio 3:5. They work in a place and the employer is satisfied with their work and gives Rs. 20 more to each. Then the ratio of their wages comes to 13:21. The sum of the original wages of the two persons is _____.

27. The value of x which satisfies the equation $\frac{5}{6-\frac{5}{6-\frac{5}{6-x}}}=1$.

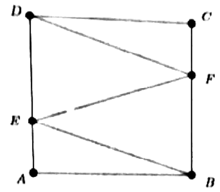
28. The current age of a father is three times that of his son. Ten years from now, the father's age will be twice that of his son. The fathers age will be 60 after _______ years.

29. The number of (x, y, z) such that xy = 6, yz = 15, zx = 10 is ______.

30. If $\frac{\sqrt{a}-\sqrt{b}}{\sqrt{a}+\sqrt{b}}=\frac{1}{2}$, The value of $\frac{a^2+ab+b^2}{a^2-ab+b^2}$ in the form $\frac{p}{q}$ is ______.

PART - A

1. On the square ABCD, point E lies on the side AD and F lies on BC so that BE = EF = FD = 30 cm. The area of the square (in square cms) is



(A) 300 (B) 900 (C) 810 (D) None of these

2. If $2016 = 2^x 3^y 5^z 7^u$ where x, y, z, u are non negative integers, the value of x + y + 2016z + 3u is

(A) 10 (B) 11 (C) 12 (D) 13

3. A is the area of triangle of sides 25, 25 and 30. B is the area of a triangle of sides 25, 25 and 40. Then

(A) A = B (B) A < B (C) A = 3B (D) A = 2B

4. A number on being divided by 5 leaves a remainder 2 and when divided 7, leaves a remainder 4. The remainder when the same number is divided by 5 x 7 is

(A) 20 (B) 23 (C) 32 (D) None

5. The sum of three numbers is 204. If the ratio of the first to second is 2 : 3 and that of the second to third is 5 : 3. Then the second number is

(A) 60 (B) 65 (C) 58 (D) 90

6. Anirud goes to the vegetable market to buy onions. He carries money to buy 3 kg onions. But on reaching the market he finds that the price of onions has increased by 20%. If he buys onions for the money he has, the quantity he could buy is

(A) 2.5 kg (B) 2.2 kg (C) 2 kg (D) 2.8 kg

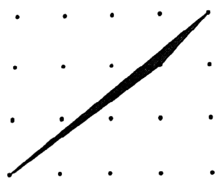
7. Two runners cover the same distance at the rate of 15 km per hour and 16 km per hour respectively. The first runner took 16 minutes longer than the second to cover the distance. Then the distance (in km) is

(A) 58 (B) 64 (C) 66 (D) 73

8. The total surface area of a cube is 600 cm^2. The length of its diagonal in cms is

(A) 10 (B) 30 (C) $10\sqrt{2}$ (D) $10\sqrt{3}$

9. In the figure below the distance between any two horizontal or vertical dots is one unit. The area of the triangle shown is



(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) $\frac{1}{6}$

10. The number of natural numbers less than 400 that are not divisible by 17 or 23 is

(A) 290 (B) 320 (C) 360 (D) 370

11. If a is a % of b and b is b % of c, where a is a positive real number, then the value of c is

(A) 120 (B) 200 (C) 150 (D) 100

12. The sum of the reciprocals of all the positive integers that divide 24 is

(A) $\frac{7}{2}$ (B) $\frac{1}{2}$ (C) $\frac{5}{2}$ (D) $\frac{3}{2}$

13. N is a positive integer and p, q are primes. If N = pq and $\frac{1}{N}+\frac{1}{p}=\frac{1}{q}$, the value of N is

(A) 6 (B) 7 (C) 8 (D) 9

14. The number of two digit numbers that leave a remainder 1 when divided by 4 is

(A) 20 (B) 21 (C) 22 (D) 23

15. If $(a + b)^2 + (b + c)^2 + (c + d)^2 = 4(ab + bc + cd)$, then

(A) a + b or b + c or c + d must be zero

(B) Two of a, b, c, d are zero and other two non zero

(C) a = b = c = d

(D) None of these

PART - B

16. A race horse eats (3a + 2b) bags of oats every week. The number of weeks in which it can eat $(12a^2 - 7ab - 10b^2)$ bags of oats is ______.

17. Choose 4 digits a, b, c, d from {2, 0, 1, 6} and form the number $(10a + b)^{10c + d}$. For example, if a = 2, b = 0, c = 1, d = 6, we will get 20^{16}. For all such choices of a, b, c, d the number of distinct numbers that will be formed is _______.

18. A fraction F becomes $\frac{1}{2}$ when its denominator is increased by 4 and becomes $\frac{1}{3}$ when its numerator is decreased by 5. Then F equals ______.

19. The average of 5 consecutive positive integers starting with m is n. Then the average of 5 consecutive integers starting with n is (in terms of m) is _______.

20. Two boys came to Mahadevan and asked his age. Mahadevan told, "Delete all the vowels and repeated letters from my name. Find the numerical value of the remaining letters (for example, D has value 4, G has 7 etc). Add all of them. Find the number got by interchanging its digits. Add both the numbers. That is my age." One boy ran away. The other boy calculate correctly. The age of Mahadevan is _______.

21. If $A = \frac{2^4 + 2^4}{2^{-4} + 2^{-4}}, B = \frac{3^2 + 3^2}{3^{-2} + 3^{-2}}, C = \frac{4^2 + 4^2}{4^{-2} + 4^{-2}}$ the integral part of $\frac{A + C}{B}$ is _____.

22. A six-digit number is formed using the digits 1, 1, 2, 2, 3, 3. The number of 6-digit numbers in which the 1s are separated by one digit, 2s are separated by two digits and 3s are separated by 3 digits is ______.

23. In the addition shown below, P, I, U are digits. The value of U is _______.

24. There are four cows, eight hen, a fish, a cow, a girl and a boy in a garden. Outside the garden there is one dog, a peacock and some cats. The number of legs of all of them inside the garden is equal that outside the garden. The number of cats is _______.

25. Two sides of a triangle are 8 cm and 5 cm. The length of the third side in cms is also an integer. The number of such triangles is _______.

26. If $a^2 - a - 10 = 0$, then $(a + 1)(a + 2)(a - 4)$ is ______.

27. There are 5 points on the circumference of a circle. The number of chords which can be drawn joining them is _______.

28. Each side of an equilateral triangle is 3 cm longer than each side of a square. The total perimeter of the square and the triangle is 51 cm. Then the side of the triangle in cms is _______.

29. The largest three digit number that is a multiple of 3 and 5 is _______.

30. Consider the sequence 0, 6, 24, 60, 120, ... The 6th term of this sequence is ______.

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AMTI (NMTC) - 2017

KAPREKAR CONTEST - SUB - JUNIOR LEVEL

(Standard - VII & VIII)

Note :

1. Fill in the response sheet with your Name, Class and the institution through which you appear in the specified places.
2. Diagrams are only visual aids; they are NOT drawn to scale.
3. You are free to do rough work on separate sheets.
4. Duration of the test : 2 pm to 4 pm – 2 hours.

PART - A

Note :

- Only one of the choices A, B, C, D is correct for each question. Shade the alphabet of your choice in the response sheet. If you have any doubt in the method of answering, seek the guidance of the supervisor.
- For each correct response you get 1 mark. For each incorrect response you lose $\frac{1}{2}$ mark.

1. The function $\frac{4}{37}$ is written in the decimal from $0.a_1a_2a_3....$ The value of a_{2017} is

   (A) 8 (B) 0 (C) 1 (D) 5

2. The number of integers x satisfying the equation $(x^2 - 3x + 1)^{x+1} = 1$ is

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

3. The number of two digit numbers ab such that the number ab – ba is a prime number is

   (A) 0 (B) 1 (C) 2 (D) 3

4. If $A = \frac{5425}{1444} - \frac{2987}{3045} - \frac{493}{4284}$, then

   (A) $1 < A < 2$ (B) $2 < A < 3$ (C) $3 < A < 4$ (D) $A < 1$

5. What is the 2017th letter in ABRACADABRAABRACADABRA..., where the word ABRACADABRA is respectively written ?

   (A) A (B) B (C) C (D) R

6. How many of the following statements are true ?

   (a) A 10 % increase followed by another 5 % increase is equivalent to a 15 % increase.

   (b) If the radius of a circle is doubled then the ratio of the area of the circle to the circumference is doubled.

   (C) If a positive fraction is substracted from 1 and the resulting fraction is again subtracted from 1 we get the original fraction.

   (A) 0 (B) 1 (C) 2 (D) 3

7. In the adjoining figure the breadth of the rectangle is 10 units. Two semicircles are drawn on the breadth as diameter. The area of the shaded region is 100 sq units. The shortest distance between the semicircles is

   (A) $\frac{5\pi}{2}$ (B) 5π (C) $\frac{5\pi}{3}$ (D) $\frac{3\pi}{4}$

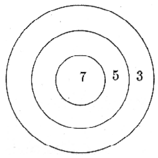
8. When you arrange the following is descending order :

   A. 15% of 30 B. 8% of 15 C. 20% of 20
   D. 26% of 10 E. 9% of 25

   the middle one is

   (A) 15% of 30 (B) 8 % of 15 (C) 20 % of 20 (D) 26% of 10

9. A boy aims at a target shown in the figure. When he hits the center circle he gets 7 points, first annular region 5 points and second annular region 3 points. He shoots six times. Which one of the following is a possible score ?



(A) 16 (B) 26 (C) 19 (D) 41

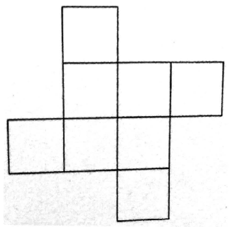
10. After simplifying the fraction $\left\{\dfrac{a+\dfrac{b-a}{1+ab}}{1-\dfrac{a(b-a)}{1+ab}}\right\}\left\{\dfrac{\dfrac{x+y}{1-xy}-y}{1+\dfrac{y(x+y)}{1-xy}}\right\}$ we get a term independent of

(A) a, y (B) b, x (C) a, b (D) x, y

11. If 7 Rasagullas are distributed to each boy of a group. 10 rasagullas would be left. If 8 are given to each boy then 5 rasagullas would be left. So the person who distributes the rasagullas brought 15 more rasagullas and distributed the same number (x) rasagullas to each. There is no rasagulla left. Then x is

(A) 10 (B) 11 (C) 12 (D) 14

12. In the adjoining diagram all squares are of the same size. The total area of the figure is 288 square cms. The perimeter of the figure (in cm) is



(A) 86 (B) 96 (C) 106 (D) 92

13. When Newton was a primary school student he had to multiply a number by 5. But by mistake he divided the number by 5. The percentage error he committed is

(A) 95% (B) 96% (C) 50% (D) 75%

14. ABC is an isosceles triangle with sides $AB = AC = 3x-4 = \frac{3}{4}x+32$. The area of the equilateral triangle with side length x is

(A) $32\sqrt{3}$ (B) $36\sqrt{3}$ (C) $54\sqrt{3}$ (D) $64\sqrt{3}$

15. Two distinct numbers a and b are selected from 1, 2, 3, ..., 60. The maximum value of - $\frac{a\times b}{a-b}$ is

(A) 6750 (B) 5270 (C) 4850 (D) 3540

PART - B

Note :

- Write the correct answer in the space provided in the response sheet.
- For each correct response you get 1 mark. For each incorrect response you lose $\frac{1}{4}$ mark.

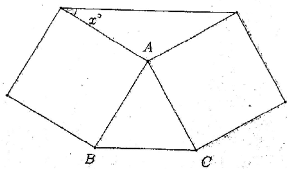
16. Two cogged wheels of which one has 16 cogs and the other 27 cogs, mesh into each other. If the latter turns 80 times in three quarters of a minute, the number of turns made by the other in 8 seconds is _______.

17. If n is a positive integer such that $a^{2n} = 2$, then $2a^{6n} - 16$ is _______.

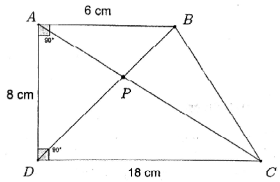
18. The least number of children in a family such that every child has at least one sister and one brother is ________.

19. A water tank is $\frac{4}{5}$ full. When 40 liters of water is removed, it becomes $\frac{3}{4}$ full. The capacity of the tank in liters is ________.

20. ABC is an equilateral triangle. Squares are described on the sides AB and AC as shown. The value of x is ________.



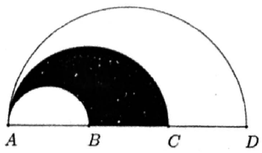
21. ABCD is a trapezium with AB = 6 cm, AD = 8 cm and CD = 18 cms. The sides AB and CD are parallel and AD is perpendicular to AB. P is the point of intersection of AC and BD. The difference between the areas of the triangles PCD and PAB is square cms is _______.



22. The price of cooking oil has increased by 25%. The percentage of reduction that a family should effect in the use of oil so as not to increase the expenditure is _______.

23. The number of natural numbers between 90 and 999 which contains exactly one zero is _____.

24. In the adjoining we hae semicircle and AB = BC = CD. The ratio of the unshaded area to the shaded area is _________.



25. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. The ratio in which these two metals be mixed so that the mixture is 15 times as heavy as water is ____.

26. Five angles of a heptagon (seven sided polygon) are 160^0, 135^0, 185^0, 145^0 and 125^0. If the other two angles are both equal to x^0, then x is _______.

27. ABCD is a trapezium with AB parallel to CD and AD perpendicular to AB. If AB = 23 cm, CD = 35 cm and AD = 5 cm. The perimeter of the given trapezium in cms is _______.

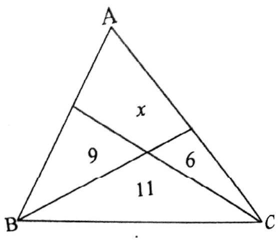
28. The number of three digit numbers which are multiples of 11 is ________.

29. If a, b are digits, ab denotes the number 10a + b. Similarly when a, b, c are digits, abc denotes the number 100a + 10b + c. If X, Y, Z are digits such that XX + YY + ZZ = XYZ, then XX x YY x ZZ is _______.

30. The positive integer n has 2,5 and 6 as its factors and the positive integer m has 4, 8, 12 as its factors. The smallest value of m + n is _______.

- - - - - - - - - - - -

1. The greatest common divisor of a and 72 is (a, 72) = 24 and the least common multiple of b and 24 is [b, 24] = 72. Find the g.c.d. (a, b) and the l.c.m. [a, b] given that a is the smallest three digit number having this property; and b is the biggest integer having this property.
2. Given that $a^2 - b^2 = 105$ and a and b are two relatively prime positive integers (two positive integers m and n are relatively prime if their g.c.d. (m, n) = 1), find all such a and b. After having found all such a and b, if one draws a triangle ABC with sides having lengths $a^2 - b^2$, $a^2 + b^2$ and 2ab find the area of all such triangles.
3. A is a set 2004 positive integers. Show that there is a pair of elements in A whose difference is divisible by 2003.
4. Let ABC be an acute angled triangle with AD, BE, CF as the altitudes (i.e., D is the foot of the perpendicular from A on BC and so on....). If the altitudes meet at the point O, find $\angle BOC$, $\angle COA$, $\angle AOB$ in terms of the angles $\angle A$, $\angle B$, $\angle C$ of the triangle ABC.
5. Is the statement "If p and $p^2 + 2$ are primes than $p^3 + 2$ is also a prime" true or false ? Give reasons for your answer.
6. Let P denote the product of first n prime numbers (with n > 2). For what values of n we have.
   1. P – 1 is a perfect square
   2. P + 1 is a perfect square
7. Three counters A, B and C are coloured with three different colours red, blue and white. Of the following statements only one is true.
   1. A is red.
   2. B is not red.
   3. C is not blue.
8. The sum and least common multiple of two positive integers x, y are given as x + y = 40 and l.c.m. [x, y] = 48. Find the numbers x and y.
9. What is the greatest positive integer n which makes $n^3 + 100$ divisible by n + 10 ?
10. Find the sum of all three digit numbers that can be written using the digits 1, 2, 3, 4 (repetitions allowed).
11. Consider the collection C of all isosceles triangles of area 48 sq. units, whose bases and heights are integers. How many triangles are there in C ? How many triangles in C have their equal sides also of integral lengths ?
12. In triangle ABC, we are given that $\angle A = 90^0$. Median AM, angle bisector AK and the altitude AH are drawn. Prove that $\angle MAK = \angle KAH$.
13. Triangle ABC is divided into four regions with areas as shown in the diagram. Find x.



14. ABCD is a cyclic quadrilateral (which means that a circle passes through the vertices A, B, C, D). In other words the vertices A, B, C, D, in that order, lie on a circle. If the diagonals AC and BD cut a right angles at E, prove that $AE^2 + BE^2 + CE^2 + DE^2 = 4R^2$ where R is the radius of the circle ABCD.
15. A = {a, b, c, d, e} is a set of five integers. We take two out of the numbers in A and add. The following ten sums are obtained

   0, 6, 11, 12, 17, 20, 23, 26, 32, 37

   Find the five integers in the set A.

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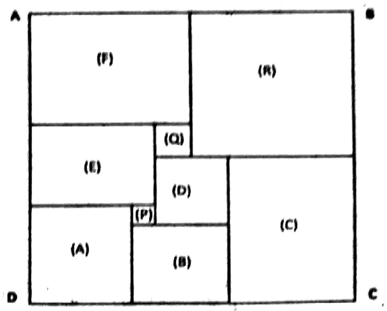
KAPREKAR CONTEST - FINAL - SUB-JUNIOR LEVEL

1. Find all three digit and four digit natural numbers such that the product of the digits is a prime number. Find the sum of all such three digit numbers and the sum of all such four digit numbers. Find the biggest prime factor of each sum.
2. Let a sequence of numbers be denoted as t_1, t_2, t_3, ..., where $t_1 = 1$ and $t_n = t_{n-1} + n$. (n is a natural number). Find t_2, t_3, t_4, t_{10}, t_{2011}.
3. When written out completely 16^{2011} has m digits and 625^{2011} has n digits. Find the value of (m + n).
4. Four digit numbers are formed by four different digits a, b, c, d (none of them is zero) without any repetition of digits. Prove that when the sum of all such numbers when divided by the sum of the digits a, b, c, d, the quotient is 6666.
5. ABCD is a parallelogram. Through C a straight line is drawn outside the parallelogram. AP, BQ, DR are drawn perpendicular to this line from A, B and D. Prove that AP = BQ + DR.
6. Falguni puts 12 plastic bags inside another plastic bag. Each of these 12 bags is either empty or contains 12 othe plastic bags. All together if 12 bags were non-empty, find the total number of bags.
7. A, B and C are the digits of a three digit number ABC (A, C ≠ 0). The number got by reversing the digits (also a three digit number) is added to ABC and the sum is found to be a square number. Find all such three digit numbers.
8. Nine square are arranged to form a rectangle ABCD. The smallest square P has an area 4 sq. units. Find the areas of Q and R.



KAPREKAR CONTEST - FINAL - SUB-JUNIOR LEVEL

1. Find the numberof numbers coprime to and less than 2012. Find their sum. Find also the quotient when this sum is divided by 2012. (Information : 503 is a prime).

2. Composite twins are defined below :

   (a) Odd composite twin: Let a and a + 2 be two odd composite numbers. If (a – 2) and (a + 4) are primes then (a, a + 2) is called an "odd composite twin."

   (b) Even composite twin: Let b and b + 2 two even numbers (b > 2). If (b – 1) and (b + 3) are primes then (b, b + 2) is called an even composite twin.

   List all composite twins less than or equal to 100.

3. ABCD is a rectangle. The sides are extended and the external angles are bisected and the bisectors are produced in both ways to form a quadrilateral. Prove that the quadrilateral is a square.

4. (a) A single digit natural number is increased by 10. The obtained number is now increased by the same percentage as in the first increase. The result is 72. Find the original single digit number.

   (b) After two price reductions by one and the same percent the price of an article is reduced from Rs. 250 to Rs. 160. By how much percent was the price reduced each time. Write detailed steps.

5. If a finite straight line segment is divided into two parts so that the rectangle contained by the whole and first part is equal to the square on the other part, prove that the square described on the of the diagonals of the rectangle contained by the whole and the first part is three times the square on other part.

6. abcde is a five digit number. Show that abcde is divisible by 7 if and only if the number abcd – (2 x e) is divisible by 7.

7. If $a^2x^3 + b^2y^3 + c^2z^3 = p^5$, $ax^2 = by^2 = cz^2$ and $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=\frac{1}{p}$ find $\sqrt{a}+\sqrt{b}+\sqrt{c}$ only in terms of p.

8. Take any natural number. Multiply it with the next two natural numbers. Take another natural number different from the first and do the same as before. Subtract one result from the other to get a positive difference and divide the difference obtained by the positive difference of the original numbers. Add to the quotient the product of the original numbers. Prove that the final result is the product of some number by the number next above it.

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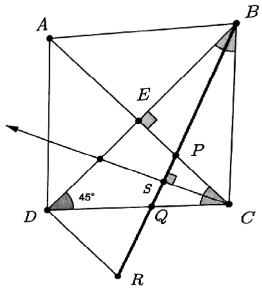
1. Prove that algebraic identity $a^3 - b^3 = \left\{\frac{a(a^3 - 2b^3)}{a^3 + b^3}\right\}^3 + \left\{\frac{b(2a^3 - b^3)}{a^3 + b^3}\right\}^3$.

2. The ratio between a two-digit number and the sum of the digits of that number is a : b. If the digits in the units place is n more than the digit in the tens place, prove that the number is given by $\frac{9na}{11b - 2a}$.

3. If $\frac{(a-b)(c-d)}{(b-c)(d-a)} = \frac{2012}{2013}$ find the value of $\frac{(a-c)(b-d)}{(a-b)(c-d)}$.

4. Q, R are the midpoints of the sides AC, AB of the isosceles triangle ABC in which AB = AC. The median AD is produced to E so that DE = AD. EQ and ER are joined to cut BC in N and M respectively. Show that AMEN is a rhombus.

5. ABCD is a square. The diagonals AC, BD, cut at E. From B a perpendicular is drawn to the bisector of ∠DCA and it cuts AC at P and DC at Q. Prove that DQ = 2 PE.



6. a) A two digit number is equal to six times the sum of its digits.

   b) Show that $\frac{10^{2013}+1}{10^{2014}+1} > \frac{10^{3013}+1}{10^{3014}+1}$.

   Prove that the two digit number formed by interchanging the digits in equal to five times the sum of its digits.

7. a) For any two natural numbers m, n prove that ($m^3 + n^3 + 4$) cannot be a perfect cube.

   b) A circle is divided into six sectors and the six numbers 1, 0, 1, 0, 0, 0 are written clockwise, one in each sector. One can add 1 to the numbers in any two adjacent sectors. Is it possible to make all the numbers equal ? If so after how many operations can this be achieved ?

8. a) All natural numbers from 1 to 2013 are written in a row in that order. Can you insert + and – signs between them so that the value of the resulting expression is zero ? If it is possible, how many + and – signs should be inserted ? Justify your answer by giving clear reasoning.

   b) The natural numbers 1, 2, 3, ... are partitioned into subsets S_1 = {1}, S_2 = {2, 3}, S_3 = {4, 5, 6}, S_4 = {7, 8, 9, 10} and so on. What are the greatest and least numbers in the set S_{2013} ?

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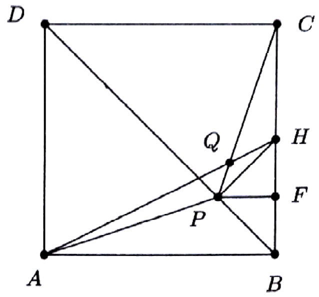
1. A hare, pursued by a gray-hound, is 50 of her own leaps ahead of him. In the time hare takes 4 leaps, the gray-hound takes 3 leaps. In one leap the hare goes $1\frac{3}{4}$ meter and the gra-hound $2\frac{3}{4}$ meter. In how many leaps will the gray-hound overtake the hare ?

2. If $\sqrt{a-x}+\sqrt{b-x}+\sqrt{c-x}=0$, show that (a + b + c + 3x) (a + b + c – x) = 4 (ab + bc + ca)

3. Some amount of work has to be completed. Anand, Bilal and Charles offered to do the job. Anand would alone take a times as many days as Bilal and Charles working together. Bilal would alone take b times as many days as Anand and Charles together. Charles would alone take c times as many days as Anand and Bilal together. Show that $\frac{a}{a+1}+\frac{b}{b+1}+\frac{c}{c+1}=2$.

4. Let P be any point on the diagonal BD of a rectangle ABCD. F is the foot of the perpendicular from P to BC. H is a point on the side BC such that FB = FH. PC cuts AH in Q. Show that Area of ΔAPQ = Area of ΔCHQ.



5. A three digit number is base 7 when expressed in base 9 has its digits reversed in order. Find the number in base 7 and base 10.

6. a) Two regular polygons have the number of their sides in the ratio 3 : 2 and the interior angles in the ratio 10 : 9. Find the number of sides of the polygons.

   b) Find two natural numbers such that their difference, sum and the product is to one another as 1, 7 and 24.

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1. (a) If $\frac{x}{a} = \frac{y}{b} = \frac{z}{c} = 2016$, where x, y, z, a, b, c are non zero real numbers, find the value of $\frac{xyz(a+b)(b+c)(c+a)}{abc(x+y(y+z)(z+x)}$.

(b) Four boys Amar, Benny, Charan, Dany and four girls Azija, Beula, Chitra and Dais have to work on a project. They should form 4 pairs, one boy and one girl in each. They know each other with the following constraints :

i. Amar knows neither Azija nor Buela

ii. Benny does not know Buela

iii. Both Charan and Dany know neither Chitra nor Daisy.

In how many ways can the pairs be formed so that each boy knows the girl in his pair.

2. In a triangle ABC, $\angle C = 90^0$ and BC = 3AC. Points D, E lie on CB such that CD = DE = EB. Prove that $\angle ABC + \angle AEC + \angle ADC = 90^0$.

3. Let m, n, p be distinct two digit natural numbers. If m = 10a + b, n = 10b + c, p = 10c + a. Find all possible values of gcd (m, n, p).

4. If xy = ab (a + b) and $x^2 + y^2 - xy = a^3 + b^3$ find the value of $\left(\frac{x}{a} - \frac{y}{b}\right)\left(\frac{x}{b} - \frac{y}{a}\right)$.

5. The square ABCD of side length a cm is rotated about A in the clockwise direction by an angle 450 to become the square AB'C'D'. Show that the shaded area is $(\sqrt{2} - 1)a^2$ square cms.
