UNICUS OLYMPIADS

Sample Paper

Class 9

Unicus Non-Routine Mathematics Olympiad

Section	Total Questions	Marks per Questions	Total Questions
Classic Section	10	3	30
Scholar Section	10	6	60
Grand Total	**20**		**90**

Classic Section (Each Question is 3 Marks)

1. If the mean of a frequency distribution is 8.1 and $\Sigma f_i x_i = 132 + 5x$, $\Sigma f_i = 20$, then x = ?

   a. 3
   b. 4
   c. 5
   d. 6

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2. If the point $\{x_1 + t(x_2 - x_1), y_1 + t(y_2 - y_1)\}$ divides the join of (x_1, y_1) and (x_2, y_2) internally then the condition of t will be.

   a. $t < 0$
   b. $t = 1$
   c. $0 < t < 1$
   d. $t > 1$

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3. The angle of elevation of the top of a tower from a point A due south of the tower is x and from B due east of the tower is y. If AB = h, then calculate the height of the tower.

   a. $h/\sqrt{(\cot^2 x + \cot^2 y)}$
   b. $h/\sqrt{(\cot^2 x - \cot^2 y)}$
   c. $2h/\sqrt{(\cot^2 x - \cot^2 y)}$
   d. $2 \tan x/\sqrt{(\cot^2 x + \cot^2 y)}$

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4. If $\cos x + \cos^2 x = 1$, then $\sin^{12} x + 3\sin^{10} x + 3\sin^8 x + \sin^6 x$ = ?

   a. 0
   b. $\sqrt{2}$
   c. 1
   d. 2

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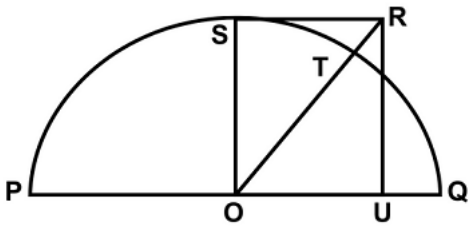
5. A semicircle having a centre at O and a radius equal to 4 is drawn with PQ as the diameter as shown in the figure given below. OSRU is a rectangle such that the ratio of the area of the semicircle to the area of the rectangle is $2\pi : 3$ or cuts the semicircle at T. Find the length of line segment TQ.



   a. $(5/3)\sqrt{5}$
   b. $(8/5)\sqrt{5}$
   c. $(17/9)\sqrt{5}$
   d. $(9/2)\sqrt{5}$

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6. BC is the diameter of a semi-circle. The sides AB and AC of a triangle ABC meet the semi-circle in p and q respectively. PQ subtends 140o at the centre of the semi-circle. Find the value of $\angle A$.

   a. 10^o
   b. 20^o
   c. 30^o
   d. 40^o

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7. The area of a square inscribed in a semicircle to the area inscribed in a quadrant of the same circle.

a. 2 : 1
b. 3 : 2
c. 5 : 3
d. 8 : 5

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8. Let α, β, γ be the roots of $x^3 + qx + r = 0$, then the equation whose roots are $\beta^2 + \beta\gamma + \gamma^2$; $\gamma^2 + \sqrt{\alpha} + \alpha^2$ and $\alpha^2 + \alpha\beta + \beta^2$ is.

a. $(y - q)^3 = 0$
b. $(y + q)^3 = 0$
c. $(y + 2q)^3 = 0$
d. $(y - 2q)^3 = 0$

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9. If α and β are the roots of the equation $x^2 - px + q = 0$ and $\alpha > 0$, $\beta > 0$, then find the value of $\alpha^{1/4} + \beta^{1/4}$.

a. $[P + \sqrt{q} + 4q^{1/4}\sqrt{(P + \sqrt{q})}]^4$
b. $[P + 6\sqrt{q} + 4q^{1/4}\sqrt{(P + 2\sqrt{q})}]^4$
c. $[P + \sqrt{q} + 4q^{1/4}\sqrt{(P + 4\sqrt{q})}]^4$
d. $[P + 6\sqrt{q} + 4q^{1/4}\sqrt{(P + 4\sqrt{q})}]^4$

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10. The p^{th} term of an A.P. is 20 and q^{th} term is 10. Find the sum of the first (p + q) terms.

a. $(p - q)/2\{30 + \{10/(p + q)\}$
b. $(p + q)/2\{30 + \{10/(p – q)\}$
c. $(p + q)/2\{30 - \{10/(p – q)\}$
d. $(p - q)/2\{10 + \{30/(p – q)\}$

Scholar Section (Each Question is 6 Marks)

11. If $u_i = (xi – 25)/10$, $\Sigma f_i u_i = 20$, $\Sigma f_i = 100$, then $\bar{x}$ = ?

a. 23
b. 24
c. 27
d. 25

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12. If $S_n = \sum tr = 1/6\ n\ (2n^2 + 9n + 13)$, then $\sum \sqrt{tr}$ = ?

a. 1/2 n (n + 1)
b. 1/2 n (n + 2)
c. 1/2 n (n + 3)
d. 1/2 n (n + 5)

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13. The value of $(1 + \cos \pi/8)(1 + \cos 3\pi/8).(1 + \cos 5\pi/8)(1 + \cos 7\pi/8)$ is equal to:

a. 1/8
b. -1/8
c. 1/4
d. -1/4

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14. If $\tan\theta = 1 - e^2$, then $\sec\theta + \tan 3\theta \operatorname{cosec}\theta$ = ?

a. $(1 - e^2)3/2$
b. $(2 - e^2)1/2$
c. $(2 - e^2)3/2$
d. $(2 - e^3)3/2$

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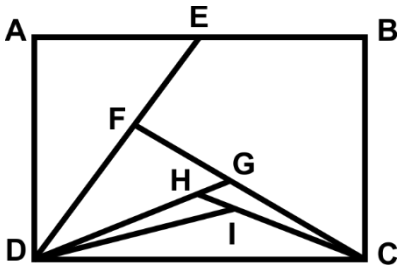
15. Square ABCD has an area of 4. E is the midpoint of AB. Similarly, F, G, H and I are midpoints of DE, CF, DG and CH. Find the area ΔIDC.



a. 1/4
b. 1/8
c. 1/16
d. 1/32

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16. Two circles with centres A and B intersect at points P and Q so that ∠PAQ = 60° and ∠PBQ = 90°. What is the ratio of the area of the circle with centre A to the area of the circle with centre B?

a. 3 : 1
b. 3 : 2
c. 4 : 3
d. 2 : 1

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17. Four circles of r = 1, are each tangent of two sides of a square and externally tangent to a circle of r = 2. If the area of the square is A, then find A - 12√2.

a. 14
b. 21
c. 22
d. 24

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18. Given that $x^6 + 4x^5 + 6x^4 + 6x^3 + 4x^2 + 2x + 1$ can be factorized as $(x^2 + ax + 1)(x^4 + bx^3 + cx^2 + dx + 1)$ then (a + b) = ?

a. 1
b. 2
c. 3
d. 4

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19. Simplify $[\sqrt[3]{(6\sqrt{a9})}]4\ [6\sqrt{(\sqrt[3]{a9})}]4$ is

a. a^{16}
b. a^{12}
c. a^8
d. a^4

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20. Solve the equation $(x - 1)^4 + (x - 5)^4 = 82$.

a. x = ± 1, 4, 2
b. x = 4, 2, -3 -5i, 2 + i
c. x = 3 ± 5i, 4, 2
d. x = 3 ± 5i, ± 1

Answer Key

1.	d	2.	c	3.	a	4.	c	5.	b	6.	b	7.	d
8.	b	9.	b	10.	b	11.	c	12.	c	13.	a	14.	c
15.	b	16.	d	17.	c	18.	d	19.	d	20.	a		