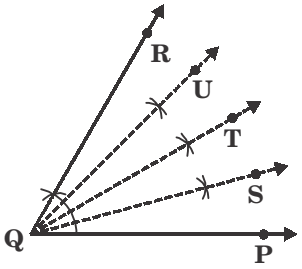
Unified International Mathematics Olympiad

UIMO SAMPLE QUESTIONS

CLASS - 09

MATHEMATICS - 1

01. **In the following figure, ∠PQR = 60°, ∠PQR is bisected and the resultant angles are bisected again.**



Find ∠TQS + ∠SQU + ∠PQS.

(A) 20° (B) 15° (C) 60° (D) 18°

02. **If the product of $x^2 - 6x + 5$ and $2x^2 - 7x + 3$ is 0, which of the following is not a value of 'x' ?**

(A) 3 (B) 2 (C) $\frac{1}{2}$ (D) 1

03. **If $y = 3^x$ and 'x' and 'y' are both integers, which of the following is equivalent to $3^{2x} + 3^x \times 3$?**

(A) $y\,(y + 3)$ (B) $y^2 + 3$ (C) $3y + 3$ (D) $3(y + 3)$

04. **If the height of a cylinder is doubled, by what number must the radius of its base be multiplied so that the resulting cylinder has the same volume as that of the original cylinder ?**

(A) 4 (B) $\frac{1}{\sqrt{2}}$ (C) 2 (D) $\frac{1}{2}$

05. **A square is inscribed in a circle with radius 'r'. What is the probability that a randomly selected point within the circle is not within the square ?**

(A) $\frac{\pi - 2}{\pi^2}$ (B) $\frac{\pi - \frac{1}{2}}{\pi}$ (C) $\frac{\pi - 2}{\pi}$ (D) $\frac{1 - r}{\pi}$

MATHEMATICS - 2

01. **What is the diameter of the largest sphere which can be carved out from a cube of side x cm ?**

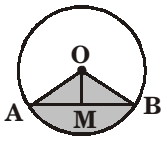
(A) One third of sum of all edges.

(B) One twelfth of sum of all edges.

(C) One half of sum of length of diagonals.

(D) $\frac{1}{\sqrt{3}}$ times of length of any diagonal.

02. **In a circle with centre O, OM is perpendicular from O to the chord AB. Which of the following is/are correct ?**



(A) AM = MB (B) AM ≠ AB

(C) M is the mid point of AB (D) OM bisects AB

03. **Identify the volume of largest cone which can be carved out from a cube of edge 'a' cm.**

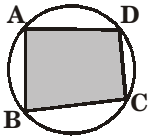
(A) $\frac{\pi a^3}{12}$ (B) $\frac{\pi a^3}{9}$

(C) $\frac{\sqrt{3}\pi}{108}$ (diagonal)^3 (D) $\frac{\pi}{36\sqrt{3}}$ (diagonal)^3

04. **Which of the following are the factors of $x^3 + 3x^2 - x - 3$?**

(A) $x + 1$ (B) $x - 1$ (C) $x + 3$ (D) $x - 3$

05. **If A, B, C, D are points on the circle, identify the correct statement.**

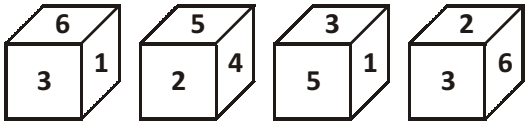


(A) ∠A + ∠B = 180° (B) ∠B + ∠D = 180°

(C) ∠B + ∠C = 180° (D) ∠A + ∠C = 180°

REASONING

01. **A die has been cast four times and the results are as shown.**



Which number is opposite to number 3 ?

(A) 4 (B) 5 (C) 6 (D) 7

02. **A person travels 7 km towards East, then travels 9 km South, then travels 1 km towards left, then travels 9 km North, then finally travels 11 km West. How far is he from his original place and in what direction ?**

(A) 4 km to the East (B) 5 km to the West

(C) 3 km to the West (D) 5 km to the North

03. **Identify the missing letters in the following.**

__m__*l*__*l*__m*l*__m__

(A) *ll* m *lll* (B) m*l* m *ll* m (C) *ll* m *ll* m (D) m*l* m*l* mm

04. Which number should replace the question mark ?

45	(	2	)	52
97	(	10	)	33
67	(	?	)	72

(A) 3 (B) 9 (C) 4 (D) 6

05. Which is the odd one out ?

(A)  (B)  (C)  (D) 

CRITICAL THINKING

01. Assertion (A) : India is a democratic country.

Reason (R) : India has a Constitution of its own.

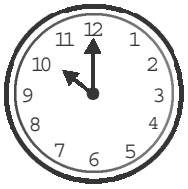
(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is NOT the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

02. What time will it be after the minute hand completes 2008 cycles, starting from 10o'clock in the morning ?



(A) 2.00 am (B) 2.00 pm (C) 1.00 am (D) 1.00 pm

03. Janu, Anusha and Mithali each has a different hobby: swimming, hiking or reading. Read the following and identify Janu's hobby.

Janu does not like sports and Anusha does not like water.

(A) Swimming (B) Hiking

(C) Reading (D) Cannot be determined

04. Here are some words translated from an artificial language.

agnoscrenia means poisonous spider

delanocrenia means poisonous snake

agnosderry means brown spider

Which word could mean "Black widow spider" ?

(A) deeryclostagnos (B) agnosdelano

(C) agnosvitriblunin (D) trymuttiagnos

05. **160 beads are strung in this pattern: 5 red, 3 white, 4 black, 5 red, 3 white, 4 black, ... How many red beads are there ?**

(A) 69 (B) 96 (C) 90 (D) 86

KEY & SOLUTION

MATHEMATICS - 1

01. **(C)** Given $\angle PQR = 60°$, $\angle PQT = \frac{60°}{2} = 30°$ $\angle PQS = \angle SQT = \frac{30°}{2} = 15°$

$\angle TQU = \angle UQR = \frac{30°}{2} = 15°$

$\therefore TQS + \angle SQU + \angle PQS = 15° + 30° + 15° = 60°$

02. **(B)** Given $(x^2 - 6x + 5)(2x^2 - 7x + 3) = 0$

$(x - 5)(x - 1)(x - 3)(2x - 1) = 0$

$\therefore x = 5$ (or) 1 (or) 3 (or) $\frac{1}{2}$

03. **(A)** $3^{2x} + 3^x \times 3 = (3^x)^2 + 3^x + 3$

$= y^2 + 3y$

$= y(y + 3)$

04. **(B)** Given $\pi r_1^2 h = \pi r_2^2 (2h)$

$r_1^2 = 2r_2^2$

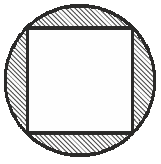
$r_1^2 = \left(\sqrt{2} r_2\right)^2$

$r_1 = \sqrt{2} r_2$

$\therefore r_2 = \frac{r_1}{\sqrt{2}}$

05. **(C)** Diagonal of a square = diamter of the circle

$\therefore$ d = 2r



$\therefore$ Area of a square = $\frac{d^2}{2}$

$= \frac{(2r)^2}{2} = \frac{4r^2}{2} = 2r^2$

Area of circle other than square = $\pi r^2 - 2r^2 = r^2(\pi - 2)$

Probability that a ramdomly selected point with in the circle but not with the square

$= \frac{r^2(\pi-2)}{\pi r^2} = \frac{\pi-2}{\pi}$

MATHEMATICS - 2

01. **(B,D)** Given diameter = x

(A) $\frac{1}{3}$ of sum of edges = $\frac{1}{3} \times 12x = 4x$

(B) $\frac{1}{12}$ of sum of edges = $\frac{1}{12} \times 12x = x$

(C) $\frac{1}{2}$ of of the diagonals = $\frac{1}{2} \times 4 \times \sqrt{3}x = 2\sqrt{3}x$

(D) $\frac{1}{\sqrt{3}}$ time of a diagonal = $\frac{1}{\sqrt{3}} \times \sqrt{3}x = x$

02. **(A,C,D)** (A) AM = MB [$\because$ CPCT]

(C) AM = MB $\Rightarrow$ 'M' is the midpoint of AB

(D) OM bisects AB

03. **(A,C,D)** Given largest cone is curved from a cube

diameter of cone = height of cone = side of cube

Volume of cone = $\frac{1}{3}\pi\left(\frac{a}{2}\right)^2 \times (a) = \frac{1}{3}\pi\frac{a^2}{4} \times a = \frac{\pi a^3}{12}$

Volume of cone = $\frac{\pi a^3}{12} = \frac{\pi}{12}\left(\frac{d}{\sqrt{3}}\right)^3 = \frac{\pi a^3}{12 \times 3\sqrt{3}} = \frac{\pi d^3}{36\sqrt{3}}$

$\frac{\pi d^3}{36\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}\pi d^3}{108}$

04. **(A,B,C)** $x^3 + 3x^2 - x - 3 = x^2(x + 3) - 1(x + 3)$

$(x + 3)(x^2 - 1)$

$= (x + 3)(x + 1)(x - 1)$

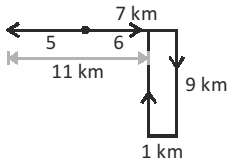
05. **(B,D)** $\angle B + \angle D = 180°$ and $\angle A + \angle C = 180°$

REASONING

01. **(A)** The numbers adjacent to 3 are 6, 1, 5, 2

∴ The number opposite to 3 is 4.

02. **(B)**



5 km to the west

03. **(A)** *l* m*l l* m*l l* m*l l* m*l*

04. **(C)** (4 + 5) – (5 + 2) = 2

(9 + 7) – (3 + 3) = 10

(6 + 7) – (7 + 2) = 4

05. **(B)** Adjacent # symbols

CRITICAL THINKING

01. **(B)** India is a democratic country because its government is the government of the people, for the people and by the people. It is also true that India has its own Constitution.

02. **(A)** The clock will show 10 o'clock after the minute hand has completed 12 cycles.

2008 ÷ 12 = 167 R 4

Odd number or rounds is 10.00 pm.

The clock will show 2.00 am

03. **(C)** Find the facts from the given conditions and mark on the table with ○ and ×.

	Swimming	Hiking	Reading
Janu	×	×	○
Anusha	×	○	×
Mithali	○	×	×

Janu : Reading, Anusha : Hiking, Mithali : Swimming

04. **(C)** In the given language, the noun appears first and the adjectives follow. Since agnos means spider and should appear first, choices (A) and (D) can be ruled out. Choice (B) can be ruled out because delano means snake.

05. **(A)** 5 + 3 + 4 = 12 160 ÷ 12 = 13 R 4

$\underbrace{R_1\ R_2\ R_3\ R_4\ R_5}_{\text{red}}\ \underbrace{R_6\ R_7\ R_8}_{\text{white}}\ \underbrace{R_9\ R_{10}\ R_{11}\ R_{12}}_{\text{black}}$

The last bead is red

13 × 5 + 4 = 69

There are 69 red beads