EXERCISE - O

SINGLE CORRECT TYPE QUESTIONS

1. In triangle ABC, if $\sin^3 A+\sin^3 B+\sin^3 C=3\sin A\cdot\sin B\cdot\sin C$, then the triangle is

(A) Isosceles (B) right angled (C) scalene (D) equilateral

MTS001

2. In a triangle ABC, if $\angle C = 105°, \angle B = 45°$ and length of side $AC = 2$ units, then the length of the side AB is equal to

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

MTS002

3. In a triangle ABC, if $a = 13, b = 14$ and $c = 15$, then angle A is equal to
(All symbols used have their usual meaning in a triangle.)

(A) $\sin^{-1}\frac{4}{5}$ (B) $\sin^{-1}\frac{3}{5}$ (C) $\sin^{-1}\frac{3}{4}$ (D) $\sin^{-1}\frac{2}{3}$

MTS003

4. In triangle ABC, if $AC = 8, BC = 7$ and D lies between A and B such that $AD = 2, BD = 4$, then the length CD equals

(A) $\sqrt{46}$ (B) $\sqrt{48}$ (C) $\sqrt{51}$ (D) $\sqrt{75}$

MTS004

5. In triangle ABC, if $2b = a + c$ and $A - C = 90°$, then $\sin B$ equals
[**Note:** All symbols used have usual meaning in triangle ABC.]

(A) $\frac{\sqrt{7}}{5}$ (B) $\frac{\sqrt{5}}{8}$ (C) $\frac{\sqrt{7}}{4}$ (D) $\frac{\sqrt{5}}{3}$

MTS005

6. In a triangle ABC, $a^3 + b^3 + c^3 = c^2(a + b + c)$
(All symbol used have usual meaning in a triangle.)
Statement–1: The value of $\angle C = 60°$.
Statement –2: ΔABC must be equilateral.
(A) Statement–1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

MTS006

7. In triangle ABC, If $\frac{1}{a+c}+\frac{1}{b+c}=\frac{3}{a+b+c}$ then angle C is equal to
[**Note:** All symbols used have usual meaning in triangle ABC.]

(A) 30° (B) 45° (C) 60° (D) 90°

MTS007

8. In a triangle ABC, if $b = (\sqrt{3}-1)a$ and $\angle C = 30°$, then the value of $(A - B)$ is equal to
(All symbols used have usual meaning in a triangle.)

(A) 30° (B) 45° (C) 60° (D) 75°

MTS008

9. Angles A, B and C of a triangle ABC are in A.P. If $\frac{b}{c}=\sqrt{\frac{3}{2}}$, then $\angle A$ is equal to

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{5\pi}{12}$ (D) $\frac{\pi}{2}$

MTS009

10. AD and BE are the medians of a triangle ABC. If $AD=4$, $\angle DAB=\frac{\pi}{6}, \angle ABE=\frac{\pi}{3}$, then area of triangle ABC equals

(A) $\frac{8}{3}$ (B) $\frac{16}{3}$ (C) $\frac{32}{3}$ (D) $\frac{32}{9}\sqrt{3}$

MTS010

11. In a triangle ABC, if $(a+b+c)(a+b-c)(b+c-a)(c+a-b)=\frac{8a^2b^2c^2}{a^2+b^2+c^2}$, then the triangle is

[**Note:** All symbols used have usual meaning in triangle ABC.]

(A) isosceles (B) right angled (C) equilateral (D) scalene

MTS011

12. For right angled isosceles triangle, $\frac{r}{R}=$

[**Note:** All symbols used have usual meaning in triangle ABC.]

(A) $\tan\frac{\pi}{12}$ (B) $\cot\frac{\pi}{12}$ (C) $\tan\frac{\pi}{8}$ (D) $\cot\frac{\pi}{8}$

MTS012

13. If K is a point on the side BC of an equilateral triangle ABC and if $\angle BAK=15°$, then the ratio of lengths $\frac{AK}{AB}$ is

(A) $\frac{3\sqrt{2}\left(3+\sqrt{3}\right)}{2}$ (B) $\frac{\sqrt{2}\left(3+\sqrt{3}\right)}{2}$ (C) $\frac{\sqrt{2}\left(3-\sqrt{3}\right)}{2}$ (D) $\frac{3\sqrt{2}\left(3-\sqrt{3}\right)}{2}$

MTS013

14. Let ABC be a right triangle with length of side $AB=3$ and hypotenuse $AC=5$.

If D is a point on BC such that $\frac{BD}{DC}=\frac{AB}{AC}$, then AD is equal to

(A) $\frac{4\sqrt{3}}{3}$ (B) $\frac{3\sqrt{5}}{2}$ (C) $\frac{4\sqrt{5}}{3}$ (D) $\frac{5\sqrt{3}}{4}$

MTS014

15. The ratio of the sides of a triangle ABC is $1:\sqrt{3}:2$. Then ratio of $A:B:C$ is

(A) 3 : 5 : 2 (B) 1 : $\sqrt{3}$: 2 (C) 3 : 2 : 1 (D) 1 : 2 : 3

MTS015

16. If in a triangle $\sin A:\sin C=\sin(A-B):\sin(B-C)$, then a^2, b^2, c^2

(A) are in A.P. (B) are in G.P. (C) are in H.P. (D) are in A.G.P

MTS016

17. In a triangle $\tan A : \tan B : \tan C = 1 : 2 : 3$, then $a^2 : b^2 : c^2$ equals

(A) 5 : 8 : 9 (B) 5 : 8 : 12 (C) 3 : 5 : 8 (D) 5 : 8 : 10

MTS017

18. In an acute triangle ABC, $\angle ABC = 45°, AB = 3$ and $AC = \sqrt{6}$. The angle $\angle BAC$, is

(A) 60° (B) 65° (C) 75° (D) 15° or 75°

MTS018

19. Consider a triangle ABC and let a, b and c denote the lengths of the sides opposite to vertices A, B and C respectively. If $a = 1, b = 3$ and $C = 60°$, then $\sin^2 B$ is equal to

(A) $\frac{27}{28}$ (B) $\frac{3}{28}$ (C) $\frac{81}{28}$ (D) $\frac{1}{3}$

MTS019

20. In triangle ABC, If $s = 3 + \sqrt{3} + \sqrt{2}$, $3B - C = 30°, A + 2B = 120°$, then the length of longest side of triangle is

[**Note:** All symbols used have usual meaning in triangle ABC.]

(A) 2 (B) $2\sqrt{2}$ (C) $2(\sqrt{3}+1)$ (D) $\sqrt{3}-1$

MTS020

MULTIPLE CORRECT TYPE QUESTIONS

21. Given an acute triangle ABC such that $\sin C = \frac{4}{5}$, $\tan A = \frac{24}{7}$ and $AB = 50$. Then-

(A) centroid, orthocentre and incentre of ΔABC are collinear

(B) $\sin B = \frac{4}{5}$

(C) $\sin B = \frac{4}{7}$

(D) area of $\Delta ABC = 1200$

MTS036

22. In ΔABC, angle A is 120°, $BC + CA = 20$ and $AB + BC = 21$, then

(A) $AB > AC$ (B) $AB < AC$

(C) ΔABC is isosceles (D) area of $\Delta ABC = 14\sqrt{3}$

MTS037

23. In which of the following situations, it is possible to have a triangle ABC?

(All symbols used have usual meaning in a triangle.)

(A) $(a + c - b)(a - c + b) = 4bc$ (B) $b^2 \sin 2C + c^2 \sin 2B = ab$

(C) $a = 3, b = 5, c = 7$ and $C = \frac{2\pi}{3}$ (D) $\cos\left(\frac{A-C}{2}\right) = \cos\left(\frac{A+C}{2}\right)$

MTS038

24. If the lengths of the medians AD, BE and CF of triangle ABC are 6, 8,10 respectively, then-

(A) AD & BE are perpendicular (B) BE and CF are perpendicular

(C) area of $\Delta ABC = 32$ (D) area of $\Delta DEF = 8$

MTS039

25. In ΔABC, angle A, B and C are in the ratio 1 : 2 : 3, then which of the following is (are) correct? (All symbol used have usual meaning in a triangle.)

(A) Circumradius of $\Delta ABC = c$ (B) $a : b : c = 1 : \sqrt{3} : 2$

(C) Perimeter of $\Delta ABC = 3 + \sqrt{3}$ (D) Area of $\Delta ABC = \frac{\sqrt{3}}{8} c^2$

MTS040

26. In a triangle ABC, let $BC = 1$, $AC = 2$ and measure of angle C is 30°. Which of the following statement(s) is (are) correct?

(A) $2\sin A = \sin B$

(B) Length of side AB equals $5 - 2\sqrt{3}$

(C) Measure of angle A is less than 30°

(D) Circumradius of triangle ABC is equal to length of side AB

MTS041

COMPREHENSION TYPE QUESTIONS

Paragraph for Question No. 27 to 28

Let incircle of ΔABC with $\angle B = \angle C$, touches AB, BC, CA at R, P, Q respectively. If inradius 'r' is integer and perimeter of ΔABC is smallest possible integer such that $\frac{2}{AR} + \frac{5}{BP} + \frac{5}{CQ} = \frac{6}{r}$ then

27. The value of 'r' is

(A) 4 (B) 3 (C) 2 (D) 1

MTS042

28. Area of ΔABC is

(A) 15 sq. unit (B) 21 sq. unit (C) 24 sq. unit (D) 27 sq. unit

MTS043

MATRIX MATCH TYPE QUESTION

29. If symbols have usual notations in triangle ABC, then match the following columns :

	Column-I		**Column-II**
(A)	$r\, r_1 r_2 r_3$	(P)	rs^2
(B)	$r_1 r_2 r_3$	(Q)	$4R\cos C$
(C)	$r_1 + r_2 - r_3 + r$	(R)	$\frac{1}{2Rr}$
(D)	$\frac{1}{bc} + \frac{1}{ca} + \frac{1}{ab}$	(S)	Δ^2

MTS044

30. If sides of a triangle ABC are a = 6, b = 8 & c = 10, then match the following (using usual notations)

Column-I	**Column-II**
(A) r is equal to	(P) 4
(B) r_1 is equal to	(Q) 24
(C) R is equal to	(R) 2
(D) Δ is equal to	(S) 6
	(T) 5

MTS067

EXERCISE - S

1. A triangle has vertices A, B and C, and the respective opposite sides have lengths a, b and c. This triangle is inscribed in a circle of radius R. If $b = c = 1$ and the altitude from A to side BC has length $\sqrt{\frac{2}{3}}$, then $8R^2$ equals

MTS021

2. A circle is inscribed in a right triangle ABC, right angled at C. The circle is tangent to the segment AB at D and length of segments AD and DB are 7 and 13 respectively. Area of triangle ABC is equal to

MTS022

3. The sides a, b, c (taken in that order) of triangle ABC are in A.P.

If $\cos\alpha = \frac{a}{b+c}, \cos\beta = \frac{b}{c+a}, \cos\gamma = \frac{c}{a+b}$ then $\tan^2\left(\frac{\alpha}{2}\right) + \tan^2\left(\frac{\gamma}{2}\right)$ is equal to $\frac{k}{6}$, then the value of k is

[**Note:** All symbols used have usual meaning in triangle ABC.]

MTS023

4. In ΔABC, if $a = 2b$ and $A = 3B$, then the value of $\frac{2c^2}{b^2}$ is equal to

MTS024

5. If the angle A, B and C of a triangle are in an arithmetic progression and if a, b and c denote the lengths of the sides opposite to A, B and C respectively, then the value of expression $E = \left(\frac{a}{c}\sin 2C + \frac{c}{a}\sin 2A\right)$, is λ, then the value of λ^2 is

MTS025

6. In a ΔABC with usual notations, if $3a + 3b = 4c$ then $\cot\frac{A}{2}\cot\frac{B}{2}$ is

MTS045

7. In ΔABC (with usual notations), if $r_1 = \Delta$ & $r_1 = r + r_2 + r_3$, then r is equal to

MTS046

8. In ΔABC with usual notations, if $a = 3, b = 2$ and $\cos(A - B) = \frac{12}{13}$, then area of ΔABC is

MTS047

9. If in a ΔABC, $a = 6, b = 3$ and $\cos(A - B) = 4/5$, then find its area.

MTS065

10. If the area of a triangle is 100 sq.cm, $r_1 = 10$ cm and $r_2 = 50$ cm, then find the value of $(b - a)$.

MTS066

EXERCISE - JEE (Main) PYQ

1. If $5, 5r, 5r^2$ are the lengths of the sides of a triangle, then r cannot be equal to : **[JEE (Main) 2019]**

(1) $\frac{3}{2}$ (2) $\frac{3}{4}$ (3) $\frac{5}{4}$ (4) $\frac{7}{4}$

MTS026

2. With the usual notation, in ΔABC, if $\angle A+\angle B=120°$, $a=\sqrt{3}+1$ and $b=\sqrt{3}-1$, then the ratio $\angle A:\angle B$, is : **[JEE (Main) 2019]**

(1) 7 : 1 (2) 5 : 3 (3) 9 : 7 (4) 3 : 1

MTS027

3. In a triangle, the sum of lengths of two sides is x and the product of the lengths of the same two sides is y. If $x^2 - c^2 = y$, where c is the length of the third side of the triangle, then the circumradius of the triangle is : **[JEE (Main) 2019]**

(1) $\frac{y}{\sqrt{3}}$ (2) $\frac{c}{\sqrt{3}}$ (3) $\frac{c}{3}$ (4) $\frac{3}{2}y$

MTS028

4. Given $\frac{b+c}{11}=\frac{c+a}{12}=\frac{a+b}{13}$ for a ΔABC with usual notation. If $\frac{\cos A}{\alpha}=\frac{\cos B}{\beta}=\frac{\cos C}{\gamma}$, then the ordered triad (α,β,γ) has a value :- **[JEE (Main) 2019]**

(1) (3, 4, 5) (2) (19, 7, 25) (3) (7, 19, 25) (4) (5, 12, 13)

MTS029

5. If the lengths of the sides of a triangle are in A.P. and the greatest angle is double the smallest, then a ratio of lengths of the sides of this triangle is : **[JEE (Main) 2019]**

(1) 5 : 9 : 13 (2) 5 : 6 : 7 (3) 4 : 5 : 6 (4) 3 : 4 : 5

MTS030

6. The angles A, B and C of a triangle ABC are in A.P. and $a: b = 1:\sqrt{3}$. If $c = 4\ cm$, then the area (in sq. cm) of this triangle is : **[JEE (Main) 2019]**

(1) $4\sqrt{3}$ (2) $\frac{2}{\sqrt{3}}$ (3) $2\sqrt{3}$ (4) $\frac{4}{\sqrt{3}}$

MTS031

7. If a ΔABC has vertices $A(-1,7), B(-7,1)$ and $C(5,-5)$, then its orthocentre has coordinates: **[JEE (Main) 2020]**

(1) (3, –3) (2) $\left(-\frac{3}{5},\frac{3}{5}\right)$ (3) (–3, 3) (4) $\left(\frac{3}{5},-\frac{3}{5}\right)$

MTS032

8. If in a triangle $ABC, AB = 5$ units, $\angle B=\cos^{-1}\left(\frac{3}{5}\right)$ and radius of circumcircle of ΔABC is 5 units, then the area (in sq. units) of ΔABC is : **[JEE (Main) 2021]**

(1) $10+6\sqrt{2}$ (2) $8+2\sqrt{2}$ (3) $6+8\sqrt{3}$ (4) $4+2\sqrt{3}$

MTS033

9. In ΔABC, the lengths of sides AC and AB are 12 cm and 5 cm, respectively. If the area of ΔABC is 30 cm^2 and R and r are respectively the radii of circumcircle and incircle of ΔABC, then the value of $2R + r$ (in cm) is equal to _____. **[JEE (Main) 2021]**

MTS034

10. The lengths of the sides of a triangle are $10 + x^2$, $10 + x^2$ and $20 - 2x^2$. If for $x = k$, the area of the triangle is maximum, then $3k^2$ is equal to : **[JEE (Main) 2022]**

(1) 5 (2) 8 (3) 10 (4) 12

MTS035

11. In a triangle ABC, if $\cos A + 2\cos B + \cos C = 2$ and the lengths of the sides opposite to the angles A and C are 3 and 7 respectively, then $\cos A - \cos C$ is equal to **[JEE (Main) 2023]**

(1) $\frac{3}{7}$ (2) $\frac{9}{7}$ (3) $\frac{10}{7}$ (4) $\frac{5}{7}$

MTS064

EXERCISE - JEE (Advanced) PYQ

1. Let ABC and ABC' be two non-congruent triangles with sides $AB = 4$, $AC = AC' = 2\sqrt{2}$ and angle $B = 30°$. The absolute value of the difference between the areas of these triangles is

[JEE (Advanced) 2009]

MTS048

2. If the angle A, B and C of a triangle are in an arithmetic progression and if a, b and c denote the length of the sides opposite to A, B and C respectively, then the value of the expression $\frac{a}{c}\sin 2C + \frac{c}{a}\sin 2A$, is -

[JEE (Advanced) 2010]

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

MTS049

3. Consider a triangle ABC and let a, b and c denote the length of the sides opposite to vertices A, B and C respectively. Suppose $a = 6, b = 10$ and the area of the triangle is $15\sqrt{3}$. If $\angle ACB$ is obtuse and if r denotes the radius of the incircle of the triangle, then r^2 is equal to

[JEE (Advanced) 2010]

MTS050

4. Let ABC be a triangle such that $\angle ACB = \frac{\pi}{6}$ and let a, b and c denote the lengths of the sides opposite to A, B and C respectively. The value(s) of x for which $a = x^2 + x + 1, b = x^2 - 1$ and $c = 2x + 1$ is/are

[JEE (Advanced) 2010]

(A) $-\left(2+\sqrt{3}\right)$ (B) $1+\sqrt{3}$ (C) $2+\sqrt{3}$ (D) $4\sqrt{3}$

MTS051

5. Let PQR be a triangle of area Δ with $a = 2, b = \frac{7}{2}$ and $c = \frac{5}{2}$, where a, b and c are the lengths of the sides of the triangle opposite to the angles at P, Q and R respectively. Then $\frac{2\sin P - \sin 2P}{2\sin P + \sin 2P}$ equals

[JEE (Advanced) 2012]

(A) $\frac{3}{4\Delta}$ (B) $\frac{45}{4\Delta}$ (C) $\left(\frac{3}{4\Delta}\right)^2$ (D) $\left(\frac{45}{4\Delta}\right)^2$

MTS052

6. In a triangle PQR, P is the largest angle and $\cos P = \frac{1}{3}$. Further the incircle of the triangle touches the sides PQ, QR and RP at N, L and M respectively, such that the lengths of PN, QL and RM are consecutive even integers. Then possible length(s) of the side(s) of the triangle is (are)

[JEE (Advanced) 2013]

(A) 16 (B) 18 (C) 24 (D) 22

MTS053

7. In a triangle the sum of two sides is x and the product of the same two sides is y. If $x^2 - c^2 = y$, where c is a third side of the triangle, then the ratio of the in-radius to the circum-radius of the triangle is - **[JEE (Advanced) 2014]**

(A) $\frac{3y}{2x(x+c)}$ (B) $\frac{3y}{2c(x+c)}$ (C) $\frac{3y}{4x(x+c)}$ (D) $\frac{3y}{4c(x+c)}$

MTS054

8. In a triangle XYZ, let x, y, z be the lengths of sides opposite to the angles X, Y, Z, respectively and $2s = x + y + z$. If $\frac{s-x}{4} = \frac{s-y}{3} = \frac{s-z}{2}$ and area of incircle of the triangle XYZ is $\frac{8\pi}{3}$, then- **[JEE (Advanced) 2016]**

(A) area of the triangle XYZ is $6\sqrt{6}$

(B) the radius of circumcircle of the triangle XYZ is $\frac{35}{6}\sqrt{6}$

(C) $\sin\frac{X}{2}\sin\frac{Y}{2}\sin\frac{Z}{2} = \frac{4}{35}$

(D) $\sin^2\left(\frac{X+Y}{2}\right) = \frac{3}{5}$

MTS055

9. In a triangle PQR, let $\angle PQR = 30°$ and the sides PQ and QR have lengths $10\sqrt{3}$ and 10, respectively. Then, which of the following statement(s) is (are) TRUE ? **[JEE (Advanced) 2018]**

(A) $\angle QPR = 45°$

(B) The area of the triangle PQR is $25\sqrt{3}$ and $\angle QRP = 120°$

(C) The radius of the incircle of the triangle PQR is $10\sqrt{3} - 15$

(D) The area of the circumcircle of the triangle PQR is 100π.

MTS056

10. In a non-right-angled triangle ΔPQR, let p, q, r denote the lengths of the sides opposite to the angles at P, Q, R respectively. The median from R meets the side PQ at S, the perpendicular from P meets the side QR at E, and RS and PE intersect at O. If $p = \sqrt{3}, q = 1$, and the radius of the circumcircle of the ΔPQR equals 1, then which of the following options is/are correct ? **[JEE (Advanced) 2019]**

(A) Area of $\Delta SOE = \frac{\sqrt{3}}{12}$ (B) Radius of incircle of $\Delta PQR = \frac{\sqrt{3}}{2}(2-\sqrt{3})$

(C) Length of $RS = \frac{\sqrt{7}}{2}$ (D) Length of $OE = \frac{1}{6}$

MTS057

11. Let x, y and z be positive real numbers. Suppose x, y and z are lengths of the sides of a triangle opposite to its angles X, Y and Z, respectively. If $\tan\frac{X}{2} + \tan\frac{Z}{2} = \frac{2y}{x+y+z}$, then which of the following statements is/are TRUE? **[JEE (Advanced) 2020]**

(A) $2Y = X + Z$ (B) $Y = X + Z$

(C) $\tan\frac{X}{2} = \frac{x}{y+z}$ (D) $x^2 + z^2 - y^2 = xz$

MTS058

12. In a triangle ABC, let $AB=\sqrt{23}$, $BC=3$ and $CA=4$. Then the value of $\frac{\cot A+\cot C}{\cot B}$ is____.

[JEE (Advanced) 2021]

MTS059

13. Consider a triangle PQR having sides of lengths p, q and r opposite to the angles P, Q and R, respectively. Then which of the following statements is (are) TRUE? **[JEE (Advanced) 2021]**

(A) $\cos P \geq 1-\frac{p^2}{2qr}$

(B) $\cos R \geq \left(\frac{q-r}{p+q}\right)\cos P+\left(\frac{p-r}{p+q}\right)\cos Q$

(C) $\frac{q+r}{p}<2\frac{\sqrt{\sin Q \sin R}}{\sin P}$

(D) If $p<q$ and $p<r$, then $\cos Q>\frac{p}{r}$ and $\cos R>\frac{p}{q}$

MTS060

14. Let $PQRS$ be a quadrilateral in a plane, where $QR=1$, $\angle PQR=\angle QRS=70°$, $\angle PQS=15°$ and $\angle PRS=40°$. If $\angle RPS=\theta°$, $PQ=\alpha$ and $PS=\beta$, then the interval(s) that contain(s) the value of $4\alpha\beta\sin\theta°$ is/are **[JEE (Advanced) 2022]**

(A) $\left(0,\sqrt{2}\right)$ (B) (1, 2) (C) $\left(\sqrt{2},3\right)$ (D) $\left(2\sqrt{2},3\sqrt{2}\right)$

MTS061

PARAGRAPH "I"

Consider an obtuse angled triangle ABC in which the difference between the largest and the smallest angle is $\frac{\pi}{2}$ and whose sides are in arithmetic progression. Suppose that the vertices of this triangle lie on a circle of radius 1.

(There are two questions based on PARAGRAPH "I", the question given below is one of them)

15. Let a be the area of the triangle ABC. Then the value of $(64a)^2$ is **[JEE (Advanced) 2023]**

MTS062

16. Then the inradius of the triangle ABC is **[JEE (Advanced) 2023]**

MTS063

JEE (Main) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION–A

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (1), (2), (3) and (4). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:

Full Marks : +4, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : –1 in all other cases.

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1. In a ΔABC, $A : B : C = 3 : 5 : 4$. Then $a + b + c\sqrt{2}$ is equal to

(1) $2b$ (2) $2c$ (3) $3b$ (4) $3a$

MTS068

2. In a ΔABC $\dfrac{bc\sin^2 A}{\cos A+\cos B\cos C}$ is equal to

(1) $b^2 + c^2$ (2) bc (3) a^2 (4) $a^2 + bc$

MTS069

3. If in a triangle ABC, $\cos A \cos B + \sin A \sin B \sin C = 1$, then the triangle is

(1) isosceles right angled (2) right angled
(3) equilateral (4) isosceles

MTS070

4. In ΔABC, $bc = 2b^2 \cos A + 2c^2 \cos A - 4bc \cos^2 A$, then ΔABC is

(1) isosceles but not necessarily equilateral
(2) equilateral
(3) right angled but not necessarily isosceles
(4) right angled isosceles

MTS071

5. In a ΔABC if $b + c = 3a$, then $\cot\dfrac{B}{2}\cdot\cot\dfrac{C}{2}$ has the value equal to:

(1) 4 (2) 3 (3) 2 (4) 1

MTS072

6. If R denotes circumradius, then in ΔABC, $\dfrac{b^2-c^2}{2a\ R}$ is equal to

(1) $\cos(B - C)$ (2) $\sin(B - C)$ (3) $\cos B - \cos C$ (4) $\sin(B + C)$

MTS073

7. In a triangle ABC, if $a : b : c = 3 : 7 : 8$, then $R : r$ is equal to

(1) 2 : 7 (2) 7 : 2 (3) 3 : 7 (4) 7 : 3

MTS074

8. If 'ℓ' is the length of median from the vertex A to the side BC of a ΔABC, then

(1) $4\ell^2 = b^2 + 4ac\cos B$ (2) $4\ell^2 = a^2 + 4bc\cos A$

(3) $4\ell^2 = c^2 + 4ab\cos C$ (4) $4\ell^2 = b^2 + 2c^2 - 2a^2$

MTS075

9. In a ΔABC, if $AB = 5\ cm$, $BC = 13\ cm$ and $CA = 12\ cm$, then the distance of vertex 'A' from the side BC is (in cm)

(1) $\frac{25}{13}$ (2) $\frac{60}{13}$ (3) $\frac{65}{12}$ (4) $\frac{144}{13}$

MTS076

10. If in a ΔABC, $\angle A = \frac{\pi}{2}$, then $\tan\frac{C}{2}$ is equal to

(1) $\frac{a-c}{2b}$ (2) $\frac{a-b}{2c}$ (3) $\frac{a-c}{b}$ (4) $\frac{a-b}{c}$

MTS077

11. A triangle has vertices A, B and C, and the respective opposite sides have lengths a, b and c. This triangle is inscribed in a circle of radius R. If $b = c = 1$ and the altitude from A to side BC has length $\sqrt{\frac{2}{3}}$, then R equals

(1) $\frac{1}{\sqrt{3}}$ (2) $\frac{2}{\sqrt{3}}$ (3) $\frac{\sqrt{3}}{2}$ (4) $\frac{\sqrt{3}}{2\sqrt{2}}$

MTS078

12. A circle is inscribed in a right triangle ABC, right angled at C. The circle is tangent to the segment AB at D and length of segments AD and DB are 7 and 13 respectively. Area of triangle ABC is equal to

(1) 91 (2) 96 (3) 100 (4) 104

MTS079

13. The sides a, b, c (taken in that order) of triangle ABC are in A.P.

If $\cos\alpha = \frac{a}{b+c}, \cos\beta = \frac{b}{c+a}, \cos\gamma = \frac{c}{a+b}$ then $\tan^2\left(\frac{\alpha}{2}\right) + \tan^2\left(\frac{\gamma}{2}\right)$ is equal to

[**Note:** All symbols used have usual meaning in triangle ABC.]

(1) 1 (2) $\frac{1}{2}$ (3) $\frac{1}{3}$ (4) $\frac{2}{3}$

MTS080

14. In ΔABC, if $a = 2b$ and $A = 3B$, then the value of $\frac{c}{b}$ is equal to

(1) 3 (2) $\sqrt{2}$ (3) 1 (4) $\sqrt{3}$

MTS081

15. In the triangle ABC, CH and CM are the lengths of the altitude and median to the base AB. If $a = 10, b = 26, c = 32$ then length HM is -

(1) 5 (2) 7 (3) 9 (4) 11

MTS082

16. In ΔABC if $a = 8$, $b = 9$, $c = 10$, then the value of $\frac{\tan C}{\sin B}$ is

(1) $\frac{32}{9}$ (2) $\frac{24}{7}$ (3) $\frac{21}{4}$ (4) $\frac{18}{5}$

MTS083

17. If the sides of a triangle are $\sin\alpha$, $\cos\alpha$, $\sqrt{1+\sin\alpha\cos\alpha}, 0<\alpha<\frac{\pi}{2}$, the largest angle is

(1) 60° (2) 90° (3) 120° (4) 150°

MTS084

18. In a triangle ABC, $\angle A = 60°$ and $b : c = \left(\sqrt{3}+1\right) : 2$ then $(\angle B - \angle C)$ has the value equal to

(1) 15° (2) 30° (3) 22.5° (4) 45°

MTS085

19. In triangle ABC, if $\Delta = a^2 - (b - c)^2$, then $\sin A =$

[**Note:** All symbols used have usual meaning in triangle ABC.]

(1) $\frac{15}{16}$ (2) $\frac{1}{2}$ (3) $\frac{8}{15}$ (4) $\frac{8}{17}$

MTS086

20. In triangle ABC, if $\cot\frac{A}{2}=\frac{b+c}{a}$, then triangle ABC must be

[Note: All symbols used have usual meaning in ΔABC.]

(1) isosceles (2) equilateral

(3) right angled (4) isosceles right angled

MTS087

SECTION-B

- This section will have **TEN** questions. Candidate can choose to attempt any 5 question out of these 10 questions. In case if candidate attempts more than 5 questions, first 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value (Answer should be rounded off to the nearest integer).
- Answer to each question will be evaluated according to the following marking scheme:

  Full Marks : +4, if only correct answer is given.

  Zero Marks : 0, if no answer is given.

  Negative Marks : -1 for incorrect answer

1. In a triangle ABC, $a : b : c = 4 : 5 : 6$. Then $3A + B$ equals to $k\pi$ then the value of k is

MTS088

2. Triangle ABC is right angle at A. The points P and Q are on hypotenuse BC such that $BP = PQ = QC$. If $AP = 3$ and $AQ = 4$, then length BC is equal to $\lambda\sqrt{5}$ then the value of λ is

MTS089

3. If in a triangle ABC, right angle at B, $s - a = 3$ and $s - c = 2$, then the value of $a + c$ is

MTS090

4. Triangle ABC is isosceles with $AB = AC$ and $BC = 65\ cm$. P is a point on BC such that the perpendicular distances from P to AB and AC are $24\ cm$ and $36\ cm$, respectively. The area of triangle ABC (in sq. cm) is $k(507)$ then the value of k is

MTS091

5. The perimeter of a triangle ABC right angled at C is 70, and the inradius is 6, then $|a - b|$ equals

MTS092

6. In any ΔABC, $\dfrac{(r_1 + r_2)(r_2 + r_3)(r_3 + r_1)}{Rs^2}$ is always equal to

MTS093

7. If in a triangle ABC, the line joining the circumcentre and incentre is parallel to BC, then $\cos B + \cos C$ is equal to :

MTS094

8. In triangle ABC, $a = 7$, $b = 6$, $c = 5$. Incircle touches the sides BC, AC and AB at D, E and F respectively and K, L, M are the feet of perpendiculars from circumcentre to sides BC, AC and AB respectively, then the value of $DK + EL + FM$ is

MTS095

9. If sides of a triangle ABC are given by 4,7,7 then length of the tangent drawn from vertex A to the ex-circle opposite to vertex A is equal to

MTS096

10. If f, g and h are the lengths of the perpendiculars from the circumcentre on the sides a, b and c of a triangle ABC respectively then $\dfrac{a}{f} + \dfrac{b}{g} + \dfrac{c}{h} = K\dfrac{abc}{4fgh}$ where K has the value equal to _____.

MTS097

JEE (Advanced) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION-I

- This section contains **FOUR** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories:

Full Marks : +3 If only the bubble corresponding to the correct option is darkened.
Zero Marks : 0 If none of the bubbles is darkened.
Negative Marks : –1 In all other cases

1. If in a triangle ABC, $(a + b + c)(b + c - a) = k.bc$, then :
(A) $k < 0$ (B) $k > 6$ (C) $0 < k < 4$ (D) $k > 4$

MTS098

2. If in a ΔABC, $\Delta = a^2 - (b - c)^2$, then $\tan A$ is equal to
(A) 15/16 (B) 8/15 (C) 8/17 (D) 1/2

MTS099

3. A triangle is inscribed in a circle. The vertices of the triangle divide the circle into three arcs of length 3, 4 and 5 units. Then area of the triangle is equal to:

(A) $\frac{9\sqrt{3}\,(1+\sqrt{3})}{\pi^2}$ (B) $\frac{9\sqrt{3}\,(\sqrt{3}-1)}{\pi^2}$ (C) $\frac{9\sqrt{3}\,(1+\sqrt{3})}{2\pi^2}$ (D) $\frac{9\sqrt{3}\,(\sqrt{3}-1)}{2\pi^2}$

MTS100

4. In a triangle ABC, if $\frac{a-b}{b-c} = \frac{s-a}{s-c}$, then r_1, r_2, r_3 are in:
(A) A.P. (B) G.P. (C) H.P. (D) none of these

MTS101

SECTION-II

- This section contains **FIVE** questions.
- Each question has **FOUR** options for correct answer(*s*). **ONE OR MORE THAN ONE** of these four option(*s*) is (are) correct option(*s*).
- For each question, choose the correct option(*s*) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks	:	+4	if only (all) the correct option(*s*) is (are) chosen.
Partial Marks	:	+3	if all the four options are correct but ONLY three options are chosen.
Partial Marks	:	+2	if three or more options are correct but ONLY two options are chosen, both of which are correct options.
Partial Marks	:	+1	if two or more options are correct but ONLY one option is chosen and it is a correct option.
Zero Marks	:	0	if none of the options is chosen (i.e. the question is unanswered).
Negative Marks	:	–2	in all other cases.

For Example : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(*s*) (second option in this case), with or without selection of any correct option(*s*) will result in –2 marks.

5. In a triangle ABC, if $\cos A \cos 2B + \sin A \sin 2B \sin C = 1$, then

(A) A, B, C are in A.P. (B) B, A, C are in A.P. (C) $\frac{r}{R} = 2$ (D) $\frac{r}{R} = \sqrt{2}\sin\frac{\pi}{12}$

MTS102

6. Let one angle of a triangle be 60°, the area of triangle is $10\sqrt{3}$ and perimeter is 20 cm. If $a > b > c$ where a, b and c denote lengths of sides opposite to vertices A, B and C respectively, then which of the following is (are) correct?

(A) Inradius of triangle is $\sqrt{3}$ (B) Length of longest side of triangle is 7

(C) Circumradius of triangle is $\frac{7}{\sqrt{3}}$ (D) Radius of largest escribed circle is $\frac{1}{12}$

MTS103

7. In triangle ABC, let $b = 10$, $c = 10\sqrt{2}$ and $R = 5\sqrt{2}$ then which of the following statement(s) is (are) correct?

[**Note:** All symbols used have usual meaning in triangle ABC.]

(A) Area of triangle ABC is 50.

(B) Distance between orthocentre and circumcentre is $5\sqrt{2}$

(C) Sum of circumradius and inradius of triangle ABC is equal to 10

(D) Length of internal angle bisector of $\angle ACB$ of triangle ABC is $\frac{5}{2\sqrt{2}}$

MTS104

8. In a triangle ABC, if $a = 4$, $b = 8$ and $\angle C = 60°$, then which of the following relations is (are) correct?

[**Note:** All symbols used have usual meaning in triangle ABC.]

(A) The area of triangle ABC is $8\sqrt{3}$

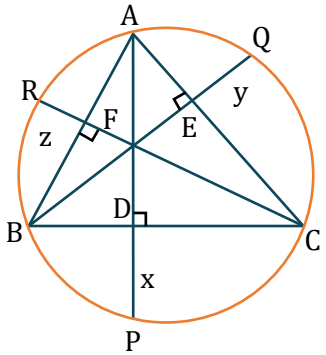
(B) The value of $\sum \sin^2 A = 2$

(C) Inradius of triangle ABC is $\frac{2\sqrt{3}}{3+\sqrt{3}}$

(D) The length of internal angle bisector of angle C is $\frac{4}{\sqrt{3}}$

MTS105

9. As shown in the figure AD is the altitude on BC and AD produced meets the circumcircle of ΔABC at P where $DP = x$. Similarly $EQ = y$ and $FR = z$. If a, b, c respectively denotes the sides BC, CA and AB then $\frac{a}{2x} + \frac{b}{2y} + \frac{c}{2z}$ has the value equal to



(A) $\tan A + \tan B + \tan C$ (B) $\cot A + \cot B + \cot C$

(C) $\cos A + \cos B + \cos C$ (D) $\operatorname{cosec} A + \operatorname{cosec} B + \operatorname{cosec} C$

MTS106

SECTION–III

- This section contains **ONE** paragraph.
- Based on each paragraph, there are **THREE** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :

Full Marks	:	+3	if only the bubble corresponding to the correct answer is darkened.
Zero Marks	:	0	in all other cases.

Comprehension # 1 (Q. 10 to 12)

The triangle formed by joining the three excentres I_1, I_2 and I_3 of ΔABC is called the excentral or excentric triangle and in this case internal angle bisector of triangle ABC are the altitudes of triangles $I_1I_2I_3$

10. Incentre I of ΔABC is the ..... of the excentral $\Delta I_1I_2I_3$.

(A) Circumcentre (B) Orthocentre

(C) Centroid (D) Excentre

MTS107

11. Sides of the $\Delta I_1I_2I_3$ are

(A) $R\cos\frac{A}{2}$, $R\cos\frac{B}{2}$ and $R\cos\frac{C}{2}$ (B) $4R\cos\frac{A}{2}$, $4R\cos\frac{B}{2}$ and $4R\cos\frac{C}{2}$

(C) $2R\cos\frac{A}{2}$, $2R\cos\frac{B}{2}$ and $2R\cos\frac{C}{2}$ (D) $8R\cos\frac{A}{2}$, $8R\cos\frac{B}{2}$ and $8R\cos\frac{C}{2}$

MTS108

12. Value of $II_1^2 + I_2I_3^2 = II_2^2 + I_3I_1^2 = II_3^2 + I_1I_2^2 =$

(A) $4R^2$ (B) $16R^2$ (C) $32R^2$ (D) $64R^2$

MTS109

SECTION–IV

- This section contains **TWO** question.
- Each question contains two columns, Column-I and Column-II.
- Column-I has four entries (A), (B), (C) and (D).
- Column-II has four entries (p), (q), (r), (s).
- Match the entries in Column-I with the entries in Column-II.
- For each question, marks will be awarded in one of the following categories:

Full Marks	: +4	If only correct answer is given.
Zero Marks	: 0	If no answer is given.
Negative Marks	: –1	For incorrect answer

13. Match the column

Column– I		**Column–II**	
(A)	In a ΔABC, $2B = A + C$ and $b^2 = ac$. Then the value of $\frac{a^2(a+b+c)}{3abc}$ is equal to	(p)	8
(B)	In any right angled triangle ABC, the value of $\frac{a^2+b^2+c^2}{R^2}$ is always equal to (where R is the circumradius of ΔABC)	(q)	1
(C)	In a ΔABC if $a = 2$, $bc = 9$, then the value of $2R\Delta$ is equal to	(r)	5
(D)	In a ΔABC, $a = 5$, $b = 3$ and $c = 7$, then the value of $3\cos C + 7\cos B$ is equal to	(s)	9

MTS110

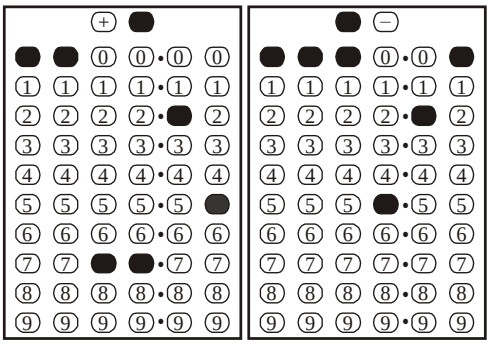
14. Match the column

	Column – I		**Column – II**
(A)	In a ΔABC, $a = 4$, $b = 3$ and the medians AA_1 and BB_1 are mutually perpendicular, then square of area of the ΔABC is equal to	(p)	27
(B)	In any ΔABC, minimum value of $\frac{r_1\ r_2\ r_3}{r^3}$ is equal to	(q)	7
(C)	In a ΔABC, $a = 5$, $b = 4$ and $\tan\frac{C}{2} = \sqrt{\frac{7}{9}}$, then side '$c$' is equal to	(r)	6
(D)	In a ΔABC, $2a^2 + 4b^2 + c^2 = 4ab + 2ac$, then value of $(8\cos B)$ is equal to	(s)	11

MTS111

SECTION–V

- This section contains **FOUR** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/ rounded-off to the **second decimal place**; e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.
  For Example : If answer is –77.25, 5.2 then fill the bubbles as follows.



- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +3 If ONLY the correct numerical value is entered as answer.
  Zero Marks : 0 In all other cases.

15. In a ΔABC, $\angle C = 60°$ and $\angle A = 75°$. If D is a point on AC such that the area of the ΔBAD is $\sqrt{3}$ times the area of the ΔBCD, if $\angle ABD$ is equal to $(6k)°$ then the value of k is –

MTS112

16. If the inradius in a right angled triangle with integer sides is 4, the greatest perimeter (in units) is $15k$ then the value of k is –

MTS113

17. If the inradius in a right angled triangle with integer sides is 5, the greatest area (in square) is 66λ then the value of λ is –

MTS114

18. If $a^2\ (s-a) + b^2\ (s-b) + c^2\ (s-c) = \lambda R\Delta\left(1+4\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}\right)$ then find the value of λ?

[**Note:** All symbols used have usual meaning in triangle ABC.]

MTS115

ANSWER KEY

EXERCISE - O

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	D	D	A	C	C	C	C	C	C	D
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	B	C	C	B	D	A	A	C	A	C
Que.	21	22	23	24	25	26	27	28		
Ans.	A,B,D	A,D	B,C	A,C,D	B,D	A,C,D	C	D		
Que.	29			30						
Ans.	A→S;B→P;C→Q;D→R			A→R; B→P; C→T; D→Q						

EXERCISE - S

1.	3	**2.**	91	**3.**	4	**4.**	6	**5.**	3
6.	**7**	**7.**	**1**	**8.**	**3**	**9.**	**9**	**10.**	**8**

EXERCISE - JEE (Main) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	4	1	2	3	3	3	3	3	15	3
Que.	11									
Ans.	3									

EXERCISE - JEE (Advanced) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	4	D	3	B	C	B,D	B	A,C,D	B,C,D	B,C,D
Que.	11	12	13	14	15			16		
Ans.	B,C	2	A,B	A,B	1007.69 to 1008.01			0.24 to 0.26		

JEE (Main) Practice Paper

	Q.	1	2	3	4	5	6	7	8	9	10
Section-A	A.	3	3	1	1	3	2	2	2	2	4
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	4	1	4	4	3	1	3	2	4	3
Section-B	Q.	1	2	3	4	5	6	7	8	9	10
	A.	1	3	7	5	1	4	1	2	9	1

JEE (Advanced) Practice Paper

Section-I	**Q.**	**1**	**2**	**3**	**4**		
	A.	C	B	A	A		
Section-II	**Q.**	**5**	**6**	**7**	**8**	**9**	
	A.	B,D	A,C	A,B,C	A,B	A	
Section-III	**Q.**	**10**	**11**	**12**			
	A.	B	B	B			
Section-IV	**Q.**	**13**				**14**	
	A.	$A \to q; B \to p; C \to s; D \to r$				$A \to s; B \to p; C \to r; D \to q$	
Section-V	**Q.**	**15**	**16**	**17**	**18**		
	A.	5	6	5	4		