Exercise-1

Marked Questions may have for Revision Questions.

*** Marked Questions may have more than one correct option.**

OBJECTIVE QUESTIONS

Section (A) : Sine Rule

A-1 In a ΔABC, a sin(B – C) + b sin (C – A) + c sin (A – B) =

(1) 0 (2) a + b + c (3) a (4) b

A-2 In a ΔABC, $\frac{a^2 \sin(B-C)}{\sin A} + \frac{b^2 \sin(C-A)}{\sin B} + \frac{c^2 \sin(A-B)}{\sin C} =$

(1) abc (2) a + b + c (3) $a^2 + b^2 + c^2$ (4) 0

A-3 The angles of a ΔABC are in A.P. (order being A, B, C) and it is being given that b : c = $\sqrt{3} : \sqrt{2}$, then ∠A is equal to

(1) 45º (2) 75° (3) 60º (4) 30º

A-4. If cos A + cos B = 4 $\sin^2\left(\frac{C}{2}\right)$, then sides a, c, b of the triangle ABC are in

(1) G.P. (2) A.P. (3) H.P. (4) A.G.P.

A-5. If in a ΔABC, $\frac{\sin A}{\sin C} = \frac{\sin(A-B)}{\sin(B-C)}$, then a^2, b^2, c^2 are in

(1) G.P. (2) H.P. (3) A.P. (4) A.G.P.

A-6. 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

A-7. If in a Δ ABC, $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$, then the triangle is :

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

A-8. In a ΔABC $\frac{bc \sin^2 A}{\cos A + \cos B \cos C}$ is equal to

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

Section (B) : Cosine Rule, projection formula

B-1 In a ΔABC, 2(bc cos A + ca cos B + ab cos C) is equal to

(1) $a^2 + b^2 + c^2$ (2) a + b + c (3) abc (4) sinA sinB sinC

B-2 In a ΔABC, $(a-b)^2 \cos^2 \frac{C}{2} + (a+b)^2 \sin^2 \frac{C}{2}$ is equal to

(1) b^2 (2) a^2 (3) c^2 (4) abc

B-3 In a ΔABC, $b^2 \sin 2C + c^2 \sin 2B$ is equal to
(1) 2bc cos A (2) bc sin A (3) bc cos A (4) 2bc sin A

B-4 In a ΔABC, $\left(\frac{c - a\cos B}{b - a\cos C}\right)\sin C$ is equal to
(1) cosA (2) cosB (3) sinB (4) acosA

B-5. In a triangle ABC, for any angle θ, $b \cos (A - \theta) + a \cos (B + \theta)$ is equal to
(1) $b \sin\theta$ (2) $c \sin\theta$ (3) $a \cos\theta$ (4) $c \cos \theta$.

B-6. If in a triangle ABC, the altitude AM be the bisector of $\angle BAD$, where D is the mid point of side BC, then $(b^2 - c^2)$ is equal to
(1) a^2 (2) $a^2/2$ (3) ab (4) bc

B-7. In a ΔABC, $2\left[a\sin^2\frac{C}{2} + c\sin^2\frac{A}{2}\right] = c + a - b$.
(1) c + a + b (2) c – a – b (3) c + a – b (4) c – a + b

B-8. If in a triangle ABC, $(a + b + c)(b + c - a) = k.\, bc$, then :
(1) $k < 0$ (2) $k > 6$ (3) $0 < k < 4$ (4) $k > 4$

B-9. In a triangle ABC, a: b: c = 4: 5: 6. Then 3A + B equals to :
(1) 4C (2) 2π (3) $\pi - C$ (4) π

B-10. The distance between the middle point of BC and the foot of the perpendicular from A is :
(1) $\frac{-a^2 + b^2 + c^2}{2a}$ (2) $\frac{b^2 - c^2}{2a}$ (3) $\frac{b^2 + c^2}{\sqrt{bc}}$ (4) $\frac{b^2 + c^2}{2a}$

Section (C) : Napiar formulae, Area of Triangle

C-1. In a triangle ABC, $4\Delta(\cot A + \cot B + \cot C)$ is equal to
(1) $a^2 - b^2 + c^2$ (2) $a^2 + b^2 + c^2$ (3) $a^2b^2c^2$ (3) abc

C-2 If in a Δ ABC, a = 6, b = 3 and $\cos(A - B) = 4/5$, then its area is equal to
(1) 6 sq. unit (2) 12 sq. unit (3) 9 sq. unit (4) 18 sq. unit

C-3. If in a triangle ABC, $\angle A = 30^o$ and the area of triangle is $\frac{\sqrt{3}\,a^2}{4}$, then
(1) C = 4B (2) C = B. (2) C = 2B. (4) C = 3B.

C-4. In a ΔABC, $A = \frac{2\pi}{3}$, $b - c = 3\sqrt{3}$ cm and area $(\Delta ABC) = \frac{9\sqrt{3}}{2}$ cm^2. Then 'a' is
(1) $6\sqrt{3}$ cm (2) 9 cm (3) 18 cm (4) 7 cm

Section (D) : Half Angle formulae

D-1 In a ΔABC, $\frac{\cos^2\frac{A}{2}}{a} + \frac{\cos^2\frac{B}{2}}{b} + \frac{\cos^2\frac{C}{2}}{c}$ is equal to

(1) $\frac{s}{abc}$ (2) $\frac{2s^2}{abc}$ (3) $\frac{3s^2}{abc}$ (4) $\frac{s^2}{abc}$

D-2. In a ΔABC, $4\left(bc.\cos^2\frac{A}{2}+ca.\cos^2\frac{B}{2}+ab.\cos^2\frac{C}{2}\right)$ is equal to

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

D-3. In a ΔABC,. $\left(\frac{2abc}{a+b+c}\right)\cos\frac{A}{2}.\cos\frac{B}{2}.\cos\frac{C}{2}$ is equal to

(1) 2Δ (2) Δ (3) Δ/2 (4) Δ/abc

D-4. If the sides a, b, c of a triangle are in A.P., then the value of $\tan\frac{A}{2} + \tan\frac{A}{2}$ is equal to

(1) $\frac{1}{3}\cot\frac{B}{2}$ (2) $\frac{3}{2}\cot\frac{B}{2}$ (3) $\frac{2}{3}\cot\frac{B}{2}$. (4) $\frac{1}{2}\cot\frac{B}{2}$.

D-5. If in a triangle ABC, $b\cos^2\frac{A}{2} + a\cos^2\frac{B}{2} = \frac{3}{2}c$, then a, c, b are :

(1) in A.P. (2) in G.P. (3) in H.P. (4) None

D-6. In a Δ ABC if b + c = 3a, then $\cot\frac{B}{2}\cdot\cot\frac{C}{2}$ has the value equal to:

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

D-7. If in a ΔABC, $\Delta = a^2 - (b - c)^2$, then tan A is equal to

(1) 15/16 (2) 8/15 (3) 8/17 (4) 1/2

D-8. 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) $\frac{a-b}{c}$

D-9. In ΔABC, $\frac{2ab}{(a+b+c)\Delta}\ .\ \cos^2\frac{C}{2}$ is equal to

(1) $\frac{s-a}{\Delta}$ (2) $\frac{s-b}{\Delta}$ (2) $\frac{a+b+c}{\Delta}$ (4) $\frac{s-c}{\Delta}$

Section (E) : Circumradius and Inradius

E-1. In ΔABC, R r (sin A + sin B + sin C) is equal to

(1) Δ (2) 2Δ (3) 3Δ (4) Δ/2

E-2. In ΔABC, a cos B cos C + b cos C cos A + c cos A cos B is equal to

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

E-3. In ΔABC, $\frac{1}{ab}+\frac{1}{bc}+\frac{1}{ca}$ is equal to

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

E-4. In ΔABC, $\cos^2\frac{A}{2}+\cos^2\frac{B}{2}+\cos^2\frac{C}{2}$

(1) $2+\frac{r}{2R}$ (2) $1+\frac{r}{2R}$ (3) $1+\frac{r}{R}$ (4) $2+\frac{r}{R}$

E-5. In ΔABC, acot A + b cot B + c cot C

(1) R + r (2) 2R + r (3) R + 2r (4) 2(R + r)

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

(1) cos (B – C) (2) sin (B – C) (3) cos B – cos C (4) sin(B + C)

E-7. In a Δ ABC, the value of $\frac{a\cos A+b\cos B+c\cos C}{a+b+c}$ is equal to:

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

E-8. 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

E-9. In a ΔABC, a = 1 and the perimeter is six times the arithmetic mean of the sines of the angles. Then measure of ∠ A is

(1) $\frac{\pi}{3}$ (2) $\frac{\pi}{2}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{4}$

Section (F) : Length of Median, angle bisector, altitude

F-1. If α, β, γ are the respective altitudes of a triangle ABC, $\left(\frac{1}{\alpha^2}+\frac{1}{\beta^2}+\frac{1}{\gamma^2}\right)$ is equal to

(1) $\frac{a^2+b^2+c^2}{\Delta^2}$ (2) $\frac{a^2+b^2+c^2}{4\ \Delta^2}$ (3) $\frac{a^2+b^2+c^2}{2\Delta^2}$ (4) $\frac{a+b+c}{4\Delta^2}$

F-2. If α, β, γ are the respective altitudes of a triangle ABC, $\frac{1}{\alpha}+\frac{1}{\beta}-\frac{1}{\gamma}$ is equal to

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

F-3. 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) $\frac{144}{13}$

F-4. If AD, BE and CF are the medians of a ΔABC, then $(AD^2 + BE^2 + CF^2) : (BC^2 + CA^2 + AB^2)$ is equal to
(1) 4 : 3 (2) 3 : 2 (3) 3 : 4 (4) 2 : 3

F-5. In an acute angled triangle ABC, AP is the altitude. Circle drawn with AP as its diameter cuts the sides AB and AC at D and E respectively, then length DE is equal to
(1) $\frac{\Delta}{2R}$ (2) $\frac{\Delta}{3R}$ (3) $\frac{\Delta}{4R}$ (4) $\frac{\Delta}{R}$

F-6. 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) $4\ell^2 = b^2 + 2c^2 - 2a^2$

Exercise-2

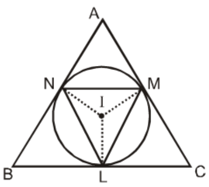
Marked Questions may have for Revision Questions.
*** Marked Questions may have more than one correct option.**

PART - I : OBJECTIVE QUESTIONS

1. If in a triangle ABC, right angle at B, s − a = 3 and s − c = 2, then
(1) a = 2, c = 3 (2) a = 3, c = 4 (3) a = 4, c = 3 (4) a = 6, c = 8

2. If in a triangle ABC, the line joining the circumcentre and incentre is parallel to BC, then cos B + cos C is equal to :
(1) 0 (2) 1 (3) 2 (4) 1/2

3. If the incircle of the Δ ABC touches its sides at L, M and N as shown in the figure and if x, y, z be the circumradii of the triangles MIN, NIL and LIM respectively, where I is the incentre, then the product xyz is equal to :



(1) $R r^2$ (2) $r R^2$ (3) $\frac{1}{2} R r^2$ (4) $\frac{1}{2} r R^2$

4. 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:
(1) $\frac{9\sqrt{3}(1+\sqrt{3})}{\pi^2}$ (2) $\frac{9\sqrt{3}(\sqrt{3}-1)}{\pi^2}$ (3) $\frac{9\sqrt{3}(1+\sqrt{3})}{2\pi^2}$ (4) $\frac{9\sqrt{3}(\sqrt{3}-1)}{2\pi^2}$

5. In a triangle ABC, B = 60° and C = 45°. Let D divides BC internally in the ratio 1 : 3, then value of $\frac{\sin\angle BAD}{\sin\angle CAD}$ is
(1) $\sqrt{\frac{2}{3}}$ (2) $\frac{1}{\sqrt{3}}$ (3) $\frac{1}{\sqrt{6}}$ (4) $\frac{1}{3}$

6. With usual notations, if in a Δ ABC, $\frac{b+c}{11} = \frac{c+a}{12} = \frac{a+b}{13}$, then which of the following is false

(1) $\cos A = \frac{1}{5}$ (2) $\cos B = \frac{19}{35}$ (3) $\cos C = \frac{5}{7}$ (4) $\sin C = \frac{19}{35}$

7. Let a, b and c be the sides of a ΔABC. If a^2, b^2 and c^2 are the roots of the equation $x^3 - Px^2 + Qx - R = 0$, where P, Q & R are constants, then find the value of $\frac{\cos A}{a} + \frac{\cos B}{b} + \frac{\cos C}{c}$ in terms of P, Q and R.

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

8. In a ΔABC, $(b - c)\cot\frac{A}{2} + (c - a)\cot\frac{B}{2} + (a - b)\cot\frac{C}{2}$ is equal to

(1) 0 (2) abc (3) a+ b + c (4) $(a+b+c)^2$

9.. A regular hexagon & a regular dodecagon are inscribed in the same circle. If the side of the dodecagon is $\left(\sqrt{3} - 1\right)$, if the side of the hexagon is $\sqrt[4]{k}$, then find value of k.

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

10. If H is the orthocentre of a triangle ABC, then the radii of the circle circumscribing the triangles BHC, CHA and AHB are respectively equal to :

(1) R, R, R (2) $\sqrt{2}R, \sqrt{2}R, \sqrt{2}R$

(3) 2R, 2R, 2R (4) $\frac{R}{2}, \frac{R}{2}, \frac{R}{2}$

11 Let f, g, h be the lengths of the perpendiculars from the circumcentre of the Δ ABC on the sides BC, CA and AB respectively. If $\frac{a}{f} + \frac{b}{g} + \frac{c}{h} = \lambda \frac{abc}{fgh}$, then the value of 'λ' is:

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

12. AA_1, BB_1 and CC_1 are the medians of triangle ABC whose centroid is G. If points A, C_1, G and B_1 are concyclic, then

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

PART - II : MISCELLANEOUS QUESTIONS

Section (A) : ASSERTION/REASONING

DIRECTIONS :

Each question has 4 choices (1), (2), (3) and (4) out of which ONLY ONE is correct.

(1) Both the statements are true.

(2) Statement-I is true, but Statement-II is false.

(3) Statement-I is false, but Statement-II is true.

(4) Both the statements are false.

A-1. **Statement-1 :** In a triangle ABC, the harmonic mean of the three exradii is three times the inradius.
Statement-2 : In any triangle ABC, $r_1 + r_2 + r_3 = 4R$.

A-2. **Statement-1 :** If R be the circumradius of a ΔABC, then circumradius of its excentral $\Delta I_1I_2I_3$ is 2R.

Statement-2 : If circumradius of a triangle be R, then circumradius of its pedal triangle is $\frac{R}{2}$.

Section (B) : MATCH THE COLUMN

B-1. 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

B-2 **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 $\frac{r_1r_2r_3}{r^3}$ 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

Section (C) : ONE OR MORE THAN ONE OPTIONS CORRECT

C-1. If in a ΔABC, a = 5, b = 4 and $\cos(A - B) = \frac{31}{32}$, then

(1) c = 6 (2) sin A = (3) area of ΔABC = (4) c = 8

C-2. Which of the following holds good for any triangle ABC?

(1) $\frac{\cos A}{a} + \frac{\cos B}{b} + \frac{\cos C}{c} = \frac{a^2+b^2+c^2}{2abc}$ (2) $\frac{\sin A}{a} + \frac{\sin B}{b} + \frac{\sin C}{c} = \frac{3}{2R}$

(3) $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$ (4) $\frac{\sin 2A}{a^2} = \frac{\sin 2B}{b^2} = \frac{\sin 2C}{c^2}$

C-3. In a triangle ABC, right angled at B, then

(1) r = $\frac{AB+BC-AC}{2}$ (2) r = $\frac{AB+AC-BC}{2}$ (3) r = $\frac{AB+BC+AC}{2}$ (4) R = $\frac{s-r}{2}$

C-4. If in a triangle ABC, cos A cos B + sin A sin B sin C = 1, then the triangle is

(1) isosceles (2) right angled (3) equilateral (4) None of these

C-5. The product of the distances of the incentre from the angular points of a Δ ABC is:

(1) 4 R^2 r (2) 4 Rr^2 (3) $\frac{(abc)R}{s}$ (4) $\frac{(abc)r}{s}$

C-6. Three equal circles of radius unity touches one another. Radius of the circle touching all the three circles is :

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

C-7 In a triangle ABC, with usual notations the length of the bisector of internal angle A is :

(1) $\frac{2bc\ \cos\frac{A}{2}}{b+c}$ (2) $\frac{2bc\ \sin\ \frac{A}{2}}{b+c}$ (3) $\frac{abc\,\text{cosec}\,\frac{A}{2}}{2R\ \ (b+c)}$ (4) $\frac{2\Delta}{b+c}\cdot\text{cosec}\,\frac{A}{2}$

Exercise-3

Marked Questions may have for Revision Questions.

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PART - I : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

1. The sum of the radii of inscribed and circumscribed circles for an n sided regular polygon of side 'a', is : **[AIEEE - 2002 (3, –1), 225]**

(1) a cot$\left(\frac{\pi}{n}\right)$ (2) $\frac{a}{2}$ cot$\left(\frac{\pi}{2n}\right)$ (3) a cot$\left(\frac{\pi}{2n}\right)$ (4) $\frac{a}{4}$ cot$\left(\frac{\pi}{2n}\right)$

2. If in a triangle ABC, a $\cos^2\left(\frac{C}{2}\right)$ + c $\cos^2\left(\frac{A}{2}\right)$ = $\frac{3b}{2}$, then the sides a, b and c : **[AIEEE - 2003 (3, –1), 225]**

(1) are in A.P. (2) are in G.P. (3) are in H.P. (4) satisfy a + b = c.

3. In a triangle ABC, medians AD and BE are drawn. If AD = 4, ∠DAB = $\frac{\pi}{6}$ and ∠ABE = $\frac{\pi}{3}$, then the area of the ΔABC is : **[AIEEE - 2003 (3, –1), 225]**

(1) $\frac{8}{3}$ (2) $\frac{16}{3}$ (3) $\frac{32}{3\sqrt{3}}$ (4) $\frac{64}{3}$.

4. The sides of a triangle are sinα, cosα and $\sqrt{1+\sin\alpha\cos\alpha}$ for some 0 < α < $\frac{\pi}{2}$. Then the greatest angle of the triangle is : **[AIEEE - 2004 (3, –1), 225]**

(1) 60º (2) 90º (3) 120º (4) 150º

5. In a triangle ABC, let ∠C = π/2, if r is the inradius and R is the circumradius of the triangle ABC, then 2(r+R) equals : **[AIEEE - 2005 (3, 0), 225]**

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

6. If in a ΔABC, the altitudes from the vertices A,B,C on opposite sides are in H.P., then sinA, sinB, sinC are in: **[AIEEE - 2005 (3, 0), 225]**

(1) HP (2) Arithemetico-Geometric Progression

(3) AP (4) GP

7. For a regular polygon, let r and R be the radii of the inscribed and the circumscribed circles. A **false** statement among the following is **[AIEEE - 2010 (4, –1), 144]**

(1) There is a regular polygon with $\frac{r}{R}=\frac{1}{\sqrt{2}}$. (2) There is a regular polygon with $\frac{r}{R}=\frac{2}{3}$.

(3) There is a regular polygon with $\frac{r}{R}=\frac{\sqrt{3}}{2}$. (4) There is a regular polygon with $\frac{r}{R}=\frac{1}{2}$.

8. ABCD is a trapezium such that AB and CD are parallel and BC ⊥ CD. If ∠ADB = θ , BC = p and CD = q, then AB is equal to : **[AIEEE - 2013, (4, –1),360]**

(1) $\frac{(p^2+q^2)\sin\theta}{p\cos\theta+q\sin\theta}$ (2) $\frac{p^2+q^2\cos\theta}{p\cos\theta+q\sin\theta}$ (3) $\frac{p^2+q^2}{p^2\cos\theta+q^2\sin\theta}$ (4) $\frac{(p^2+q^2)\sin\theta}{(p\cos\theta+q\sin\theta)^2}$

PART - I : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

1. If I_n is the area of n sided regular polygon inscribed in a circle of unit radius and O_n be the area of the polygon circumscribing the given circle, prove that **[IIT-JEE-2003, Main.,(4)/60]**

$I_n = \frac{O_n}{2}\left(1+\sqrt{1-\left(\frac{2I_n}{n}\right)^2}\right)$.

2. If the angles of a triangle are in the ratio 4 : 1 : 1, then the ratio of the longest side to the perimeter is– **[IIT-JEE-2003, Scr., (3, –1)/84]**

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

3. If a,b,c are the sides of a triangle such that a : b : c = 1 : $\sqrt{3}$: 2, then ratio A : B : C is equal to – **[IIT-JEE-2004, Scr., (3, –1)/84]**

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

4. In an equilateral triangle, 3 coins of radii 1 unit each are kept so that they touch each other and also the sides of the triangle. Area of the triangle is **[IIT-JEE - 2005, Scr- (3, – 1), 84]**

(A) 4 + 2$\sqrt{3}$ (B) 6 + 4$\sqrt{3}$ (C) 12 + $\frac{7\sqrt{3}}{4}$ (D) 3 + $\frac{7\sqrt{3}}{4}$

5. If a,b,c denote the lengths of the sides of a triangle opposite to angles A,B,C respectively of a ΔABC, then the correct relation among a,b,c, A,B and C is given by – **[IIT-JEE-2005, Scr., (3, –1)/ 84]**

(A) $(b + c) \sin\left(\frac{B+C}{2}\right) = a \cos \frac{A}{2}$
(B) $(b - c) \cos \frac{A}{2} = a \sin\left(\frac{B-C}{2}\right)$
(C) $(b - c) \cos \frac{A}{2} = 2a \sin\left(\frac{B-C}{2}\right)$
(D) $(b - c) \sin\left(\frac{B-C}{2}\right) = a \cos \frac{A}{2}$

6. Circles with radii 3, 4 and 5 touch each other externally. If P is the point of intersection of tangents to these circles at their points of contact, find the distance of P from the points of contact.
[IIT-JEE-2005, Main.,(2)/60]

7. Given an isosceles triangle, whose one angle is 120° and radius of its incircle is $\sqrt{3}$ unit. Then the area of the triangle in sq. units is **[IIT-JEE-2006, Main.,(3, –1)/184]**

(A) $7 + 12\sqrt{3}$ (B) $12 - 7\sqrt{3}$ (C) $12 + 7\sqrt{3}$ (D) 4π

8.* Internal bisector of ∠A of triangle ABC meets side BC at D. A line drawn through D perpendicular to AD intersects the side AC at E and the side AB at F. If a, b, c represent sides of ΔABC, then
[IIT-JEE-2006, Main.,(5, –1)/184]

(A) AE is HM of b and c
(B) $AD = \frac{2bc}{b+c} \cos \frac{A}{2}$
(C) $EF = \frac{4bc}{b+c} \sin \frac{A}{2}$
(D) the triangle AEF is isosceles

9. Let ABC and ABC' be two non-congruent triangles with sides AB = 4, AC = AC' = $2\sqrt{2}$ and angle B= 30º. Find the absolute value of the difference between the areas of these triangles.
[IIT-JEE 2009, Paper-2, (4, –1), 80]

10*. In a triangle ABC with fixed base BC, the vertex A moves such that $\cos B + \cos C = 4 \sin^2 \frac{A}{2}$. If a, b and c denote the lengths of the sides of the triangle opposite to the angles A, B and C respectively, then
[IIT-JEE 2009, Paper-2, (4, –1), 80]

(A) b + c = 4a
(B) b + c = 2a
(C) locus of points A is an ellipse
(D) locus of point A is a pair of straight lines

11. If the angle A, B and C of a triangle are in 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 the expression $\frac{a}{c} \sin 2C + \frac{c}{a} \sin 2A$ is
[IIT-JEE 2010, Paper-1, (3, –1), 84]

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

12. 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)
[IIT-JEE 2010, Paper-1, (3, 0), 84]

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

13. Consider a triangle ABC and let a, b and c denote the lengths 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 ∠ACB is obtuse and if r denotes the radius of the incircle of the triangle, then r^2 is equal to **[IIT-JEE 2010, Paper-2, (3, 0), 79]**

14. 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
[IIT-JEE 2012, Paper-2, (3, –1), 66]

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

15.* In a triangle PQR, P is the largest angle and cosP = $\frac{1}{3}$. 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, Paper-2, (3, –1)/60]

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

16. 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 the third side of the triangle, then the ratio of the in-radius to the circum-radius of the triangle is
[JEE (Advanced) 2014, Paper-2, (3, –1)/60]

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

17. 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, Paper-1, (4, –2)/62]

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

Answers

EXERCISE # 1

Section (A)

A-1	(1)	**A-2**	(4)	**A-3**	(2)	**A-4.**	(2)	**A-5.**	(3)	**A-6.**	(3)	**A-7.**	(3)
A-8.	(3)												

Section (B)

B-1	(1)	**B-2**	(3)	**B-3**	(4)	**B-4**	(3)	**B-5.**	(4)	**B-6.**	(2)	**B-7.**	(3)
B-8.	(3)	**B-9.**	(4)	**B-10.**	(2)								

Section (C)

C-1.	(2)	**C-2**	(3)	**C-3.**	(1)	**C-4.**	(2)

Section (D)

D-1	(4)	**D-2.**	(3)	**D-3.**	(2)	**D-4.**	(3)	**D-5.**	(1)	**D-6.**	(3)	**D-7.**	(2)
D-8.	(4)	**D-9.**	(4)										

Section (E)

E-1.	(1)	**E-2.**	(4)	**E-3.**	(2)	**E-4.**	(1)	**E-5.**	(4)	**E-6.**	(2)	**E-7.**	(1)
E-8.	(2)	**E-9.**	(3)										

Section (F)

F-1.	(2)	**F-2.**	(1)	**F-3.**	(2)	**F-4.**	(3)	**F-5.**	(4)	**F-6.**	(2)

EXERCISE # 2

PART-I

1.	(2)	**2.**	(2)	**3.**	(3)	**4.**	(1)	**5.**	(3)	**6.**	(4)	**7.**	(1)
8.	(1)	**9.**	(1)	**10.**	(1)	**11**	(1)	**12.**	(3)				

PART-II

Section (A) :

A-1. (3) **A-2.** (1)

Section (B) :

B-1. (A) → (q), (B) → (p), (C) → (s), (D) → (r)

B-2 (A) → (s), (B) → (p), (C) → (r), (D) → (q)

Section (C) :

C-1.	(1,2)	**C-2.**	(1,2)	**C-3.**	(1,4)	**C-4.**	(1,2)	**C-5.**	(2,4)
C-6.	(1,3)	**C-7**	(1,3,4)						

EXERCISE # 3

PART-I

1.	(2)	**2.**	(1)	**3.**	(3)	**4.**	(3)	**5.**	(3)	**6.**	(3)	**7.**	(2)
8.	(1)												

PART-II

2.	(A)	**3.**	(C)	**4.**	(B)	**5.**	(B)	**6.**	($\sqrt{5}$)	**7.**	(C)		
8.*	(ABCD)	**9.**	(BC)	**10*.**	(B,C)	**11.**	(D)	**12.**	(B)	**13.**	3	**14.**	(C)
15.*	(B, D)	**16.**	(B)	**17.**	(A,C,D)								