UNICUS OLYMPIADS

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Sample Paper

Class 9

Unicus Global Mathematics Olympiad (UGMO)

Time: 60 minutes

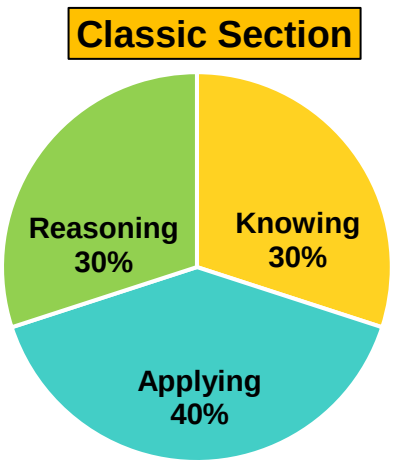
Pattern and Marking Scheme			
Section	**Total Questions**	**Marks per Question**	**Total Marks**
Classic Section	30	1	30
Scholar Section	15	2	30
Grand Total	**45**		60

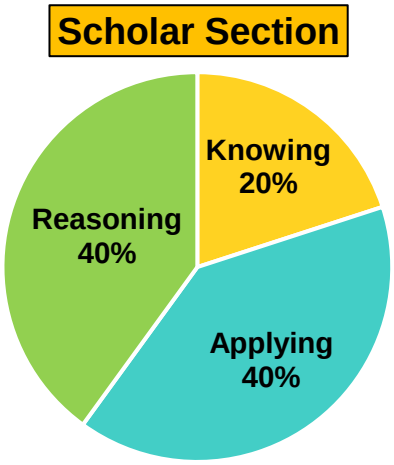
Unicus Global Mathematics Olympiad (UGMO)

The **Unicus Global Olympiad** is organised around two dimensions:

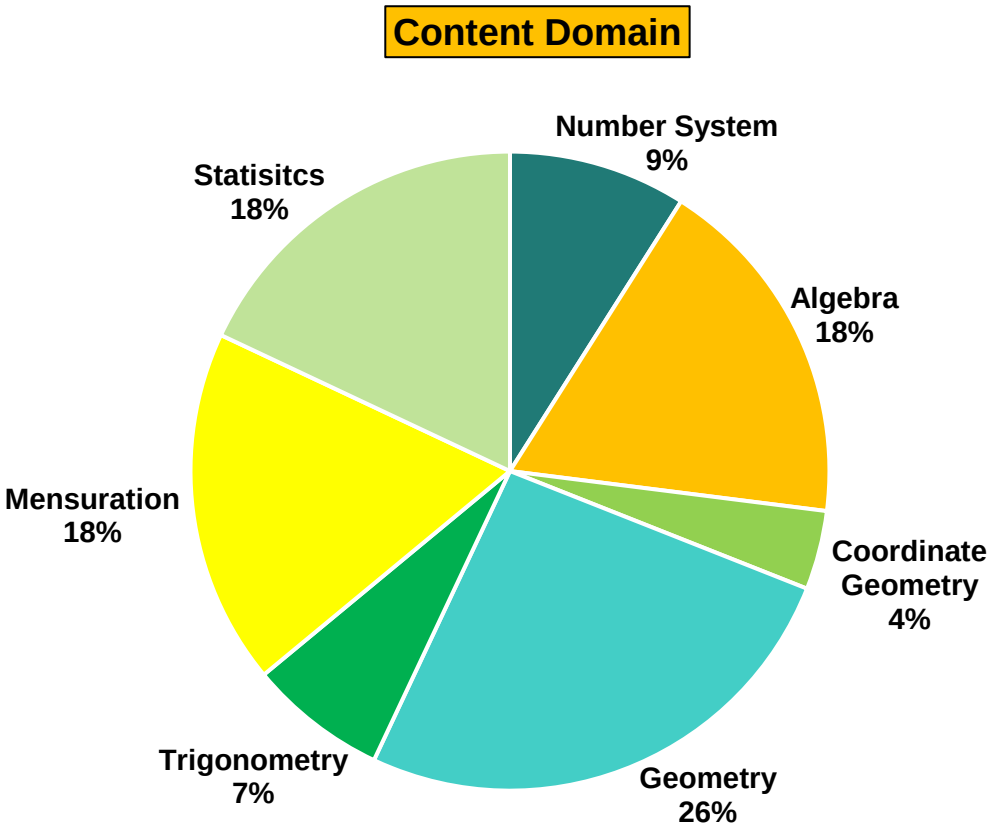
1. Content dimension, specifying the subject matter domains to be assessed
2. Cognitive dimension, specifying the thinking processes to be assessed

Target percentages of the question paper devoted to cognitive domains





Target percentages of the question paper devoted to content domains



For more details, visit https://www.unicusolympiads.com/.

Classic Section (Each Question is 1 Mark)

Cognitive Domain: Applying	Content Domain: Algebra

1. A and B are friends. A is older than B by 5 years. B's sister C is half the age of B while A's father D is 8 years older than twice the age of B. If the present age of D is 52 years, find the present ages of A, B and C.

a. 25, 20, 10
b. 27, 22, 11
c. 31, 26, 13
d. 29, 24, 12

Cognitive Domain: Reasoning	Content Domain: Algebra

2. 5 men and 8 women can complete a task in 34 days, whereas 4 men and 18 women can complete the same task in 28 days. In how many days can the same task can be completed by 3 men and 5 women?

a. 64 days
b. 72 days
c. 56 days
d. 36 days

Cognitive Domain: Reasoning	Content Domain: Algebra

3. A boat can go 30 km downstream and 24 km upstream in 2 hours 27 minutes. Also, it can go 20 km downstream and 8 km upstream in 74 minutes. What is the speed of the boat in still water in km/h?

a. 24 km/h
b. 20 km/h
c. 22 km/h
d. 18 km/h

Cognitive Domain: Knowing	Content Domain: Algebra

4. If $a^2 + b^2 + c^2 = 20$ and $a + b + c = 9$, then find the value of $ab + bc + ca$.

a. 61/2
b. 101/2
c. 67/2
d. 51/2

Cognitive Domain: Applying	Content Domain: Algebra

5. If $(x + 2)$ and $(2x - 1)$ are factors of $(2x^3 + ax^2 + bx + 10)$, then find the value of $(a^2 + b^2)$.

a. 198
b. 289
c. 338
d. 74

Cognitive Domain: Reasoning	Content Domain: Algebra

6. If x + y + z = 0, then find the value of:

$$\left[\frac{(y - z - x)}{2}\right]^3 + \left[\frac{(z - x - y)}{2}\right]^3 + \left[\frac{(x - y - z)}{2}\right]^3$$

a. 3xyz
b. 0
c. 3(x + y + z)
d. 1

Cognitive Domain: Reasoning	Content Domain: Algebra

7. What should be multiplied to $(2x^2 + 3x - 4)$ to get $4x^4 - 9x^2 + 24x - 16$.

a. $2x^2 - 3x - 4$
b. $2x^2 - 3x + 4$
c. $2x^2 + 24x - 16$
d. $2x^2 + 3x + 4$

Cognitive Domain: Knowing	Content Domain: Coordinate Geometry

8. The points (0, 0), (0, 10), (8, 16) and (8, 6) are joined to form a quadrilateral. Find the type of quadrilateral.

a. Rhombus
b. Square
c. Rectangle
d. Parallelogram

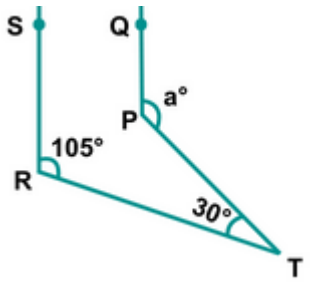
Cognitive Domain: Knowing	Content Domain: Geometry

9. John and Mike are the same age. Sam is also the same age as Mike. Identify Euclid's axiom that describes the relationship between the ages of John and Sam.

a. First axiom
b. Second axiom
c. Third axiom
d. Fourth axiom

Cognitive Domain: Applying	Content Domain: Geometry

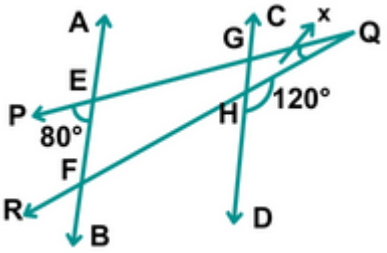
10. In the following figure, PQ ∥ RS. If ∠TRS = 105°, ∠PTR = 35°, ∠QPT = a°, find the value of a.



a. 135°
b. 75°
c. 67.5°
d. 60°

Cognitive Domain: Reasoning	Content Domain: Geometry

11. In the given figure, AB || CD and PQ, QR intersects AB and CD both at E, F and G, H respectively. Find the value of x.



a. 20°
b. 40°
c. 10°
d. 60°

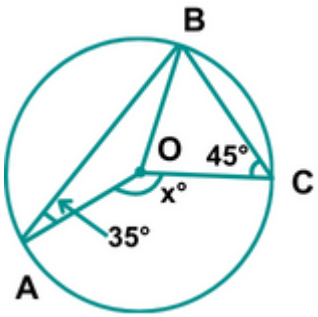
Cognitive Domain: Applying	Content Domain: Geometry

12. In an equilateral triangle ABC, the side BC is trisected at D. What is the ratio of AD^2 to AB^2?

a. 7 : 9
b. 9 : 7
c. 3 : 4
d. 4 : 5

Cognitive Domain: Reasoning	Content Domain: Geometry

13. In the figure, O is the centre of the circle. If ∠BAO = 35° and ∠BCO = 45°, then find the value of x.



a. 160°
b. 170°
c. 80°
d. 140°

Cognitive Domain: Knowing	Content Domain: Number system

14. Find the value of:

$2.\overline{6} - 0.\overline{82}$

a. 181/99
b. 182/99
c. 82/99
d. 24/9

Cognitive Domain: Knowing	Content Domain: Number system

15. The length, breadth and height of a room are 5 m 25 cm, 3 m 25 cm and 1 m 25 cm respectively. Find the length of the longest rod which can measure the three dimensions of the room exactly.

a. 50 cm
b. 75 cm
c. 1 m
d. 25 cm

Cognitive Domain: Applying	Content Domain: Number system

16. If $x = 5 + \sqrt{24}$, find the value of $x^2 + 1/x^2$.

a. 98
b. 100
c. 10
d. 25

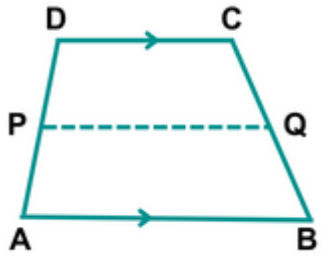
Cognitive Domain: Reasoning	Content Domain: Number system

17. If $a = (\sqrt{2} + 1)/(\sqrt{2} - 1)$ and $b = (\sqrt{2} - 1)/(\sqrt{2} + 1)$, then find the value of $a^2 - 4ab + b^2$.

a. 30
b. 70
c. 40
d. 34

Cognitive Domain: Applying	Content Domain: Geometry

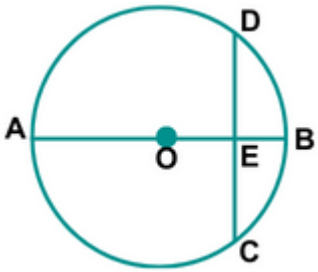
18. In the given figure, ABCD is a trapezium. P and Q are the midpoints of non-parallel side AD and BC respectively. Find: PQ, if AB = 12 cm and DC = 10 cm.



a. 8 cm
b. 11 cm
c. 13 cm
d. 15 cm

Cognitive Domain: Applying	Content Domain: Geometry

19. In the given figure, O is the centre of a circle and diameter AB bisects the chord CD at a point E such that CE = ED = 8 cm and EB = 4 cm. Find the radius of the circle.



a. 8 cm
b. 10 cm
c. 15 cm
d. 20 cm

Cognitive Domain: Knowing	Content Domain: Trigonometry

20. If 5 cot θ = 12, find the value of:
cosec θ + sec θ.

a. 147/60
b. 181/60
c. 221/60
d. 131/55

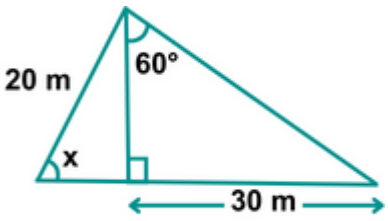
Cognitive Domain: Applying	Content Domain: Trigonometry

21. If tan x = 1⅓, find the value of:
$4 \sin^2 x - 3 \cos^2 x + 2$

a. 25/64
b. 87/25
c. 61/38
d. 66/25

Cognitive Domain: Reasoning	Content Domain: Trigonometry

22. Find the angle x, if:



a. 30°
b. 45°
c. 55°
d. 60°

Cognitive Domain: Knowing	Content Domain: Mensuration

23. A landscaper is designing a triangular flower bed in the shape of an isosceles triangle, where the base is 10 cm wide and the two other sides, which are equal, each measure 13 cm. What is the area of this flower bed?

a. 30 cm^2
b. 45 cm^2
c. 52 cm^2
d. 60 cm^2

Cognitive Domain: Knowing	Content Domain: Mensuration

24. An architect designs a triangular window with sides measuring 17 m, 144 m and 145 m. What is the area of the window?

a. 1224 m^2
b. 1230 m^2
c. 1232.5 m^2
d. 1200 m^2

Cognitive Domain: Applying	Content Domain: Mensuration

25. A civil engineering team is planning to construct a triangular building in a city. The sides of the building are designed to be in the ratio 12 : 17 : 25 and the total perimeter is 540 m. What is the area of the building?

a. 5000 m^2
b. 9000 m^2
c. 12000 m^2
d. 14500 m^2

Cognitive Domain: Applying	Content Domain: Mensuration

26. If the length of a certain rectangle is decreased by 4 cm and breadth is increased by 2 cm, it would result in a square of the same area. What is the perimeter of the original rectangle?

a. 16 cm
b. 20 cm
c. 24 cm
d. 28 cm

Cognitive Domain: Applying	Content Domain: Statistics

27. The weight of 20 students has been shown in the table given below:

Weight (in kg)	Number of students
48	6
51	3
60	2
53	4
56	5

What are the mode and the median of the data given above respectively?

a. 53 and 56
b. 48 and 53
c. 51 and 48
d. 60 and 53

Cognitive Domain: Knowing	Content Domain: Statistics

28. The numbers 5, 7, 8, 10, 12, 13 and N are arranged in ascending order. If the mean of the numbers is equal to the median, then find the value of N.

a. 15
b. 18
c. 21
d. 25

Cognitive Domain: Applying	Content Domain: Statistics

29. A speaks the truth 5 out of 7 times and B speaks truth 8 out of 9 times. What is the probability that they contradict each other in stating the same fact?

a. 1/9
b. 1/4
c. 1/3
d. 1/7

Cognitive Domain: Reasoning	Content Domain: Statistics

30. Three cards are drawn one after another with replacements from a pack of cards. What is the probability of getting first card a Jack, second card a black card and third card an even-numbered card?

a. 5/388
b. 20/388
c. 25/26
d. 5/169

Scholar Section (Each Question is 2 Marks)

Cognitive Domain: Applying	Content Domain: Algebra

31. A test has 300 questions. A candidate gets 2 marks for each correct answer loses 1 mark for each wrong answer and loses 1/2 mark for leaving the question unattempt. A student scored 330 marks. If the student left 36 questions unattempted, find the number of questions he marked wrong.

a. 60
b. 120
c. 204
d. 150

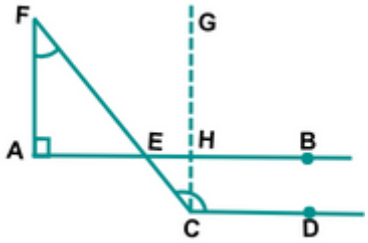
Cognitive Domain: Knowing	Content Domain: Coordinate Geometry

32. A, B and C are three collinear points. The coordinates of A and B are (3, 4) and (7, 7) respectively and AC = 10 units. Find the coordinates of C.

a. (10, 11)
b. (17, 18)
c. (11, 10)
d. (18, 17)

Cognitive Domain: Knowing	Content Domain: Geometry

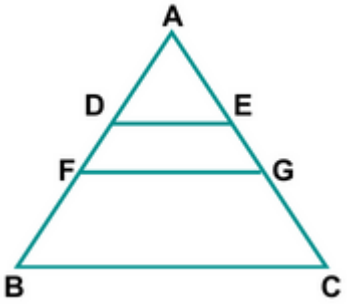
33. In the given figure, AB || CD and ∠F = 30°, find ∠ECD.



a. 60°
b. 120°
c. 150°
d. 140°

Cognitive Domain: Applying	Content Domain: Geometry

34. In the given triangle, D and E are the middle points of AF and AG, respectively and F and G are the midpoints of AB and AC respectively. If DE is 2.4 cm, then what is the value of BC?



a. 4.8 cm
b. 9.6 cm
c. 7.2 cm
d. 3.6 cm

Cognitive Domain: Applying	Content Domain: Geometry

35. ABCD is a plate in the shape of a parallelogram. EF is the line parallel to DA and passes through the point of intersection O of the diagonals AC and BD. Further, E lies on DC and F lies on AB. The triangular portion of DOE is cut out from the plate ABCD. What is the ratio of area of remaining portion of the plate to the whole?

a. 1 : 2
b. 8 : 5
c. 6 : 7
d. 7 : 8

Cognitive Domain: Knowing	Content Domain: Geometry

36. A circular pizza has a radius of 89 cm. If you cut the pizza straight across, leaving a space of 39 cm between the centre of the pizza and the cut, how wide is the slice of pizza you've made?

a. 80 cm
b. 135 cm
c. 160 cm
d. 180 cm

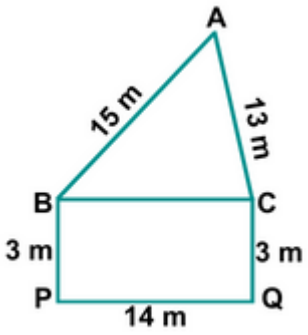
Cognitive Domain: Reasoning	Content Domain: Geometry

37. AB and BC are two chords of a circle with centre O. Both chords are on either side of the centre O. Point A and point C are connected to the centre O, such that ∠BAO = 36° and ∠BCO = 48°. What is the degree measure of the angle subtended by the minor arc AC at the centre O?

a. 84°
b. 134°
c. 152°
d. 168°

Cognitive Domain: Reasoning	Content Domain: Mensuration

38. A municipal corporation wall on the side has dimensions as shown in the figure. The wall is to be used for advertisements and it yields an earning of \$40 per m^2 in a year. Find the total amount of revenue earned in a year.



a. \$2520
b. \$3250
c. \$4400
d. \$5040

Cognitive Domain: Applying	Content Domain: Statistics

39. Three boxes contain 6 red, 4 black; 4 red, 6 black and 5 red, 5 black balls respectively. One of the boxes is selected at random and a ball is drawn from it. If the ball drawn is red, then what will be the probability that it is drawn from the first box?

a. 1/2
b. 2/5
c. 3/5
d. 1/5

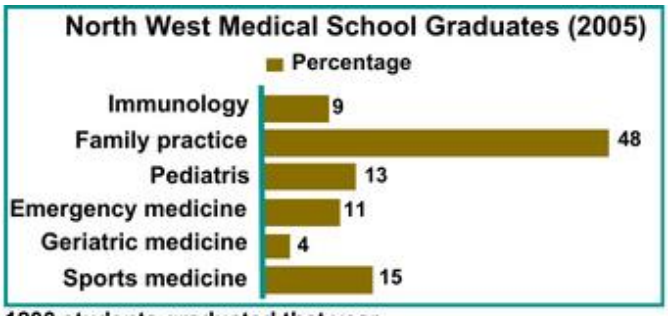
Cognitive Domain: Reasoning	Content Domain: Statistics

40. In grade 11 of a school, 40 students opted for Physics,17 opted for Biology and 20 opted for Chemistry. If the total number of students in grade 11 was 60, all of these students opted for at least one of the three subjects mentioned here, and exactly five of these students opted for all these three subjects, what is the probability that a randomly selected student of grade 11 of this school would have opted for exactly one of these three subjects?

a. 0.40
b. 0.60
c. 0.80
d. 0.85

Directions (41-42): Study the bar graph given below and answer the questions based on it.

The bar graph below shows the specialisations of North West Medical School graduates in 2005. Percentages have been rounded to the nearest whole number.



1200 students graduated that year.

Specialisation	Men : Total
Paediatrics	14 : 26
Emergency Medicine	13 : 22
Geriatric Medicine	3 : 4
Sports Medicine	24 : 45
Immunology	6 : 9
Family Practice	8 : 12

Cognitive Domain: Applying	Content Domain: Statistics

41. What is the percentage of females who decided to specialise in immunology over the total number of males in geriatric medicine and sports medicine? (approximately)

a. 15%
b. 19%
c. 24%
d. 27%

Cognitive Domain: Reasoning	Content Domain: Statistics

42. If one-twelfth of the total students plan to work abroad (assuming the students who went abroad are proportional from all the departments). Then what will be the ratio of the males who decide to practise in India from family practice and paediatrics departments?

a. 24 : 9
b. 32 : 7
c. 26 : 11
d. 31 : 11

Directions (43-45): Read the passage given below and answer the given questions:

Four friends—Robin, Alex, Leo and Max—decided to embark on a picnic at a popular hill station. Upon their arrival, they discovered that due to the peak season, securing accommodation within the city was impossible. Fortunately, the weather was pleasant, which presented them with the alternative of camping outdoors. Equipped with 300 m^2 of cloth, the group set about constructing their temporary abode in a local park.
They opted to fashion a conical tent. The design specifics of the tent included a height of 10 m and a diameter of 14 m. Once the structure of the tent was completed, they utilised the remaining cloth to cover the floor, ensuring a comfortable and dry living space during their stay.

Cognitive Domain: Applying	**Content Domain: Mensuration**

43. How much of the remaining cloth did the friends use to cover the floor of their tent?

a. 12.6 m^2
b. 22.3 m^2
c. 31.6 m^2
d. 54.85 m^2

Cognitive Domain: Reasoning	**Content Domain: Mensuration**

44. What was the total surface area of the tent?

a. 247.5 m^2
b. 400 m^2
c. 396.8 m^2
d. 422.4 m^2

Cognitive Domain: Reasoning	**Content Domain: Mensuration**

45. What was the volume of the tent?

a. 463.3 m^3
b. 513.3 m^3
c. 593.5 m^3
d. 624 m^3

Answer Key

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