



Sample Junior IVMO
Time allowed - 1 hour

1. Add,

$$\begin{array}{r} 28 \\ 47 \\ 13 \\ 72 \\ + 51 \\ \hline \end{array}$$

2. Draw a ring around the number below that is divisible by 9.

511765

763521

420673

485316

453688

3. Subtract

$$\begin{array}{r} 95747 \\ - 65748 \\ \hline \end{array}$$

4.

$$\begin{array}{r} 96 \\ \times 91 \\ \hline \end{array}$$

5.

$$\begin{array}{r} 107 \\ \times 112 \\ \hline \end{array}$$

6.

$$\begin{array}{r} 106 \\ \times 93 \\ \hline \end{array}$$

7. 16.4×5

8. $23.6 \div 5$

9. 65^2

$$\begin{array}{r} 312 \\ \times 308 \\ \hline \end{array}$$

11. Divide

$$9 \overline{) 4261}$$

12. Divide,

$$11 \overline{) 47539}$$

13. What is the Highest Common Factor of 96 and 112?

14. What is the Lowest Common Multiple of 96 and 112?

15. Divide,

$$\begin{array}{r} 879 \overline{) 101003} \\ \hline \end{array}$$

16. 63×1001

17. $\frac{3}{5} + \frac{2}{9}$

18. $5\frac{5}{8} \times 1\frac{7}{9}$

19. Convert $\frac{21}{25}$ to decimal

20. 992^2

21. 273×516

22. 9.8×0.00093

23. How many pieces of wire, each 31 cm long can be cut from a roll of length 100 metres and what will be the remainder?

24. A car park has 85 rows each with 87 spaces. If there are 170 empty spaces, how many cars are in the car park?

25. Solve,
 $7x - 5 = 4x + 10$

26. 16.8% of 25

27. During a period of 18 years the population of Russia decreased by 4% down to 144 million. What was the population before the decline?

28. In a certain town, $\frac{1}{4}$ of the population is Angolese, $\frac{2}{5}$ is Bongalese, $\frac{1}{12}$ is Chongalese and the reminder is Dangalese. What fraction is Dangalese?

29. Write the following fractions in order of size, starting with the smallest:

30. A recipe for 6 people requires 900g of tomatoes. How many grams of tomatos are needed for 4 people?

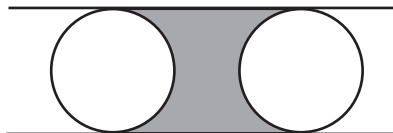
$$\frac{1}{113} \quad \frac{2}{225} \quad \frac{4}{447} \quad \frac{2}{227}$$

31. 50003×52467

32. $471845 \div 23$

33. The result of the calculation, 123456789×8 is almost the same as 987654321 except that two of the digits are in the wrong order. What is the sum of those two digits?

34.



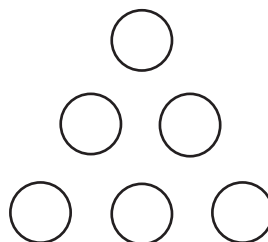
Two circles of radius 1 cm fit exactly between two parallel lines, as shown. The centres of the circles are 3 cm apart. What is the area of the shaded region? (Leave your answer in terms of π)

35. A certain positive integer has exactly eight factors. Two of the factors are 15 and 21. What is the sum of all eight factors?

36. The eight-digit number $ppppqqqq$, where p and q are digits, is a multiple of 45. Find the two possible values of p .

37. Place the numbers 2, 3, 4, 5, 6 and 10 into the six circles so that the products of the numbers along each edge are the same. What is the product?

38.

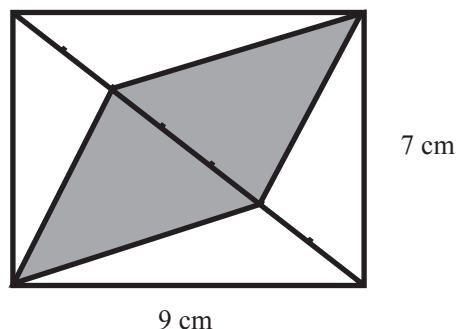


39. Jamie wanted to multiply 238×479 using bar numbers (viculums) for large digits. He set out his calculation as shown on the right.

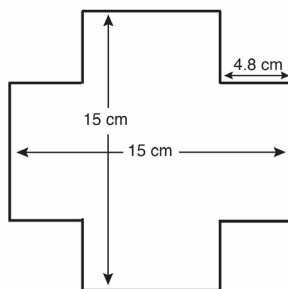
Draw a circle around the place where he made a mistake.

$$\begin{array}{r} 24\bar{2} \\ \times 5\bar{2}\bar{1} \\ \hline 11,8,0\bar{8}2 \\ \hline 117022 \end{array}$$

40. The diagram show a rectangle in which a diagonal is divided into 7 equal parts. What is the area of the shaded region?



41. Work out the perimeter of this cross.



42. Pinocchio's nose is 5 cm long. Each time he tells a lie his nose doubles in length. After he has told nine lies his nose will be roughly as long as one of the following: (Draw a ring round the correct answer.)

A Domino B Tennis racket C Pool table D Tennis court E Football pitch

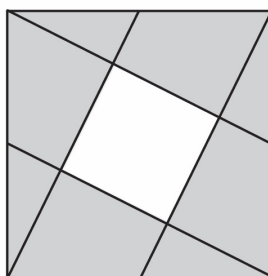
43. The word 'thirty' contains 6 letters and 30 is a multiple of 6. The word 'forty' contains 5 letters and 40 is a multiple of 5. Which of the following is not a multiple of the number of letters it contains? (Draw a ring round the correct answer.)

A Six B Twelve C Eighteen D Seventy E Ninety

44. How many different digits are there when $\frac{17}{11}$ is converted to a decimal? (Draw a ring round the correct answer.)

A 2 B 3 C 4 D 5 E 6

45. What fraction of the square is left unshaded?



46. If it takes 9 men 21 days to build a wall, how long will it take 7 men working at the same rate?

47. The first four terms of a sequence are, 6, 15, 24, 33

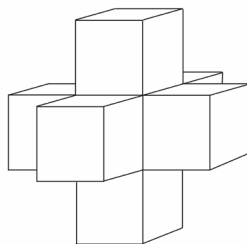
Work out the 999th term of this sequence.

48. Solve,

$$\frac{x+1}{3} - \frac{x+2}{5} = \frac{x+6}{15}$$

49. The solid as shown is made by fixing cubes on each face of a central cube. The solid has a volume of 875 cm^3 .

What is the surface area of the solid?



50. There are 39 boys and 23 girls in a dance group. Every week, 6 boys and 8 girls join the group and no one leaves the group. What is the total number of people in the dance group in the week when the number of boys is equal to the number of girls?



Sample Junior IVMO

Time allowed - 1 hour

1. Add,

$$\begin{array}{r} 28 \\ 47 \\ 13 \\ 72 \\ + 51 \\ \hline 211 \end{array}$$

2. Draw a ring around the number below that is divisible by 9.

511765

763521

420673

485316

453688

By elimination and retention

3. Subtract

$$\begin{array}{r} 95747 \\ - 65748 \\ \hline 29999 \end{array}$$

By inspection

4.

96 - 04

$\times 91 - 09$

87 36

All from 9 and the last from 10

5.

107 + 07

$\times 112 + 12$

119 84

All from 9 and the last from 10

6.

106 + 06

$\times 93 - 07$

99 42

98 58

All from 9 and the last from 10

7. 16.4×5 82

Proportionately

8. $23.6 \div 5$ 4.72

Proportionately

9. 65^2 4225

By one more than the one before

10. 33×37 1221

By one more than the one before
When the final digits add to 10

11. Divide

$$\begin{array}{r} 9 \overline{)13021} \\ 1446 / 8 \end{array}$$

All from 9 and the last from 10

12. Divide,

$$\begin{array}{r} 11 \overline{)47539} \\ 4321 / 8 \end{array}$$

Transpose and apply

13. What is the Highest Common Factor of 96 and 112?

$$\begin{array}{r|rr} 4 & 96 & 112 \\ 4 & 24 & 28 \\ \hline & 6 & 7 \end{array}$$

$$\text{HCF} = 4 \times 4 = 16$$

Vertically and crosswise

15. Divide,

$$\begin{array}{r|rrrr} 879 & 101 & 003 \\ 121 & 12 & 1 \\ & 1 & 21 \\ & & 484 \\ \hline & 114 & 797 \end{array}$$

All from 9 and the last from 10

17. $\frac{3}{5} + \frac{2}{9} = \frac{3 \times 9 + 2 \times 5}{45} = \frac{37}{45}$

Vertically and crosswise

14. What is the Lowest Common Multiple of 96 and 112?

$$\begin{array}{r|rr} 4 & 96 & 112 \\ 4 & 24 & 28 \\ \hline & 6 & 7 \end{array}$$

$$\text{LCM} = 6 \times 112 = 7 \times 96 = 672$$

Vertically and crosswise

16. $63 \times 1001 = 63063$

Specific and general

18. $5\frac{5}{8} \times 1\frac{7}{9} = \frac{45}{8} \times \frac{16}{9} = 10$

First by the first, last by the last, Proportionately

19. Convert $\frac{21}{25}$ to decimal

$$\frac{21}{25} = \frac{84}{100} = 0.84$$

Proportionately

20. $997^2 = 994009$

Whatever the deficiency, lessen it further, and set up the square

21. 273×516

$$\begin{array}{r} 273 \\ \times 516 \\ \hline 1403868 \end{array}$$

Vertically and crosswise

22. 9.8×0.00093

$$\begin{array}{r} 98-02 \\ \times 93-07 \\ \hline 91 \quad 14 \\ \hline 0.009114 \end{array}$$

All from 9 and the last from 10

23. How many pieces of wire, each 31 cm long can be cut from a roll of length 100 metres and what will be the remainder?

$$\begin{array}{r} 3^1 \overline{) 10_1 0_1 0_2 / 0} \\ 3 \ 2 \ 2 / 18 \end{array}$$

Vertically and crosswise

24. A car park has 85 rows each with 87 spaces. If there are 170 empty spaces, how many cars are in the car park?

$$87 \times 85 - 2 \times 85 = 85^2 = 7225$$

By one more than the one before

25. Solve,

$$7x - 5 = 4x + 10$$

$$x = \frac{10+5}{7-4} = 5$$

Transpose and apply

26. 32% of 75

$$= 75\% \text{ of } 32 = 24$$

Transpose and apply

Proportionately

27. During a period of 18 years the population of Russia decreased by 4% down to 144 million. What was the population before the decline?

$$x : 144 = 100 : 96$$

$$x = \frac{14400}{96} = \frac{1200}{8} = 150 \text{ million}$$

Product of the means

equals product of the extremes

Proportionately

28. In a certain town, $\frac{1}{4}$ of the population is Angolese, $\frac{2}{5}$ is Bongalese, $\frac{1}{12}$ is Chongalese and the remainder is Dangalese. What fraction is Dangalese?

$$1 - \frac{15+24+5}{60} = 1 - \frac{44}{60} = \frac{4}{15}$$

Proportionately

29. Write the following fractions in order of size, starting with the smallest:

$$\begin{array}{cccc} \frac{1}{113} & \frac{2}{225} & \frac{4}{447} & \frac{2}{227} \\ \frac{4}{452} & \frac{4}{450} & \frac{4}{447} & \frac{4}{454} \\ \frac{2}{227} & \frac{1}{113} & \frac{2}{225} & \frac{4}{447} \end{array}$$

Proportionately

30. A recipe for 6 people requires 900g of tomatoes. How many grams of tomatoes are needed for 4 people?

$$6 : 900 = 4 : x$$

$$x = \frac{900 \times 4}{6} = \frac{3600}{6} = 600 \text{ g}$$

Product of the means

equals product of the extremes

31.
$$\begin{array}{r} 50003 + 00003 \\ \times \quad 52467 + 02467 \\ \hline 2)52470 / 07_1 4_2 0_2 1 \\ \hline 26235 / 07 \quad 4 \quad 0 \quad 2 \end{array}$$

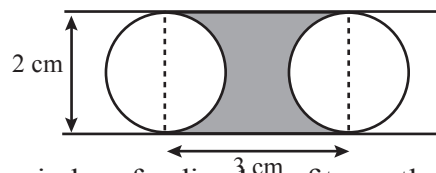
32. $471845 \div 23$
$$\begin{array}{r} 2^3 \overline{) 471845} \\ \underline{205150} \end{array}$$

33. The result of the calculation, 123456789×8 is almost the same as 987654321 except that two of the digits are in the wrong order. What is the sum of those two digits?

3

By the last digits

- 34.



Two circles of radius 1 cm fit exactly between two parallel lines, as shown. The centres of the circles are 3 cm apart. What is the area of the shaded region? (Leave your answer in terms of π)

$6 - \pi$

By completion and non-completion

35. A certain positive integer has exactly eight factors. Two of the factors are 15 and 21. What is the sum of all eight factors?

LCM of 21 and 15 is 105

Factors: 1, 3, 5, 7, 15, 21, 35, 105

Sum = 192

All the multipliers

36. The eight-digit number $ppppqqqq$, where p and q are digits, is a multiple of 45. Find the two possible values of p .

If $q = 0$, digital root of $4p$ is 9, so p is 9

If $q = 5$, digital root of $4p$ is 7, so p is 4

By elimination and retention

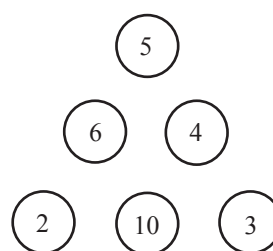
By addition

37. Place the numbers 2, 3, 4, 5, 6 and 10 into the six circles so that the products of the numbers along each edge are the same. What is the product?

60

By elimination and retention

- 38.



39. Jamie wanted to multiply 238×479 using bar numbers (viculums) for large digits. He set out his calculation as shown on the right.

Draw a circle around the place where he made a mistake.

$$\begin{array}{r} 24\bar{2} \\ \times 5\bar{2}\bar{1} \\ \hline 11,8,0\bar{8}2 \\ 117(0)22 \end{array}$$

$$11,8,0\bar{8}2 = 117922$$

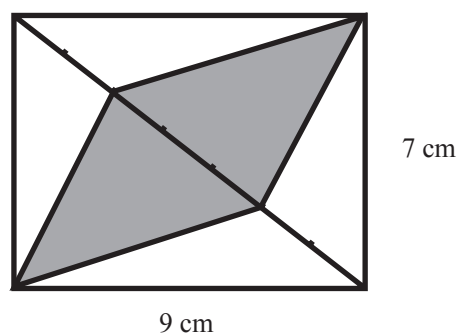
By inspection

Vertically and crosswise

40. The diagram show a rectangle in which a diagonal is divided into 7 equal parts. What is the area of the shaded region?

$$\frac{3}{7} \text{ of } 63 = 27 \text{ cm}^2$$

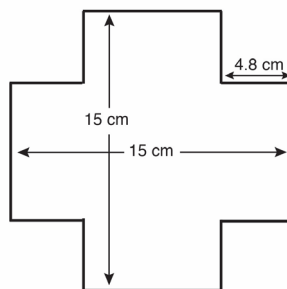
When the total is the same, the difference is nought



41. Work out the perimeter of this cross.

$$4 \times 15 = 60 \text{ cm}$$

By inspection



42. Pinocchio's nose is 5 cm long. Each time he tells a lie his nose doubles in length. After he has told nine lies his nose will be roughly as long as one of the following: (Draw a ring round the correct answer.)

A Domino B Tennis racket C Pool table **D Tennis court** E Football pitch

$$5 \times 2^9 = 5 \times 8^3 = 5 \times 512 = 2560 \text{ cm} = 25.6 \text{ metres}$$

Proportionately

43. The word 'thirty' contains 6 letters and 30 is a multiple of 6. The word 'forty' contains 5 letters and 40 is a multiple of 5. Which of the following is not a multiple of the number of letters it contains? (Draw a ring round the correct answer.)

A Six B Twelve **C Eighteen** D Seventy E Ninety

By inspection

44. How many different digits are there when $\frac{17}{11}$ is converted to a decimal? (Draw a ring round the correct answer.)

A 2 **B 3** C 4 D 5 E 6

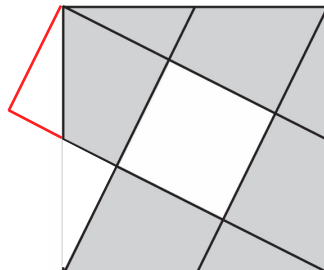
$$\frac{17}{11} = 1\frac{6}{11} = 1.5\dot{4} \quad \text{Transpose and apply}$$

45. What fraction of the square is left unshaded?

$$\frac{1}{5}$$

By inspection

Transpose and apply



46. If it takes 9 men 21 days to build a wall, how long will it take 7 men working at the same rate?

$$9 \times 21 = 7 \times x \quad \text{Proportionately}$$

$$x = 27 \text{ days}$$

47. The first four terms of a sequence are, 6, 15, 24, 33

Work out the 999th term of this sequence.

$$\begin{array}{ccccccc} -3 & \leftarrow & 6 & 15 & 24 & 33 & \\ & & 9 & 9 & 9 & & \end{array} \quad \begin{array}{l} 999 \times 9 - 3 = 111 \times 81 - 3 \\ = 8991 - 3 = 8988 \end{array}$$

$$nth \text{ term} = 9n - 3$$

By one more than the one before Proportionately

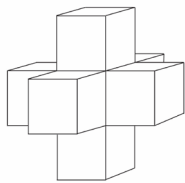
Transpose and apply

48. Solve,

$$\frac{x+1}{3} - \frac{x+2}{5} = \frac{x+6}{15}$$

$$\begin{array}{l} 5x + 5 - 3x - 6 = x + 6 \\ 2x - 1 = x + 6 \\ x = 7 \end{array} \quad \begin{array}{l} \text{Vertically and crosswise} \\ \text{Transpose and apply} \end{array}$$

49. The solid as shown is made by fixing cubes on each face of a central cube. The solid has a volume of 875 cm^3 . What is the surface area of the solid?



$$\begin{array}{ll} \text{Volume of one cube is } 875 \div 7 = 125 \text{ cm}^3 & \text{By inspection} \\ \text{Edge length of each} = \sqrt[3]{125} = 5 \text{ cm} & \text{Transpose and apply} \\ \text{Total surface area} = 5 \times 25 \times 6 = 750 \text{ cm}^2 & \end{array}$$

50. There are 39 boys and 23 girls in a dance group. Every week, 6 boys and 8 girls join the group and no one leaves the group. What is the total number of people in the dance group in the week when the number of boys is equal to the number of girls?

$$\begin{array}{l} 39 - 23 = 16, \quad 8 - 6 = 2, \quad 16 \div 2 = 8 \text{ weeks} \quad \text{Proportionately} \\ 39 + 6 \times 8 = 23 + 8 \times 8 = 87, \text{ Total} = 174 \end{array}$$