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M. Prakash Institute	**23 April 2023**
Entrance Test	**10am-12noon**
2 Year foundation program	**Paper type: AB**

1. If $\dfrac{5}{x} + \dfrac{14}{y} = 2$ and $\dfrac{2}{x} + \dfrac{7}{y} = \dfrac{11}{12}$ then find $x + y$.

2. Sum of five consecutive natural numbers is 35. Find the sum of next five consecutive natural numbers.

3. Find the smallest natural number to be subtracted from 2023 so that we get a perfect square.

4. Points A, B, C, and D are on a line in that order. The distance from A to D is 24 . The distance from B to D is 3 times the distance from A to B. Point C is halfway between B and D. What is the distance from A to C ?

5. In the diagram, $ABCF$ is a rectangle with $AB = 30$ and $AF = 14$. Points E and D are on FC so that $FE = 5$ and the area of quadrilateral $ABDE$ is 266. The length of DC is
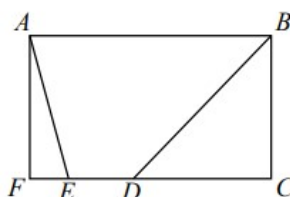
6. The average of a, b and c is 16 . The average of c, d and e is 26 . The average of $a, b, c, d,$ and e is 20 . The value of c is

7. A positive number is increased by 25%. By what percentage should the result be decreased to return to the original value?

8. Points A, B, C, D, E, F, G, H, and I are evenly spaced on the circle with centre O. The measure of $\angle AEO$ is

9. A rectangle has positive integer side lengths and an area of 24 . The perimeter of the rectangle cannot be
(If your answer is 20, mark 20 as your answer. If your answer is 28, mark 28 as your answer, etc.)
(A) 20   (B) 22   (C) 28   (D) 50   (E) 36

10. The operation $a \nabla b$ is defined by $a \nabla b = \dfrac{a+b}{a-b}$ for all integers a and b with $a \neq b$. For example, $2 \nabla 3 = \dfrac{2+3}{2-3} = -5$. If $3 \nabla b = -4$, what is the value of b ?

11. If x is 20% of y and x is 50% of z, then what percentage is z of y ?

12. $ABCDE$ is regular pentagon. $PQCD$ is a square. Find the measure of $\angle PED$.
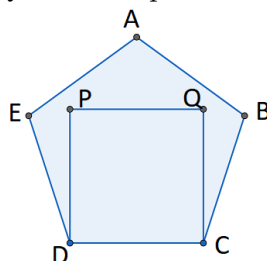
13. In the diagram, PQR is a straight line segment. If $x + y = 76$, what is the value of x?
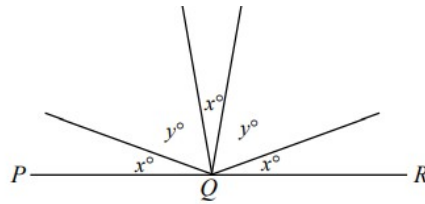

14. If $3^x = 5$, the value of 3^{x+2} is

15. A group of friends are sharing a bag of candy. On the first day, they eat $\frac{1}{2}$ of the candies in the bag. On the second day, they eat $\frac{2}{3}$ of the remaining candies. On the third day, they eat $\frac{3}{4}$ of the remaining candies. At the end of the third day, there is 1 candy remaining in the bag. How many candies were in the bag before the first day?

16. The variables a, b, c, d, e, and f represent the numbers $4, 12, 15, 27, 31$, and 39 in some order. Suppose that

$$a + b = c$$
$$b + c = d$$
$$c + e = f$$

The value of $a + c + f$ is

17. In the diagram, pentagon $PQRST$ has $PQ = 13$, $QR = 18, ST = 30$, and area of the pentagon $PQRST$ is $270..$ Also, $\angle QRS = \angle RST = \angle STP = 90°$. Find the perimeter of $PQRST$.
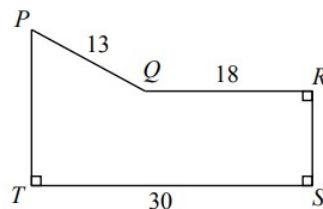
18. Virat chooses three different numbers from the set $\{-5, -3, -2, 0, 1, 3, 5, 6\}$ and multiplies them together to obtain the integer n. What is the greatest possible value of n ?

19. In the diagram, two circles are centred at O. The smaller circle has a radius of 1 and the larger circle has a radius of 3. Points P and Q are placed on the larger circle so that the areas of the two shaded regions are equal. If $\angle POQ = x°$, what is the value of x? ?
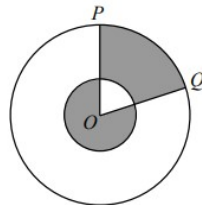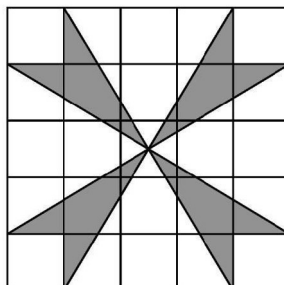

20. $\dfrac{\sqrt{507} + \sqrt{845} + \sqrt{1183}}{\sqrt{3} + \sqrt{5} + \sqrt{7}} =.$

Key:

| 1	2	3	4	5	6	7	8	9	10
18	60	87	15	17	26	20	10	36	5
11	12	13	14	15	16	17	18	19	20
40	81	28	45	24	73	82	90	40	13

2

1. What is the area of the shaded pinwheel shown in the 5×5 grid?

2. Pick two consecutive positive integers whose sum is less than 90 . Square both of those integers and then find the difference of the squares. Which of the following could be the difference?

   (A) 2   (B) 64   (C) 77   (D) 96   (E) 99

3. A mixture of 30 liters of paint is 25% red tint, 30% yellow tint, and 45% water. Five liters of yellow tint are added to the original mixture. What is the percent of yellow tint that is the mixture?

4. In square $ABCE, AF = 2FE$ and $CD = 2DE$. If area of $\triangle BFD = 90$, Find AB ?
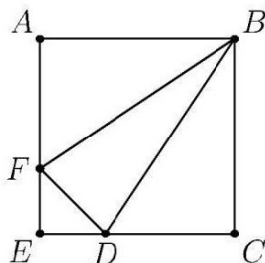

5. Few VIII std students in M. Prakash Institute gave olympiad batch selection test. $\dfrac{5}{6}$ of the boys and $\dfrac{4}{5}$ of the girls passed the test, and an equal number of boys and girls passed the test. What is the minimum possible number of students appeared for the test?

6. A shape is created by joining seven cubes of 1 unit side length, as shown. What is the surface area in square units?
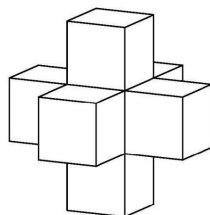

7. The average age of the 6 people in Room A is 40 . The average age of the 4 people in Room B is 25 . If the two groups are combined, what is the average age of all the people?

8. Two angles of an isosceles triangle measure $70°$ and $x°$. $2K$ is the sum of the three possible values of x. $K = ?$

9. The numbers $52, 32, 12, 43, 25, 18, 56, 36, 16, 50$ are grouped in pairs in such a way that the sum of each pair is the same. The number paired with 18 is

10. Given X is 50% larger than Z and Y is 25% larger than Z. Then X is what percent larger than Y ?

11. Half of 4^{40} is 2^x. Then $x =$?

12. If $2^a \times 3^b = 576$ then $\frac{a}{b}$ is

13. 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

14. Two squares of different sizes overlapped as shown in the given figure. What is the difference between the non-overlapping areas?
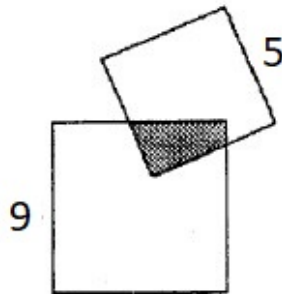
15. Find the natural number with which if we divide 2023 we get a perfect square.

16. The area of trapezium $ABCD$ is 164. The altitude is $8, AB$ is 10, and CD is 17. What is BC?
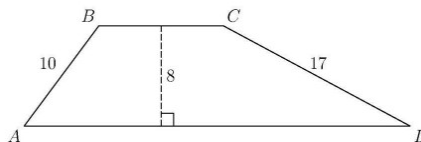

17. The average of the five numbers in a list is 54 . The average of the first two numbers is 48 . What is the average of the last three numbers?

18. If $(a + b + c) = 0$ then find $\dfrac{(a^2 + b^2 + c^2)^2}{a^2b^2 + b^2c^2 + c^2a^2}$

19. For a class, copies of 9 maths books and 16 science books cost Rs.220. Each books costs a whole number of rupees. How much will it cost if one copy of each Maths and Science book is bought?

20. A man is due at a certain place at a certain time. If he walks at the rate of 6kms per hour, he will be 15 minutes late; if he walks at the rate of 8kms an hour, he will be 15 minutes early. Find the distance he has to walk.

Answer Key:

1	2	3	4	5	6	7	8	9	10
6	77	40	18	49	30	34	75	50	20
11	12	13	14	15	16	17	18	19	20
79	3	13	56	7	10	58	4	19	12

M. Prakash Institute
Entrance Test
2 Year foundation program

**20 Nov 2022**
10am-12noon
Paper Type AB

1. $\square ABCD$ is a square inscribed in a circle of diameter $7\sqrt{2}$. Find the area of the shaded region. Consider value of π as $\frac{22}{7}$.
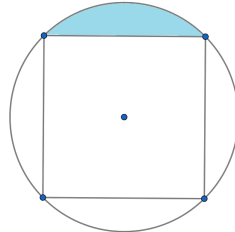
2. The distance between 2 towns is 380 km. A passenger car and a truck start moving towards each other from the 2 towns at the same time and meet each other 4 hours later. If the car drives 5 km/hr faster than the truck, what is the speed of the truck.

3. $ABCDE$ is a regular pentagon. $\triangle CFD$ is on isoceles triangle with $CF = DF$. $m\angle CFD = 130$. Find $m\angle ECF$.
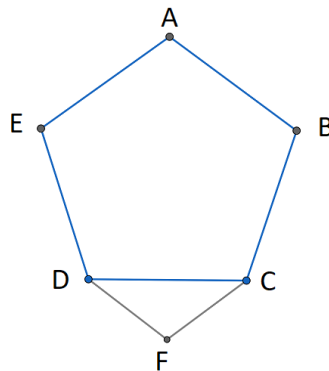
4. Two numbers are in the ratio 2.75 : 5.25. If 13 is added to both numbers, their ratio becomes 1.8 : 3.2. Find the first number.

5. A tree grows by 10% of its existing height every year. If the tree is now 42.35 feet tall, how tall was it two years ago?

6. $\triangle PAB$ is on equilateral triangle AB is the diamet of the circle $AB = 8$. Let K be the area of $\square ABCD$. Find $2\sqrt{3} \times K$.
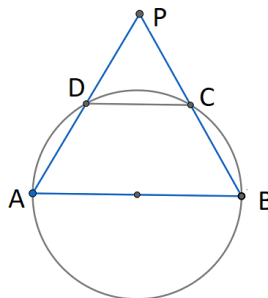
7. $\left(\dfrac{\sqrt{28} + \sqrt{12} + \sqrt{20}}{\sqrt{7} + \sqrt{5} + \sqrt{3}} \right)^5 =$

8. $\square ABCD$ ia a kite. $AB = AD = 5$, $CB = CD = 10$, $AM = 3$. Let K be the midpoint of $\overline{MC}$. Find DK^2
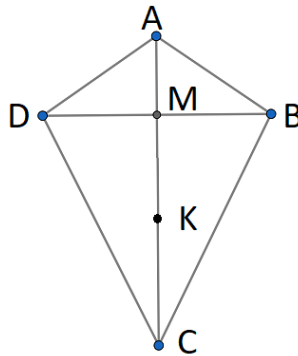

9. Four children have some toys. The first child has $\frac{1}{10}^{th}$ of the toys. The 2nd has 12 toys more than the first. The 3rd has one more toy than the first, the 4th child has double the 3rd child. How many toys are there altogether?

10. In the number pyramid below, the number at the top is the result of addition of the 2 numbers directly below it. Fill in the numbers in the blank squares and hence find the number in place of X.
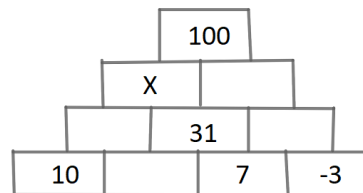

11. A Square and circle have the same perimeter. In such a case, the ratio of area of circle to the area of square is $\dfrac{m}{n}$ when we consider value of π as $\frac{22}{7}$, m, n are co-prime numbers. Find $m + n$.

12. In the given figure, $\triangle ABC$ is isoceles and $\triangle PQR$ is equilateral $\triangle$. $\angle ARQ = 47°$ and $\angle PQC = 33°$, find $\angle RPB$.
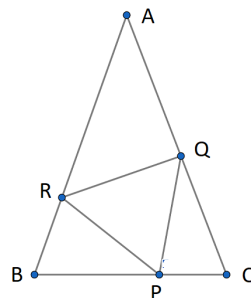
13. The product of a certain two digit number (say ab) and its digits in the reverse order (ba) is 1855. What is the sum of both the number (ab+ba)?

14. As shown in the figure, Rectangle $ABCD$ is inscribed in a quarter circle. $AB = 3$, $BC = 4$. Find distance CE.
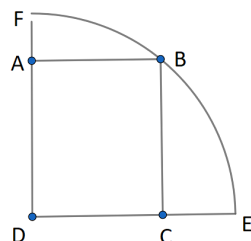
15. A class average mark in a test is 70. The average of students who scored below 60 is 50. The average of students who scored 60 or more is 75. If the total number of students is 20, how many students scored below 60?

16. If $10^{2y} = \dfrac{1}{25}$, find 10^{-y}.

17. If the ratio $\dfrac{1}{7}$ is written in decimal form, what is the digit on 2022th place after decimal point?

18. A square piece of cardboard has an area of 36 cm square. A square of 1 cm × 1 cm is cut from each corner. The sides are folded in order to make an open box. What is the volume of the box in cm cubed?
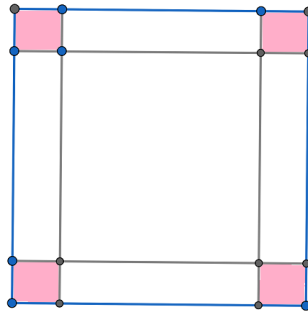

19. A 5 litre container full of orange juice has 2 litres of juice removed and is filled up with water and mixed thoroughly. It then has 2 litres of the mixture removed and is again filled up with water. What percentage of the final mixture is orange juice?

20. A computer is programmed to scan the digits of the counting numbers. For example it scans 1 2 3 4 5 6 7 8 9 10 11 12 and then it has scanned 15 digits. The computer begins its task and scans the first 1788 digits. The last counting number scanned is K? Report sum of digits of K.

Answer Key

Q.No.	1	2	3	4	5	6	7	8	9	10
Ans	7	45	61	77	35	72	32	37	30	65
Q.No.	11	12	13	14	15	16	17	18	19	20
Ans	25	40	88	2	4	5	7	16	36	11

1. In $\triangle ABC, \angle B = 90°. BD : DC = 1 : 2. AB = 20$. Area of $\triangle ADC = 140$. Find AC.
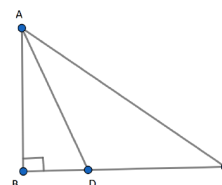
2. Sum of two real numbers is 28 and their product is 188. Find square of their difference.

3. Perimeter of a triangle is 15 . How many such non congruent triangles with integer length sides are possible?

4. $(\sqrt{2} + \sqrt{3} + \sqrt{6})^2 - 4\sqrt{3} = K + 2\sqrt{3}(\sqrt{2} + \sqrt{3} + \sqrt{6})$. Find K.

5. If $3^{t+1} - 3^{7-t} = 216$, find t

6. Arun gets 55% marks and Varun gets 67% marks and if difference in total marks they got is 84 , what is the total marks of the examination

7. As shown in figure, in $\triangle ABC, AB = AC$, and $BC = BD = ED = EF = AF$. Find measure of angle DEF.
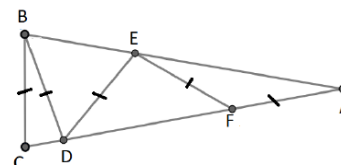
8. Find the GCD of 357 and 5304 .

9. $\frac{\sqrt{343} + \sqrt{637} + \sqrt{1225}}{\sqrt{7} + \sqrt{13} + T} = 7$, find T.

10. $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{1}{4}$ of $\frac{1}{5}$ of $\frac{1}{6}$ of L is 7 , find L.

11. The angle between hour hand and minute hand of an analog (non digital) clock when the time is $4 : 35$ is $\left(\frac{t}{2}\right)°$. Find t.

12. As shown in the figure, pentagon $ABCDE$ is such that $\angle BCD = \angle ADE = \angle DAB = 90°$. $AB = 2, BC = 7, CD = 6, DE = 12$, find AE
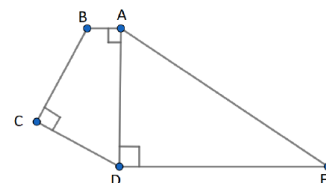
13. Unit digit of the sum of the first 99 natural numbers is ?

14. If $a + b + c = 0$, then $\frac{b^2 + c^2 + a^2}{b^2 - ca}$ is

15. A circle has area 18π. Area of the largest possible square inscribed in this circle is

16. As shown in figure there are two squares. The side of each square is a whole number. The area of the figure is 58 square units, find the perimeter of the figure $ABCEFG$.
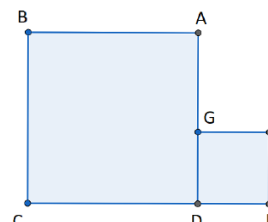
17. Turning a screw driver by $90°$, we can drive a screw 2 mm deeper into a piece of wood. How many complete revolutions are needed to drive a screw 8cms into wood?

18. In a class there are boys and girls. If 15 girls leave the class the ratio of number of girls to number of boys becomes 1:2. After this if 40 boys leave, the ratio becomes $1 : 1$. What is total number of students in that class in the begining?

19. If $[3(230 + x)]^2 = 492a04$, then $a + x$ is

20. The smallest positive integer to be subtracted form 2022 so that we get a perfect square is X. The smalles positive integer to be added to 2022 so that we get perfect cube is Y. Find X + Y.

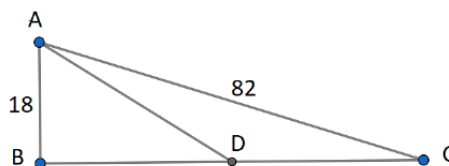**Answers**

1	2	3	4	5	6	7	8	9	10
29	32	7	5	4	700	100	51	5	5040
11	12	13	14	15	16	17	18	19	20
145	15	0	2	36	34	10	135	12	261

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1. In $\triangle ABC, \angle B = 90°$. D is midpoint of $\overline{BC}$. $AB = 18, AC = 82$. Find area of $\triangle ADC$.

2. Sum of two natural numbers is 16 and sum of their squares is 130 . Find their positive difference.

3. Area of a rectangle (quadrilateral with measure of all four angles 90) having integer sides is 144 sq. units. How many different rectangles are possible?

4. $(2 + 3\sqrt{5})^2 = m + n\sqrt{5}$. Find $m - n$.

5. If $2^{k+1} + 2^{8-k} = 72$, find sum of all positive integer values of k.

6. Arun gets 30% marks and gets 12 marks less than the passing marks. Varun gets 40% marks and gets 8 marks more than the passing maiks. Find the percentage of marks required for passing.

7. As shown in figure, A, B, E are collinear points. (lie on same straight line) D is point on segment BC. $BE = BD = DC = AD$. $\angle ACD = x$ and $\angle BED = 2x$. Find x.
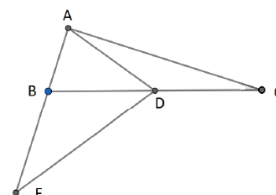
8. Find the GCD of 504,5292 .

9. $\dfrac{\sqrt{338}+\sqrt{507}+\sqrt{845}}{\sqrt{5}+\sqrt{2}+\sqrt{3}} =$.

10. A basket of oranges is emptied by one person taking half of them and one more, a second person taking half of the remainder and 2 more and a third person taking half of the remainder and 3 more. How many oranges were there in the basket at first?

11. The angle between hour hand and minute hand of an analogous (non digital) clock when the time is $7 : 25$ is $\left(\frac{t}{2}\right)^\circ$. Find t.

12. As shown in the figure, pentagon $ABCDE$ is such that $\angle ABC = \angle ADC = \angle AED = 90°$. $AB = 24, BC = 7, CD = 20, DE = 9$, find AE

9
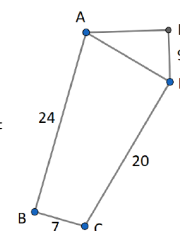
13. $ABCDE$ is a regular pentagon. Circle with $\overline{DC}$ as diameter intersects $\overline{EC}$ at K. Let M be the midpoint of $\overline{DC}$. Find $m\angle KMD$.
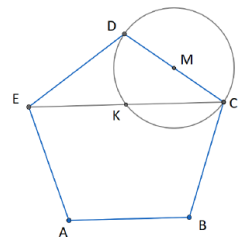
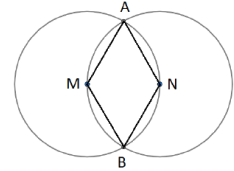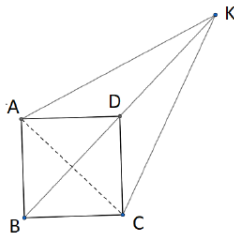14. Two congruent circles with radius 2 and centers M, N intersect each other at A, B as shown in fig. Also each circle pass through center of the other. Let K be the area of $\square AMBN$. Find $\sqrt{27}K$

15. $\square ABCD$ is a square. Diagonal $\overline{BD}$ is extended such that $BD = DK$. Let $AB = 2$. Find $A(\triangle AKC)$.

16. Given $\frac{a}{b} = \frac{3}{7}$. Find $20 \times \left(\frac{a^2+b^2}{a^2-b^2}\right)$

17. $2022^2 - \left(2021^2 - \left(2020^2 - \cdots - \left(3^2 - \left(2^2 - 1^1\right)\right)\cdots\right)\right) =$

18. Find the number of integers between x and y, where $x^3 = 2022$ and $y^2 = 2022$.

19. As shown in figure $ABCDE$ is regular pentagon with side $\sqrt{\frac{200}{7\pi}}$. Circles with half the side as radius and vertex as center are drawn. Find the area of shaded region.
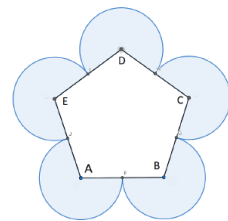
20. As shown in figure, $ABCD$ is square with side length 12 . Given $DE = 5$ find distance, d of B from $\overline{CE}$. Report $13d$
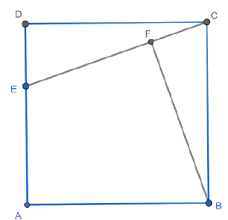
Answers

1	2	3	4	5	6	7	8	9	10
360	2	8	37	7	36	18	252	13	34
11	12	13	14	15	16	17	18	19	20
145	12	72	18	6	-29	2045253	32	25	144

1 In $\triangle PQR$, point U is on side QR such that $\angle PUQ = 70°$ and $\angle UPR = 25°$. Point T is on segment PR such that segment QT intersects segment PU at V and $\angle PVQ = 135°$. Point S is on side QR extended such that $\angle STR = 10°$. Find $m\angle RST$.

2 What is the smallest positive integer that has exactly 10 factors? (for example, the number 6 has 4 factors namely $1, 2, 3, 6$.)
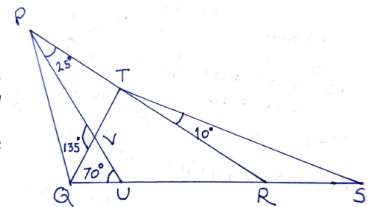
3 If $\overleftarrow{n}$ denotes the number obtained by digit reversal of natural number n (For example, $\overleftarrow{583} = 385$.) then find the value of $(10 + 11 + 12 + 13 + \cdots + 99) - (\overleftarrow{10} + \overleftarrow{11} + \overleftarrow{12} + \overleftarrow{13} + \cdots + \overleftarrow{99})$

4 Distinct integers a, b, c, d are chosen among the numbers $1, 2, 3, 4, 5, 6, 7, 8, 9$. What is the largest integer $\frac{a+b}{c+d}$ can be?

5 Find the 1000th digit after the decimal point in the decimal representation of $\frac{4}{7}$.

6 A train having length 500 meter crosses a man standing at the platform in 20 seconds. The same train crosses the platform in 90 seconds. Find the length of the platform in meter.

7 The sum of two numbers is 156 and their HCF (GCD) is 13. How many such pairs exist?

8 Find m if $7^{m+1} + 7^{m+2} = 2744$.

9 Simplify: $\frac{\sqrt{3}+\sqrt{27}+\sqrt{75}+\sqrt{147}+\sqrt{243}+\sqrt{363}}{3\sqrt{3}}$

10 If the numbers $2^{55}, 17^{14}, 31^{11}$ are arranged in ascending order, find the unit place digit of the greatest number among these.

11 The market price of a watch is Rs. 800/-. A shopkeeper gives two consecutive discounts and sells the watch at Rs.612/-. If the first discount is 10%, and if the second discount is $x\%$, find x.

12 m, n are positive integers such that $m + n = 2021$. Find the value of the expression $(-1)^m + (-1)^{m+1} + (-1)^{m+2} + (-1)^{m+3} + \cdots + (-1)^{m+10} + (-1)^n + (-1)^{n+1} + (-1)^{n+2} + (-1)^{n+3} + \cdots + (-1)^{n+10}$

13 The prime factorization of the number $1^{100} \times 2^{100} \times 3^{100} \times 4^{100} \times \cdots \times 10^{100}$ is written as $2^a \times 3^b \times 5^c \times 7^d$. Find $a + b + c + d$.

14 A can finish a job in 8 days. B can finish the same job in 10 days. They finish the job together and get paid Rs. 4500 /- for the whole work done. How much pay in rupees will A get?

15 The number $12^{546} \times 63^{546} \times 29^{546}$ is written as $(a \times (a+1) \times (a+2))^{546}$, for a positive integer a. Find a.

16 There are 30 students in a hostel. 10 new students joined so the total expense of a month increased by Rs. 600/-. But the average per head reduced by Rs. 10/-. What is the initial monthly expenditure of the hostel?

17 In $\triangle ABC, m\angle ABC = 90°$.
$AB = x + \frac{1}{x} = 3, BC = x^2 + \frac{1}{x^2}$. Find AC^2.
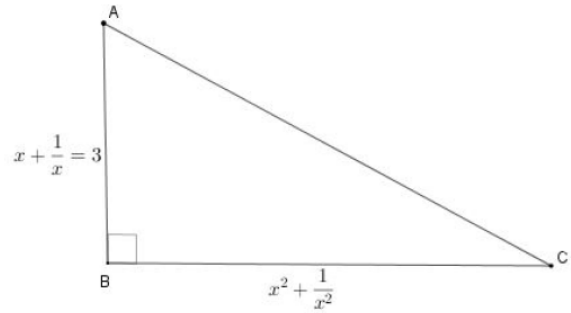
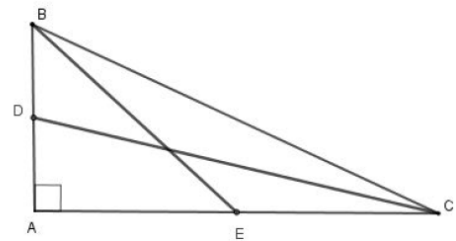18 The ratio of milk and water in 55 litre of mixture of milk and water is $7 : 4$. How many litres of water should be added to the mixture to make the ratio 7:6?.

19 In $\triangle ABC, m\angle BAC = 90°$. D is the midpoint of $\overline{AB}$ and E is the midpoint of $\overline{AC}$. If $CD = 7$, and $BE = 4$, then find BC^2.

20 $1 \times 1 \times 1$ cubes are glued so that a $4 \times 5 \times 6$ cuboid is formed as shown in figure. Then all the faces of the cuboid are painted and again all the cubes are separated. If m is the number of $1 \times 1 \times 1$ cubes with exactly one face painted and n is the number of $1 \times 1 \times 1$ cubes with exactly 2 faces are painted, find value of $m + n$.
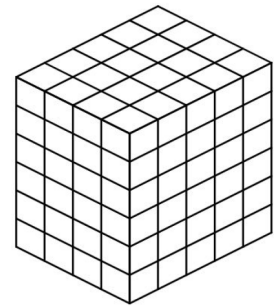
Answers:

1	2	3	4	5	6	7	8	9	10
35	48	405	5	4	1750	2	2	12	9
11	12	13	14	15	16	17	18	19	20
15	0	1500	2500	27	3000	58	10	52	88

1. Virat is in the class of 16 students. In one maths exam Virat got 45 marks and the class average was 60 . After receiving answer paper Virat realised that his total was wrong. He pointed it out to teacher and he got M extra marks. Now his total marks are equal to new average of the class. Find M.

2. $\overline{XY}$ is line segment. M is point on $\overline{XY}$. A and B are as shown. $m\angle AYX = m\angle BXY = 90°$ $AX = 11, AM = 7, BY = 10, BM = 8$. Find value of $(XM)^2 - (YM)^2$.
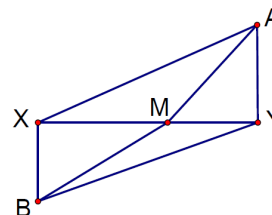
3. Consider N sided regular polygons whose interior angles measured in degrees are natural numbers. What is maximum possible value of N. Report sum of digits of N.

4. The 20 digit number N is divisible by 11. Find missing digit X. $N = 60028022015X28022015$

5. It is known that in the sequence "$A, X, B, C, D, Y, 11$" the sum of any three consecutive terms is 19 . Find the value of $A + B + C + D$

6. How many 3 digited perfect square numbers has 9 in their unit place.

7. Let $A_1, A_2, \cdots A_8$ be the 8 vertices in cyclic order of a regular octogon. (polygon with 8 sides). Find $m\angle A_1 A_3 A_7$ in degrees.

8. A wooden $5 \times 5 \times 5$ cube is painted. Then it in cut into 25 small cubes of size $1 \times 1 \times 1$. How many of the small cubes will have at least one side painted?

9. Find the perimeter of the figure.

10. Side of cube is $3\sqrt{6\pi}$. What is radius of circle having area equal to surface area of cube.

11. $\triangle ABC$ is equilateral. Point P is in the interior of $\triangle ABC$. $\overline{PD}, \overline{PE}, \overline{PF}$ are perpendiculars from P on $\overline{BC}, \overline{CA}, \overline{AB}$ with D, E, F on corresponding sides. If $PD = 7, PF = 10$ and $PE = 8$, find distance of A from $\overline{BC}$.
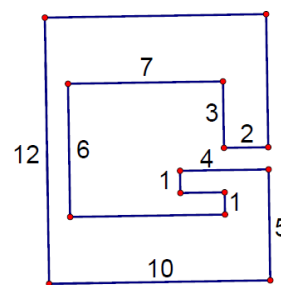
Figure for Q9

12. $A_1 A_2 \cdots A_{15}$ is 15 sided regular polygon. $A_1 A_2 BCDE$ is regular hexagon. Both are external to each other. Find measure of $\angle A_3 A_2 B$.

13. Consider first 13 natural numbers $\{1, 2, \cdots 13\}$. One of the 13 numbers is removed. Average of remaining numbers is $\frac{27}{4}$. Which number is removed?

14. Distance of midpoint of ladder from ground is twice that from the wall. The height on the wall the ladder reaches is $8\sqrt{5}$ meters. Find the length of ladder in meters.

15. $\square ABCD$ is square. $\triangle PDC$ is equilateral triangle as shown in the figure. If $AB = 10$ find area of $\triangle APD$.
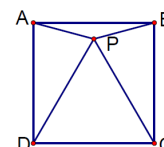
16. P is a point in the rectangle $\square ABCD$ such that $PA = 18, PB = 4, PC = 12$. Find PD.
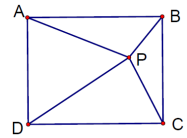
17. Two sides of an isosceles triangles have lengths 3 and 8 . What is the sum of all possible perimeters of triangle.

18. There are 4 children of different integer ages under 14. The product of their ages $= 450$. What is the sum of their ages.

19. How many of the first 2020 positive integer (natural numbers) are perfect squares?

20. If 45 is sum of n consecutive positive integers what is the largest possible value of n

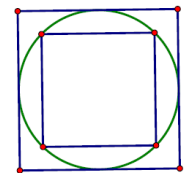21. Let x, y, z be positive integers such that $x + \frac{1}{y + \frac{1}{z}} = \frac{26}{21}$. Find value of xyz.

22 . If $a = \sqrt{2} + 1$ what is the value of $\left(1 + \frac{1}{2 + \frac{1}{a}}\right)^2$

23. Area of outer square is 64 . Find area of inner square.

24. Sum of 5 consecutive integers is 95 . What is the largest integer?

25. Radius of circle B is 125% of radius of circle A. Then area of circle A is $X\%$ of area of circle B. Find X.

Figure for Q23

26. Ten perecent of the students taking a math exam fail the exam. Forty percent of the students taking the exam are boys and fifteen percent of these boys fail the exam. Twenty girls fail the exam. Find how many boys fail the exam.

27. How many rectangles are there in the figure?

28. A takes 2 hours to wash 500 dishes and B takes 3 hours to wash 450 dishes. How long will they take working together to wash 600 dishes. (in minutes)
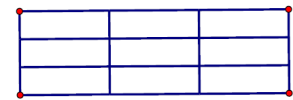
Figure for Q27

29. Number of bacteria in a bottle doubles every minute. It was found that after 15 minutes one fourth of the bottle was full. How long will it take in minutes such that the complete bottle is full of bacteria.

30. Land is divided among the three sons Amar, Akabar and Anthony. Amar gets $\frac{2}{5}$ th of the total land. Akabar gets $\frac{1}{4}$ th of the total and Anthony gets 14 acres land. How many acres does Amar get?

Answers

1	2	3	4	5	6	7	8	9	10
16	36	9	6	30	4	45	98	76	18
11	12	13	14	15	16	17	18	19	20
25	84	81	20	25	14	19	25	44	9
21	22	23	24	25	26	27	28	29	30
20	2	32	21	64	30	36	90	17	16

1. Find x, if $x - 6\sqrt{x+1} + 10 = 0$.

2. 10% of N is $\frac{2}{5}$ of 33 . Then $\frac{3}{4}$ of N equals .

3. 32490 can be factorised into $a \times b$ where a, b are natural numbers and $a > b$. What is minimum difference between a and b.

4. If $a - b = 9$ and $a^2 + b^2 = 881$, where a and b are natural numbers. Find $a + b$.

5. Given $\frac{9^3 + 5^3}{9^2 + 5^2 - x} = 14$. Find x.

6. L is LCM of 336,252 and 322. G is GCD or HCF of 336,252 and 322 . Find the value of $\frac{L}{23G}$.

7. Raju's profit in first month is Rs.1600. His profit increases by Rs. 50 per month. That is in second month his profit is Rs.1650. In third month it is Rs. 1700 and so on. If his profit in 25th month is Rs. K then $\frac{K}{1000}$ equals .

8. Given $\sqrt[3]{7^{x+5}} = 7^5$. Find x.

9. Given $\frac{2\frac{2}{3} - 1\frac{1}{8}}{3\frac{1}{2} + 1\frac{3}{4}} = K$ then $(126K)$ equals .

10. Find a natural number such that if 69 is added to $\frac{1}{8}^{th}$ of $\frac{1}{3}$ of the number we get same natural number

11. If $\frac{a}{b} = \frac{4}{5}$ and $\frac{b}{c} = \frac{15}{16}$ then $\frac{c^2 + a^2}{c^2 - a^2} = K$. Find smallest integer value of $7K$.

12. Vishal completes the job in 25 days. Sachin can do the same job in 10 days. If Sachin works for 6 days then how many days Vishal will take to complete remaining job .

13. Average of Hardik in 30 cricket matches is 50 . His average in first 18 matches is 30 . What is his average in next 12 matches.

14. Average of first seven numbers in row is 45 . Average of first four is 42 . Average of last 4 is 46 . What is 4th number?

15. How many seconds will require for a train of length 385 meter running at 63Km/Hr to cross an electric pole .

16. What is the angle between minute hand and hour hand when the clock shows time 4 hrs 10 minutes.

17. Measures of interior angles of triangle are $2x + 45, x + 10$ and $2x + 20$. Find measure of smallest angle.
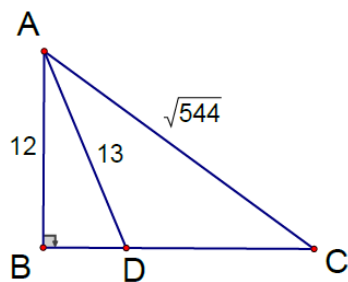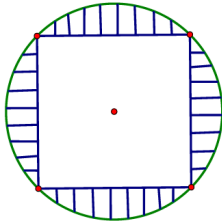

18. In right angled $\triangle ABC$ as shown in figure $AB = 12, AD = 13$ and $AC = \sqrt{544}$. Find DC.
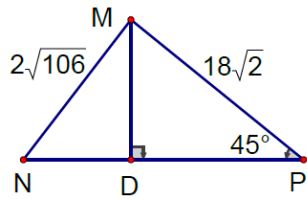
19. In $\triangle MNP, m\angle MPN = 45°.\overline{MD}$ is perpendicular to $\overline{NP}$ as shown. If $MP = 18\sqrt{2}$ and $MN = 2\sqrt{106}$. Find NP.

20. Find the ratio of volume of a cube having side 12 units to surface area of the cube.

21. Square is inscribed in a circle as shown in figure. Area of shaded region is $144\pi - 288$. Find the radius of circle.

22. $\square ABCD$ is trapezium. Distance between two parallel sides AB and CD is h.
$DC = 2AB = 2h$. Area of $ABCD = 384$. Find h.
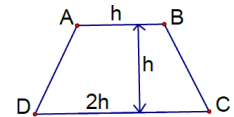
23. 6 kg of brass is made using 98.8% copper and remaining zinc. How many grams of zinc is required?

24. 10% of 20% of 30% of 40% of 50% of 10000 is .

Answers

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12
Ans.	8	99	19	41	45	72	2.8	10	37	72	25	10
Q.No.	13	14	15	16	17	18	19	20	21	22	23	24
Ans.	80	37	22	65	31	15	28	2	12	16	72	12

1. Given $a^7 = y^2z^2w^2x$, $b^7 = z^2w^2x^2y$, $c^7 = w^2x^2y^2z$, $d^7 = x^2y^2z^2w$. If $x = \frac{b^{n_1}c^{n_2}d^{n_3}}{a^{n_4}}$ then $n_1 + n_2 + n_3 + n_4 =$

2. In a river from point A to B, a boat takes 4 hours to travel. Same boat takes 6 hours to come back from B to A, assuming speed of boat is constant. If a wooden block is put in the same river at A, how much time in hrs. it will take to reach B.

3. Cost of 21 bananas and 21 oranges put together is equal to 28 apples. Instead of buying 21 bananas and 21 oranges, in the same cost if Sachin wants to buy equal number of all three fruits, find how many apples can Sachin buy?

4. A box is filled with black and white balls. After $1/5^{\text{th}}$ of total black balls are removed ratio of number of black balls to that of white balls in the box is 2 : 3. Then 44 white balls are removed from the box. Now the ratio of number of black balls to that of white balls now in the box is 5 : 2. Find how many balls are now remaining in the box.

5. Find sum of all natural number n such that $n^2 + 19n + 65$ is perfect square.

6. In a rectangular garden with length 72 meters and width 30 meters, a road of fixed width is constructed as shown in the figure. Area of remaining portion of the garden is half that of original rectangular garden. Find width of the road in meters.
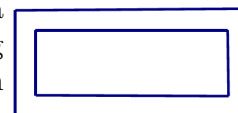
7. A man has to reach his office at 9 : 30am. If he walks 3 km/hr, he is 10 minutes late and if he walks 4 km/hr, he is 15 minutes early. What is the distance (in km) between his house and office?

8. What is the angle between the hour hand and the minute hand of a clock at 1:10?

9. Eight men can do a work in 12 days. After 6 days of work, 4 more men are engaged to finish the work. In how many days would remaining work be completed?

10. Let $a = \frac{1}{\sqrt{1}} + \frac{1}{\sqrt{3}} + \frac{1}{\sqrt{5}} + \cdots$ and $b = \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{4}} + \frac{1}{\sqrt{6}} + \cdots$, then $\left(\frac{a}{b} + 1\right)^2$ equals

11. Three numbers a, b, c are such that $ab = 174375$ and $ac = 173600$. b is greater than c by 1 . Find the sum of digits of a.

12. The diameter of all the circles is 6 cm. The circles are touching each other as shown in the figure. Find the area of shaded region.
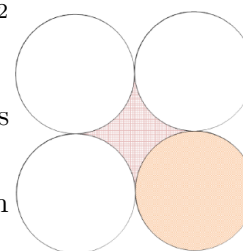
13. A cube of side 4 cm is painted on all of its surfaces as shown in the figure and then it is cut into smaller cubes each of side 1 cm. Let x denote the number of cubes having only two surfaces painted and y denote the number of cubes having three surfaces painted. Find $(x - y)$.
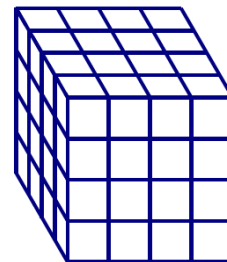
14. If each interior angle of a regular polygon is 10 times its exterior angle then find the number of sides of the polygon.

15. The number of students in three classrooms is 138 . The ratio of number of students in 1st room and 2 nd room is 3 : 4 and that of 2 nd room and 3 rd room is 7 : 5. Find the number of students in the first room.

16. Let $k = 1 + 11 + 111 + \cdots\cdots$ upto 50 terms. Find thousandth place digit in k.

17. How many times we should subtract GCD of 119 ans 153 from LCM of 119 and 153 so that we get number equal to sum of 119 and 153 .

18. $\overline{AB}$ is parallel to $\overline{FG}$. Angles are as shown in figure. Find x and report answer as $x/2$.
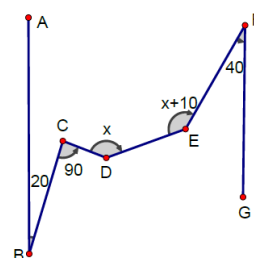
19. Two squares of side 18 each are placed in such a way that A coincides with the center of square $PQRS$ and side AB trisects side RS ($RK/KS = 1/2$). Find overlapping area of two squares.
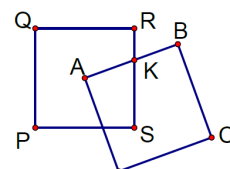
20. In $\triangle ABC$, $\angle B = 90°, \angle C = 60°, \angle A = 30°$. $\overline{BD} \perp \overline{AC}$, $\overline{BE}$ is angle bisector of $\angle ABD$ where D and E are on $\overline{AC}$. If $AE = 13$, find BC.

21. Tap A can fill a tank in 4 hours while tap B can empty it in 6 hours. If both taps are opened together at the same time when the tank is empty, then find the number of hours required to fill the tank completely.

22. Two circles with radii $\frac{7}{\sqrt{\pi}}$ and $\frac{4}{\sqrt{\pi}}$ intersect each other. Find difference in areas of non intersecting parts of these circles.

23. Three natural numbers x, y, z leave remainders $18, 21, 20$ respectively. When divided by 23 . Find the remainder when $(x + y + z)$ is divided by 23

24. 100 rupee change is to be tendered in the denominations of Rs.20, Rs. 10 and Rs. 5 notes. The only condition is that, the tendered change must have at least one note from each denomination. How many combination are possible? For example: One possible combination is 4 Rs.20, 1 Rs. 10 and 2 Rs. 5 note.

Answers

| Q.No.	1	2	3	4	5	6	7	8	9	10	11	12
Ans.	11	24	12	56	16	6	5	25	4	2	19	36
Q.No.	13	14	15	16	17	18	19	20	21	22	23	24
Ans.	16	22	42	2	47	70	81	13	12	33	13	16

1. The ratio between the length and the perimeter of a rectangular plot is $1 : 3$. The ratio between the length and the breadth of the plot is $k : 1$. Find k.

2. If $mn = 1, a + b = 0$ and $m + a = 32$, then find the value of $\left[\dfrac{\left(m + \frac{1}{n}\right)^2 - \frac{2m}{n}}{m + \frac{1}{n}}\right] + \left[\dfrac{a^2 + b^2}{a - b}\right]$.

3. Find the value of $\dfrac{\sqrt[3]{81} + \sqrt[3]{-192} + \sqrt[3]{375}}{\sqrt[3]{24}}$.

4. The circumference of front wheel of a wagon is 2π meters and the circumference of back wheels are 3π meters. To cover x meters distance, front wheels have made 7 more revolutions than the back wheels. Find value of $x - 100$.

5. In the given figure, bisectors of $\angle B$ and $\angle D$ of quadrilateral $ABCD$ meet ray CD and ray AB at P and Q respectively. If $\angle A + \angle C = 170°$, Find $\angle BPC + \angle AQD$.
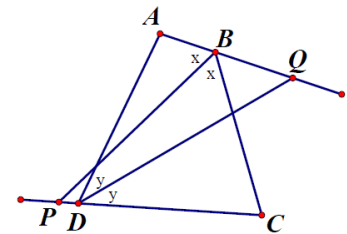
6. Water is pouring into a cubical reservoir at the rate of 60 liters per minute. If the volume of reservoir is 108 m^3, find the number of hours it will take to fill the reservoir.

7. There are two types of workers in a workshop, skilled and unskilled. The average salary of all workers in a workshop is Rs. $10, 600$. The average salary of 8 skilled workers is Rs. $15,000$ and the average salary of all remaining unskilled workers is Rs. $9,000$. Find the total number of workers in the workshop.

8. Sides of regular hexagen are as shown. Find value of r.
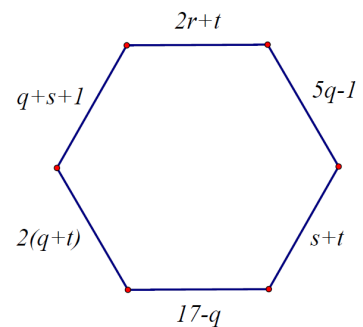
9. The value of a TV set depreciates every year by 25%. Present value of a TV set is Rs. $45,000$. If it's value after one year is $(1250 \times n)$ Find n.

10. If $\dfrac{3^{3.5} \times 21^2 \times 42^{2.5} \times 7^{3.5}}{2^{2.5}} = 21^x$. Find the value of x.

11. Length, breadth and height of the rectangular box are denotes as L, B, H respectively $L : B : H = 2 : 3 : 4$, Difference between the cost of covering it with sheet of paper at the rates Rs. 8 per m^2 and Rs. 9.50 per m^2 is Rs. $1,248$. Find the height of the box.

12. If $\frac{2}{3}(4x - 1) - \left\{4x - (\frac{1-3x}{2})\right\} = \frac{x-7}{2}$ then find x.

13. Rohit secured 42% of the total marks and secured 10 marks more than the passing marks. In the same exam, Mohit scored 29% of the total marks and failed by 16 marks. What was the passing percentage?

14. $n = 123112233111222333\cdots\overbrace{111\cdots1}^{10 \text{ times}}\overbrace{22\cdots2}^{10 \text{ times}}\overbrace{33\cdots\cdots3}^{10\text{times}}$. Let K denotes the number of digit of n. Find $\frac{K}{5}$.

15. Evaluate: $\dfrac{1 + \sqrt{2} + \sqrt{4} + \sqrt{8}}{1 + \sqrt{2}} + \dfrac{1 + \sqrt{3} + \sqrt{9} + \sqrt{27}}{1 + \sqrt{3}}$.

16. In $\triangle ABC, \angle C = 90°$. $AC : BC = 1 : 4$. Point E is on BC such that $BE : CE = 2 : 3$. If $AB = 35\sqrt{17}$, find AE.
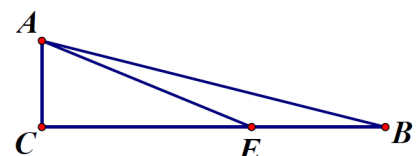
17. If the principle is increased by Rs. $10,000$ then simple interest increases by Rs. $2,100$ in the period of 3 years. Find the rate of interest per cent per annum.

18. A alone completes a piece of work in 4 days and B alone completes it in 6 days. If A and B work on alternate days and B starts on first day, how many days are required to complete the work?

19. LCM of the LCM and GCD of 2 non-coprime numbers a and b is 96. What is the LCM of a and b?

20. A CFL bulb costs 100 and lasts for 2.5 years while a regular bulb costs 15 and lasts for 5 months. By what percentage should the price of CFL bulb be reduced to break even with the regular bulb.

21. Each square of the grid is filled with one of the number $1, 2, 3, 4$ such that each row, column and both diagonals contain all 4 numbers. Mark the largest number formed by the digits in the first two squares (marked portion).

22. When $3x^2 - ax + 8$ is divided by $(x - 2)$ and $5x^2 + ax - 17$ is divided by $(x + 3)$, the remainders are the same. Find a.

23. Fig 1 shows 6 equilateral triangle are arranged to form a regular hexagon of side a. In Fig 2, a regular hexagon of side $2a$ is formed with 24 equilateral triangles. If a regular hexagon of length $5a$ is formed by n equilateral triangles, find $\frac{n}{6}$.
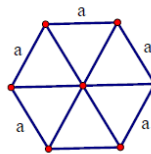
Fig 1
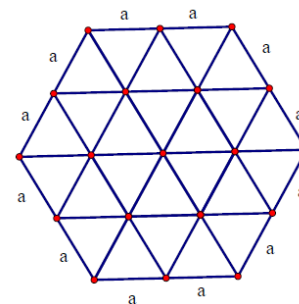
Fig 2

24. Find the value of $\dfrac{\sqrt{28.8} + \sqrt{72} + \sqrt{43.2}}{\sqrt{0.2} + \sqrt{0.3} + \sqrt{0.5}}$.

Answers

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12
Ans.	2	32	2	32	95	30	30	5	27	8	16	1
Q.No.	13	14	15	16	17	18	19	20	21	22	23	24
Ans.	37	33	7	91	7	5	96	10	43	8	25	12

Q 1. If $n = (2 \times 10^{100}) + 3$, then find the sum of the digits of n^2.

Q 2. n is a natural number divisible by 75. If n^2 is written in decimal notation as $5k05h25$, then find the value of $k^2 + 4h$.

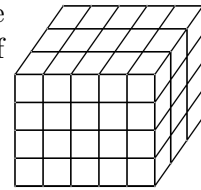**Q 3.** $ABCD$ is a parallelogram and P is a point in its interior. If the areas of $\triangle APB, \triangle BPC$ and $\triangle CPD$ are 18, 25 and 39 respectively, then find the area of $\triangle DPA$.
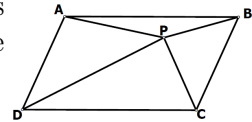
Q 4. Consider a wooden cuboid of size $3 \times 4 \times 5$. If a cubical block of size $1 \times 1 \times 1$ is cut away from each of its corners, find the total surface area of the resulting object. .

Q 5. Eleven batsmen score runs as follows:

i. The first five players together score 4 times the total score of the remaining players;

ii. The first six players together score 5 times the total score of the remaining players; and

iii. The average score of all eleven players is 30.

Find the score of the sixth batsman.

Q 6. From 3:00 AM to 3:00 PM, determine the number of times that the hour hand and minute hand are symmetrically placed with respect to line corresponding to six o'clock position.

Q 7. As shown in the figure, a strip with a constant width of 1 meter is paved along the boundary inside a rectangular ground, whose length and breadth are in the ratio 3 : 2. If the area of the paved region is 46 square meters, then find the outer perimeter of the ground in meters.
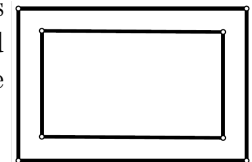
Q 8. As shown in the figure, $B_1, B_2, \cdots, B_{11}$ are eleven equidistant points lying on a straight line, in that order. Point A is chosen so that AB_1B_{11} is an equilateral triangle. A is joined to each of B_1 to B_{11}. Find the total number of acute-angled triangles in the given figure.
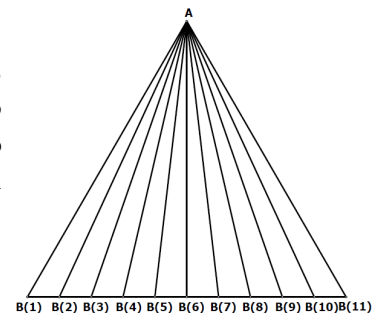
Q 9. A square array of numbers is said to be a magic square, if the sum of the numbers in each of its row, column and main diagonals is equal. In the following 4×4 magic square, find $(a + b + c + d)$ if the sum of the remaining 12 entries is 150.

a			
	b		
		c	
			d

Q 10. Find two digit natural number n such that the greatest common divisor of 2520 and $n + 100$ is 21.

Q 11. Hardik takes 50 minutes to reach his school from his home, when he walks at a constant speed. If he wants to reach his school in 40 minutes, then by what percent should he increase his walking speed?

Q 12. $\triangle ABC$ is an equilateral triangle. D is a point on line BC such that C is the midpoint of BD. Let M be the midpoint of AD. If $AB = 4$, then find BM^2.
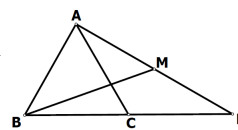
Q 13. Given a rhombus whose area is 240, and one of the diagonals is 16; find the perimeter of the rhombus.

Q 14. Let $a * b$ denote the length of the hypotenuse of a right-angled triangle whose remaining two sides have lengths a, b. If $(12 * 16) * k = 25$, then find the value of k.

Q 15. n is a natural number such that the least common multiple of n and 72 is 360. Find the average of all possible values of n between 52 and 98, which satisfy the above condition.

Q 16. Find the value of $\left[\frac{4}{\sqrt{7}-\sqrt{3}} + \frac{2}{\sqrt{5}+\sqrt{3}}\right]^2 - \sqrt{140}$.

Q 17. $ABCD$ is a cyclic quadrilateral. Lines AD and BC meet at point E. If $m\angle BAD = 75°$ and $\angle ADC = 100°$, then find $m\angle AEB$.
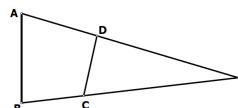
Q 18. n is a two-digit number whose ten's digit is a, and unit's digit is b. When we interchange the digits, the value of the number increases by 20%. Find the value of n.

Q 19. An ant is at point A of a segment AB, having length 12. The ant moves as follows: First it moves 3 units towards B, then moves 2 units towards A; again moves 3 units towards B, then moves 2 units towards A, and so on. Find the total distance traveled by the ant, when it reaches point B for the first time.

Q 20. In a party, each boy dances with exactly three girls, and each girl dances with exactly four boys. If a total of 35 students are present at the party, how many boys are there?

Q 21. If m, n are distinct natural numbers, then find the value of $\frac{1}{1+2025^{m-n}} + \frac{1}{1+2025^{n-m}} + \sqrt{2025}$.

Q 22. A bag contains several 50-paise, 1-rupee and 2-rupee coins, in the ratio 8:6:7 respectively. If the value of the contribution of 2-rupee coins is more by 12 rupees than the contribution of all the remaining coins, then find the total number of coins.

Q 23. In an examination, the ratio of the number of students who passed to the number of students who failed is 4:1. If 20 more students had appeared, and 2 more had passed, then the ratio would have been 2:1. Find the number of students who appeared in the exam originally.

Q 24. Person A can do a piece of work in 26 days. Person B is 30% more efficient than A. In how many days can B complete the same work?

Q 25. As shown in the diagram, two concentric circles have a common center M. P is a point on the smaller circle. A line is constructed perpendicular to MP at P, which meets the bigger circle in points A, B. Given $AB = 12$, and if the area of the region/ring between the two circles is $k\pi$, then find the value of k.
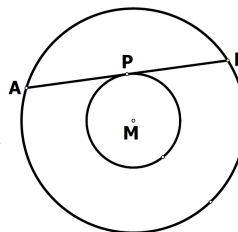
Answers

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	
Ans.	16	40	32	94	11	13	50	25	50	47	25	28	
Q.No.	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	68	15	75	12	25	45	48	20	46	63	85	20	36

Q1. Virat runs twice as fast as he walks. He travels from his house to school by walking some distance and by running some distance. On Monday his walking time is twice his running time and reaches the school in 30 minutes. On Tuesday his running time is twice his walking time. Find the time in minutes he takes to reach the school on Tuesday.

Q2. The fraction $\frac{35}{16}$ can be written in the form $\frac{35}{16} = 2 + \cfrac{1}{x + \cfrac{1}{y}}$ where x, y are natural numbers.

Find $(x + y)^2$.

Q3. Let $n = 100^{25} - 25$. Let S denote the sum of the digits of n. Find the smallest natural number k such that $S + k$ is a perfect square.

Q4. If $1.236 \times 10^{15} - 5.23 \times 10^{14} = a.bc \times 10^k$ where a, b, c are digits from 1 to 9 and k is a natural number. Find $(a + b + c + k)$.

Q5. Two adults have their birthday on the same day. On a particular birthday the product of their ages is 770. Find the sum of their ages on that birthday.

Q6. Mohit bought a number of balls. He was required to pay 5% tax on his purchase. If he did not have to pay the tax he could have bought 3 more balls in the total amount he had spent. How many balls did Mohit buy?

Q7. Two candles of length one feet each start burning at the same time. One of the candles will burn down in 40 hours and the other in 24 hours. If after H hours one of the candle has length 3 times the length of the other candle, find H.

Q8. 125 small cubes of size $1 \times 1 \times 1$ are put together to form a cube of size $5 \times 5 \times 5$. Two cubes of size $1 \times 1 \times 1$ are said to be neighbours if they are placed such that their one face of size 1×1 touches each other. Find the number of $1 \times 1 \times 1$ cubes having exactly four neighbours. (Note that a cube has 8 vertices, 12 edges and 6 faces.)

Q9. In $\triangle ABC$, three points P_1, P_2, P_3 are placed on segment BC and each joined to vertex A. The resulting figure contains all together 10 triangles. Find the total number of triangles present in the figure if 12 points $P_1, P_2, \cdots, P_{11}, P_{12}$ are placed on segment BC and each is joined to vertex A.
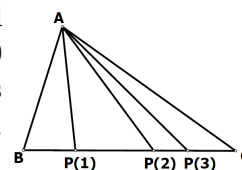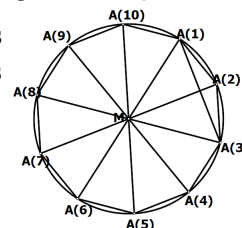
Q10. As shown in the figure $\square ABCD$ is a square and $\triangle EBC$ is an equilateral triangle. Find the measure of $\angle DAE$.
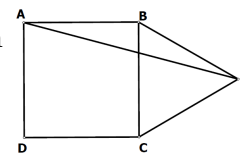
Q11. A polygon $A_1 A_2 A_3 .... A_{10}$ of 10 sides is inscribed in a circle, that is all the vertices lie on the circumference of the same circle. All the 10 sides are of equal length. Let M be the center of the circle.
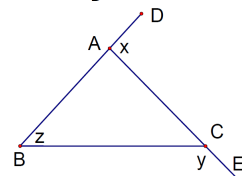
Find the measure of $\angle A_3 A_1 A_2$.

Q12. In $\triangle ABC$ D is on segment BC such that $BD = x$ and $DC = 2x$. M is the midpoint of segment AC. If area of $\triangle ABD$ is 26 units find the area of $\triangle BMA$.

Q13. In $\triangle ABC$, D is the foot of the altitude from A on segment BC. If $AD = 24$, $AC = 30$ and $BC = 28$. Find AB.
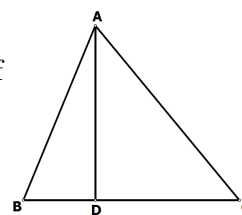
Q14. As shown in the figure $m\angle DAC = x°, m\angle BCE = y°$ and $m\angle ABC = z°$. Find $\frac{1}{12}(x + y - z)$.

Q15. I have a 14 digit interesting number. The sum of its any three consective digits is same. If its first digit is 4, its 5th digit is 7 and the sum of its all digits is 79 then find the sum of its last 4 digits.

Q16. Let $n = (7584)^2 + 4(7584)(1208) + 4(1208)^2$. Find the smallest value of the natural number m such that the product of m and n is a perfect cube.

Q17. Let m be the largest divisor of 72^3 other than itself. Let n be the largest divisor of 75^4 other than itself. If L.C.M. of m and $n = p^a q^b r^c$ where p, q, r are distinct prime numbers then find the value of $a + b + c$.
(Note that the largest divisor of 10^3 other than 10^3 is 500).

**Q18.** We define a new operation $*$ as given below.
$a * b = a^2 + b$. For example, $8 * 5 = 8^2 + 5 = 69$.
If n is a natural number and p is a prime number then find the smallest value of p satisfying $8 * p = n * 6$.

Q19. Find the value of $(2\sqrt{20} + 4\sqrt{8})(6\sqrt{2} - \sqrt{45})$.

Q20. If $a^2 - b^2 = 132$ and $a + b = 22$ then find the value of $a + b^2$.

Q21. As shown in the following figure equilateral triangle of size 1 is formed using 3 match sticks. To form an equilateral triangle of size 3 with all the equilateral triangle of size 1 inside it we require 18 match sticks. Find the total number of match sticks required to construct a size 6 equilateral triangle with all the equilteral triangle of size 1 inside it.
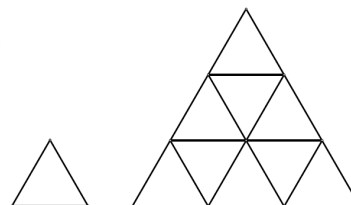
Q22. Consider the 8-digit number $3681m42n$ where m and n are digits from 0 to 9. Find the value of $m^2 + n$ if given 8-digit number is divisible by 72.

Q23. Find the value of $100(1 - \frac{1}{8})(1 - \frac{1}{9})(1 - \frac{1}{10})........(1 - \frac{1}{20})$.

Q24. Integer k is 4th power of another integer. If 18 is a factor of k then find the smallest value of $\frac{k}{18}$.

Q25. Club G has several members. Average age of members of G increases by one year if either five members each 9 year old leave G or new five members each 17 year old join G. Find the present number of members in G.

Answers:

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	
Ans.	24	64	40	25	57	60	20	36	91	75	18	39	
Q.No.	13	14	15	16	17	18	19	20	21	22	23	24	25
Ans.	26	15	24	10	22	23	36	78	63	68	35	72	20

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