



# UNICUS OLYMPIADS

## Sample Paper (2020-21)

**Class 9 & 10**

**Unicus Non-Routine Mathematics Olympiad**



<b>Section – Class*</b> <small>*Syllabus covered</small>	<b>Total Questions</b>	<b>Marks per Question</b>	<b>Total Marks</b>
Classic Section – Class 9 & 10	10	3	30
Scholar Section – Class 9 & 10	10	6	60
<b>Grand Total</b>	<b>20</b>		<b>90</b>

Note: There will be negative marking of 1/3<sup>rd</sup> of the marks allotted for that question if the answer is incorrect.

1. The  $p^{\text{th}}$  term of an A.P is 20 and  $q^{\text{th}}$  term is 10. Find the sum of first  $(p+q)^{\text{th}}$  terms.
- a)  $5(p+q/p-q)\{(3p-(q-1))\}$
  - b)  $5(p+q/p-q)\{(3p-(q+1))\}$
  - c)  $5(p+q/p-q)\{(3p-(-q-1))\}$
  - d)  $5(p+q/p-q)\{(3p-(1-q))\}$

**Correct Answer: b**

**3 Marks**

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2. If  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 - px + q = 0$  and  $\alpha > 0, \beta > 0$ . then 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)  $[P + 6\sqrt{q} + 4q^{1/4} \sqrt{(P + 4\sqrt{q})}]^4$

**Correct Answer: b**

**3 Marks**

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3. Let  $\alpha, \beta, \gamma$  are the roots of  $x^3 + qx + r = 0$ , then the equation whose roots are  $\beta^2 + \beta\gamma + \gamma^2; \gamma^2 + \gamma\alpha + \alpha^2$  and  $\alpha^2 + \alpha\beta + \beta^2$  is.
- a)  $(y - q)^3 = 0$
  - b)  $(y + q)^3 = 0$
  - c)  $(y + 2q)^3 = 0$
  - d)  $(y - 2q)^3 = 0$

**Correct Answer: b**

**3 Marks**

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4. 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

**Correct Answer: d**

**3 Marks**

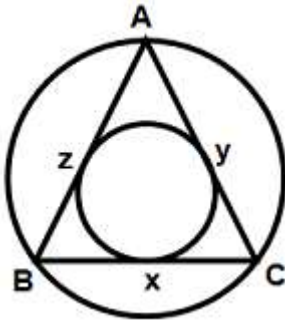
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5. BC is the diameter of a semi circle. The sides AB and AC of a triangle ABC meet the semi circle in p and q respectively. PQ subtends  $140^\circ$  at the centre of the semi circle then  $\angle A = ?$
- $10^\circ$
  - $20^\circ$
  - $30^\circ$
  - $40^\circ$

**Correct Answer: b**

*3 Marks*

6. Let the circum radius of  $\triangle ABC$  be 4 and the in radius of  $\triangle XYZ$  be 2 of the area of  $\triangle ABC = 32$ , then area of  $\triangle XYZ = ?$



- 8
- 16
- 4
- 20

**Correct Answer: b**

*3 Marks*

7. If  $\cos x + \cos^2 x = 1$ , then  $\sin^{12} x + 3\sin^{10} x + 3\sin^8 x + \sin^6 x =$
- 0
  - $\sqrt{2}$
  - 1
  - 2

**Correct Answer: c**

*3 Marks*

8. 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)  $2 \tan x/\sqrt{(\cot^2 x + \cot^2 y)}$

**Correct Answer: a**

**3 Marks**

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9. 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) None of these

**Correct Answer: c**

**3 Marks**

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10. If the mean of a frequency distribution is 8.1 and  $\sum f_i x_i = 132 + 5x$ ,  $\sum f_i = 20$ , then  $x = ?$
- a) 3
  - b) 4
  - c) 5
  - d) 6

**Correct Answer: d**

**3 Marks**

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11. Solve the equation  $(x - 1)^4 + (x - 5)^4 = 82$ .
- a)  $x = \pm 1, 4, 2$
  - b)  $x = 4, 2, -3 - 5i, 2 + i$
  - c)  $x = 3 \pm 5i, 4, 2$
  - d)  $x = 3 \pm 5i, \pm 1$

**Correct Answer: a**

**6 Marks**

12. Simplify  $[\sqrt[3]{(6\sqrt{a^9})}]^4 [6\sqrt[3]{(a^9)}]^4$  is
- a)  $a^{16}$
  - b)  $a^{12}$
  - c)  $a^8$
  - d)  $a^4$

**Correct Answer: d**

**6 Marks**

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13. 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

**Correct Answer: d**

**6 Marks**

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14. 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  $A - 12\sqrt{2} = ?$
- a) 14
  - b) 21
  - c) 22
  - d) 24

**Correct Answer: c**

**6 Marks**

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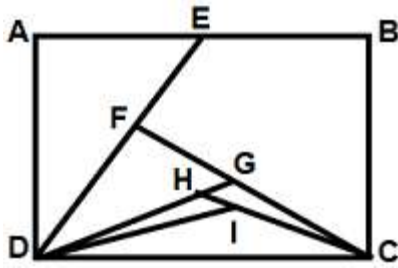
15. Two circles with centres A and B intersect at points P and Q so that  $\angle PAQ = 60^\circ$  and  $\angle PBQ = 90^\circ$ . What is the ratio of the area of the circle with centre A to the area of the circle with centre B?
- a) 3 : 1
  - b) 3 : 2
  - c) 4 : 3
  - d) 2 : 1

**Correct Answer: d**

**6 Marks**

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16. Square ABCD has an area 4, E is the midpoint of AB. Similarity F, G, H and I are mid points of DE, CF, DG and CH, then area  $\Delta IDC = ?$



- a)  $1/4$
- b)  $1/8$
- c)  $1/16$
- d)  $1/32$

**Correct Answer: b**

6 Marks

17. It  $\tan \theta = 1 - e^2$ , 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) None of these

**Correct Answer: c**

6 Marks

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

- a)  $1/8$
- b)  $-1/8$
- c)  $1/4$
- d)  $-1/4$

**Correct Answer: a**

6 Marks

19. If  $S_n = \sum t_r = \frac{1}{6} n (2n^2 + 9n + 13)$ , then  $\sum \sqrt{t_r} = ?$
- a)  $\frac{1}{2} n (n + 1)$
  - b)  $\frac{1}{2} n (n + 2)$
  - c)  $\frac{1}{2} n (n + 3)$
  - d)  $\frac{1}{2} n (n + 5)$

**Correct Answer: c**

*6 Marks*

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20. If  $u_i = (x_i - 25)/10$ ,  $\sum f_i u_i = 20$ ,  $\sum f_i = 100$ , then  $\bar{x} = ?$
- a) 23
  - b) 24
  - c) 27
  - d) 25

**Correct Answer: c**

*6 Marks*

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