



IVMO 2021 Junior
Time allowed - 1 Hour

1. Which of the following is smallest?

- A 0.405 B 45% C 0.045 D $\frac{9}{20}$ E $\frac{45}{100}$

2. At a very large wedding there are 4261 guests all to be seated at round tables, each with nine seats. If all the tables are full except one, how many guests are on the table without nine?

- A 0 B 1 C 2 D 3 E 4

3. When using Vertically and crosswise to calculate 234×614 , what is the result of the third step before any carry digits have been added?

- A 8 B 13 C 24 D 35 E 36

4. What is the whole number remainder when 247647 is divided by 11?

- A 4 B 5 C 6 D 7 E 8

5. $684.4 \times 5 = 3422$. Which operation gives a quick method for multiplying numbers by 5?

- A Halve the number and multiply by 10 B Double the number and divide by 10
C Halve the number and divide by ten D Double the number and multiply by 10
E None of these

6. What is the digital root of the product of the digital roots in the calculation 35×31 ?

- A 1 B 2 C 3 D 4 E 5

7. When digits of 29847 greater than 5 are replaced with vinculum digits, which of the following is correct?

- A $30\bar{2}5\bar{2}$ B $40\bar{2}6\bar{3}$ C $30\bar{2}5\bar{3}$ D $30\bar{1}5\bar{2}$ E $3\bar{1}\bar{2}5\bar{3}$

8. Find the correct devinculated version of $350\bar{3}1\bar{2}\bar{4}$

- A 3496076 B 3407075 C 3486095 D 3407276 E 3497076

9. What is half of a quarter of an eighth of double sixty-four?

- A 2 B 4 C 8 D 16 E 32

10. What is the Highest Common Factor of 315 and 1050?

- A 3 B 5 C 21 D 35 E 105

11. What is the Lowest Common Multiple of 315 and 1050?

- A 315 B 1050 C 2205 D 3150 E 6915

12. The difference between $\frac{1}{3}$ of a certain number and $\frac{1}{9}$ of the same number is 8. What is that number?

- A 18 B 24 C 27 D 36 E 72

13. Which of the following is exactly divisible by 9?

- A 3636363636361 B 2342342342347 C 9999999993
D 81818181818181 E 45454572728

14. One of the following shows the correct working for 864×997 using Nikhilam multiplication. Which one?

- | | | | | |
|---|--|--|--|--|
| $\begin{array}{r} 864 - 135 \\ \times 997 - 003 \\ \hline 861 / 408 \end{array}$ | $\begin{array}{r} 864 - 136 \\ \times 997 - 003 \\ \hline 861 / 408 \end{array}$ | $\begin{array}{r} 864 - 135 \\ \times 997 - 002 \\ \hline 861 / 408 \end{array}$ | | |
| <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 50%; vertical-align: top;"> $\begin{array}{r} 864 - 146 \\ \times 997 - 003 \\ \hline 861 / 408 \end{array}$ </td> <td style="text-align: center; width: 50%; vertical-align: top;"> $\begin{array}{r} 864 - 246 \\ \times 997 - 003 \\ \hline 861 / 408 \end{array}$ </td> </tr> </table> | | | $\begin{array}{r} 864 - 146 \\ \times 997 - 003 \\ \hline 861 / 408 \end{array}$ | $\begin{array}{r} 864 - 246 \\ \times 997 - 003 \\ \hline 861 / 408 \end{array}$ |
| $\begin{array}{r} 864 - 146 \\ \times 997 - 003 \\ \hline 861 / 408 \end{array}$ | $\begin{array}{r} 864 - 246 \\ \times 997 - 003 \\ \hline 861 / 408 \end{array}$ | | | |

15. A bottling factory produces 19,866 bottles in 42 hours. In using straight division to find how many bottles are produced each hour, what is the second to last step?

- A $(38 - 26) \div 4$ B $(26 - 14) \div 4$ C $(32 - 20) \div 4$ D $(14 - 2) \div 4$ E $(86 - 74) \div 4$

16. Calculate, $4\bar{1} \times 7\bar{2}$

- A 2546 B 2562 C 2652 D 2752 E 2952

17. The product of two prime numbers is 2021, which can be worked out using the rule, *When the final digits add to 10*. What are the two prime numbers?

- A 79×61 B 83×17 C 37×23 D 53×67 E 43×47

18. In calculating 0.00000035^2 , Ramesh wrote the incorrect answer as 0.0000001225. How many zeros should there be *between* the decimal point and the digits 1225?

A 4 B 8 C 10 D 12 E 18

19. When using Nikhilam division to calculate $12032 \div 879$, which of the following has the correct working?

$\begin{array}{r} 879 \overline{) 12/032} \\ 121 \quad \underline{142} \\ 153 \end{array}$ <p>A</p>	$\begin{array}{r} 879 \overline{) 12/032} \\ 121 \quad \underline{121} \\ 363 \end{array}$ <p>B</p>	$\begin{array}{r} 879 \overline{) 12/032} \\ 131 \quad \underline{131} \\ 263 \end{array}$ <p>C</p>		
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; vertical-align: middle;"> $\begin{array}{r} 879 \overline{) 12/032} \\ 121 \quad \underline{121} \\ 121 \end{array}$ <p>D</p> </td> <td style="text-align: center; vertical-align: middle;"> $\begin{array}{r} 879 \overline{) 12/032} \\ 221 \quad \underline{121} \\ 373 \end{array}$ <p>E</p> </td> </tr> </table>			$\begin{array}{r} 879 \overline{) 12/032} \\ 121 \quad \underline{121} \\ 121 \end{array}$ <p>D</p>	$\begin{array}{r} 879 \overline{) 12/032} \\ 221 \quad \underline{121} \\ 373 \end{array}$ <p>E</p>
$\begin{array}{r} 879 \overline{) 12/032} \\ 121 \quad \underline{121} \\ 121 \end{array}$ <p>D</p>	$\begin{array}{r} 879 \overline{) 12/032} \\ 221 \quad \underline{121} \\ 373 \end{array}$ <p>E</p>			

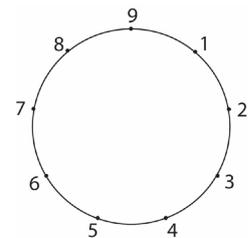
20. Each shape stands for a number. What is the value of the triangle?

$$\begin{aligned} \square + \bigcirc - \triangle &= 8 \\ \bigcirc + \triangle - \square &= 10 \\ \square + \bigcirc + \triangle &= 24 \\ \triangle &= ? \end{aligned}$$

A 8 B 9 C 10 D 11 E 12

21. On the circle of nine points, if lines are drawn joining pairs of numbers that sum to a multiple of 3, how many lines will there be?

A 12 B 11 C 10 D 9 E 8



22. On a digital clock the ten digits are made up using horizontal and vertical bars as shown below.



How many of these digits have a prime number of bars and are also prime numbers?

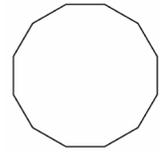
A 1 B 2 C 3 D 4 E 5

23. What is the decimal equivalent of $\frac{101}{125}$?

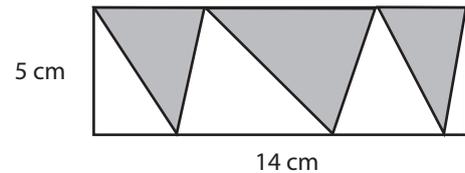
- A 0.8 B 0.88 C 0.088 D 0.808 E 0.888

24. How many lines of symmetry does a regular dodecagon have?

- A 8 B 12 C 16 D 24 E 36



25. What is the total area of the shaded regions in cm^2 ?



- A 28 B 35 C 70 D 42 E Not enough information

26. A conference hall has 51 rows, each with 53 seats. If 2700 people attend the conference, how many spare seats will there be?

- A 3 B 13 C 23 D 33 E 43

27. There are 100 students in a class. Exactly 99% of them have their books. How many students with books must leave the room to bring down the percentage with books to 98%?

- A 1 B 2 C 10 D 49 E 50

28. A waiter's pay consists of tips and a salary. During one month, his tips were $\frac{5}{4}$ of his salary. What fraction of his pay came from tips?

- A $\frac{4}{9}$ B $\frac{5}{9}$ C $\frac{4}{5}$ D $\frac{9}{5}$ E $\frac{9}{4}$

29. Harry the hedgehog was timed walking from one end of the garden to the other. He covered 11 metres in 19.6 seconds. Approximately, how fast is this in km per hour?

- A 0.5 B 1 C 2 D 4 E 8

30. The perimeter of a right-angled triangle is 72 cm. The lengths of the sides are in the ratio 3 : 4 : 5. What is the area of the triangle in cm^2 ?

- A 144 B 216 C 270 D 360 E 1620

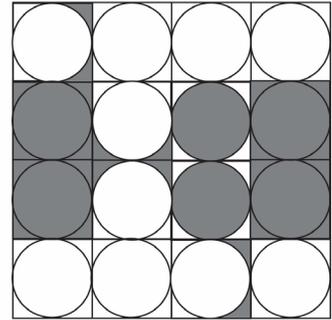
31. What is the value of,

$$\frac{3+6+9+12+15+18+21+24+27}{1+2+3+4+5+6+7+8+9}?$$

- A 3 B 9 C 27 D 81 E 243

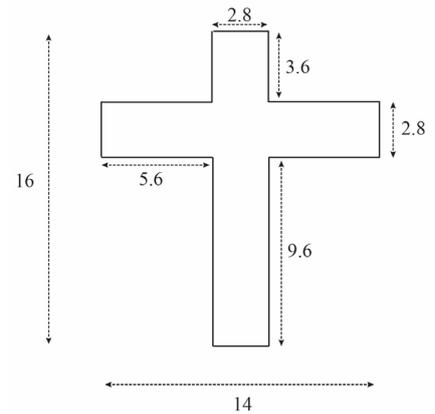
32. What fraction of the square is shaded?

- A $\frac{1}{4}$ B $\frac{3}{8}$ C $\frac{3}{16}$ D $\frac{5}{16}$ E $\frac{7}{16}$



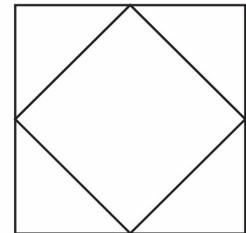
33. The cross in the diagram has one vertical line of symmetry. All measurements are in centimetres. What is the perimeter?

- A 24.4 B 45.2 C 52 D 60 E 76



34. The large square in the figure has edge length 96 cm. The smaller square is formed by joining the midpoints of the sides of the large square. What is the area of the small square in cm^2 ?

- A 4804 B 4406 C 4468 D 4408 E 4608



35. Which fraction is the smallest?

- A $\frac{1}{2000000008}$ B $\frac{2}{4000000015}$ C $\frac{4}{8000000036}$ D $\frac{8}{16000000056}$ E $\frac{2}{4000000017}$

36. What is the sum of the first ten odd numbers?

- A 20 B 50 C 55 D 100 E 144

37. Find the value of x in the equation,

$$\frac{2x+1}{3} - \frac{x-2}{2} = 3$$

- A 7 B 10 C 12 D 13 E 17

38. The first five terms of a sequence are 0 3 8 15 24
What is the 98th term?

A 9409 B 9506 C 9603 D 9605 E 9801

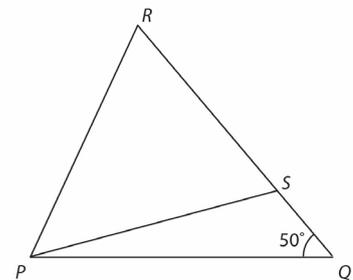
39. A newspaper company reduced its print run by 12% to 38,720 copies per day. What was the print-run before the decrease?

A 40,000 B 42,000 C 44,000 D 46,000 E 48,000

40. If it takes 8 bricklayers 12 days to build a particular wall, how long will it take 6 bricklayers, working at the same rate?

A 14 B 15 C 16 D 18 E 20

41. In the figure, $PQ = QR$ and $PS = PR$. Angle $PQS = 50^\circ$. What is the size of angle QPS ?



A 15° B 20° C 25° D 30° E 35°

42. Which of the following is divisible by all of the integers from 1 to 10, inclusive?

A 23×34 B 34×45 C 45×56 D 56×67 E 67×78

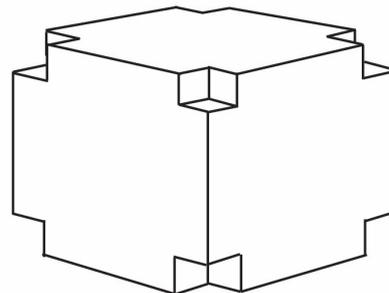
43. In a knock-out tennis competition, each match has a winner and a loser and a winner goes through to the next round. Rounds continue until there are two players left in the final. In the women's singles at Wimbledon there are 128 players at the start. How many matches are there altogether?

A 256 B 129 C 128 D 127 E 64

44. A nine-digit number is randomly composed using the digits from 1 to 9. What is the probability that it is divisible by 18?

A $\frac{1}{3}$ B $\frac{4}{9}$ C $\frac{1}{2}$ D $\frac{3}{4}$ E $\frac{5}{9}$

45. A cube with edge length 6 cm has its 8 corners cut away. Each cut is in the shape of a cube of edge length 1 cm. What is the surface area of the remaining shape in cm^2 ?



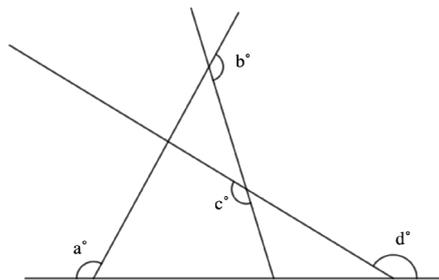
- A 192 B 216 C 228 D 256 E 320

46. How many two-digit numbers can be written as the sum of six different powers of 2, including 2^0 ?

- A 0 B 1 C 2 D 3 E 4

47. Four straight lines intersect as shown. What is the value of $a + b + c + d$?

- A 180°
 B 360°
 C 540°
 D 720°
 E 900°



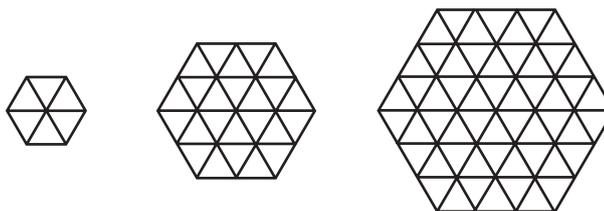
48. The ancient scriptural language of India is Sanskrit. It has 33 consonants and each consonant can have one of 16 sounds following, like vowels, etc. For example, p can have vowels to form *pa* or *pi* or *pu*. A syllable is one of these *or* one of these with a final consonant, for example, *pat*, *pit* or *put*. How many possible syllables are there in Sanskrit?

- A 518 B 8288 C 17424 D 17952 E 18561

49. If $5x - y = 18$ and $5y - x = 12$, what is the value of $x - y$?

- A 0 B 1 C 3 D 6 E 9

50. Following the pattern in the first three figures below, how many small triangles are there in the 5th figure?



- A 75 B 96 C 150 D 192 E 216

Answer Key Junior IVMO 2021

1. C	11. D	21. A	31. A	41. A
2. E	12. D	22. D	32. B	42. C
3. D	13. D	23. D	33. D	43. D
4. A	14. B	24. B	34. E	44. B
5. A	15. B	25. B	35. C	45. B
6. E	16. C	26. A	36. D	46. C
7. C	17. E	27. E	37. B	47. C
8. E	18. D	28. B	38. C	48. D
9. A	19. B	29. C	39. C	49. B
10. E	20. A	30. B	40. C	50. C

Answer Sheet

1.		11.		21.		31.		41.	
2.		12.		22.		32.		42.	
3.		13.		23.		33.		43.	
4.		14.		24.		34.		44.	
5.		15.		25.		35.		45.	
6.		16.		26.		36.		46.	
7.		17.		27.		37.		47.	
8.		18.		28.		38.		48.	
9.		19.		29.		39.		49.	
10.		20.		30.		40.		50.	