International Vedic Maths Olympiad 2023
Intermediate
Time allowed - 1 Hour

Questions 1 - 25: Score 2 marks for each correct answer and 0 marks for each incorrect answer.

1. $2(1 + 2(1 + 2(1 + 2(1 + 2(1 + 2(1 + 2))))))$

A 63 **B** 126 **C** 127 **D** 254 **E** 274

2. 0.0000426×0.005

A 0.00213 **B** 0.000213 **C** 0.0000213 **D** 0.00000213 **E** 0.000000213

3. From the prime numbers less than 20, what is the difference between the squares of the highest and lowest?

A 357 **B** 289 **C** 285 **D** 352 **E** 360

4. 7946×9992

A 72986452 **B** 783816432 **C** 79396432 **D** 74493272 **E** 79466342

5. Which of the following is **not** a multiple of 9?

A 768321 **B** 224433 **C** 891548 **D** 243756 **E** 830106

6. What is 36.4% of $25

A $9.10 **B** $16.92 **C** $18.20 **D** $12.64 **E** $8.30

7. What is the whole number remainder when 242871 is divided by 897?

A 487 **B** 851 **C** 475 **D** 206 **E** 681

8. 2023 has a square factor whose square root ends in 7. What is that square root?

A 7 **B** 17 **C** 27 **D** 37 **E** 47

9. The One Day International World Cup Final took place at Narendra Modi Stadium in Ahmedabad on 19th November 2023. It was a sell-out event. The stadium is the largest in the world and can seat 132000 people. The total takings from sale of tickets was $46 596 000. What was the mean price of each ticket?

A $343 **B** $283 **C** $353 **D** $348 **E** $348

10. 79^3

A 493039 **B** 627429 **C** 534149 **D** 467229 **E** 510239

11. 992^2

A 978464 **B** 987664 **C** 976764 **D** 984064 **E** 988264

12. When placed in order of size, which fraction is in the middle?

A $\frac{9}{11}$ **B** $\frac{12}{13}$ **C** $\frac{18}{23}$ **D** $\frac{36}{43}$ **E** $\frac{72}{89}$

13. A, B and C are three digits. B and C add up to 10.

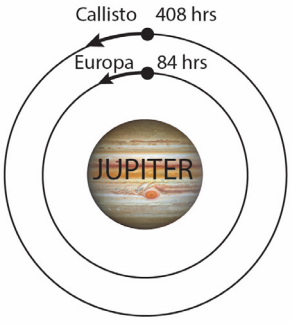
What is the value of A?

$$\begin{array}{r} A\ B \\ \times\ A\ C \\ \hline 4216 \end{array}$$

A 2 **B** 3 **C** 4

D 5 **E** 6

14. Callisto and Europa are two moons of Jupiter with orbital periods of 408 hours and 84 hours. If they start in line, after how many hours will they be in the same position again?



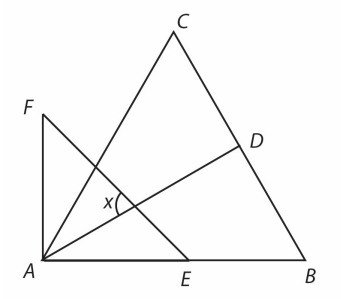
A 2040 hrs **B** 2856 hrs **C** 6582 hrs

D 3108 hrs **E** 8568 hrs

15. What are the vinculum digits in the Nikhilam multiplication of 524 X 492 when using a working base of 500 and a real base of 1000?

A $\overline{144}$ **B** $\overline{192}$ **C** $\overline{326}$ **D** $\overline{808}$ **E** $\overline{162}$

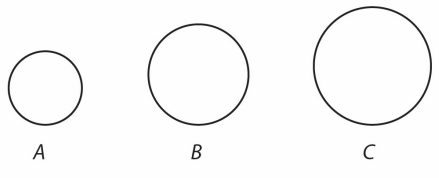
16. Triangle *ABC* is equilateral and *D* is the midpoint of *BC*. Triangle *AEF* is right-angled and isosceles. What is the size of angle *x*?



A 65˚ **B** 70˚ **C** 75˚

D 80˚ **E** 85˚

17. Three spheres, *A*, *B* and *C*, are such that the volume of B is 50% more than *A* and the volume of *C* is 60% more than *B*. What fraction is the volume of A of the volume of *C*?



A $\frac{3}{10}$ **B** $\frac{2}{5}$ **C** $\frac{4}{11}$

D $\frac{4}{9}$ **E** $\frac{5}{12}$

18. Simplify $\frac{3\sqrt{3}}{3-\sqrt{3}}$

A $\sqrt{3}+1$ **B** $\frac{12\sqrt{3}}{9-\sqrt{3}}$ **C** $\frac{3\sqrt{3}+3}{2}$ **D** $\frac{9}{3-\sqrt{3}}$ **E** $\frac{3}{1-\sqrt{3}}$

19. A sequence starts, 4, 5, 8, 13, 20,...
What is the 98th term in this sequence?

A 9511 **B** 9413 **C** 9697 **D** 9707 **E** 9805

20. When converted into a decimal, the fraction, $\frac{10}{89}$, has 44 digits in its recurring pattern. What are the first seven decimal digits?

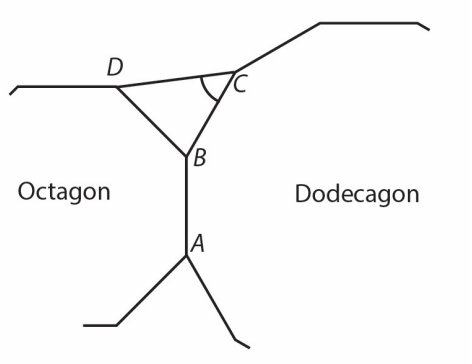
A 0.1123595 **B** 0.0123595 **C** 0.1285135 **D** 0.1153485 **E** 0.1132575

21. Which of the following is the correct fraction equivalent to the partly recurring decimal,

$0.3\dot{2}\dot{7}$ $(= 0.3272727...)$?

A $\frac{109}{330}$ **B** $\frac{12}{37}$ **C** $\frac{36}{101}$ **D** $\frac{18}{55}$ **E** $\frac{109}{333}$

22. A regular octagon (8 sides) and a regular dodecagon (12 sides) share a comon edge, *AB*. Vertices *D* and *C* are joined with a line. What is the size of angle *DCB*?



A 37.5˚ **B** 45.5˚ **C** 57.5˚ **D** 55.5˚ **E** 52.5˚

23. At the Rio Cafe in Alexandria, Anthony buys three cups of coffee and four cups of mint tea for a total of $15.70. Meanwhile, Cleopatra buys two cups of coffee and five cups of mint tea for $14.90.

What is the cost of a cup of coffee at the cafe?

A $1.90 **B** $2.20 **C** $2.70 **D** $2.90 **E** $3.10

24. Which of the following is an equation of the straight line which passes through the point (-3, 2) and that is perpendicular to the line with equation, $5x-3y=19$?

A $3x+5y=-9$ **B** $3x+5y=1$ **C** $y=-\frac{5}{3}x-3$ **D** $y=-\frac{3}{5}x-\frac{9}{5}$ **E** $5y=3x+19$

25. Four of the following points are vertices of the same kite. Whish point is not a vertex of this kite?

A $(-2,-1)$ **B** $(-1,6)$ **C** $(2,7)$ **D** $(1,2)$ **E** $(3,4)$

Questions 26 - 35: Score 3 marks for each correct answer and -1 mark for each incorrect answer.

26. When the denominator of $\frac{3\sqrt{3}}{3-\sqrt{3}}$ is rationalised, the anwer is,

A $\frac{\sqrt{3}+1}{1}$ **B** $\frac{3\sqrt{3}-3}{4}$ **C** $\frac{3\sqrt{3}+3}{2}$ **D** $\frac{\sqrt{3}+3}{2}$ **E** $\frac{3\sqrt{3}-1}{9}$

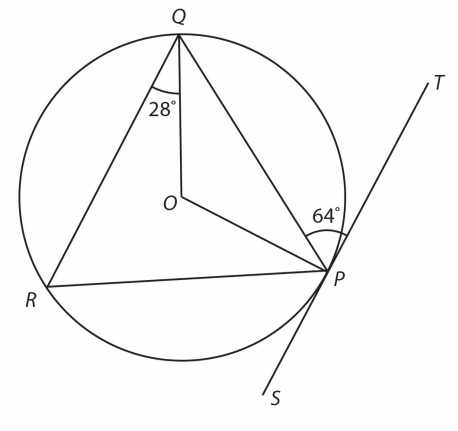
27. Which of the following is a factor of $3x^3+11x^2+30x+72$?

A $(x+1)$ **B** $(x+2)$ **C** $(x+3)$ **D** $(x+4)$ **E** $(x+6)$

28. After the decimal point, how many non-recurring digits are there in the decimal equivalent for $\frac{17}{384}$?

A 3 **B** 4 **C** 5 **D** 6 **E** 7

29. *SPT* is tangent to the circle with centre *O*. Points *Q* and *R* lie on the circumference.
Angle *TPQ* = 64˚ and angle *RQO* = 28˚
What is the size of angle *RPO*?



A 32˚ **B** 46˚ **C** 36˚

D 26˚ **E** 28˚

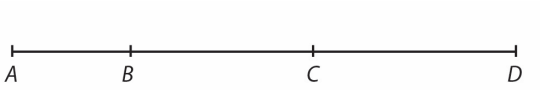
30. The men's world record for a 100 metre sprint is 9.58 seconds, set by Usain Bolt in 2009. How fast is this in kilometres per hour? (Answer to the nearest whole number)

A 35 km/h **B** 36 km/h **C** 37 km/h **D** 38 km/h **E** 39 km/h

31. What is the value of *x* for which, $2^{2x} \times 8^{x-1} = 16^{x+3}$?

A 0 **B** 9 **C** 15 **D** 16 **E** 48

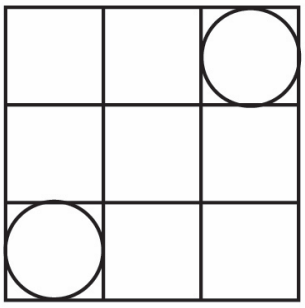
32. *A, B, C* and *D* are points on a straight line.
The ratio *AB* : *BD* = 2 : 5.
The ratio *AC* : *CD* = 7 : 3.
What is the ratio, *AB* : *BC* : *CD*?



A 16 : 21 : 28 **B** 7 : 10 : 17 **C** 21 : 30 : 25

D 20 : 29 : 21 **E** 60 : 85 : 69

33. Each square in this grid has side length one unit. Two circles, each with diameter one unit are placed in two opposite squares.
What is the shortest distance between the two circles?



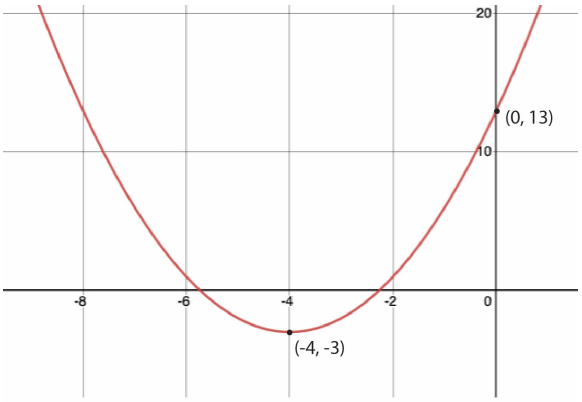
A 3 **B** 2 **C** 2√2

D √2 + 1 **E** 2√2 - 1

34. What is the simplified form of, $(2x^2+3x+1)^2-(x^2-3x-1)^2$?

A $3x^2(x^2+6x+2)$ **B** $3x^2(x^2+6)$ **C** $3x^4+20x^2+12x$ **D** $3x^4+20x^2-1$ **E** $3x^2(x^2-6x-2)$

35. The graph of a parabola has *y*-intercept at (0, 13) and turning point at (-4, -3).
Which of the following is the equation for the parabola?



A $y=2x^2-4x+13$ **B** $y=x^2+7x+9$

C $y=3x^2+16x+13$ **D** $y=x^2+8x+13$

E $y=4x^2+48x-13$

Questions 36 - 40: Score 4 marks for each correct answer and -2 marks for each incorrect answer.

36. What is the value of *p*, given that,

$$(4x^2-3px+2)(x^2+px+1) = 4x^4+px^3-7px^2-px+2$$

A 1 **B** 3 **C** 5 **D** 7 **E** 9

37. How many three-digit numbers can be written as the sum of five different powers of 3, including 3^0?

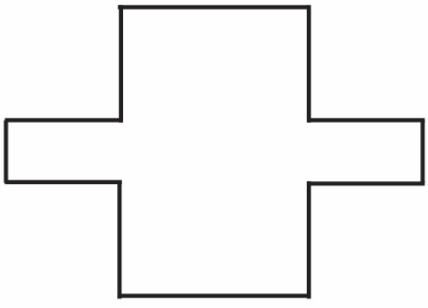
A 5 **B** 6 **C** 7 **D** 8 **E** 9

38. In this magic square, the products of numbers in each row, each column and each diagonal are all the same. The missing numbers are 2, 4, 5, 10, 25, 50 and 100.
Which number must be placed in the square labelled M?

	1	20
M		

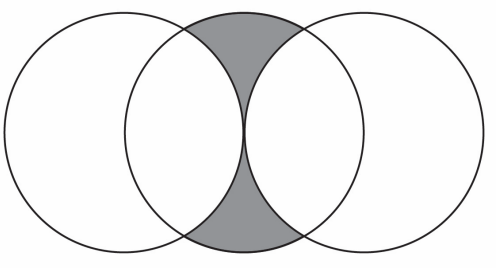
A 2 **B** 4 **C** 5 **D** 10 **E** 25

39. A rectangular piece of card is 3 cm longer than its width. It has 3 cm by 3 cm squares cut away from each corner. The area of the resulting shape is numerically the same as the perimeter.
What is the area?



A 34 cm^2 **B** 36 cm^2 **C** 38 cm^2 **D** 40 cm^2 **E** 42 cm^2

40. Three circles, each with a radius of one unit, are set out as shown with the circumference of the middle circle passing through the centres of the outer two circles.
What is the area of the shaded region in terms of π?



A $2\sqrt{3}-\frac{2\pi}{3}$ **B** $\frac{2\sqrt{3}-\pi}{6}$ **C** $\sqrt{3}-\frac{\pi}{3}$

D $\frac{4\pi}{3}-\sqrt{3}$ **E** $\frac{2\pi}{3}-\sqrt{3}$

Answer Key Intermediate IVMO 2023

Questions 1 - 25: Score 2 marks for each correct answer and 0 marks for each incorrect answer.
Questions 26 - 35: Score 3 marks for each correct answer and -1 mark for each incorrect answer.
Questions 36 - 40: Score 4 marks for each correct answer and -2 marks for each incorrect answer.

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

Answer Sheet Intermediate IVMO 2023

Write your name in Block Capitals here

Write yours answers, A, B, C, D or E in the boxes below.

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