PART # 02

TRIGONOMETRY

EXERCISE # 01

SECTION-1 : (ONE OPTION CORRECT TYPE)

401. The difference between the greatest and least values of the function f (x) = cos x + $\frac{1}{2}$ cos 2x – $\frac{1}{3}$ cos 3x is

(A) $\frac{2}{3}$ (B) $\frac{8}{7}$ (C) $\frac{9}{4}$ (D) $\frac{3}{8}$

402. If in a ΔABC cosA + 2cosB + cosC = 2, then a, b, c are in

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

403. If $f(x) = \sin^{4n}x - \cos^{4n}x$ and g(x) = sinx + cosx, then general solution of $f(x) = \left[g\left(\frac{\pi}{10}\right)\right]$ is (where [.] is greatest integer less than equal to x)

(A) $2n\pi + \frac{\pi}{3}, n \in I$ (B) $n\pi + \frac{\pi}{2}, n \in I$ (C) $n\pi + \frac{\pi}{4}, n \in I$ (D) none of these

404. The maximum value of $(\sin\alpha_1)(\sin\alpha_2) \ldots (\sin\alpha_n)$ under the restrictions $0 \le \alpha_1, \alpha_2, \ldots \alpha_n \le \frac{\pi}{2}$ and $(\tan\alpha_1)(\tan\alpha_2) \ldots (\tan\alpha_n) = 1$ is

(A) $\frac{1}{2^n}$ (B) $\frac{1}{2n}$ (C) $\frac{1}{2^{n/2}}$ (D) 1

405. In a ΔABC, (a + b + c)(b + c – a) = kbc if

(A) k < 0 (B) k > 0 (C) 0 < k < 4 (D) k > 4

406. Least value of $(\sin^{-1}x)^3 + (\cos^{-1}x)^3$ is

(A) $-\frac{\pi^3}{8}$ (B) $-\frac{\pi^3}{32}$ (C) $\frac{\pi^3}{32}$ (D) $\frac{\pi^3}{8}$

407. If r, r_0 be the in–radius and ex-radius of equilateral triangles having sides 2 and 3 respectively, then r : r_0 is equal to

(A) 2 : 3 (B) 1 : 3 (C) 1 : 9 (D) 2 : 9

408. In a Δ ABC, given that tan A : tan B : tan C = 3 : 4 : 5, then the value of sin A sin B sin C is

(A) $\frac{2}{\sqrt{5}}$ (B) $\frac{2\sqrt{5}}{7}$ (C) $\frac{2\sqrt{5}}{9}$ (D) $\frac{2}{3\sqrt{5}}$

409. The equation $\sin^{-1}x = |x - a|$ will have atleast one solution if

(A) $a \in [-1, 1]$ (B) $a \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

(C) $a \in \left[1-\frac{\pi}{2}, 1+\frac{\pi}{2}\right]$ (D) None of these

410. The solution set of x for which min(sinx, cosx) > min(–sinx, – cosx) where $x \in (0, 2\pi)$

(A) $\left(0, \frac{3\pi}{4}\right) \cup \left(\frac{7\pi}{4}, 2\pi\right)$ (B) $(0, \pi)$

(C) $\left(\frac{3\pi}{4}, 2\pi\right)$ (D) None of these

411. The value of $\tan(\sin^{-1} \cos \sin^{-1}x) \tan(\cos^{-1} \sin \cos^{-1}x)\ \forall\ x \in \left(0, \frac{\pi}{2}\right)$ is

(A) 0 (B) 1

(C) –1 (D) none of these

412. If sin A = sin B and cos A = cos B, then

(A) $A = n\pi + (-1)^n B$ (B) $A = 2n\pi \pm B$

(C) $A = 2n\pi + B$ (D) none of these

413. If in a triangle ABC, tan A + tan B + tan C = 6 and tan A · tan B = 2, then the triangle is

(A) equilateral (B) obtuse angled

(C) acute angled (D) right angled isosceles

414. Inside a big circle exactly n small circles each of radius r can be drawn in such a way that each small circle touches the big circle and two small circles. If $n \geq 3$, then the radius of the bigger circle is

(A) $r \operatorname{cosec}\left(\frac{\pi}{n}\right)$ (B) $r\left\{1+\operatorname{cosec}\left(\frac{\pi}{n}\right)\right\}$

(C) $r\left\{1+\operatorname{cosec}\left(\frac{2\pi}{n}\right)\right\}$ (D) $r\left\{1+\operatorname{cosec}\left(\frac{\pi}{2n}\right)\right\}$

415. In a right angled triangle ABC, if $\angle C = \frac{\pi}{2}$ and $\angle A = 2\angle B$, then $\frac{R}{r}$ is

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

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

416. If in a triangle $\sin^4 A + \sin^4 B + \sin^4 C = \sin^2 B \sin^2 C + 2 \sin^2 C \sin^2 A + 2 \sin^2 A \sin^2 B$, then angle A can be equal to

(A) 120° (B) 50°

(C) 30° (D) 45°

417. If the hypotenuse of the right angled triangle is twice the length of perpendicular drawn from opposite vertex to it, then the difference of two acute angles is

(A) 75 (B) 0

(C) 30 (D) 60

418. The area of the circle and area of a regular pentagon having perimeter equal to that of the circle are in the ratio

(A) $\tan\left(\frac{\pi}{5}\right) : \frac{\pi}{5}$ (B) $\cot\left(\frac{\pi}{5}\right) : \frac{\pi}{5}$ (C) $\sin\left(\frac{\pi}{5}\right) : \frac{\pi}{5}$ (D) $\cos\left(\frac{\pi}{5}\right) : \frac{\pi}{5}$

419. Let α, β, γ be the altitudes on the sides a, b, c respectively of a ΔABC. If α, β, γ are the roots of the equation $x^3 - 12x^2 + 44x - 48$, then the inradius of the ΔABC is :

(A) $\frac{11}{12}$ (B) $\frac{12}{11}$

(C) 5 (D) 3

420. The maximum value of the function f (x) = $(\sin^{-1}(\sin x))^2 - \sin^{-1}(\sin x)$ is

(A) $\frac{\pi}{4}[\pi + 2]$ (B) $\frac{\pi}{4}[\pi - 2]$

(C) $\frac{\pi}{2}[\pi + 2]$ (D) $\frac{\pi}{2}[\pi - 2]$

421. The value of $\tan^4\frac{\pi}{16} + 4\tan^3\frac{\pi}{16} - 6\tan^2\frac{\pi}{16} - 4\tan\frac{\pi}{16}$ is equal to

(A) 0 (B) 1

(C) –1 (D) 2

422. If (sinθ, cosθ) and (3, 2) lie on the same side of the line x + y = 1, then θ lies between

(A) $\left(0, \frac{\pi}{2}\right)$ (B) $(0, \pi)$

(c) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ (D) $\left(0, \frac{\pi}{4}\right)$

423. The number of possible real solutions of $\tan^{-1}(x^2 + x + 1) + \cos^{-1}(x^2 + 2x + 9) = \frac{3\pi}{2}$ is:

(A) 0 (B) 1

(C) 2 (D) 4

424. Sides of a ΔABC are in A.P. If a < min{b, c} and c > max{a, b}, then cosA is :

(A) $\frac{3c - 4b}{2b}$ (B) $\frac{3c - 4b}{2c}$

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

425. The number of ordered pairs (x, y) satisfying the system of equations given by
sinx + siny = sin(x + y) and |x| + |y| = 1 is

(A) 2 (B) 4

(C) 6 (D) none of these

Section-2 (MORE THAN ONE option correct type)

426. The equation $2\sin\frac{x}{2}\cos^2 x - 2\sin\frac{x}{2}\sin^2 x = \cos^2 x - \sin^2 x$ has a root for which

(A) sin2x = 1 (B) $\cos 2x = -\frac{1}{2}$ (C) sin2x = – 1 (D) $\cos x = \frac{1}{2}$

427. The side of ΔABC satisfy the equation $2a^2 + 4b^2 + c^2 = 4ab + 2ac$. Then -

(A) the triangle is isosceles (B) the triangle is obtuse

(C) $B = \cos^{-1}\frac{7}{8}$ (D) $A = \cos^{-1}\frac{1}{4}$

428. If $\left(\cos^2 x + \frac{1}{\cos^2 x}\right)(1+\tan^2 2y)(3+\sin 3z) = 4$, then

(A) x may be a multiple of π (B) z can be a multiple of π

(C) y can be a multiple of $\frac{\pi}{2}$ (D) x cannot be an even multiple of π

429. If $\cos^{-1}\frac{x^2-1}{x^2+1} + \tan^{-1}\frac{2x}{x^2-1} = \frac{2\pi}{3}$, then x is equal to

(A) $\sqrt{3}$, when x > 1 (B) $2-\sqrt{3}$, when 0 < x < 1

(C) $2+\sqrt{3}$, when 0 < x < 1 (D) $-\frac{1}{\sqrt{3}}$, when x > 2

430. If inside a big circle exactly 24 small circles, each of radius 2, can be drawn in such a way that each small circle touches the big circle and also touch both its adjacent small circles, then radius of the big circle is

(A) $2\left(1+\operatorname{cosec}\frac{\pi}{24}\right)$ (B) $\left(\frac{1+\tan\frac{\pi}{24}}{\cos\frac{\pi}{24}}\right)$ (C) $2\left(1+\operatorname{cosec}\frac{\pi}{12}\right)$ (D) $\frac{2\left(\sin\frac{\pi}{48}+\cos\frac{\pi}{48}\right)^2}{\sin\frac{\pi}{24}}$

431. If $\tan^{-1}\left(x^2 + 3|x| - 4\right) + \cot^{-1}\left(4\pi + \sin^{-1}\sin 14\right) = \frac{\pi}{2}$, then the value of $\sin^{-1}\sin 2x$ is equal to

(A) $6 - 2\pi$ (B) $2\pi - 6$ (C) $\pi - 3$ (D) $3 - \pi$

432. Let f(x) = ab sinx + $b\sqrt{1-a^2}$ cosx + c, where |a| < 1, b > 0 then

(A) maximum value of f(x) is b if c = 0

(B) difference of maximum and minimum value of f(x) is 2b

(C) f(x) = c if $x = -\cos^{-1}a$ (D) f(x) = c if $x = \cos^{-1}a$

433. If in a triangle ABC, $A \le B \le C$ and $\sin A \le \sin B \le \sin C$, then the triangle may be

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

434. If $\cos\alpha = \frac{1}{2}\left(x+\frac{1}{x}\right)$ and $\cos\beta = \frac{1}{2}\left(y+\frac{1}{y}\right)$, (xy > 0) x, y, α, $\beta \in R$ then

(A) $\sin(\alpha+\beta+\gamma) = \sin\gamma\ \forall\ \gamma \in R$ (B) $\cos\alpha\cos\beta = 1\ \forall\ \alpha, \beta \in R$

(C) $(\cos\alpha + \cos\beta)^2 = 4\ \forall\ \alpha, \beta \in R$ (D) $\sin(\alpha+\beta+\gamma) = \sin\alpha + \sin\beta + \sin\gamma\ \forall\ \alpha, \beta, \gamma \in R$

435. If $(a\cos\theta_1, a\sin\theta_1)$, $(a\cos\theta_2, a\sin\theta_2)$, $(a\cos\theta_3, a\sin\theta_3)$ represents the vertices of an equilateral triangle inscribed in a circle, then

(A) $\cos\theta_1 + \cos\theta_2 + \cos\theta_3 = 0$ (B) $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 0$

(C) $\tan\theta_1 + \tan\theta_2 + \tan\theta_3 = 0$ (D) $\cot\theta_1 + \cot\theta_2 + \cot\theta_3 = 0$

436. $\theta = \tan^{-1}(2\tan^2\theta) - \tan^{-1}\left(\frac{1}{3}\tan\theta\right)$, then $\tan\theta$ is

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

437. If $0 < \alpha, \beta < \pi$ and $\cos\alpha + \cos\beta - \cos(\alpha + \beta) = \frac{3}{2}$ then

(A) $\alpha = \frac{\pi}{3}$ (B) $\beta = \frac{\pi}{3}$ (C) $\alpha = \beta$ (D) $\alpha + \beta = \frac{\pi}{3}$

438. Let ABC be an isosceles triangle with base BC. If 'r' is the radius of the circle inscribed in ΔABC and 'ρ' be the radius of the circle described opposite to the angle A, then the product 'ρr' can be equal to

(A) $R^2 \sin^2 A$ (B) $R^2 \sin^2 2B$ (C) $\frac{1}{2}a^2$ (D) $\frac{a^2}{4}$

439. Which of the following functions have maximum value unity?

(A) $\sin^2 x - \cos^2 x$ (B) $\sqrt{\frac{6}{5}}\left(\frac{1}{\sqrt{2}}\sin x + \frac{1}{\sqrt{3}}\cos x\right)$

(C) $\cos^6 x + \sin^6 x$ (D) $\cos^2 x + \sin^4 x$

440. Let $S_n = \tan^{-1}\frac{4}{7} + \tan^{-1}\frac{4}{19} + ... + \tan^{-1}\frac{4}{4n^2+3}$, then

(A) $S_n = \tan^{-1}\left(\frac{2n+5}{4n}\right)$ (B) $S_n = \cot^{-1}\left(\frac{2n+5}{4n}\right)$

(C) $S_\infty = \tan^{-1}2$ (D) $S_\infty = \cot^{-1}2$

441. If $\cos\alpha = \frac{1}{2}\left(x + \frac{1}{x}\right)$ and $\cos\beta = \frac{1}{2}\left(y + \frac{1}{y}\right)$, $(xy > 0)$ $x, y, \alpha, \beta \in R$ then

(A) $\sin(\alpha + \beta + \gamma) = \sin\gamma \ \forall \ \gamma \in R$ (B) $\cos\alpha \cos\beta = 1 \ \forall \ \alpha, \beta \in R$

(C) $(\cos\alpha + \cos\beta)^2 = 4 \ \forall \ \alpha, \beta \in R$ (D) $\sin(\alpha + \beta + \gamma) = \sin\alpha + \sin\beta + \sin\gamma \ \forall \ \alpha, \beta, \gamma \in R$

442. If [x] represents the greatest integer less than or equal to x, then which of the following statement is true

(A) sin[x] = cos[x] has no solution (B) sin[x] = tan[x] has infinitely many solutions

(C) sin[x] = cos[x] possess unique solution (D) sin[x] = tan[x] for no value of x

443. Triangles $A_1A_2A_3$ and $B_1B_2B_3$ have side lengths a_1, a_2, a_3 and b_1, b_2, b_3 respectively satisfying the relation $\sqrt{a_1 + a_2 + a_3}\sqrt{b_1 + b_2 + b_3} = \sqrt{a_1b_1} + \sqrt{a_2b_2} + \sqrt{a_3b_3}$, then which one of the following statements is/are true?

(A) $\frac{a_1}{b_1} = \frac{a_2}{b_2} = \frac{a_3}{b_3}$ (B) $\frac{a_1}{b_1} = \frac{a_2}{b_2} = \frac{a_3}{b_3} = 1$

(C) $\Delta A_1A_2A_3$ and $\Delta B_1B_2B_3$ are similar (D) $\Delta A_1A_2A_3$ and $\Delta B_1B_2B_3$ are congruent

444. If $\theta_R \in [0, \pi]$ for $1 \le k \le 10$, then the maximum value of $\prod_{R=1}^{10}(1 + \sin^2\theta_R)(1 + \cos^2\theta_R)$ is -

(A) $\left(\frac{3}{2}\right)^{10}$ (B) $\left(\frac{9}{4}\right)^{10}$ (C) $\left(\frac{3}{2}\right)^{20}$ (D) $\left(\frac{9}{4}\right)^{5}$

445. If $0 \le \alpha, \beta \le \frac{\pi}{2}$ and $\cos\alpha + \cos\beta = 1$, then -

(A) $\alpha + \beta \ge \frac{\pi}{2}$ (B) $\cos(\alpha + \beta) \le 0$ (C) $\alpha + \beta \le \frac{\pi}{2}$ (D) $\cos(\alpha + \beta) \ge 0$

446. If 3 sin β = sin (2α + β), then tan (α + β) – 2 tan α is :
(A) independent of α (B) independent of β
(C) dependent of both α and β (D) independent of α but dependent of β

447. If x = sec φ – tan φ & y = cosec φ + cot φ then:

(A) $x = \frac{y+1}{y-1}$ (B) $y = \frac{1+x}{1-x}$

(C) $x = \frac{y-1}{y+1}$ (D) xy + x – y + 1 = 0

448. (a + 2) sin α + (2a – 1) cos α = (2a + 1) if tan α =

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

449. $\sin x - \cos^2 x - 1$ assumes the least value for the set of values of x given by:
(A) $x = n\pi + (-1)^{n+1}(\pi/6)$, $n \in I$ (B) $x = n\pi + (-1)^n(\pi/6)$, $n \in I$
(C) $x = n\pi + (-1)^n(\pi/3)$, $n \in I$ (D) $x = n\pi - (-1)^n(\pi/6)$, $n \in I$

450. If the numerical value of $\tan(\cos^{-1}(4/5) + \tan^{-1}(2/3))$ is a/b then
(A) a + b = 23 (B) a – b = 11 (C) 3b = a + 1 (D) 2a = 3b

451. It is known that $\sin\beta = \frac{4}{5}$ & $0 < \beta < \pi$ then the value of $\frac{\sqrt{3}\sin(\alpha+\beta) - \frac{2}{\cos\frac{\pi}{6}}\cos(\alpha+\beta)}{\sin\alpha}$ is:

(A) independent of α for all β in (0, π) (B) $\frac{5}{\sqrt{3}}$ for tan β > 0

(C) $\frac{\sqrt{3}(7+24\cot\alpha)}{15}$ for tan β < 0 (D) None

452. If the sides of a right angled triangle are {cos2α + cos2β + 2cos(α + β)} and {sin2α + sin2β + 2sin(α + β)}, then the length of the hypotenuse is:

(A) 2[1+cos(α – β)] (B) 2[1 – cos(α + β)] (C) $4\cos^2\frac{\alpha-\beta}{2}$ (D) $4\sin^2\frac{\alpha+\beta}{2}$

453. If $\tan x = \frac{2b}{a-c}$, (a ≠ c)
$y = a\cos^2 x + 2b\sin x\cos x + c\sin^2 x$
$z = a\sin^2 x - 2b\sin x\cos x + c\cos^2 x$, then
(A) y = z (B) y + z = a + c (C) y – z = a – c (D) $y - z = (a-c)^2 + 4b^2$

454. $\left(\frac{\cos A + \cos B}{\sin A - \sin B}\right)^n + \left(\frac{\sin A + \sin B}{\cos A - \cos B}\right)^n$

(A) $2\tan^n\frac{A-B}{2}$ (B) $2\cot^n\frac{A-B}{2}$: n is even
(C) 0 : n is odd (D) none

455. The equation $\sin^6 x + \cos^6 x = a^2$ has real solution if

(A) $a \in (-1, 1)$ (B) $a \in \left(-1, -\frac{1}{2}\right)$ (C) $a \in \left(-\frac{1}{2}, \frac{1}{2}\right)$ (D) $a \in \left(\frac{1}{2}, 1\right)$

456. cos4x cos8x – cos5x cos9x = 0 if

(A) cos12x = cos 14 x (B) sin13 x = 0
(C) sinx = 0 (D) cosx = 0

457. In a ΔABC, following relations hold good. In which case(s) the triangle is a right angled triangle?

(A) $r_2 + r_3 = r_1 - r$ (B) $a^2 + b^2 + c^2 = 8R^2$
(C) $r_1 = s$ (D) $2R = r_1 - r$

458. In a triangle ABC, with usual notations the length of the bisector of angle A is :

(A) $\dfrac{2bc\cos\frac{A}{2}}{b+c}$ (B) $\dfrac{2bc\sin\frac{A}{2}}{b+c}$ (C) $\dfrac{abc\,\text{cosec}\,\frac{A}{2}}{2R(b+c)}$ (D) $\dfrac{2\Delta}{b+c}\cdot\text{cosec}\,\dfrac{A}{2}$

459. AD, BE and CF are the perpendiculars from the angular points of a Δ ABC upon the opposite sides, then :

(A) $\dfrac{\text{Perimeter of } \Delta DEF}{\text{Perimeter of } \Delta ABC} = \dfrac{r}{R}$ (B) Area of ΔDEF = 2 Δ cosA cosB cosC

(C) Area of ΔAEF = $\Delta\cos^2 A$ (D) Circum radius of ΔDEF = $\dfrac{R}{2}$

460. In a triangle ABC, points D and E are taken on side BC such that BD = DE = EC. If angle ADE = angle AED = θ, then:

(A) $\tan\theta = 3\tan B$ (B) $3\tan\theta = \tan C$

(C) $\dfrac{6\tan\theta}{\tan^2\theta - 9} = \tan A$ (D) angle B = angle C

461. With usual notation, in a Δ ABC the value of $\Pi\,(r_1 - r)$ can be simplified as:

(A) $abc\,\Pi\tan\dfrac{A}{2}$ (B) $4rR^2$ (C) $\dfrac{(abc)^2}{R(a+b+c)^2}$ (D) $4Rr^2$

462. α, β and γ are three angles given by

$\alpha = 2\tan^{-1}(\sqrt{2} - 1)$, $\beta = 3\sin^{-1}\dfrac{1}{\sqrt{2}} + \sin^{-1}\left(-\dfrac{1}{2}\right)$ and $\gamma = \cos^{-1}\dfrac{1}{3}$. Then

(A) $\alpha > \beta$ (B) $\beta > \gamma$ (C) $\alpha < \gamma$ (D) $\alpha > \gamma$

463. $\cos^{-1}x = \tan^{-1}x$ then

(A) $x^2 = \left(\dfrac{\sqrt{5}-1}{2}\right)$ (B) $x^2 = \left(\dfrac{\sqrt{5}+1}{2}\right)$

(C) $\sin(\cos^{-1}x) = \left(\dfrac{\sqrt{5}-1}{2}\right)$ (D) $\tan(\cos^{-1}x) = \left(\dfrac{\sqrt{5}-1}{2}\right)$

464. For the equation $2x = \tan(2\tan^{-1}a) + 2\tan(\tan^{-1}a + \tan^{-1}a^3)$, which of the following is invalid?

(A) $a^2x + 2a = x$ (B) $a^2 + 2ax + 1 = 0$
(C) $a \neq 0$ (D) $a \neq -1, 1$

465. The sum $\sum\limits_{n=1}^{\infty} \tan^{-1}\dfrac{4n}{n^4 - 2n^2 + 2}$ is equal to:

(A) $\tan^{-1}2 + \tan^{-1}3$ (B) $4\tan^{-1}1$ (C) $\pi/2$ (D) $\sec^{-1}\left(-\sqrt{2}\right)$

SECTION - 3: (COMPREHENSION TYPE)

COMPREHENSION-1

Paragraph for Questions Nos. 466 to 468

The functions $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$, $\cot^{-1}x$, $\operatorname{cosec}^{-1}x$ and $\sec^{-1}x$ are called inverse circular or inverse trigonometric functions which are defined as follows

$\sin^{-1}x$	$-1 \le x \le 1$	$\frac{\pi}{2} \le \sin^{-1}x \le \frac{3\pi}{2}$	
$\cos^{-1}x$	$-1 \le x \le 1$	$-\pi \le \cos^{-1}x \le 0$	
$\tan^{-1}x$	$x \in R$	$-\frac{\pi}{2} < \tan^{-1}x < \frac{\pi}{2}$	
$\operatorname{cosec}^{-1}x$	$\lvert x\rvert \ge 1$	$\frac{\pi}{2} \le \operatorname{cosec}^{-1}x \le \frac{3\pi}{2}$	$\ne \pi$
$\sec^{-1}x$	$\lvert x\rvert \ge 1$	$-\pi \le \sec^{-1}x \le 0$	$\ne -\frac{\pi}{2}$
$\cot^{-1}x$	$x \in R$	$0 < \cot^{-1}x < \pi$	

466. For $x \in [0, 1]$, $\sin^{-1}x$ is equal to

(A) $\cos^{-1}\sqrt{1-x^2} + \pi$ (B) $\cos^{-1}\sqrt{1-x^2} + \frac{\pi}{2}$ (C) $-\cos^{-1}\sqrt{1-x^2}$ (D) None of these

467. Number of solutions of $\tan^{-1}|x| - \cos^{-1}x = 0$ is/ are

(A) 2
(B) 1
(C) 0
(D) None of these

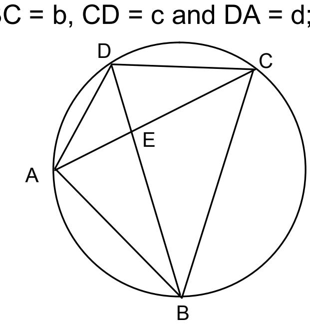
468. $\lim_{x\to 0} \tan\left(\frac{\sin^{-1}x^4 + \sin^{-1}x^9}{4}\right)$

(A) Does not exist as L.H.L. and R.H.L. both are finite and unequal
(B) Exist as L.H.L. = R.H.L.
(C) R.H.L. and L.H.L. are unequal
(D) None of these

COMPREHENSION-2

Paragraph for Questions Nos. 469 to 471

ABCD be a cyclic quadrilateral and AB = a, BC = b, CD = c and DA = d; AC = x and BD = y,



469. If a = 2, b = 6, c = 4, d = 3 and y = 5, then the value of x will be

(A) 26 (B) $\frac{18}{5}$ (C) $\frac{8}{5}$ (D) $\frac{26}{5}$

470. If a, b, c and d have above values, then the value of $\angle B$ will be

(A) $\cos^{-1}\left(-\frac{15}{48}\right)$ (B) $\cos^{-1}\left(\frac{1}{2}\right)$ (C) $\cos^{-1}\left(-\frac{1}{2}\right)$ (D) $\cos^{-1}\left(\frac{15}{48}\right)$

471. The minimum value of $\frac{(a^2+b^2+c^2)}{d^2}$ in any quadrilateral, where a, b, c and d are sides of quadrilateral, will be

(A) 1 (B) $\frac{1}{2}$ (C) $\frac{1}{3}$ (D) $\frac{1}{4}$

COMPREHENSION-3

Paragraph for Questions Nos. 472 to 474

Consider the equation $\frac{4}{\sin x}+\frac{1}{1-\sin x}=k,$ where x and k are real.

472. The values of x for which the equation is defined

(A) $x \neq n\pi$, $x \neq (2n-1)\frac{\pi}{2}$, $n \in I$

(B) $x \neq n\pi$, $x \neq (2n+1)\frac{\pi}{2}$, $n \in I$

(C) $x \neq n\pi$, $x \neq (4n+1)\frac{\pi}{2}$, $n \in I$

(D) none of these

473. The least value of 'k' for which the given equation has a solution in $\left(0, \frac{\pi}{2}\right)$ must be

(A) 3 (B) 6 (C) 9 (D) 5

474. If K = 10, then the number of solution in $\left(0, \frac{\pi}{2}\right) \cup \left(\frac{\pi}{2}, \pi\right)$ must be

(A) 0 (B) 1 (C) 2 (D) none of these

COMPREHENSION-4

Paragraph for Questions Nos. 475 to 477

ΔABC is inscribed in a circle and AL, BM and CN are diameters (2R) of circumcircle of ΔABC, then

475. The area of ΔBLC is

(A) $R^2 \sin A \sin B \sin C$

(B) $2R^2 \sin A \cos B \cos C$

(C) $2R^2 \sin A \sin B \sin C$

(D) $R^2 \sin A \sin B \cos C$

476. Area of ΔANB is

(A) $2R^2 \sin A \sin B \sin C$

(B) $2R^2 \sin A \sin B \cos C$

(C) $2R^2 \sin A \cos B \cos C$

(D) $2R^2 \sin C \cos A \cos B$

477. Area of ΔBLC + area of ΔCMA + area of ΔANB is equal to

(A) $\frac{abc}{R}$

(B) $\frac{abc}{2R}$

(C) $\frac{abc}{3R}$

(D) None of these

COMPREHENSION-5

Paragraph for Questions Nos. 478 to 480

Let Δ ABC be an equilateral triangle of sides of length a. On side AB produced, a point P is chosen such that PA = AB.

478. Inradius of ΔAPC is

(A) $\frac{a\sqrt{3}}{2}$ (B) $\frac{a}{2}$

(C) $\frac{a\sqrt{3}}{2\left(2+\sqrt{3}\right)}$ (D) None of these

479. Circumradius of ΔPBC is

(A) 2a (B) a

(C) $\frac{a}{2}$ (D) $\frac{a\sqrt{3}}{2}$

480. Let the excircle of ΔPBC w.r.t. side BC touch PC produced at E, then CE is equal to

(A) $\frac{3a+a\sqrt{3}}{2}$ (B) $\frac{3a-a\sqrt{3}}{2}$

(C) $a\sqrt{3}$ (D) None of these

COMPREHENSION-6

Paragraph for Questions Nos. 481 to 483

In a triangle ABC, the equation of the side BC is $2x - y = 3$ and its circumcentre and orthocentre are at (2, 4) and(1, 2) respectively.

481. Circumradius of triangle ABC is

(A) $\sqrt{\frac{61}{5}}$ (B) $\sqrt{\frac{51}{5}}$

(C) $\sqrt{\frac{41}{5}}$ (D) $\sqrt{\frac{43}{5}}$

482. The value of sin B sin C is equal to

(A) $\frac{9}{2\sqrt{61}}$ (B) $\frac{9}{4\sqrt{61}}$

(C) $\frac{9}{\sqrt{61}}$ (D) $\frac{9}{3\sqrt{61}}$

483. The distance of orthocentre to vertex A is equal to

(A) $\frac{1}{\sqrt{5}}$ (B) $\frac{6}{\sqrt{5}}$

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

COMPREHENSION-7

Paragraph for Questions Nos. 484 to 486

Let S_1 be the set of all those solutions of the equation $(1 + a) \cos\theta \cos(2\theta - b) = (1 + a \cos2\theta)\cos(\theta - b)$ which are independent of a and b and S_2 be the set of all such solutions which are dependent on a and b. Then

484. The set S_1 and S_2 are

(A) $\{n\pi, n \in Z\}$ and $\frac{1}{2}\{n\pi + (-1)^n \sin^{-1}(a \sin b) + b; n \in Z\}$

(B) $\{n\frac{\pi}{2}, n \in Z\}$ and $\{n\pi + (-1)^n \sin^{-1}(a \sin b); n \in Z\}$

(C) $\{n\frac{\pi}{2}, n \in Z\}$ and $\{n\pi + (-1)^n \sin^{-1}(\frac{a}{2} \sin b); n \in Z\}$

(D) None of these

485. Conditions that should be imposed on a and b such that S_2 is non-empty

(A) $\left|\frac{a}{2}\sin b\right| < 1$ (B) $\left|\frac{a}{2}\sin b\right| \le 1$ (C) $|a \sin b| \le 1$ (D) None of these

486. All the permissible values of b if a = 0 and S_2 is a subset of $(0, \pi)$:

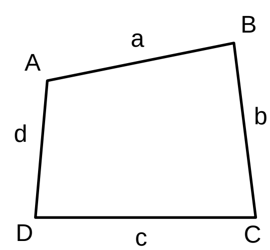
(A) $b \in (-n\pi, 2n\pi), n \in Z$ (B) $b \in (-n\pi, 2\pi - n\pi), n \in Z$

(C) $b \in (-n\pi, n\pi), n \in Z$ (D) None of these

COMPREHENSION-8

Paragraph for Questions Nos. 487 to 489

A quadrilateral ABCD is such that a circle can be inscribed in it and a circle can be circumscribed about it.



487. If $\frac{a}{b} = \frac{c}{d}$, then

(A) $\angle A = 90°$ (B) $\angle A = 90°$ (C) $\angle B = 90°$ (D) $\angle C = 90°$

488. $\tan^2\left(\frac{A}{2}\right)$ is

(A) $\frac{ab}{cd}$ (B) $\frac{bc}{ad}$

(C) $\frac{ac}{bd}$ (D) $\frac{bd}{ac}$

489. Let P_1 and P_2 be the points of contact of AB and AD respectively with the incircle of quadrilateral ABCD. Then $\cos A + \cos\angle P_1OP_2$ (where O is incentre of quadrilateral ABCD)

(A) 2cosB (B) 0

(C) 1 (D) can't be determined

COMPREHENSION-9

Paragraph for Questions Nos. 490 to 492

If $\theta = (2n + 1)\dfrac{\pi}{7}$ and n = 0, 1, 2, 3, 4, 5, 6, then

490. The value of $\sec\frac{\pi}{7}+\sec\frac{3\pi}{7}+\sec\frac{5\pi}{7}$ is

(A) 4 (B) – 3 (C) 3 (D) None of these

491. The value of $\sec^2\frac{\pi}{7}\sec^2\frac{3\pi}{7}+\sec^2\frac{3\pi}{7}\sec^2\frac{5\pi}{7}+\sec^2\frac{5\pi}{7}\sec^2\frac{\pi}{7}$ is

(A) – 80 (B) 80 (C) 24 (D) – 24

492. The value of $\tan^2\frac{\pi}{7}\tan^2\frac{3\pi}{7}\tan^2\frac{5\pi}{7}$ is

(A) 6 (B) 7 (C) 8 (D) None of these

COMPREHENSION-10

Paragraph for Questions Nos. 493 to 495

Consider $\left(1+\sin\theta+\sin^2\theta\right)^n=\sum_{r=0}^{2n}a_r(\sin\theta)^r$; $\theta \in R$.

493. $a_{n+1} + a_{n+2} + \ldots + a_{2n-1}$ equals

(A) $\dfrac{3^n}{2}$ (B) $\dfrac{3^n - a_n}{2}$

(C) $2(3^n - a_n)$ (D) $3^n - a_n$

494. $a_0^2 - a_1^2 + a_2^2 - \ldots a_{2n}^2$ is equal to

(A) a_n (B) a_n^2

(C) $2a_n^2$ (D) $\dfrac{a_n}{2}$

495. The value of $a_0 + 2a_1 + 3a_2 + \ldots + (2n + 1)a_{2n}$ is

(A) $n\,3^{n-1}$ (B) $n\,3^n$

(C) $(n + 1)3^n$ (D) None of these

SECTION - 4 (MATRIX MATCH Type)

496. Match the following:

List – I	List – II
(A) $\sin x \cos^3 x > \cos x \sin^3 x$, $0 \le x \le 2\pi$ is	(i) $\left[-\pi, -\frac{3\pi}{4}\right] \cup \left[-\frac{\pi}{4}, \frac{\pi}{4}\right] \cup \left[\frac{3\pi}{4}, \pi\right]$
(B) $4\sin^2 x - 8\sin x + 3 \le 0$, $0 \le x \le 2\pi$, is	(ii) $\left[\frac{3\pi}{2}, 2\pi\right] \cup \{0\}$
(C) $\lvert\tan x\rvert \le 1$ and $x \in [-\pi, \pi]$ is	(iii) $\left(0, \frac{\pi}{4}\right)$
(D) $\cos x - \sin x \ge 1$ and $0 \le x \le 2\pi$	(iv) $\left[\frac{\pi}{6}, \frac{5\pi}{6}\right]$

497. Match the following :

List – I	List – II
(A) The number of pairs (x, y) satisfying the equation $\sin x + \sin y = \sin(x + y)$ $\lvert x\rvert + \lvert y\rvert = 1$ is	(i) 3
(B) The number of values of x for which f (x) is valid $f(x) = \sqrt{\sec^{-1}\left(\frac{1-\lvert x\rvert}{2}\right)}$	(ii) 8
(C) If $x, y \in [0, 2\pi]$, then total number of ordered pairs (x, y) satisfying $\sin x \cos y = 1$	(iii) ∞
(D) $f(x) = \sin x - \cos x - kx + b$ decreases for all values of real values of x when $4\sqrt{2}k$ is always greater than	(iv) 6

498. Match the following

List – I	List – II
(A) If $y = \cos^{-1}(\cos x)$ then for $-\pi \le x \le 0$, value of y is	(i) $x - \pi$
(B) For $x \in (-\infty, -1] \cup (1, \infty)$ if $y = \sec(\sec^{-1} x)$, then value of y is equal t	(ii) $x + \pi$
(C) For $\frac{\pi}{2} < x < \frac{3\pi}{2}$ $y = \tan^{-1}(\tan x)$, then value of y is equal to	(iii) x
(D) For $-\frac{3\pi}{2} < x < -\frac{\pi}{2}$ if $y = \tan^{-1}(\tan x)$, then value of y is equal to	(iv) $-x$

499. Match the following :

List – I	List – II
(A) $f(x) = \int_0^{\sin x} t^2 dt$, then period of $f'(x)$ is	(i) $\frac{\pi}{14}$
(B) If area of ellipse $b^2x^2 + a^2y^2 = a^2b^2$ (a > b), enclosed by x-axis and the ordinates x = 0 and x = b be $\frac{1}{8}$ th the area of entire ellipse, then $e\sqrt{1-e^2} + \sin^{-1}\sqrt{1-e^2} =$	(ii) $\frac{\pi}{2}$
(C) Let $f(x) = \frac{\operatorname{cosec}^{-1}x + \cos^{-1}\left(\frac{1}{x}\right)}{\operatorname{cosec} x}$, then greatest value is	(iii) $\frac{\pi}{4}$
(D) $\cos^{-1}\left(\sin\left(\frac{46\pi}{7}\right)\right)$ is	(iv) 2π

500. Match the following :

List – I	List – II
(A) Period of $\tan\frac{\pi}{2}[x]$ (where [.] denotes the greatest integer function)	(i) 2π
(B) Period of $\sin\left(2\pi x + \frac{\pi}{3}\right) + 2\sin\left(3\pi x + \frac{\pi}{4}\right) + 3\sin 5\pi x$	(ii) $\frac{\pi}{2}$
(C) Period of $\sin^4 x + \cos^4 x$	(iii) 2
(D) Period of $1 + \sin^{10} x$	(iv) π

501. Match the following :

List – I	List – II
(A) The number of roots of equation 2 cosx – 2x + 1 = 0 in the interval $\left[\frac{\pi}{2}, \pi\right]$ is	(i) 2
(B) The number of solutions of $10[\ln x] + 10[2^x] = 31 + 10[\sin x]$ (where [.] denotes the greatest integer function) is	(ii) 3
(C) The number of solutions of $e^{-x^2} = \cos x$ in $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ is	(iii) 0
(D) If tangents to the parabola $y^2 = 4x$ are normal to $x^2 = 4by$, $\|b\| < \frac{1}{\sqrt{k}}$, then the numerical quantity k should be	(iv) 8

502. Match the following:

List – I	List – II
(A) Fundamental period of $f(x) = \sec^2 x - \tan^2 x$ is	(i) no fundamental period
(B) Fundamental period of $f(x) = \sin^2 x + \cos^2 x$ is	(ii) π
(C) Fundamental period of $f(x) = \tan x.\cot x$ is	(iii) $\pi/2$
(D) Fundamental period of $f(x) = \text{cosec}^2 x - \cot^2 x + \{x\}$	(iv) non-periodic

503. Match the following:

List – I	List – II
(A) The value of 'a' for which the equation $4\,\text{cosec}^2\pi(a + x) + a^2 - 4a = 0$ has real solution is	(i) 1
(B) The number of solutions of equation $\tan^2 x - \sec^{10} x + 1 = 0$ in (0, 10) is	(ii) 2
(C) $\sum_{n=1}^{\infty} \sin^{-1} \frac{\sqrt{n} - \sqrt{n-1}}{\sqrt{n(n+1)}} = \frac{\pi}{a}$	(iii) 3

504. Match the list:

List – I	List – II
(A) In a ΔABC if area $\Delta = a^2 - (b - c)^2$, then 15tanA is	(i) $\frac{1}{3}$
(B) In a ΔABC a = 6, b = 3 and $\cos(A - B) = \frac{4}{5}$, then area of ΔABC is	(ii) 2
(C) If a, b, c, d are the sides of quadrilateral, then the minimum value of $\frac{a^2 + b^2 + c^2}{d^2}$ is	(iii) 3
(D) ΔPRQ is right angled triangle where P(3, 1), Q(6, 5) and R(x, y) and area of $\Delta PRQ = 7$, then number of such point R is	(iv) 8
	(v) 9

505. Match the following:

List – I	List – II
(A) $\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{3}\right) + \ldots + \infty$	(i) $\frac{\pi}{2}$
(B) $\sin^{-1}\left(\frac{12}{13}\right) + \cos^{-1}\left(\frac{4}{5}\right) + \tan^{-1}\left(\frac{63}{16}\right)$	(ii) $\frac{\pi}{4}$
(C) $\sin^{-1}\left(\frac{4}{5}\right) + 2\tan^{-1}\left(\frac{1}{3}\right)$	(iii) π
(D) $\cot^{-1} 9 + \text{cosec}^{-1}\left(\frac{\sqrt{41}}{4}\right)$	(iv) $\frac{\pi}{3}$

506. Match the following with their minimum values, ($x \in R$)

(A) sinx + cosx — (i) -1

(B) sinx + |cosx| — (ii) $-\sqrt{2}$

(C) |sinx| + cosx — (iii) 1

(D) |sinx| + |cosx| — (iv) none

507. Match the following:

List I	**List – II**
(A) $\sin^{-1}x - \cos^{-1}x = 0$, then $\cos(5\cos^{-1}x + \sin^{-1}x)$ is equal to	(i) 3
(B) $\tan\left(\cos^{-1}\left(\frac{4}{5}\right)+\tan^{-1}\left(\frac{2}{3}\right)\right) = \frac{p}{q}$,(where p and q are coprime), then $3q - p$ is equal to	(ii) 2
(C) $\sin^{-1}x + 4\cos^{-1}x = 2\pi$, then x is equal to	(iii) 1
(D) In ΔABC, 2cosA sinC = sinB, then $\frac{2a}{c}$ is equal to	(iv) 0

508. Match the following:

List –I	**List-II**
(A) Number of solutions of the equation $\sin^{-1}x + \cos^{-1}x^2 = \frac{\pi}{2}$	(i) 1
(B) The number of ordered pairs (x, y) satisfying $\frac{\sin^{-1}x}{x} + \frac{\sin^{-1}y}{y} = 2$ is	(ii) 2
(C) Number of solutions of the equation cos(cosx) = sin(sinx) is	(iii) 0
(D) Number of solutions of the equation $\tan\left(x+\frac{\pi}{6}\right)$ = 2 tanx is	(iv) 3

509. Match the following

(A) Number of solutions of the equation $\sin^{-1}x + \cos^{-1}x^2 = \frac{\pi}{2}$	(1) 1
(B) The number of ordered pairs (x, y) satisfying $\frac{\sin^{-1}x}{x} + \frac{\sin^{-1}y}{y} = 2$ is	(2) 2
(C) Number of solutions of the equation cos(cosx) = sin(sinx) is	(3) 0
(D) Number of solutions of the equation $\tan\left(x+\frac{\pi}{6}\right)$ = 2 tanx is	(4) 3

510. Match the following pair of curves with their angle of intersections :

	Column– I		Column – II
(A)	$x^2 + y^2 = 2\pi^2$ and $y = \sin^{-1}\left[x^2+\frac{1}{2}\right]+\cos^{-1}\left[x^2-\frac{1}{2}\right]$ (where [x] = greatest integer function)	(P)	$\frac{\pi}{4}$
(B)	$y^2 = 2x$ and $y = [\lvert\sin x\rvert + \lvert\cos x\rvert]$ where [x] = greatest integer function	(Q)	$\cot^{-1}(1/3)$
(C)	$x^2 = 4ay$, $y = \frac{8a^3}{x^2+4a^2}$	(R)	$\frac{3\pi}{4}$
(D)	$y^2 = \frac{2x}{\pi}$, $y = \sin x$	(S)	$\cot^{-1}(\pi)$

Section-5 : (INTEGER type)

511. The total number of positive integral solution of $\sin^{-1}\left(\frac{x}{\sqrt{1+x^2}}\right)+\cos^{-1}\left(\frac{y}{\sqrt{1+y^2}}\right)=\sin^{-1}\left(\frac{3}{\sqrt{10}}\right)$ is ______________

512. If circum radius of ΔABC is 3 cm and its area is 6 cm^2 and DEF is triangle formed by foot of perpendicular drawn from A, B, C on sides BC, CA, AB respectively then perimeter of ΔDEF in cm is ________.

513. The greatest and least values of $(\sin^{-1}x)^3 + (\cos^{-1}x)^3$ are I_{max} and I_{min} then $\frac{I_{max}}{I_{min}}$ is ____________

514. In a ΔABC, b cotB + c cotC = 2(r + R). If the base AC = 3 units and $\angle A = 60°$, BC is ______________

515. If in a ΔABC, a = 2, b = 3, c = 4, then the value of $a^3 \cos(B - C) + b^3 (C - A) + c^3 \cos(A - B)$ is ____________

516. In a right angled triangle ΔABC with C as a right angle, a perpendicular CD is drawn to AB. The radii of the circles inscribed into the triangles ACD and BCD are equal to 3 and 4 respectively. Then the radius of the circle inscribed into the ΔABC is ______________

517. In ΔABC, $\frac{\sum a\sin\frac{A}{2}\cos\left(\frac{B-C}{2}\right)}{\sum \sin A} = nR$ where R is the radius of circumcircle, then n is equal to

518. In the quadrilateral, the length AC and BD are x and y respectively, AB = 5, BC = 7, CD = 6, AD = 8 and if angle between OD and OC is ω, where O is the point of intersection of two diagonals then, the value of $2xy \cos\omega$ is _______________

519. In an acute angled triangle the minimum value of secA secB secC(1 + secA)(1 + secB)(1 + secC) is——— .

520. P is any point and O being the origin. On the circle with OP as diameter two point Q and R are on same side of OP such that ∠POQ = ∠QOR = θ. Let P, Q, R be z_1, z_2, z_3 such that $2\sqrt{3}z_2^2 = (2+\sqrt{3})z_1z_3$. Then the degree measure of θ is________ .

521. In a triangle ABC, side AB = 20, AC = 11, BC = 13, then the diameter of the semicircle inscribed in triangle ABC, whose diameter lies on AB and is touching AC and BC is _________

522. If $x^2 + y^2 \le 1$, then $\min\left\{\frac{kx^2}{y^2} + \frac{1}{k}\left(\frac{y+kx^2}{x^2}\right)\right\}$ (where k is positive) is ______________

523. The number of solutions that the equation sin(cos(sinx)) = cos(sin(cosx)) has in $\left[0, \frac{\pi}{2}\right]$ is _________.

524. If $\sin^{-1}x \in \left(0, \frac{\pi}{2}\right)$, then the value of $\tan\left[\frac{\cos^{-1}\left(\sin\left(\cos^{-1}x\right)\right) + \sin^{-1}\left(\cos\left(\sin^{-1}x\right)\right)}{2}\right]$ is ________

525. If $\sqrt{4\sin^4\theta + \sin^2 2\theta} + 4\cos^2\left(\frac{\pi}{4} - \frac{\theta}{2}\right) = k$, when θ lies in third quadrant, then k is equal to

526. The smallest positive integral value of p for which the equation tan (p sin x) = cot (p cos x) in x has a solution in [0, 2π] is :

527. Let $A_1, A_2, \ldots\ldots, A_n$ be the vertices of an n–sided regular polygon such that; $\frac{1}{A_1A_2} = \frac{1}{A_1A_3} + \frac{1}{A_1A_4}$.

Find the value of n.

528. Find the value of $\operatorname{cosec}\frac{4\pi}{15} + \operatorname{cosec}\frac{8\pi}{15} + \operatorname{cosec}\frac{16\pi}{15} + \operatorname{cosec}\frac{32\pi}{15}$

529. In any ΔABC, then minimum value of $\frac{r_1 r_2 r_3}{r^3}$ is equal to :

530. The radii r_1, r_2, r_3 of escribed circles of a triangle ABC are in harmonic progression. If its area is 24 sq. cm and its perimeter is 24 cm, find the sum of squares of lengths of its sides.

Answer Key

Qs.	Ans.	Qs.	Ans.	Qs.	Ans.
401	C	451	BC	501	A-(iii), B-(iii), C-(ii), D-(iv)
402		452	AC	502	A-(ii), B-(i), C-(iii), D-(iv)
403	B	453	BC	503	A-(ii), B-(iii), C-(ii)
404	C	454	BC	504	A-(iv), B-(v), C-(i), D-(ii)
405	C	455	BD	505	A-(ii), B-(iii), C-(i), D-(ii)
406	C	456	ABC	506	A-(ii), B-(i), C-(i), D-(iii)
407	D	457	ABCD	507	A-(iv), B-(iii), C-(iv), D-(ii)
408	B	458	ACD	508	A-(ii), B-(iii), C-(iii), D-(iii)
409	C	459	ABCD	509	A-(2), B-(3), C-(3), D-(3)
410	A	460	ACD	510	A-(PR), B-(PR), C-(Q), D-(S)
411	B	461	ACD	511	2
412	C	462	BC	512	4
413	C	463	AC	513	28
414	B	464	BC	514	6
415	C	465	AD	515	76
416		466	A	516	5
417	B	467	B	517	1
418	A	468	C	518	52
419	B	469	D	519	216
420	A	470	D	520	15
421	A	471	C	521	11
422	D	472	C	522	3
423	A	473	C	523	1
424		474	D	524	1
425		475	B	525	2
426	ABCD	476	D	526	2
427	ACD	477	D	527	7
428	AC	478	C	528	0
429	ABC	479	B	529	27
430	AD	480	B	530	200
431	AB	481	A		
432	ABC	482	A		
433	ABCD	483	B		
434	ABC	484	A		
435	AB	485	C		
436	AB	486	B		
437	ABC	487	A		
438	ABD	488	A		
439	ABCD	489	B		
440	BC	490	A		
441	ABCD	491	B		
442	AB	492	B		
443	AC	493	B		
444	BC	494	A		
445	AB	495	C		
446	AB	496	A-(iii), B-(iv), C-(i), D-(ii)		
447	BCD	497	A-(iv), B-(iii), C-(i), D-(ii)		
448	BD	498	A-(iv), B-(iii), C-(i), D-(ii)		
449	AD	499	A-(iv), B-(iii), C-(ii), D-(i)		
450	ABC	500	A-(iii), B-(iii), C-(ii), D-(iv)		