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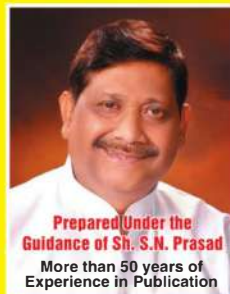
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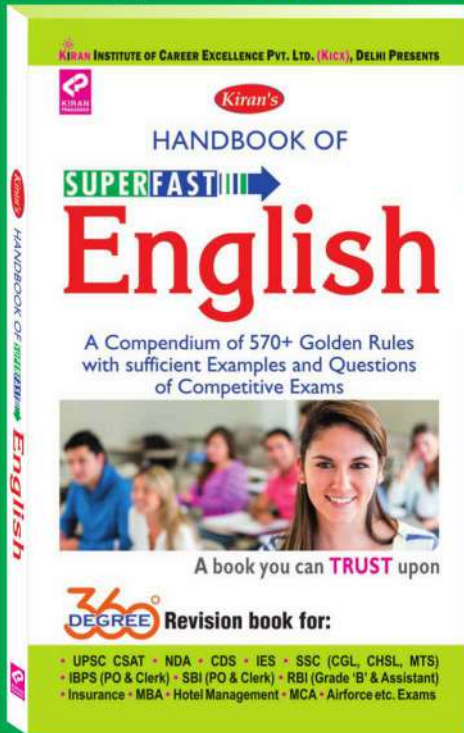
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COMMON ERRORS IN ENGLISH A MUST FOR ALL ASPIRANTS

It is generally said that subtleness is the foundation of success. In today's world of competition, seeking opportunity by faring in competitive examinations has really become indisputably a tough affair. In this context, the importance of English, as a subject, is undeniable. Not only for the sake of examinations, but just to master English, one should have the knowledge of good and apt English, correct standard of written English, proper art of conversation and application of correct dialogue, as well as personal development, which all pose as a stairway of qualities towards sound English proficiency.

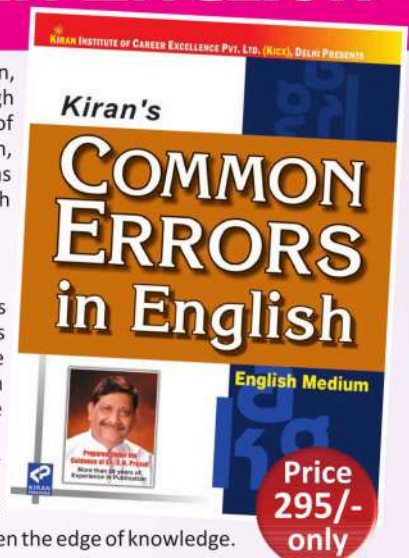
AN OUTSTANDING BOOK THAT HELPS ASPIRANTS In their SUCCESSFUL PREPARATION FOR COMPETITIVE EXAMS

In order to test the knowledge of English Language in various competitive examinations, questions are set in several patterns to ascertain one's understanding of the language. Among the various patterns, one is related to the topic of Common Errors. Having essential knowledge in Grammar, we learn to read and write, as well as talk correct English. Due to the presence of various topics in Grammar and the host of rules that are related to those topics, we somehow miss to explore the correct usage of English.

In this book, all these topics have been widely discussed with explanations and examples for better grasp of the minute differences that appear in examinations and which restrain us from dealing with those questions related to Common Errors. The explanations which have been given at the end of each chapter, are in all way helpful to understand each and every problem with clarity and thus sharpen the edge of knowledge.

Salient Features

- This book has been divided into two parts. The first part contains several topics of English Grammar, which are classified into 14 different chapters. Each chapter discusses a topic at length. The second part consists of Model Question Papers.
- In each of the 14 chapters, concepts about the Fundamental and Basic Principles/Rules have been provided. Simultaneously, while discussing the various aspects of the chapter, several related examples have been provided. The variety of the questions tell the tale of the nature of questions asked in different competitive exams.
- Each chapter is essentially supplemented with 'a ready reckoner', which helps in understanding and recapitulating the basic rules at a glance.
- Each chapter is supplemented with a number of questions based on the topic discussed. The questions may have Error in one part and you are required to find out that error.
- The questions have been explained adequately, which help you understand the root cause of the error.
- Model Question Papers help in understanding the overall genre of a topics and thereby assist in developing a solid and sound knowledge of the topic of discussion.



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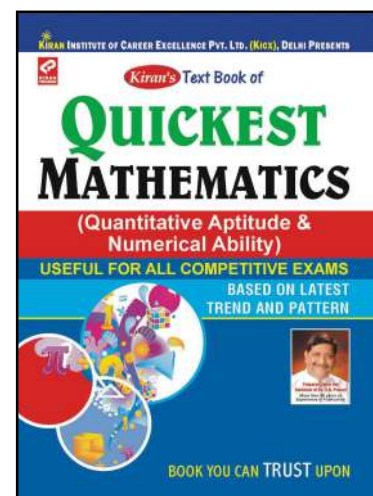
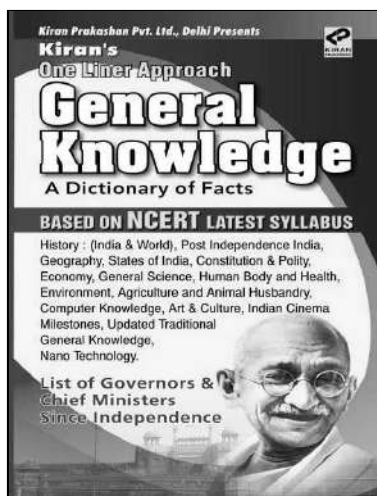
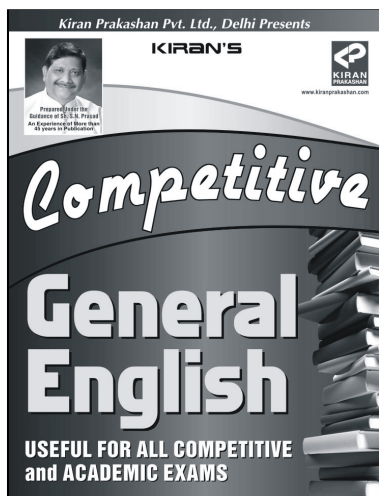
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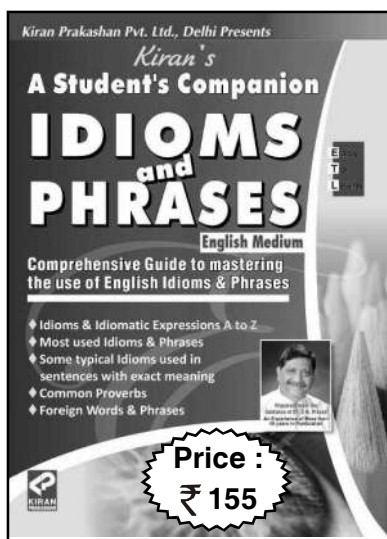
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The book **KIRAN'S A STUDENT'S COMPANION : IDIOMS AND PHRASES** is designed with the belief that it will be of immense value to all users of English. This book has been designed with an attempt to facilitate the aspirants' insight into questions related to idioms and phrases. The book has categorically been divided into 7 chapters covering all the basic idioms and phrases important for attempting competitive examinations.

The book is important for all those who are appearing at or are preparing for various examinations like – Bank PO, Bank Clerk, Railway, Staff Selection Commission (SSC), Insurance, UPSC, NDA, CDS, Airforce, MBA, BBA, CLAT and other competitive exams.

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| 5. | LCM and HCF | 01 | — | — | 03 | — |
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| 33. | Circle | 02 | 1 | — | 02 | 02 |
| 34. | Trigonometry | 08 | 10 | 10 | 11 | 10 |
| | Total Questions | 100 | 100 | 100 | 100 | 100 |

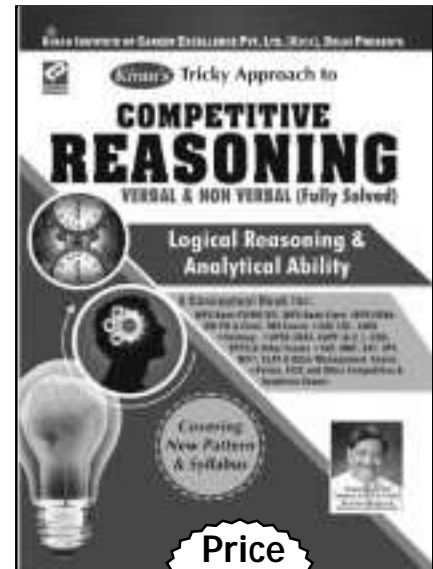
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| | Total Questions | 200 | 200 | 200 | 200 | 200 |

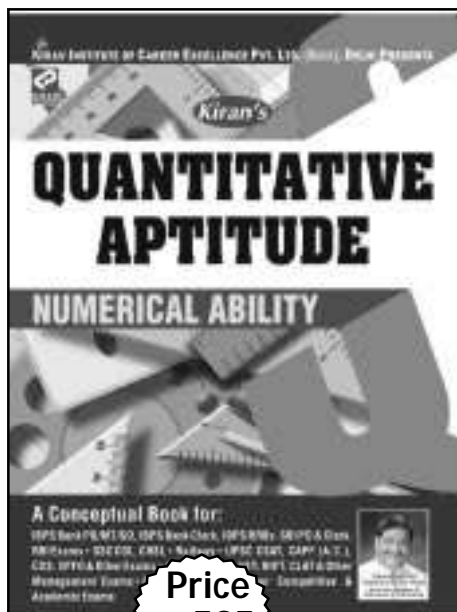
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OBJECTIVE QUESTIONS ON ALGEBRA ASKED IN VARIOUS EXAMS CONDUCTED BY SSC IN PREVIOUS YEARS'

1. If $x + \frac{1}{2x} = 2$, find the value of

$$8x^3 + \frac{1}{x^3}.$$

- (1) 48 (2) 88
(3) 40 (4) 44

2. If $x = 2 - 2^{1/3} + 2^{2/3}$, then the value of $x^3 - 6x^2 + 18x + 18$ is

- (1) 22 (2) 33
(3) 40 (4) 45

3. If $x + \frac{1}{x} = 2$ and x is real, then

the value of $x^{17} + \frac{1}{x^{19}}$ is

- (1) 1 (2) 0
(3) 2 (4) -2

4. If $x^2 + y^2 - 4x - 4y + 8 = 0$, then the value of $x - y$ is

- (1) 4 (2) -4
(3) 0 (4) 8

5. If $a^3 - b^3 - c^3 - 3abc = 0$, then

- (1) $a = b = c$
(2) $a + b + c = 0$
(3) $a + c = b$ (4) $a = b + c$

6. If $2x + \frac{1}{3x} = 5$, find the value

of $\frac{5x}{6x^2 + 20x + 1}$.

- (1) $\frac{1}{4}$ (2) $\frac{1}{6}$

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

7. If for two real constants a and b , the expression $ax^3 + 3x^2 - 8x + b$ is exactly divisible by $(x + 2)$ and $(x - 2)$, then

- (1) $a = 2, b = 12$
(2) $a = 12, b = 2$
(3) $a = 2, b = -12$
(4) $a = -2, b = 12$

8. If $x^2 - 3x + 1 = 0$, then the value of $x^3 + \frac{1}{x^3}$ is

- (1) 9 (2) 18
(3) 27 (4) 1

9. If $x^2 + y^2 + 2x + 1 = 0$, then the value of $x^{31} + y^{35}$ is

- (1) -1 (2) 0
(3) 1 (4) 2

10. The lines $2x + y = 5$ and $x + 2y = 4$ intersect at the point :

- (1) (1,2) (2) (2,1)
(3) $(\frac{5}{2}, 0)$ (4) (0,2)

11. The value of the expression $x^4 - 17x^3 + 17x^2 - 17x + 17$ at $x = 16$ is

- (1) 0 (2) 1
(3) 2 (4) 3

12. If $(2^x)(2^y) = 8$ and $(9^x)(3^y) = 81$, then (x, y) is :

- (1) (1,2) (2) (2, 1)
(3) (1,1) (4) (2, 2)

13. If $x = 3 + 2\sqrt{2}$, then the value of $(\sqrt{x} - \frac{1}{\sqrt{x}})$ is :

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

14. If $a = 23$ and $b = -29$ then the value of $25a^2 + 40ab + 16b^2$ is :

- (1) 1 (2) -1
(3) 0 (4) 2

15. If $x + \frac{1}{4x} = \frac{3}{2}$, find the value

of $8x^3 + \frac{1}{8x^3}$.

- (1) 18 (2) 36
(3) 24 (4) 16

16. If $x = \frac{4ab}{a+b}$ ($a \neq b$), the value of

$$\frac{x+2a}{x-2a} + \frac{x+2b}{x-2b}$$
 is

- (1) a (2) b
(3) 2 ab (4) 2

17. If $x = b + c - 2a, y = c + a - 2b, z = a + b - 2c$, then the value of $x^2 + y^2 - z^2 + 2xy$ is

- (1) 0 (2) $a + b + c$
(3) $a - b + c$ (3) $a + b - c$

18. If $(a - 1)^2 + (b + 2)^2 + (c + 1)^2 = 0$, then the value of $2a - 3b + 7c$ is

- (1) 12 (2) 3
(3) -11 (4) 1

19. $(y - z)^3 + (z - x)^3 + (x - y)^3$ is equal to

- (1) 3 (y - z) (z + x) (y - x)
(2) (x - y) (y + z)(x - z)
(3) 3 (y - z) (z - x) (x - y)
(4) (y - z) (z - x) (x - y)

20. If the sum of $\frac{a}{b}$ and its reciprocal is 1 and $a \neq 0, b \neq 0$, then the value of $a^3 + b^3$ is

- (1) 2 (2) -1
(3) 0 (4) 1

21. If $x^2 + y^2 + \frac{1}{x^2} + \frac{1}{y^2} = 4$, then the value of $x^2 + y^2$ is

- (1) 2 (2) 4
(3) 8 (4) 16

22. If $x^2 = y + z, y^2 = z + x, z^2 = x + y$, then the value of

$$\frac{1}{x+1} + \frac{1}{y+1} + \frac{1}{z+1}$$
 is

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

23. If $x + \frac{1}{x} = \sqrt{3}$ then the value of $x^{18} + x^{12} + x^6 + 1$ is

- (1) 0 (2) 1
(3) 2 (4) 3

24. If $a^2 + b^2 = 2$ and $c^2 + d^2 = 1$, then the value of $(ad - bc)^2 + (ac + bd)^2$ is

- (1) $\frac{4}{9}$ (2) $\frac{1}{2}$
 - (3) 1 (4) 2
- 25.** If $x^4 + \frac{1}{x^4} = 119$ and $x > 1$, then the value of $x^3 - \frac{1}{x^3}$ is
- (1) 54 (2) 18
 - (3) 72 (4) 36
- 26.** If $x - y = \frac{x+y}{7} = \frac{xy}{4}$, the numerical value of xy is
- (1) $\frac{4}{3}$ (2) $\frac{3}{4}$
 - (3) $\frac{1}{4}$ (4) $\frac{1}{3}$
- 27.** If $(x + y - z)^2 + (y + z - x)^2 + (z + x - y)^2 = 0$, then the value of $x + y - z$ is
- (1) $\sqrt{3}$ (2) $3\sqrt{3}$
 - (3) 3 (4) 0
- 28.** If $x + y + z = 0$, then $\frac{x^2}{yz} + \frac{y^2}{zx} + \frac{z^2}{xy} = ?$
- (1) $(xyz)^2$ (2) $x^2 + y^2 + z^2$
 - (3) 9 (4) 3
- 29.** If $x^2 + 2 = 2x$, then the value of $x^4 - x^3 + x^2 + 2$ is
- (1) 0 (2) 1
 - (3) -1 (4) $\sqrt{2}$
- 30.** If $2^x = 3^y = 6^{-z}$ then $\left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right)$ is equal to
- (1) 0 (2) 1
 - (3) $\frac{3}{2}$ (4) $-\frac{1}{2}$
- 31.** If $\frac{1}{x+y} = \frac{1}{x} + \frac{1}{y}$ ($x \neq 0, y \neq 0, x \neq y$) then, the value of $x^3 - y^3$ is
- (1) 0 (2) 1
 - (3) -1 (4) 2
- 32.** For real a, b, c if $a^2 + b^2 + c^2 = ab + bc + ca$, then value of $\frac{a+c}{b}$ is

- (1) 1 (2) 2
 - (3) 3 (4) 0
- 33.** If $x = a(b - c), y = b(c - a)$ and $z = c(a - b)$, then
- $$\left(\frac{x}{a}\right)^3 + \left(\frac{y}{b}\right)^3 + \left(\frac{z}{c}\right)^3 =$$
- (1) $\frac{xyz}{3abc}$ (2) $3xyzabc$
 - (3) $\frac{3xyz}{abc}$ (4) $\frac{xyz}{abc}$
- 34.** If $a + b + c = 0$, then the value of
- $$\frac{1}{(a+b)(b+c)} + \frac{1}{(a+c)(b+a)} + \frac{1}{(c+a)(c+b)}$$
- is:
- (1) 1 (2) 0
 - (3) -1 (4) -2
- 35.** If the square root of x is the cube root of y , then the relation between x and y is
- (1) $x^3 = y^2$ (2) $x^2 = y^3$
 - (3) $x = y$ (4) $x^6 = y^5$
- 36.** If $\frac{2p}{p^2 - 2p + 1} = \frac{1}{4}, p \neq 0$, then the value of $p + \frac{1}{p}$ is
- (1) 4 (2) 5
 - (3) 10 (4) 12
- 37.** If x varies inversely as $(y^2 - 1)$ and is equal to 24 when $y = 10$, then the value of x when $y = 5$ is
- (1) 99 (2) 12
 - (3) 24 (4) 100
- 38.** If $m + \frac{1}{m-2} = 4$, find the value of $(m-2)^2 + \frac{1}{(m-2)^2}$.
- (1) -2 (2) 0
 - (3) 2 (4) 4
- 39.** If $\frac{a}{1-a} + \frac{b}{1-b} + \frac{c}{1-c} = 1$, then the value of

- $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c}$ is
- (1) 1 (2) 2
 - (3) 3 (4) 4
- 40.** If $x + y = a$ and $xy = b^2$, then the value of $x^3 - x^2y - xy^2 + y^3$ in terms of a and b is :
- (1) $(a^2 + 4b^2)a$ (2) $a^3 - 3b^2$
 - (3) $a^3 - 4b^2a$ (4) $a^3 + 3b^2$
- 41.** The value of the expression
- $$\frac{(a-b)^2}{(b-c)(c-a)} + \frac{(b-c)^2}{(a-b)(c-a)} + \frac{(c-a)^2}{(a-b)(b-c)}$$
- is :
- (1) 0 (2) 3
 - (3) $\frac{1}{3}$ (4) 2
- 42.** If $\frac{2x-y}{x+2y} = \frac{1}{2}$, then value of $\frac{3x-y}{3x+y}$ is :
- (1) $\frac{1}{5}$ (2) $\frac{3}{5}$
 - (3) $\frac{4}{5}$ (4) 1
- 43.** For what value(s) of a is $x + \frac{1}{4}\sqrt{x} + a^2$ a perfect square?
- (1) $\pm \frac{1}{18}$ (2) $\pm \frac{1}{8}$
 - (3) $-\frac{1}{5}$ (4) $\frac{1}{4}$
- 44.** If $x = \frac{\sqrt{3}}{2}$, then $\frac{\sqrt{1+x}}{1+\sqrt{1+x}} + \frac{\sqrt{1-x}}{1-\sqrt{1-x}}$ is equal to
- (1) 1 (2) $2/\sqrt{3}$
 - (3) $2-\sqrt{3}$ (4) 2
- 45.** If $\sqrt{7\sqrt{7\sqrt{7\sqrt{7\sqrt{\dots}}}}} = (343)^{y-1}$, then y is equal to

- (1) $\frac{2}{3}$ (2) 1
 (3) $\frac{4}{3}$ (4) $\frac{3}{4}$
46. If $x = \frac{\sqrt{5}-2}{\sqrt{5}+2}$, then $x^4 + x^{-4}$ is
 (1) a surd
 (2) a rational number but not an integer
 (3) an integer
 (4) an irrational number but not a surd
47. If $x = \frac{2\sqrt{6}}{\sqrt{3}+\sqrt{2}}$, then the value of $\frac{x+\sqrt{2}}{x-\sqrt{2}} + \frac{x+\sqrt{3}}{x-\sqrt{3}}$ is :
 (1) $\sqrt{2}$ (2) $\sqrt{3}$
 (3) $\sqrt{6}$ (4) 2
48. If $x = 2 + \sqrt{3}$, then the value, of $\sqrt{x} + \frac{1}{\sqrt{x}}$ is:
 (1) $\sqrt{3}$ (2) $\sqrt{6}$
 (3) $2\sqrt{6}$ (4) 6
49. If $x = \frac{\sqrt{3}}{2}$, then the value of $\sqrt{1+x} + \sqrt{1-x}$ will be
 (1) $\frac{1}{\sqrt{3}}$ (2) $2\sqrt{3}$
 (3) $\sqrt{3}$ (4) 2
50. If $x = 1 + \sqrt{2} + \sqrt{3}$, then the value of $(2x^4 - 8x^3 - 5x^2 + 26x - 28)$ is
 (1) $6\sqrt{6}$ (2) 0
 (3) $3\sqrt{6}$ (4) $2\sqrt{6}$
51. If $x + \frac{1}{x} = 5$, then the value of $\frac{x^4 + \frac{1}{x^2}}{x^2 - 3x + 1}$ is
 (1) 70 (2) 50
 (3) 110 (4) 55

52. If $x = 2 + \sqrt{3}$, $y = 2 - \sqrt{3}$, then the value of $\frac{x^2 + y^2}{x^3 + y^3}$ is
 (1) $\frac{7}{38}$ (2) $\frac{7}{40}$
 (3) $\frac{7}{19}$ (4) $\frac{7}{26}$
53. If $x = 27$ and $\sqrt[3]{x} + \sqrt[3]{y} = \sqrt[3]{729}$, then $y =$
 (1) 64 (2) 125
 (3) 216 (4) 81
54. If $\frac{3-5x}{x} + \frac{3-5y}{y} + \frac{3-5z}{z} = 0$, the value of $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$ is
 (1) -5 (2) 5
 (3) 2 (4) 3
55. If $x^2 - 3x + 1 = 0$ and $x > 1$, then the value of $\left(x - \frac{1}{x}\right)$ is
 (1) $\sqrt{5}$ only (2) 1
 (3) $-\sqrt{5}$ only (4) $\pm\sqrt{5}$
56. If $a^x = (x+y+z)^y$, $a^y = (x+y+z)^z$ and $a^z = (x+y+z)^x$, then the value of $x+y+z$ (given $a \neq 0$) is
 (1) 0 (2) a^3
 (3) 1 (4) a
57. If $x = 2 + \sqrt{3}$, the value of $\frac{x^6 + x^4 + x^2 + 1}{x^3}$ is
 (1) 65 (2) 56
 (3) 69 (4) 67
58. If $x = (0.08)^2$, $y = \frac{1}{(0.08)^2}$ and $z = (1 - 0.08)^2 - 1$, then out of the following, the true relation is
 (1) $y < x$ and $x = z$
 (2) $x < y$ and $x = z$
 (3) $y < z < x$
 (4) $z < x < y$

59. If $x^4 + \frac{1}{x^4} = 23$, then the value of $\left(x - \frac{1}{x}\right)^2$ will be
 (1) 7 (2) -7
 (3) -3 (4) 3
60. If $a + b + 1 = 0$, then the value of $(a^3 + b^3 + 1 - 3ab)$ is
 (1) 3 (2) 0
 (3) -1 (4) 1
61. For what value of K is the points A (-2, 3), B (1, 2) and C (K, 0) are collinear.
 (1) 5 (2) 6
 (3) -7 (4) 7
62. If the points A (-2, -1), B (1, 0), C (x, 3) and D (1, y) are the vertices of a parallelogram. Then the values of x and y will be
 (1) (2, 4) (2) (1, 2)
 (3) (4, 2) (4) (-4, 2)
63. The point on x-axis which is equidistant from (7, 6) and (-3, 4) will be
 (1) (3, 0) (2) (0, 3)
 (3) (-3, 0) (4) (1, 2)
64. The angle between the lines whose slopes are $(2 - \sqrt{3})$ and $(2 + \sqrt{3})$ is
 (1) 30° (2) 45°
 (3) 60° (4) 150°
65. The equation of a line which makes an angle 150° with x-axis and passing through (3, -5) will be
 (1) $x + \sqrt{3}y = 0$
 (2) $x + \sqrt{3}y = 3 - 5\sqrt{3}$
 (3) $\sqrt{3}x + y = 3 + 5\sqrt{3}$
 (4) $\sqrt{3}x - y - 5\sqrt{3} = 0$
66. The slope of a line whose inclination is 135° is
 (1) -1 (2) 1
 (3) $-\frac{1}{2}$ (4) $\frac{1}{2}$

67. The inclination of a line whose slope is $\sqrt{3}$ is
 (1) 30° (2) 45°
 (3) 90° (4) 60°
68. What will be the slope of a line which passes through the points $(-1, 2)$ and $(-2, -4)$
 (1) 5 (2) 6
 (3) -6 (4) 1
69. For what value of x , the line through $(4, x)$ and $(2, 5)$ is perpendicular to the line through $(-1, 4)$ and $(0, 6)$
 (1) 2 (2) 4
 (3) -4 (4) 5
70. For what value of k the lines passing through $(1, 2)$ and $(k, 4)$ is parallel to the line passing through $(-1, 4)$ and $(6, 5)$
 (1) 12 (2) 15
 (3) -1 (4) 7
71. What will be the equation of a line parallel to x-axis and at a distance of 7 units above it.
 (1) $x - 7 = 0$
 (2) $y + 7 = 0$
 (3) $y - 7 = 0$
 (4) $x + 7 = 0$
72. What will be the inclination of the line $\sqrt{3}x - y - 4 = 0$
 (1) 60° (2) 135°
 (3) 150° (4) 180°
73. The angle between the lines $\sqrt{3}x + y = 1$ and $x + \sqrt{3}y = 1$ will be
 (1) 30° (2) 60°
 (3) 45° (4) 120°
74. The length of perpendicular from the point (a, b) to the line $\frac{x}{a} + \frac{y}{b} = 1$ is given by
 (1) $\frac{ab}{a^2 + b^2}$ (2) $\frac{ab}{\sqrt{a^2 + b^2}}$
 (3) $\frac{a + b}{\sqrt{a^2 + b^2}}$ (4) $\frac{2ab}{\sqrt{a^2 + b^2}}$
75. The coordinates of the point which divides the join of P $(-$

- 5, 11) and Q $(4, -7)$ in the ratio $2 : 7$ will be
 (1) $(4, 2)$ (2) $(-4, -2)$
 (3) $(-3, 7)$ (4) $(-2, 4)$
76. The equation of the line which has $p = 3$ and $\alpha = 150^\circ$ is given by
 (1) $\sqrt{3}x + y + 5 = 0$
 (2) $\sqrt{3}x - y - 6 = 0$
 (3) $\sqrt{3}x - y + 6 = 0$
 (4) $\sqrt{3}x = y$
77. If the slope of the line passing through the points $(3, 5)$ and $(x, 2)$ is 3, then the value of x will be
 (1) 2 (2) -1
 (3) 3 (4) 4
78. The distance of the point $(2, 3)$ from the line $2x - 4y + 5 = 0$ is
 (1) $\frac{2}{\sqrt{20}}$ units
 (2) $\frac{3}{\sqrt{20}}$ units
 (3) $\frac{4}{\sqrt{15}}$ units
 (4) $\frac{5}{\sqrt{20}}$ units
79. The distance between the parallel lines $2x + 3y + 5 = 0$ and $4x + 6y + 9 = 0$ is
 (1) $\frac{1}{\sqrt{13}}$ units (2) $\frac{1}{3\sqrt{13}}$ units
 (3) $\frac{1}{2\sqrt{15}}$ units
 (4) $\frac{1}{2\sqrt{13}}$ units
80. For what value of k the lines $3x + y = 2$, $kx + 2y = 3$ and $2x - y = 3$ may intersect at a point.
 (1) 2 (2) -5
 (3) 6 (4) 5

ANSWERS

| | | | |
|---------|---------|---------|---------|
| 1. (3) | 2. (3) | 3. (3) | 4. (3) |
| 5. (4) | 6. (4) | 7. (3) | 8. (2) |
| 9. (1) | 10. (2) | 11. (2) | 12. (1) |
| 13. (2) | 14. (1) | 15. (1) | 16. (4) |
| 17. (1) | 18. (4) | 19. (3) | 20. (3) |
| 21. (1) | 22. (2) | 23. (1) | 24. (4) |
| 25. (4) | 26. (1) | 27. (4) | 28. (4) |
| 29. (1) | 30. (1) | 31. (1) | 32. (2) |
| 33. (3) | 34. (2) | 35. (1) | 36. (3) |
| 37. (1) | 38. (3) | 39. (4) | 40. (3) |
| 41. (2) | 42. (2) | 43. (2) | 44. (2) |
| 45. (3) | 46. (3) | 47. (4) | 48. (2) |
| 49. (3) | 50. (1) | 51. (4) | 52. (4) |
| 53. (3) | 54. (2) | 55. (4) | 56. (4) |
| 57. (2) | 58. (4) | 59. (4) | 60. (2) |
| 61. (4) | 62. (3) | 63. (1) | 64. (3) |
| 65. (2) | 66. (1) | 67. (4) | 68. (2) |
| 69. (2) | 70. (2) | 71. (3) | 72. (1) |
| 73. (1) | 74. (2) | 75. (3) | 76. (3) |
| 77. (1) | 78. (2) | 79. (4) | 80. (4) |

EXPLANATIONS

1. (3) $x + \frac{1}{2x} = 2 \Rightarrow 2x + \frac{2}{2x} = 4$
 $\Rightarrow 2x + \frac{1}{x} = 4$
 On Cubing
 $8x^3 + \frac{1}{x^3} + 3.2x. \frac{1}{x} \left(2x + \frac{1}{x} \right) = 64$
 $\Rightarrow 8x^3 + \frac{1}{x^3} + 6 \times 4 = 64$
 $\Rightarrow 8x^3 + \frac{1}{x^3} = 64 - 24 = 40$
2. (3) $x = 2 - \frac{1}{2^{\frac{1}{3}}} + \frac{2}{2^{\frac{2}{3}}}$
 $\Rightarrow x - 2 = \frac{2}{2^{\frac{2}{3}}} - \frac{1}{2^{\frac{1}{3}}}$
 On Cubing
 $x^3 - 3x^2 \times 2 + 3x \times 4 - 8$
 $= \left(\frac{2}{2^{\frac{2}{3}}} \right)^3 - \left(\frac{1}{2^{\frac{1}{3}}} \right)^3$

$$-3 \cdot 2^{\frac{2}{3}} \cdot 2^{\frac{1}{3}} \left(\frac{2}{2^{\frac{2}{3}}} - 2^{\frac{1}{3}} \right)$$

$$\begin{aligned} &\Rightarrow x^3 - 6x^2 + 12x - 8 \\ &= 4 - 2 - 6(x - 2) \\ &\Rightarrow x^3 - 6x^2 + 12x - 8 \\ &= 2 - 6x + 12 \\ &\Rightarrow x^3 - 6x^2 + 18x + 18 \\ &= 2 + 12 + 8 + 18 = 40 \end{aligned}$$

3. (3) $x + \frac{1}{x} = 2$

$$\begin{aligned} &\Rightarrow x^2 - 2x + 1 = 0 \\ &\Rightarrow (x - 1)^2 = 0 \Rightarrow x = 1 \end{aligned}$$

$$\therefore x^{17} + \frac{1}{x^{19}} = 1 + 1 = 2$$

4. (3) $x^2 + y^2 - 4x - 4y + 8 = 0$

$$\begin{aligned} &\Rightarrow x^2 - 4x + 4 + y^2 - 4y + 4 = 0 \\ &\Rightarrow (x - 2)^2 + (y - 2)^2 = 0 \\ &\Rightarrow x = 2 \text{ and } y = 2 \\ &\therefore x - y = 2 - 2 = 0 \end{aligned}$$

5. (4) $a^3 + b^3 + c^3 - 3abc = 0$

$$\begin{aligned} &\text{if } a + b + c = 0 \\ &\therefore a^3 - b^3 - c^3 - 3abc = 0 \\ &\Rightarrow a - b - c = 0 \\ &\Rightarrow a = b + c \end{aligned}$$

6. (4) $2x + \frac{1}{3x} = 5$

$$\begin{aligned} &\Rightarrow 6x^2 + 1 = 15x \\ &\Rightarrow 6x^2 + 20x + 1 = 15x + 20x \\ &= 35x \end{aligned}$$

$$\therefore \frac{5x}{6x^2 + 20x + 1} = \frac{5x}{35x} = \frac{1}{7}$$

7. (3) $P(x) = ax^3 + 3x^2 - 8x + b$

$$\begin{aligned} &\therefore P(-2) = -8a + 12 + 16 + b = 0 \\ &\Rightarrow -8a + b + 28 = 0 \dots\dots(i) \\ &\Rightarrow P(2) = 8a + 12 - 16 + b = 2 \\ &\Rightarrow 8a + b - 4 = 0 \dots\dots(ii) \\ &\text{By equation (i) + (ii)} \\ &2b + 24 = 0 \end{aligned}$$

$$\Rightarrow b = -\frac{24}{2} = -12$$

$$\begin{aligned} &\text{From equation (i),} \\ &-8a - 12 + 28 = 0 \\ &\Rightarrow -8a = -16 \\ &\Rightarrow a = 2 \end{aligned}$$

8. (2) $x^2 - 3x + 1 = 0$

$$\begin{aligned} &\Rightarrow x^2 + 1 = 3x \\ &\Rightarrow x + \frac{1}{x} = 3 \end{aligned}$$

$$\begin{aligned} &\therefore x^3 + \frac{1}{x^3} \\ &= \left(x + \frac{1}{x}\right)^3 - 3x \cdot \frac{1}{x} \left(x + \frac{1}{x}\right) \\ &= 27 - 3 \times 3 = 18 \end{aligned}$$

9. (1) $x^2 + y^2 + 2x + 1 = 0$

$$\begin{aligned} &\Rightarrow x^2 + 2x + 1 + y^2 = 0 \\ &\Rightarrow (x + 1)^2 + y^2 = 0 \\ &\Rightarrow x + 1 = 0 \Rightarrow x = -1 \\ &\text{and } y = 0 \end{aligned}$$

$$\therefore x^{31} + y^{35} = -1$$

10. (2) $2x + y = 5 \dots(i)$

$$x + 2y = 4 \dots(ii)$$

By equation (i) $\times 2$ - equation (ii), we have

$$\begin{aligned} 4x + 2y &= 10 \\ x + 2y &= 4 \end{aligned}$$

$$\begin{array}{r} - \quad - \quad - \\ \hline \end{array}$$

$$\begin{aligned} 3x &= 6 \\ \Rightarrow x &= 2 \end{aligned}$$

$$\begin{aligned} &\text{From equation (i),} \\ &2 \times 2 + y = 5 \\ &\Rightarrow y = 5 - 4 = 1 \end{aligned}$$

$$\therefore \text{Point of intersection} = (2, 1)$$

11. (2) $x^4 - 17x^3 + 17x^2 - 17x + 17$

$$= x^4 - 16x^3 + 16x^2 - 16x - x^3 + x^2 - x + 17$$

$$\text{When } x = 16,$$

$$\begin{aligned} \text{Expression} &= 16^4 - 16^4 + 16^3 - \\ &16^2 - 16^3 + 16^2 - 16 + 17 = 1 \end{aligned}$$

12. (1) $2^x \cdot 2^y = 8$

$$\begin{aligned} &\Rightarrow 2^{x+y} = 2^3 \\ &\Rightarrow x + y = 3 \dots(i) \end{aligned}$$

$$\begin{aligned} &9^x \cdot 3^y = 3^4 \\ &\Rightarrow 3^{2x} \cdot 3^y = 3^4 \end{aligned}$$

$$\Rightarrow 2x + y = 4 \dots(ii)$$

$$\begin{aligned} &\text{By equation (ii) - (i),} \\ &x = 1 \end{aligned}$$

$$\begin{aligned} &\text{From equation (i),} \\ &1 + y = 3 \\ &\Rightarrow y = 2 \end{aligned}$$

13. (2) $x = 3 + 2\sqrt{2}$

$$\therefore \frac{1}{x} = \frac{1}{3 + 2\sqrt{2}}$$

$$= \frac{1}{3 + 2\sqrt{2}} \times \frac{3 - 2\sqrt{2}}{3 - 2\sqrt{2}}$$

$$= \frac{3 - 2\sqrt{2}}{9 - 8} = 3 - 2\sqrt{2}$$

$$\therefore \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2 = x + \frac{1}{x} - 2$$

$$= 3 + 2\sqrt{2} + 3 - 2\sqrt{2} - 2 = 4$$

$$\therefore \sqrt{x} - \frac{1}{\sqrt{x}} = 2$$

14. (1) $25a^2 + 40ab + 16b^2$

$$\begin{aligned} &= (5a + 4b)^2 \\ &= (5 \times 23 - 29 \times 4)^2 \\ &= (115 - 116)^2 = 1 \end{aligned}$$

15. (1) $x + \frac{1}{4x} = \frac{3}{2}$

$$\Rightarrow 2x + \frac{1}{2x} = 3$$

Cubing both sides,

$$8x^3 + \frac{1}{8x^3} + 3 \times 2x \times \frac{1}{2x}$$

$$\left(2x + \frac{1}{2x}\right) = 27$$

$$\Rightarrow 8x^3 + \frac{1}{8x^3} + 3 \times 3 = 27$$

$$\Rightarrow 8x^3 + \frac{1}{8x^3} = 27 - 9 = 18$$

16. (4) $x = \frac{4ab}{a + b}$

$$\Rightarrow \frac{x}{2a} = \frac{2b}{a + b}$$

By componendo and dividendo,

$$\frac{x + 2a}{x - 2a} = \frac{2b + a + b}{2b - a - b} = \frac{3b + a}{b - a}$$

Again,

$$\frac{x}{2b} = \frac{2a}{a+b}$$

$$\Rightarrow \frac{x+2b}{x-2b} = \frac{2a+a+b}{2a-a-b} = \frac{3a+b}{a-b}$$

$$\therefore \frac{x+2a}{x-2a} + \frac{x+2b}{x-2b}$$

$$= \frac{3b+a}{b-a} + \frac{3a+b}{a-b}$$

$$= \frac{3b+a-3a-b}{b-a} = \frac{2b-2a}{b-a}$$

$$= \frac{2(b-a)}{b-a} = 2$$

17. (1) $x^2 + y^2 - z^2 + 2xy$
 $= x^2 + y^2 + 2xy - z^2$
 $= (x+y)^2 - z^2 = (x+y+z)(x+y-z)$
 $= (b+c-2a+c+a-2b+a+b-2c)(x+y-z)$
 $= 0$

18. (4) $(a-1)^2 + (b+2)^2 + (c+1)^2 = 0$
 $\Rightarrow a-1=0 \Rightarrow a=1;$
 $b+2=0 \Rightarrow b=-2$
 $c+1=0 \Rightarrow c=-1$
 $\therefore 2a-3b+7c$
 $= 2-3(-2)+7(-1)$
 $= 2+6-7=1$

19. (3) If $a+b+c=0$,
 then, $a^3+b^3+c^3=3abc$
 Here, $y-z+z-x+x-y=0$
 $\therefore (y-z)^3+(z-x)^3+(x-y)^3$
 $= 3(y-z)(z-x)(x-y)$

20. (3) From the question,
 $\frac{a}{b} + \frac{b}{a} = 1$
 $\Rightarrow a^2 + b^2 = ab$
 $\Rightarrow a^2 - ab + b^2 = 0$
 $\therefore a^3 + b^3$
 $= (a+b)(a^2 - ab + b^2) = 0$

21. (1) $x^2 + y^2 + \frac{1}{x^2} + \frac{1}{y^2} - 4 = 0$
 $\Rightarrow x^2 + \frac{1}{x^2} - 2 + y^2 + \frac{1}{y^2} - 2 = 0$
 $\Rightarrow \left(x - \frac{1}{x}\right)^2 + \left(y - \frac{1}{y}\right)^2 = 0$

$$\Rightarrow x - \frac{1}{x} = 0$$

$$\Rightarrow x^2 - 1 = 0 \Rightarrow x = 1$$

Similarly,
 $y = 1$

$$\therefore x^2 + y^2 = 1 + 1 = 2$$

22. (2) $x^2 = y + z$
 $\Rightarrow x^2 + x = x + y + z$
 $\Rightarrow x(x+1) = x + y + z \dots(i)$
 Similarly,
 $y(y+1) = x + y + z \dots(ii)$
 and, $z(z+1) = x + y + z \dots(iii)$

$$\therefore \frac{1}{x+1} + \frac{1}{y+1} + \frac{1}{z+1}$$

$$= \frac{x}{x+y+z} + \frac{y}{x+y+z} + \frac{z}{x+y+z}$$

$$= \frac{x+y+z}{x+y+z} = 1$$

23. (1) $x + \frac{1}{x} = \sqrt{3}$

Cubing both sides,

$$x^3 + \frac{1}{x^3} + 3\left(x + \frac{1}{x}\right) = (\sqrt{3})^3$$

$$\Rightarrow x^3 + \frac{1}{x^3} + 3\sqrt{3} = 3\sqrt{3}$$

$$\Rightarrow x^3 + \frac{1}{x^3} = 0$$

Now, $x^{18} + x^{12} + x^6 + 1$
 $= x^{12}(x^6 + 1) + 1(x^6 + 1)$
 $= (x^{12} + 1)(x^6 + 1)$

$$= (x^{12} + 1) \cdot x^3 \left(x^3 + \frac{1}{x^3}\right) = 0$$

24. (4) $(ad - bc)^2 + (ac + bd)^2$
 $= a^2d^2 + b^2c^2 - 2abcd + a^2c^2 + b^2d^2 - 2abcd$
 $= a^2d^2 + b^2c^2 + a^2c^2 + b^2d^2$
 $= a^2d^2 + b^2d^2 + b^2c^2 + a^2c^2$
 $= d^2(a^2 + b^2) + c^2(b^2 + a^2)$
 $= (a^2 + b^2)(c^2 + d^2)$
 $= 2 \times 1 = 2$

25. (4) $x^4 + \frac{1}{x^4} = 119$

$$\Rightarrow \left(x^2 + \frac{1}{x^2}\right)^2 - 2 = 119$$

$$\Rightarrow \left(x^2 + \frac{1}{x^2}\right)^2 = 121$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 11$$

$$\Rightarrow \left(x - \frac{1}{x}\right)^2 + 2 = 11$$

$$\Rightarrow \left(x - \frac{1}{x}\right)^2 = 9 \Rightarrow x - \frac{1}{x} = 3$$

Cubing both sides,

$$\left(x - \frac{1}{x}\right)^3 = 27$$

$$\Rightarrow x^3 - \frac{1}{x^3} - 3\left(x - \frac{1}{x}\right) = 27$$

$$\Rightarrow x^3 - \frac{1}{x^3} - 3 \times 3 = 27$$

$$\Rightarrow x^3 - \frac{1}{x^3} = 27 + 9 = 36$$

26. (1) $x - y = \frac{x+y}{7} = \frac{xy}{4} = k$

$$\Rightarrow x - y = k$$

$$x + y = 7k$$

$$\therefore (x+y)^2 - (x-y)^2$$

$$= 49k^2 - k^2$$

$$\Rightarrow 4xy = 48k^2$$

$$\Rightarrow 16k = 48k^2$$

$$\Rightarrow k = \frac{1}{3}$$

$$\therefore xy = 4k = 4 \times \frac{1}{3} = \frac{4}{3}$$

27. (4) $(x+y-z)^2 + (y+z-x)^2 + (z+x-y)^2 = 0$

$$\Rightarrow (x+y-z) = 0$$

28. (4) $\frac{x^2}{yz} + \frac{y^2}{zx} + \frac{z^2}{xy}$

$$= \frac{x^3 + y^3 + z^3}{xyz} = \frac{3xyz}{xyz} = 3$$

29. (1) $x^2 + 2 = 2x$
 $\Rightarrow x^2 - 2x + 2 = 0$

$$\begin{array}{r} x^2 - 2x + 2 \quad x^4 - x^3 + x^2 + 2(x^2 + x + 1) \\ x^4 - 2x^3 + 2x^2 \\ \hline - \quad + \quad - \\ x^3 - x^2 + 2 \\ x^3 - 2x^2 + 2x \\ \hline - \quad + \quad - \\ x^2 - 2x + 2 \\ x^2 - 2x + 2 \\ \hline x \end{array}$$

$\therefore x^4 - x^3 + x^2 + 2$
 $= (x^2 - 2x + 2)(x^2 + x + 1) = 0$

30. (1) $2^x = 3^y = 6^{-z} = k$

$\Rightarrow 2 = k^{\frac{1}{x}}; 3 = k^{\frac{1}{y}}; 6 = k^{-\frac{1}{z}}$

$\therefore 2 \times 3 = 6$

$\Rightarrow k^{\frac{1}{x}} \times k^{\frac{1}{y}} = k^{-\frac{1}{z}}$

$\Rightarrow k^{\frac{1}{x} + \frac{1}{y}} = k^{-\frac{1}{z}}$

$\Rightarrow \frac{1}{x} + \frac{1}{y} = -\frac{1}{z} \Rightarrow \frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 0$

31. (1) $\frac{1}{x+y} = \frac{1}{x} + \frac{1}{y} = \frac{y+x}{xy}$

$\Rightarrow (x+y)^2 = xy$

$\Rightarrow x^2 + 2xy + y^2 = xy$

$\Rightarrow x^2 + xy + y^2 = 0$

$\therefore x^3 - y^3 = (x-y)(x^2 + xy + y^2)$
 $= 0$

32. (2) $a^2 + b^2 + c^2 = ab + bc + ca$

$\Rightarrow 2a^2 + 2b^2 + 2c^2$

$= 2ab + 2bc + 2ca$

$\Rightarrow a^2 - 2ab + b^2 + b^2 - 2bc + c^2$
 $+ c^2 - 2ac + a^2 = 0$

$\Rightarrow (a-b)^2 + (b-c)^2 + (c-a)^2$
 $= 0$

$\Rightarrow a-b=0 \Rightarrow a=b$

$b-c=0 \Rightarrow b=c$

$c-a=0 \Rightarrow c=a$

$\Rightarrow a=b=c$

$\therefore \frac{a+c}{b} = \frac{a+a}{a} = 2$

33. (3)

$\frac{x}{a} = b-c; \frac{y}{b} = c-a; \frac{z}{c} = a-b$

Again, $b-c+c-a+a-b=0$

$\therefore \left(\frac{x}{a}\right)^3 + \left(\frac{y}{b}\right)^3 + \left(\frac{z}{c}\right)^3$

$= (b-c)^3 + (c-a)^3 + (a-b)^3$

$= 3(b-c)(c-a)(a-b)$

$= \frac{3xyz}{abc}$

34. (2) $\frac{1}{(a+b)(b+c)} + \frac{1}{(a+c)(b+a)}$

$+ \frac{1}{(c+a)(c+b)}$

$= \frac{c+a+b+c+a+b}{(a+b)(b+c)(c+a)}$

$= \frac{2(a+b+c)}{(a+b)(b+c)(c+a)}$

$= 0$ because $a+b+c=0$

35. (1) $\sqrt{x} = \sqrt[3]{y}$

$\Rightarrow x^{\frac{1}{2}} = y^{\frac{1}{3}}$

$\Rightarrow (x^{\frac{1}{2}})^6 = (y^{\frac{1}{3}})^6$

$\Rightarrow x^3 = y^2$

36. (3) $\frac{2p}{p^2 - 2p + 1} = \frac{1}{4}$

$\Rightarrow \frac{p^2 - 2p + 1}{2p} = 4$

$\Rightarrow \frac{p^2 - 2p + 1}{p} = 8$

$\Rightarrow \frac{p^2}{p} - \frac{2p}{p} + \frac{1}{p} = 8$

$\Rightarrow p + \frac{1}{p} = 8 + 2 = 10$

37. (1) $x \propto \frac{1}{y^2 - 1} \Rightarrow x = \frac{k}{y^2 - 1}$

Where k is a constant.

When $y = 10, x = 24$, then

$\therefore 24 = \frac{k}{10^2 - 1} \Rightarrow 24 = \frac{k}{99}$

$\Rightarrow k = 24 \times 99$

When $y = 5$, then

$x = \frac{k}{y^2 - 1} = \frac{24 \times 99}{5^2 - 1} = \frac{24 \times 99}{24} = 99$

38. (3) $m + \frac{1}{m-2} = 4$

$\Rightarrow (m-2) + \frac{1}{m+2} = 4 - 2 = 2$

On squaring both sides,

$(m-2)^2 + \frac{1}{(m-2)^2} +$

$2(m-2)\left(\frac{1}{m-2}\right) = 4$

\Rightarrow

$(m-2)^2 + \frac{1}{(m-2)^2} = 4 - 2 = 2$

39. (4) $\frac{a}{1-a} + \frac{b}{1-b} + \frac{c}{1-c} = 1$

$\Rightarrow \left(\frac{a}{1-a} + 1\right) + \left(\frac{b}{1-b} + 1\right) + \left(\frac{c}{1-c} + 1\right)$

$= 3 + 1 = 4$

$\Rightarrow \frac{a+1-a}{1-a} + \frac{b+1-b}{1-b} + \frac{c+1-c}{1-c} = 4$

$\Rightarrow \frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 4$

40. (3) $x^3 - x^2y - xy^2 + y^3$

$= x^3 + y^3 - x^2y - xy^2$

$= (x+y)^3 - 3xy(x+y) - xy(x+y)$

$= (x+y)^3 - 4xy(x+y) = a^3 - 4b^2a$

41. (2) $\frac{(a-b)^2}{(b-c)(c-a)} +$

$\frac{(b-c)^2}{(a-b)(c-a)} + \frac{(c-a)^2}{(a-b)(b-c)}$

$= \frac{(a-b)^3}{(a-b)(b-c)(c-a)} +$

$\frac{(b-c)^3}{(a-b)(b-c)(c-a)} +$

$\frac{(c-a)^3}{(a-b)(b-c)(c-a)}$

$$= \frac{(a-b)^3 + (b-c)^3 + (c-a)^3}{(a-b)(b-c)(c-a)}$$

$$= \frac{3(a-b)(b-c)(c-a)}{(a-b)(b-c)(c-a)} = 3$$

If $a + b + c = 0$,
 $\therefore a^3 + b^3 + c^3 = 3abc$

42. (2) $\frac{2x-y}{x+2y} = \frac{1}{2}$

$$\Rightarrow 4x - 2y = x + 2y \Rightarrow 3x = 4y$$

$$\Rightarrow \frac{x}{y} = \frac{4}{3}$$

$$\therefore \frac{3x-y}{3x+y} = \frac{y\left(3\frac{x}{y}-1\right)}{y\left(3\frac{x}{y}+1\right)}$$

$$= \frac{3 \times \frac{4}{3} - 1}{3 \times \frac{4}{3} + 1} = \frac{4-1}{4+1} = \frac{3}{5}$$

43. (2) $x + \frac{1}{4}\sqrt{x} + a^2$

$$= (\sqrt{x})^2 + 2 \cdot \sqrt{x} \cdot \frac{1}{8} + (a)^2$$

Clearly $a = \frac{1}{8}$.

Then, expression = $\left(\sqrt{x} + \frac{1}{8}\right)^2$

44. (2) Given $x = \frac{\sqrt{3}}{2}$

$$\frac{\sqrt{1+x}}{1+\sqrt{1+x}} \times \frac{1-\sqrt{1+x}}{1-\sqrt{1+x}}$$

$$+ \frac{\sqrt{1-x}}{1-\sqrt{1-x}} \times \frac{1+\sqrt{1-x}}{1+\sqrt{1-x}}$$

$$= \frac{\sqrt{1+x}-1-x}{1-1-x} + \frac{\sqrt{1-x}+1-x}{1-1+x}$$

$$= \frac{\sqrt{1-x}+1-x}{x} - \frac{\sqrt{1+x}-1-x}{x}$$

$$= \frac{\sqrt{1-x}+1-x-\sqrt{1+x}+1+x}{x}$$

$$= \frac{2+\sqrt{1-x}-\sqrt{1+x}}{x}$$

$$= \frac{2+\sqrt{1-\frac{\sqrt{3}}{2}}-\sqrt{1+\frac{\sqrt{3}}{2}}}{\frac{\sqrt{3}}{2}}$$

$$= \frac{2+\sqrt{\frac{2-\sqrt{3}}{2}}-\sqrt{\frac{2+\sqrt{3}}{2}}}{\frac{\sqrt{3}}{2}}$$

$$= \frac{2+\frac{\sqrt{4-2\sqrt{3}}}{2}-\frac{\sqrt{4+2\sqrt{3}}}{2}}{\frac{\sqrt{3}}{2}}$$

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

45. (3) Let $x = \sqrt{7\sqrt{7\sqrt{7\sqrt{7}\dots}}}$

On squaring both sides,

$$x^2 = 7x$$

$$\Rightarrow x^2 - 7x = 0$$

$$\Rightarrow x(x-7) = 0 \Rightarrow x = 7$$

$$\therefore 7 = (7^3)^{y-1} = 7^{3y-3}$$

$$\Rightarrow 3y - 3 = 1 \Rightarrow 3y = 4$$

$$\Rightarrow y = \frac{4}{3}$$

46. (3) $x = \frac{\sqrt{5}-2}{\sqrt{5}+2}$

$$= \frac{(\sqrt{5}-2)^2}{(\sqrt{5}+2)(\sqrt{5}-2)}$$

$$= \frac{5+4-4\sqrt{5}}{5-4} = 9-4\sqrt{5}$$

$$\therefore \frac{1}{x} = 9+4\sqrt{5}$$

$$\therefore x^4 + x^{-4} = x^4 + \frac{1}{x^4}$$

$$= \left(x^2 + \frac{1}{x^2}\right)^2 - 2$$

$$= \left[\left(x + \frac{1}{x}\right)^2 - 2\right]^2 - 2$$

$$= \left[(9+4\sqrt{5}+9-4\sqrt{5})^2 - 2\right]^2 - 2$$

$$= [(18)^2 - 2]^2 - 2$$

$$= (322)^2 - 2 = 103682$$

whole number

Note : It is not required to find the product.

47. (4) $x = \frac{2\sqrt{3} \times \sqrt{2}}{\sqrt{3} + \sqrt{2}}$

$$\Rightarrow \frac{x}{\sqrt{2}} = \frac{2\sqrt{3}}{\sqrt{3} + \sqrt{2}}$$

$$\Rightarrow \frac{x + \sqrt{2}}{x - \sqrt{2}} = \frac{2\sqrt{3} + \sqrt{3} + \sqrt{2}}{2\sqrt{3} - \sqrt{3} - \sqrt{2}} =$$

$$\frac{3\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}}$$

(By componendo and dividendo)

Similarly,

$$\frac{x}{\sqrt{3}} = \frac{2\sqrt{2}}{\sqrt{3} + \sqrt{2}}$$

$$\Rightarrow \frac{x + \sqrt{3}}{x - \sqrt{3}} = \frac{2\sqrt{2} + \sqrt{3} + \sqrt{2}}{2\sqrt{2} - \sqrt{3} - \sqrt{2}} =$$

$$\frac{\sqrt{3} + 3\sqrt{2}}{\sqrt{2} - \sqrt{3}}$$

\therefore Expression

$$= \frac{x + \sqrt{2}}{x - \sqrt{2}} + \frac{x + \sqrt{3}}{x - \sqrt{3}} =$$

$$\frac{3\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}} + \frac{\sqrt{3} + 3\sqrt{2}}{\sqrt{2} - \sqrt{3}}$$

$$= \frac{3\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}} - \frac{\sqrt{3} + 3\sqrt{2}}{\sqrt{3} - \sqrt{2}}$$

$$= \frac{3\sqrt{3} + \sqrt{2} - \sqrt{3} - 3\sqrt{2}}{\sqrt{3} - \sqrt{2}}$$

$$= \frac{2(\sqrt{3} - \sqrt{2})}{\sqrt{3} - \sqrt{2}} = 2$$

48. (2) $x = 2 + \sqrt{3}$

$$\frac{1}{x} = \frac{1}{2 + \sqrt{3}} = \frac{1}{2 + \sqrt{3}} \times \frac{2 - \sqrt{3}}{2 - \sqrt{3}}$$

$$= \frac{2 - \sqrt{3}}{4 - 3} = 2 - \sqrt{3}$$

$$\therefore \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2 = x + \frac{1}{x} + 2 =$$

$$2 + \sqrt{3} + 2 - \sqrt{3} + 2 = 6$$

$$\therefore \sqrt{x} + \frac{1}{\sqrt{x}} = \sqrt{6}$$

49. (3) $x = \frac{\sqrt{3}}{2}$

$$\therefore \sqrt{1+x} = \sqrt{1 + \frac{\sqrt{3}}{2}}$$

$$= \sqrt{\frac{2 + \sqrt{3}}{2}} = \sqrt{\frac{4 + 2\sqrt{3}}{4}}$$

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

$$\therefore \sqrt{1-x} = \frac{\sqrt{3}-1}{2}$$

$$\therefore \sqrt{1+x} + \sqrt{1-x}$$

$$= \frac{\sqrt{3} + 1}{2} + \frac{\sqrt{3} - 1}{2}$$

$$= \frac{\sqrt{3} + 1 + \sqrt{3} - 1}{2} = \sqrt{3}$$

50. (1) $x - 1 = \sqrt{2} + \sqrt{3}$

On squaring,

$$x^2 - 2x + 1 = 2 + 3 + 2\sqrt{6}$$

$$\Rightarrow x^2 - 2x - 4 = 2\sqrt{6}$$

On squaring again,

$$x^4 + 4x^2 + 16 - 4x^3 - 8x^2 + 16x = 24$$

$$\Rightarrow x^4 - 4x^3 - 4x^2 + 16x - 8 = 0$$

$$\Rightarrow 2x^4 - 8x^3 - 8x^2 + 32x - 16 = 0$$

$$\Rightarrow 2x^4 - 8x^3 - 5x^2 + 26x - 28 - 3x^2 + 6x + 12 = 0$$

$$\Rightarrow 2x^4 - 8x^3 - 5x^2 + 26x - 28$$

$$= 3x^2 - 6x - 12 = 3(x^2 - 2x - 4)$$

$$= 3 \times 2\sqrt{6} = 6\sqrt{6}$$

51. (4) $x + \frac{1}{x} = 5$

$$\Rightarrow x^2 - 5x + 1 = 0$$

$$\Rightarrow x^2 - 3x + 1 = 2x$$

$$\therefore \frac{x^4 + \frac{1}{x^2}}{x^2 - 3x + 1} = \frac{1}{2} \left(\frac{x^4 + \frac{1}{x^2}}{x} \right)$$

$$= \frac{1}{2} \left(x^3 + \frac{1}{x^3} \right)$$

$$= \frac{1}{2} \left[\left(x + \frac{1}{x} \right)^3 - 3 \left(x + \frac{1}{x} \right) \right]$$

$$= \frac{1}{2} (125 - 3 \times 5)$$

$$= \frac{1}{2} \times 110 = 55$$

52. (4) $x = 2 + \sqrt{3}$, $y = 2 - \sqrt{3}$

$$x + y = 4; xy$$

$$= 4 - 3 = 1$$

$$\therefore \frac{x^2 + y^2}{x^3 + y^3} = \frac{(x+y)^2 - 2xy}{(x+y)^3 - 3xy(x+y)}$$

$$= \frac{16 - 2}{64 - 3 \times 4} = \frac{14}{52} = \frac{7}{26}$$

53. (3) $x = 27$

$$\therefore \sqrt[3]{x} + \sqrt[3]{y} = \sqrt[3]{729}$$

$$\Rightarrow \sqrt[3]{27} + \sqrt[3]{y} = 9$$

$$\Rightarrow 3 + \sqrt[3]{y} = 9$$

$$\Rightarrow \sqrt[3]{y} = 9 - 3 = 6$$

$$\therefore y = (6)^3 = 216$$

54. (2) $\frac{3-5x}{x} + \frac{3-5y}{y} + \frac{3-5z}{z} = 0$

$$\Rightarrow \frac{3}{x} - \frac{5x}{x} + \frac{3}{y} - \frac{5y}{y} + \frac{3}{z} - \frac{5z}{z} = 0$$

$$\Rightarrow \frac{3}{x} + \frac{3}{y} + \frac{3}{z} - 15 = 0$$

$$\Rightarrow 3 \left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z} \right) = 15$$

$$\Rightarrow \frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 5$$

55. (4) $x^2 - 3x + 1 = 0$

$$\Rightarrow x^2 + 1 = 3x$$

On dividing by x

$$\Rightarrow x + \frac{1}{x} = 3$$

$$\therefore \left(x - \frac{1}{x} \right)^2 = \left(x + \frac{1}{x} \right)^2 - 4 = 9$$

$$- 4 = 5$$

$$\therefore x - \frac{1}{x} = \pm\sqrt{5}$$

When, $x - \frac{1}{x} = \sqrt{5}$

and $x + \frac{1}{x} = 3$

On adding

$$2x = 3 + \sqrt{5}$$

$$\Rightarrow x = \frac{3 + \sqrt{5}}{2}$$

It satisfies $x^2 - 3x + 1 = 0$

Again, when $x - \frac{1}{x} = -\sqrt{5}$ and

$$x + \frac{1}{x} = 3$$

On adding,

$$2x = 3 - \sqrt{5}$$

$$\Rightarrow x = \frac{3 - \sqrt{5}}{2}$$

$$\begin{aligned} &\therefore x^2 - 3x + 1 \\ &= \frac{(3 - \sqrt{5})^2}{4} - \frac{3(3 - \sqrt{5})}{2} + 1 \\ &= \frac{9 + 5 - 6\sqrt{5}}{4} - \frac{9 - 3\sqrt{5}}{2} + 1 \\ &= \frac{14 - 6\sqrt{5} - 18 + 6\sqrt{5} + 4}{4} = 0 \end{aligned}$$

56. (4) $a^x = (x + y + z)^y$
 $a^y = (x + y + z)^z$
 $a^z = (x + y + z)^x$
 Multiplying corresponding terms,
 $a^x \cdot a^y \cdot a^z = (x + y + z)^{x+y+z}$
 $\Rightarrow a^{x+y+z} = (x + y + z)^{x+y+z}$
 $\Rightarrow a = x + y + z$

57. (2) $\therefore x = 2 + \sqrt{3}$

$$\begin{aligned} \therefore \frac{1}{x} &= \frac{1}{2 + \sqrt{3}} \\ &= \frac{2 - \sqrt{3}}{(2 + \sqrt{3})(2 - \sqrt{3})} = \frac{2 - \sqrt{3}}{4 - 3} \\ &= 2 - \sqrt{3} \\ \therefore x + \frac{1}{x} &= 4 \end{aligned}$$

Expression

$$\begin{aligned} &= \frac{x^6 + x^4 + x^2 + 1}{x^3} \\ &= \frac{x^4(x^2 + 1) + (x^2 + 1)}{x^3} \\ &= \frac{(x^4 + 1)(x^2 + 1)}{x^3} \\ &= \left(\frac{x^4 + 1}{x^2}\right)\left(\frac{x^2 + 1}{x}\right) \\ &= \left(x^2 + \frac{1}{x^2}\right)\left(x + \frac{1}{x}\right) \end{aligned}$$

$$\begin{aligned} &= \left[\left(x + \frac{1}{x}\right)^2 - 2\right]\left(x + \frac{1}{x}\right) \\ &= (4^2 - 2)(4) = 56 \end{aligned}$$

58. (4) $x = (0.08)^2$,

$$\begin{aligned} y &= \frac{1}{(0.08)^2} = \frac{10000}{64} \\ &= 156.25 \\ z &= (1 - 0.08)^2 - 1 \\ &= 1 + (0.08)^2 - 2 \times 0.08 - 1 \\ &= (0.08)^2 - 2 \times 0.08 \\ \text{Clearly, } z &< x < y \end{aligned}$$

59. (4) $x^4 + \frac{1}{x^4} = 23$

$$\begin{aligned} \Rightarrow \left(x^2 + \frac{1}{x^2}\right)^2 - 2 &= 23 \\ \Rightarrow \left(x^2 + \frac{1}{x^2}\right)^2 &= 23 + 2 = 25 \\ \therefore x^2 + \frac{1}{x^2} &= 5 \\ \therefore \left(x - \frac{1}{x}\right)^2 & \\ &= x^2 + \frac{1}{x^2} - 2 \\ &= 5 - 2 = 3 \end{aligned}$$

60. (2) If $a + b + c = 0$ then $a^3 + b^3 + c^3 - 3abc = 0$

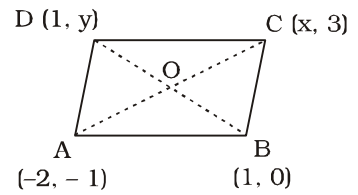
61. (4) We know that when three points are collinear, the points lie on same line. In that case the area of triangle enclosed between the points is zero.

Here, area $\Delta ABC = 0$

$$\begin{aligned} \Rightarrow \frac{1}{2} \begin{vmatrix} -2 & 3 & 1 \\ 1 & 2 & 1 \\ K & 0 & 1 \end{vmatrix} &= 0 \\ \Rightarrow -2(2 - 0) - 3(1 - K) + 1(0 - 2K) &= 0 \\ \Rightarrow -4 - 3 + 3K - 2K &= 0 \end{aligned}$$

$K = 7$

62. (3) Here, ABCD is a parallelogram.



Mid point of AC = Mid point of BD

$$\begin{aligned} \Rightarrow \frac{-2 + x}{2} &= \frac{1 + 1}{2} \\ \text{(using mid-point formula)} \\ -2 + x &= 2 \end{aligned}$$

$x = 4$

Now

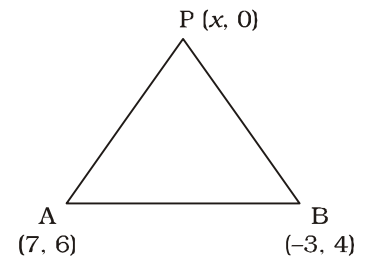
$$\frac{-1 + 3}{2} = \frac{y + 0}{2}$$

$y = 2$

$\Rightarrow x = 4, y = 2$

63. (1) We know that on x-axis, y coordinate is zero.

It is given



$PA = PB$... (1)

Using distance formula

$$PA = \sqrt{(x - 7)^2 + (6 - 0)^2}$$

$$PB = \sqrt{(x + 3)^2 + (0 - 4)^2}$$

Using equation (1)

$$\sqrt{(x - 7)^2 + 36} = \sqrt{(x + 3)^2 + 16}$$

Squaring on both sides, we get

$$\begin{aligned} (x - 7)^2 + 36 &= (x + 3)^2 + 16 \\ x^2 + 49 - 14x + 36 &= x^2 + 9 + 6x + 16 \\ \Rightarrow 85 - 25 &= 20x \end{aligned}$$

$\Rightarrow x = \frac{60}{20}$

$$x = 3$$

The point is (3, 0).

64. (3) Here, $m_1 = (2 - \sqrt{3})$

$$m_2 = (2 + \sqrt{3})$$

Let the angle between, the lines will be θ

$$\Rightarrow \tan \theta = \left| \frac{m_1 - m_2}{1 + m_1 \cdot m_2} \right|$$

$$= \left| \frac{2 - \sqrt{3} - 2 - \sqrt{3}}{1 + (2 - \sqrt{3})(2 + \sqrt{3})} \right|$$

$$= \left| \frac{-2\sqrt{3}}{1 + (4 - 3)} \right| = \frac{2\sqrt{3}}{2} = \sqrt{3}$$

$$\Rightarrow \theta = 60^\circ$$

65. (2) Let the equation of line will be

$$\frac{x - x_1}{\cos \theta} = \frac{y - y_1}{\sin \theta}$$

Here, $\theta = 150^\circ$ and the line passes through (3, -5)

$$\Rightarrow \frac{x - 3}{\cos 150^\circ} = \frac{y + 5}{\sin 150^\circ}$$

$$\frac{x - 3}{\cos (180^\circ - 30^\circ)} = \frac{y + 5}{\sin (180^\circ - 30^\circ)}$$

$$\frac{x - 3}{-\cos 30^\circ} = \frac{y + 5}{\sin 30^\circ}$$

$$\frac{x - 3}{-\frac{\sqrt{3}}{2}} = \frac{y + 5}{\frac{1}{2}}$$

$$\frac{x - 3}{-\sqrt{3}} = \frac{y + 5}{1}$$

$$x - 3 = -\sqrt{3}y - 5\sqrt{3}$$

$$\Rightarrow x + \sqrt{3}y = 3 - 5\sqrt{3}$$

66. (1) Here, $\theta = 135^\circ$

As we know that

$$m = \tan \theta$$

$$m = \tan 135^\circ$$

$$m = \tan (90^\circ + 45^\circ)$$

$$m = -\cot 45^\circ$$

$$[\because \tan (90^\circ + \theta) = -\cot \theta]$$

$$m = -1$$

67. (4) Here, $m = \sqrt{3}$

and we know that

$$m = \tan \theta$$

$$\tan \theta = \sqrt{3}$$

$$\tan \theta = \tan 60^\circ$$

$$\theta = 60^\circ$$

68. (2) We know that slope of a line is given by

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{-4 - 2}{-2 - (-1)} = \frac{-6}{-1} = 6$$

69. (2) The slope (m_1) of a line through (4, x) and (2, 5) is

$$m_1 = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_1 = \frac{5 - x}{2 - 4}$$

$$m_1 = -\frac{(5 - x)}{2}$$

Now, slope (m_2) of a line through (-1, 4) and (0, 6) is

$$m_2 = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_2 = \frac{6 - 4}{0 + 1}$$

$$m_2 = 2$$

We know that when two lines are perpendicular then

$$m_1 \cdot m_2 = -1$$

$$\frac{-(5 - x)}{2} \cdot 2 = -1$$

$$-5 + x = -1$$

$$x = 5 - 1$$

$$x = 4$$

70. (2) Let A (1, 2) and B (k, 4)

Slope of line AB

$$= \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 2}{k - 1}$$

$$m_1 = \frac{2}{k - 1}$$

Let P (-1, 4) and Q (6, 5)

slope of line PQ

$$= \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 4}{6 + 1} = \frac{1}{7}$$

We know that when two lines are parallel then $m_1 = m_2$

$$\Rightarrow \frac{2}{k - 1} = \frac{1}{7}$$

$$14 = k - 1$$

$$k = 15$$

71. (3) As the line is parallel to x-axis and 7 units above the origin its equation will be

$$y = 7 \text{ or, } y - 7 = 0$$

72. (1) Equation of the line is

$$\sqrt{3}x - y - 4 = 0$$

Slope of line,

$$m = -\frac{\text{Co-efficient of } x}{\text{Co-efficient of } y}$$

$$m = \frac{-\sqrt{3}}{-1}$$

$$m = \sqrt{3}$$

Also, $m = \tan \theta$

$$\Rightarrow \tan \theta = \sqrt{3}$$

$$\theta = 60^\circ$$

73. (1) For the equation $\sqrt{3}x + y = 1$

Its slope

$$m_1 = -\frac{\text{Co-efficient of } x}{\text{Co-efficient of } y}$$

$$m_1 = -\sqrt{3}$$

For the equation $x + \sqrt{3}y = 1$

Its slope

$$m_2 = - \frac{\text{Co-efficient of } x}{\text{Co-efficient of } y}$$

$$= - \frac{1}{\sqrt{3}}$$

Now, we know that angle between the lines is

$$\tan \theta = \left| \frac{m_1 - m_2}{1 + m_1 m_2} \right|$$

$$\tan \theta = \left| \frac{-\sqrt{3} + \frac{1}{\sqrt{3}}}{1 - \sqrt{3} \left(\frac{-1}{\sqrt{3}} \right)} \right|$$

$$= \left| \frac{-2}{\sqrt{3} \times 2} \right| = \frac{1}{\sqrt{3}}$$

$$\tan \theta = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \theta = 30^\circ$$

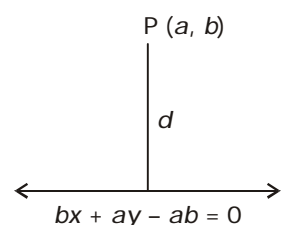
74. (2) The equation of the line

$\frac{x}{a} + \frac{y}{b} = 1$ can be written as

$$bx + ay = ab$$

$$\text{or, } bx + ay - ab = 0$$

Let the distance of the line from point P is d.



$$d = \left| \frac{b \cdot a + a \cdot b - ab}{\sqrt{b^2 + a^2}} \right|$$

$$d = \frac{ab}{\sqrt{a^2 + b^2}} \text{ Units}$$

75. (3) Let the coordinates of R will be (x, y)

Using internal section formula

$$\begin{array}{ccc} & R(x, y) & \\ P & \text{---} 2 : 7 \text{---} & Q \\ (-5, 11) & & (4, -7) \end{array}$$

$$x = \frac{mx_2 + nx_1}{m + n}$$

$$x = \frac{2 \times 4 + 7 \times -5}{2 + 7}$$

$$x = \frac{8 - 35}{9}$$

$$x = -3$$

$$y = \frac{my_2 + ny_1}{m + n}$$

$$y = \frac{2 \times -7 + 7 \times 11}{2 + 7}$$

$$y = \frac{-14 + 77}{9}$$

$$y = \frac{63}{9}$$

$$y = 7$$

∴ The coordinates of R will be (-3, 7).

76. (3) We know that equation of the line is

$$x \cdot \cos \alpha + y \sin \alpha = p$$

$$\Rightarrow x \cdot \cos 150^\circ + y \sin 150^\circ = 3$$

$$x \cos (180^\circ - 30^\circ) + y \sin (180^\circ - 30^\circ) = 3$$

$$-x \cdot \cos 30^\circ + y \sin 30^\circ = 3$$

$$- \frac{\sqrt{3}x}{2} + \frac{y}{2} = 3$$

$$- \sqrt{3}x + y = 6$$

$$\boxed{\sqrt{3}x - y + 6 = 0}$$

77. (1) We know that slope of line is

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$3 = \frac{2 - 5}{x - 3}$$

$$3x - 9 = -3$$

$$3x = 9 - 3$$

$$3x = 6$$

$$\boxed{x = 2}$$

78. (2) Let the distance be

$$d = \left| \frac{2 \cdot 2 - 4 \cdot 3 + 5}{\sqrt{2^2 + 4^2}} \right|$$

$$= \left| \frac{4 - 12 + 5}{\sqrt{20}} \right|$$

$$= \frac{3}{\sqrt{20}} \text{ units}$$

79. (4) Let the distance be

$$d = \left| \frac{4x + 6y + 9}{\sqrt{4^2 + 6^2}} \right|$$

$$d = \left| \frac{2(2x + 3y) + 9}{\sqrt{52}} \right|$$

$$= \left| \frac{2 \cdot (-5) + 9}{\sqrt{52}} \right| \because 2x + 3y = -5$$

$$= \left| \frac{1}{\sqrt{52}} \right|$$

$$= \frac{1}{2\sqrt{13}} \text{ Units}$$

80. (4) As the following lines intersect at a point.

The lines are

$$3x + y - 2 = 0 \quad \dots(1)$$

$$kx + 2y - 3 = 0 \quad \text{and} \quad \dots(2)$$

$$2x - y - 3 = 0 \quad \dots(3)$$

Solving equation (1) and (3)

$$\frac{x}{-3 - 2} = \frac{y}{-4 + 9} = \frac{-1}{-3 - 2}$$

$$\Rightarrow \frac{x}{-5} = \frac{y}{5} = \frac{1}{-5}$$

$$\Rightarrow x = \frac{-5}{-5} = 1$$

$$y = \frac{5}{-5} = -1$$

∴ The point of intersection is (1, -1) put this value in equation (2), we get

$$k(1) + 2(-1) - 3 = 0$$

$$k - 5 = 0$$

$$\boxed{k = 5}$$

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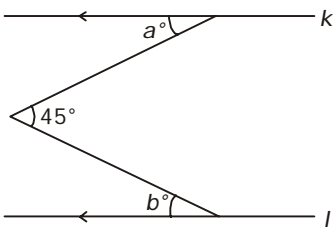
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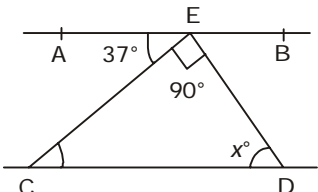
OBJECTIVE QUESTIONS ON GEOMETRY ASKED IN VARIOUS EXAMS CONDUCTED BY SSC IN PREVIOUS YEARS'

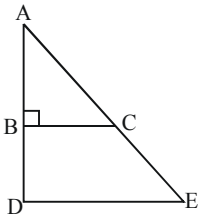
1. In $\triangle ABC$, O is the centroid and AD, BE, CF are three medians and the area of $\triangle AOE = 15 \text{ cm}^2$ then area of quadrilateral BDOF is
(1) 20 cm^2 (2) 30 cm^2
(3) 40 cm^2 (4) 25 cm^2
2. The radius of two concentric circles are 9 cm and 15 cm. If the chord of the greater circle be a tangent to the smaller circle, then the length of that chord is
(1) 24 cm (2) 12 cm
(3) 30 cm (4) 18 cm
3. O and C are respectively the orthocentre and circumcentre of an acute-angled triangle PQR. The points P and O are joined and produced to meet the side QR at S. If $\angle POS = 60^\circ$ and $\angle QCR = 130^\circ$, then $\angle RPS =$
(1) 30° (2) 35°
(3) 100° (4) 60°
4. The length of a chord of a circle is equal to the radius of the circle. The angle which this chord subtends in the major segment of the circle is equal to
(1) 30° (2) 45°
(3) 60° (4) 90°
5. In $\triangle ABC$, AD is the internal bisector of $\angle A$, meeting the side BC at D. If $BD = 5 \text{ cm}$, $BC = 7.5 \text{ cm}$, then $AB : AC$ is
(1) 2 : 1 (2) 1 : 2
(3) 4 : 5 (4) 3 : 5
6. Each interior angle of a regular polygon is 144° . The number of sides of the polygon is
(1) 8 (2) 9
(3) 10 (4) 11
7. The ratio of the areas of the circumcircle and the incircle of an equilateral triangle is
(1) 2 : 1 (2) 4 : 1
(3) 8 : 1 (4) 3 : 2
8. ABCD is a square. M is the mid-point of AB and N is the mid-point of BC. DM and AN are joined and they meet at O. Then which of the following is correct ?
(1) $OA : OM = 1 : 2$
(2) $AN = MD$
(3) $\angle ADM = \angle ANB$
(4) $\angle AMD = \angle BAN$
9. $AB = 8 \text{ cm}$ and $CD = 6 \text{ cm}$ are two parallel chords on the same side of the centre of a circle. The distance between them is 1 cm. The radius of the circle is
(1) 5 cm (2) 4 cm
(3) 3 cm (4) 2 cm
10. The circumcentre of a triangle ABC is O. If $\angle BAC = 85^\circ$ and $\angle BCA = 75^\circ$, then the value of $\angle OAC$ is
(1) 40° (2) 60°
(3) 70° (4) 90°
11. Two chords AB and CD of circle whose centre is O, meet at the point P and $\angle AOC = 50^\circ$, $\angle BOD = 40^\circ$. Then the value of $\angle BPD$ is
(1) 60° (2) 40°
(3) 45° (4) 75°
12. A straight line parallel to the base BC of the triangle ABC intersects AB and AC at the points D and E respectively. If the area of the $\triangle ABE$ be 36 sq.cm , then the area of the $\triangle ACD$ is
(1) 18 sq.cm
(2) 36 sq.cm
(3) 18 cm
(4) 36 cm
13. Two equal circles of radius 4 cm intersect each other such that each passes through the centre of the other. The length of the common chord is :
(1) $2\sqrt{3} \text{ cm}$ (2) $4\sqrt{3} \text{ cm}$
(3) $2\sqrt{2} \text{ cm}$ (4) 8 cm
14. One chord of a circle is known to be 10.1 cm. The radius of this circle must be :
(1) 5 cm
(2) greater than 5 cm
(3) greater than or equal to 5 cm
(4) less than 5 cm
15. In $\triangle ABC$, $\angle BAC = 90^\circ$ and $AB = \frac{1}{2} BC$. Then the measure of $\angle ACB$ is :
(1) 60° (2) 30°
(3) 45° (4) 15°
16. ABCD is a cyclic parallelogram. The angle $\angle B$ is equal to:
(1) 30° (2) 60°
(3) 45° (4) 90°
17. Each interior angle of a regular polygon is three times its exterior angle, then the number of sides of the regular polygon is :
(1) 9 (2) 8
(3) 10 (4) 7
18. The side AB of a parallelogram ABCD is produced to E in such way that $BE = AB$. DE intersects BC at Q. The point Q divides BC in the ratio
(1) 1 : 2 (2) 1 : 1
(3) 2 : 3 (4) 2 : 1
19. If a chord of a circle of radius 5 cm is a tangent to a circle of radius 3 cm, both the circles being concentric, then the length of the chord is
(1) 10 cm (2) 12.5 cm
(3) 8 cm (4) 7 cm
20. O is the incentre of $\triangle ABC$ and $\angle A = 30^\circ$, then $\angle BOC$ is
(1) 100° (2) 105°
(3) 110° (4) 90°
21. The length of two chords AB and AC of a circle are 8 cm and 6 cm and $\angle BAC = 90^\circ$, then the radius of circle is
(1) 25 cm (2) 20 cm
(3) 4 cm (4) 5 cm

22. The points D and E are taken on the sides AB and AC of $\triangle ABC$ such that $AD = \frac{1}{3} AB$, $AE = \frac{1}{3} AC$. If the length of BC is 15 cm, then the length of DE is :
- (1) 10 cm (2) 8 cm
(3) 6 cm (4) 5 cm
23. Each interior angle of a regular polygon is 18° more than eight times an exterior angle. The number of sides of the polygon is
- (1) 10 (2) 15
(3) 20 (4) 25
24. If a chord of length 16 cm is at a distance of 15 cm from the centre of the circle, then the length of the chord of the same circle which is at a distance of 8 cm from the centre is equal to
- (1) 10 cm (2) 20 cm
(3) 30 cm (4) 40 cm
25. Two medians AD and BE of $\triangle ABC$ intersect at G at right angles. If $AD = 9$ cm and $BE = 6$ cm, then the length of BD, in cm, is
- (1) 10 (2) 6
(3) 5 (4) 3
26. The length of the diagonal BD of the parallelogram ABCD is 18 cm. If P and Q are the centroid of the $\triangle ABC$ and $\triangle ADC$ respectively then the length of the line segment PQ is
- (1) 4 cm (2) 6 cm
(3) 9 cm (4) 12 cm
27. Two circles touch each other externally at point A and PQ is a direct common tangent which touches the circles at P and Q respectively. Then $\angle PAQ =$
- (1) 45° (2) 90°
(3) 80° (4) 100°
28. The in-radius of an equilateral triangle is of length 3 cm. Then the length of each of its medians is
- (1) 12 cm (2) $\frac{9}{2}$ cm
(3) 4 cm (4) 9 cm
29. ABCD is a cyclic trapezium whose sides AD and BC are parallel to each other. If $\angle ABC = 72^\circ$, then the measure of the $\angle BCD$ is
- (1) 162° (2) 18°
(3) 108° (4) 72°
30. In $\triangle ABC$, PQ is parallel to BC. If $AP : PB = 1 : 2$ and $AQ = 3$ cm; AC is equal to
- (1) 6 cm (2) 9 cm
(3) 12 cm (4) 8 cm
31. In a quadrilateral ABCD, with unequal sides if the diagonals AC and BD intersect at right angles, then
- (1) $AB^2 + BC^2 = CD^2 + DA^2$
(2) $AB^2 + CD^2 = BC^2 + DA^2$
(3) $AB^2 + AD^2 = BC^2 + CD^2$
(4) $AB^2 + BC^2 = 2(CD^2 + DA^2)$
32. The tangents are drawn at the extremities of a diameter AB of a circle with centre P. If a tangent to the circle at the point C intersects the other two tangents at Q and R, then the measure of the $\angle QPR$ is
- (1) 45° (2) 60°
(3) 90° (4) 180°
33. Let O be the in-centre of a triangle ABC and D be a point on the side BC of $\triangle ABC$, such that $OD \perp BC$. If $\angle BOD = 15^\circ$, then $\angle ABC =$
- (1) 75° (2) 45°
(3) 150° (4) 90°
34. AB is a chord to a circle and PAT is the tangent to the circle at A. If $\angle BAT = 75^\circ$ and $\angle BAC = 45^\circ$, C being a point on the circle, then $\angle ABC$ is equal to
- (1) 40° (2) 45°
(3) 60° (4) 70°
35. D is any point on side AC of $\triangle ABC$. If P, Q, X, Y are the mid-points of AB, BC, AD and DC respectively, then the ratio of PX and QY is
- (1) 1 : 2 (2) 1 : 1
(3) 2 : 1 (4) 2 : 3
36. PR is tangent to a circle, with centre O and radius 4 cm, at point Q. If $\angle POR = 90^\circ$, $OR = 5$ cm and $OP = \frac{20}{3}$ cm, then, in cm, the length of PR is :
- (1) 3 (2) $\frac{16}{3}$
(3) $\frac{23}{3}$ (4) $\frac{25}{3}$
37. ABC is an equilateral triangle. P and Q are two points on \overline{AB} and \overline{AC} respectively such that $\overline{PQ} \parallel \overline{BC}$. If $\overline{PQ} = 5$ cm the area of $\triangle APQ$ is :
- (1) $\frac{25}{4}$ sq. cm
(2) $\frac{25}{\sqrt{3}}$ sq. cm
(3) $\frac{25\sqrt{3}}{4}$ sq. cm
(4) $25\sqrt{3}$ sq. cm
38. Measure of each interior angle of a regular polygon can never be :
- (1) 150° (2) 105°
(3) 108° (4) 144°
39. In a triangle ABC, incentre is O and $\angle BOC = 110^\circ$, then the measure of $\angle BAC$ is :
- (1) 20° (2) 40°
(3) 55° (4) 110°
40. If an exterior angle of a cyclic quadrilateral be 50° , then the interior opposite angle is :
- (1) 130° (2) 40°
(3) 50° (4) 90°
41. ABCD is a rhombus whose side $AB = 4$ cm and $\angle ABC = 120^\circ$, then the length of diagonal BD is equal to :
- (1) 1 cm (2) 2 cm
(3) 3 cm (4) 4 cm
42. The ortho centre of a right angled triangle lies
- (1) outside the triangle
(2) at the right angular vertex
(3) on its hypotenuse
(4) within the triangle

43. Two line segments PQ and RS intersect at X in such a way that $XP = XR$. If $\angle PSX = \angle RQX$, then one must have
 (1) $PR = QS$ (2) $PS = RQ$
 (3) $\angle XSQ = \angle XRP$
 (4) $\text{ar}(\triangle PXR) = \text{ar}(\triangle QXS)$
44. AD is the median of a triangle ABC and O is the centroid such that $AO = 10$ cm. The length of OD in cm is
 (1) 4 (2) 5
 (3) 6 (4) 8
45. The external bisector of $\angle B$ and $\angle C$ of $\triangle ABC$ (where AB and AC extended to E and F respectively) meet at point P. If $\angle BAC = 100^\circ$, then the measure of $\angle BPC$ is
 (1) 50° (2) 80°
 (3) 40° (4) 100°
46. If the sum of the interior angles of a regular polygon be 1080° , the number of sides of the polygon is
 (1) 6 (2) 8
 (3) 10 (4) 12
47. A parallelogram ABCD has sides $AB = 24$ cm and $AD = 16$ cm. The distance between the sides AB and DC is 10 cm. Find the distance between the sides AD and BC.
 (1) 16 cm. (2) 18 cm.
 (3) 15 cm. (4) 26 cm.
48. ABCD is a rhombus. A straight line through C cuts AD produced at P and AB produced at Q. If $DP = \frac{1}{2} AB$, then the ratio of the lengths of BQ and AB is
 (1) 2 : 1 (2) 1 : 2
 (3) 1 : 1 (4) 3 : 1
49. If the circumradius of an equilateral triangle be 10 cm, then the measure of its in-radius is
 (1) 5 cm. (2) 10 cm.
 (3) 20 cm. (4) 15 cm.
50. If in a $\triangle ABC$, the medians CD and BE intersect each other at O, then the ratio of the areas of $\triangle ODE$ and $\triangle ABC$ is
 (1) 1 : 6 (2) 6 : 1
 (3) 1 : 12 (4) 12 : 1

51. The ratio of the angles $\angle A$ and $\angle B$ of a non-square rhombus ABCD is 4 : 5, then the value of $\angle C$ is :
 (1) 50° (2) 45°
 (3) 80° (4) 95°
52. A straight line parallel to BC of $\triangle ABC$ intersects AB and AC at points P and Q respectively. $AP = QC$, $PB = 4$ units and $AQ = 9$ units, then the length of AP is :
 (1) 25 units (2) 3 units
 (3) 6 units (4) 6.5 units
53. I is the incentre of $\triangle ABC$, $\angle ABC = 60^\circ$ and $\angle ACB = 50^\circ$. Then $\angle BIC$ is :
 (1) 55° (2) 125°
 (3) 70° (4) 65°
54. ABCD is a cyclic trapezium such that $AD \parallel BC$, if $\angle ABC = 70^\circ$, then the value of $\angle BCD$ is :
 (1) 60° (2) 70°
 (3) 40° (4) 80°
55. The tangents at two points A and B on the circle with centre O intersect at P ; if in quadrilateral PAOB, $\angle AOB : \angle APB = 5 : 1$, then measure of $\angle APB$ is :
 (1) 30° (2) 60°
 (3) 45° (4) 15°
56. In the figure below, lines k and l are parallel. The value of $a^\circ + b^\circ$ is

 (1) 45° (2) 100°
 (3) 180° (4) 360°

57. In the figure below, if $AB \parallel CD$ and $CE \perp ED$, then the value of x is

 (1) 16 (2) 15
 (3) 12 (4) 14

- (1) 53 (2) 63
 (3) 37 (4) 45
58. $\triangle ABC$ and $\triangle DEF$ are similar and their areas be respectively 64 cm^2 and 121 cm^2 . If $EF = 15.4$ cm, BC is:
 (1) 12.3 cm (2) 11.2 cm
 (3) 12.1 cm (4) 11.0 cm
59. If G is the centroid of $\triangle ABC$ and $AG = BC$, then $\angle BGC$ is:
 (1) 75° (2) 45°
 (3) 90° (4) 60°
60. By decreasing 15° of each angle of a triangle, the ratios of their angles are 2:3 : 5, The radian measure of greatest angle is :
 (1) $\frac{11\pi}{24}$ (2) $\frac{\pi}{12}$
 (3) $\frac{\pi}{24}$ (4) $\frac{5\pi}{24}$
61. If G is the centroid and AD be a median with length 12 cm of $\triangle ABC$, then the value of AG is
 (1) 4 cm (2) 8 cm
 (3) 10 cm (4) 6 cm
62. ABC is a right-angled triangle. AD is perpendicular to the hypotenuse BC. If $AC = 2 AB$, then the value of BD is
 (1) $\frac{BC}{2}$ (2) $\frac{BC}{3}$
 (3) $\frac{BC}{4}$ (4) $\frac{BC}{5}$
63. Given that $\angle ABC = 90^\circ$, BC is parallel to DE. If $AB = 12$, $BD = 6$ and $BC = 10$, then the length of DE is

 (1) 16 (2) 15
 (3) 12 (4) 14
64. If G be the centroid of $\triangle ABC$ and the area of $\triangle GBD$ is 6 sq. cm, where D is the mid-point

of side BC, then the area of $\triangle ABC$ is

- (1) 18 sq. cm (2) 12 sq. cm
(3) 24 sq. cm (4) 36 sq. cm

65. In any triangle ABC, the base angles at B and C are bisected by BO and CO respectively. Then $\angle BOC$ is

(1) $\frac{\pi}{2} + \frac{A}{2}$ (2) $\pi - \frac{A}{2}$

(3) $\frac{(\pi - A)}{2}$ (4) $\frac{\pi}{2} + A$

66. Two sides of a triangle are of length 4 cm and 10 cm. If the length of the third side is 'a' cm, then

- (1) $a > 5$ (2) $6 \leq a \leq 12$
(3) $a < 6$ (4) $6 < a < 14$

67. In $\triangle ABC$, AD is the median and $AD = \frac{1}{2} BC$. If $\angle BAD = 30^\circ$,

then measure of $\angle ACB$ is

- (1) 90° (2) 45°
(3) 30° (4) 60°

68. The three medians AD, BE and CF of $\triangle ABC$ intersect at point G. If the area of $\triangle ABC$ is 60 sq.cm. then the area of the quadrilateral BDGF is :

- (1) 10 sq.cm (2) 15 sq.cm
(3) 20 sq.cm (4) 30 sq.cm

69. In $\triangle ABC$, $\angle B = 90^\circ$, $\angle C = 45^\circ$ and D is the midpoint of AC. If $AC = 4\sqrt{2}$ units, then BD is

- (1) $2\sqrt{2}$ units (2) $4\sqrt{2}$ units

- (3) $\frac{5}{2}$ units (4) 2 units

70. A straight line parallel to the base BC of the triangle ABC intersects AB and AC at the points D and E respectively. If the area of the $\triangle ABE$ be 36 sq.cm, then the area of the $\triangle ACD$ is

- (1) 18 sq.cm (2) 36 sq.cm
(3) 18 cm (4) 36 cm

71. In $\triangle ABC$, $\angle BAC = 90^\circ$ and $AB = \frac{1}{2} BC$. Then the measure of $\angle ACB$ is :

- (1) 60° (2) 30°
(3) 45° (4) 15°

72. O is the incentre of $\triangle ABC$ and $\angle A = 30^\circ$, then $\angle BOC$ is

- (1) 100° (2) 105°
(3) 110° (4) 90°

73. The points D and E are taken on the sides AB and AC of $\triangle ABC$ such that $AD = \frac{1}{3} AB$,

$AE = \frac{1}{3} AC$. If the length of BC is 15 cm, then the length of DE is :

- (1) 10 cm (2) 8 cm
(3) 6 cm (4) 5 cm

74. Two medians AD and BE of $\triangle ABC$ intersect at G at right angles. If $AD = 9$ cm and $BE = 6$ cm, then the length of BD, in cm, is

- (1) 10 (2) 6
(3) 5 (4) 3

75. The in-radius of an equilateral triangle is of length 3 cm. Then the length of each of its medians is

(1) 12 cm (2) $\frac{9}{2}$ cm

- (3) 4 cm (4) 9 cm

76. In $\triangle ABC$, PQ is parallel to BC. If $AP : PB = 1 : 2$ and $AQ = 3$ cm; AC is equal to

- (1) 6 cm (2) 9 cm
(3) 12 cm (4) 8 cm

77. Let O be the in-centre of a triangle ABC and D be a point on the side BC of $\triangle ABC$, such that $OD \perp BC$. If $\angle BOD = 15^\circ$, then $\angle ABC =$

- (1) 75° (2) 45°
(3) 150° (4) 90°

78. D is any point on side AC of $\triangle ABC$. If P, Q, X, Y are the mid-points of AB, BC, AD and DC respectively, then the ratio of PX and QY is

- (1) 1 : 2 (2) 1 : 1
(3) 2 : 1 (4) 2 : 3

79. ABC is an equilateral triangle.

P and Q are two points on \overline{AB} and \overline{AC} respectively such that $\overline{PQ} \parallel \overline{BC}$. If $\overline{PQ} = 5$ cm the area of $\triangle APQ$ is :

(1) $\frac{25}{4}$ sq. cm

(2) $\frac{25}{\sqrt{3}}$ sq. cm

(3) $\frac{25\sqrt{3}}{4}$ sq. cm

(4) $25\sqrt{3}$ sq. cm

80. The ortho centre of a right angled triangle lies

- (1) outside the triangle
(2) at the right angular vertex
(3) on its hypotenuse
(4) within the triangle

ANSWERS

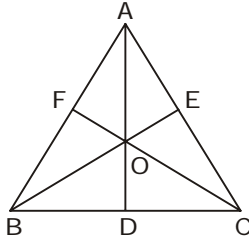
| | | | |
|---------|---------|---------|---------|
| 1. (2) | 2. (1) | 3. (2) | 4. (1) |
| 5. (1) | 6. (3) | 7. (2) | 8. (3) |
| 9. (1) | 10. (3) | 11. (3) | 12. (2) |
| 13. (2) | 14. (2) | 15. (1) | 16. (4) |
| 17. (2) | 18. (2) | 19. (3) | 20. (2) |
| 21. (4) | 22. (4) | 23. (3) | 24. (3) |
| 25. (3) | 26. (2) | 27. (2) | 28. (4) |
| 29. (4) | 30. (2) | 31. (2) | 32. (3) |
| 33. (3) | 34. (3) | 35. (2) | 36. (4) |
| 37. (3) | 38. (2) | 39. (2) | 40. (3) |
| 41. (4) | 42. (2) | 43. (2) | 44. (2) |
| 45. (3) | 46. (2) | 47. (3) | 48. (1) |
| 49. (1) | 50. (3) | 51. (2) | 52. (3) |
| 53. (2) | 54. (2) | 55. (1) | 56. (1) |
| 57. (1) | 58. (2) | 59. (3) | 60. (1) |
| 61. (2) | 62. (2) | 63. (2) | 64. (4) |
| 65. (1) | 66. (4) | 67. (4) | 68. (3) |
| 69. (1) | 70. (2) | 71. (2) | 72. (2) |
| 73. (4) | 74. (3) | 75. (4) | 76. (2) |
| 77. (3) | 78. (2) | 79. (3) | 80. (2) |

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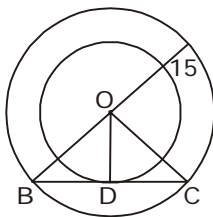
EXPLANATIONS

1. (2)



Area of quadrilateral BDOF
 = $2 \times 15 = 30$ sq.cm.

2. (1)



$BO = OC = 15$ cm.

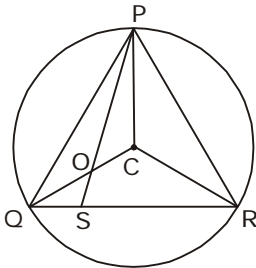
$OD = 9$ cm.

$\therefore BD = \sqrt{15^2 - 9^2}$

$= \sqrt{24 \times 6} = 12$ cm

$\therefore BC = 2 \times 12 = 24$ cm.

3. (2)



$\angle PQS = 60^\circ$

$\angle QCR = 130^\circ$

$\therefore \angle QPR = \frac{1}{2} \times 130^\circ = 65^\circ$

$\Rightarrow \angle QPR = 180^\circ - 60^\circ - 65^\circ = 55^\circ$

\therefore In $\triangle OQR$

$OQ = OR$

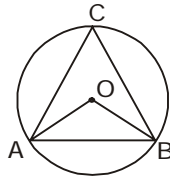
$\therefore \angle OQR = \angle ORQ = 25^\circ$

$\therefore \angle PQC = \angle QPC = 35^\circ$

$\angle CPR = 30^\circ$

$\therefore \angle RPS = 35^\circ$

4. (1)

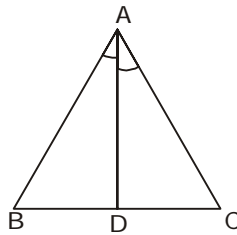


$AO = OB = AB$

$\therefore \angle AOB = 60^\circ$

$\therefore \angle ACB = 30^\circ$

5. (1)



AD is the internal bisector of $\angle A$.

$\therefore \frac{AB}{AC} = \frac{BD}{DC}$

$= \frac{5}{7.5 - 2}$

$= \frac{5}{2.5} = 2 : 1$

6. (3) If the number of sides of the polygon be n , then

$\left(\frac{2n - 4}{n}\right) \times 90^\circ = 144^\circ$

$\Rightarrow \frac{(2n - 4)5}{n} = 8$

$\Rightarrow 10n - 20 = 8n$

$\Rightarrow 2n = 20 \Rightarrow n = 10$

7. (2) For the equilateral triangle of side a ,

In radius = $\frac{a}{2\sqrt{3}}$

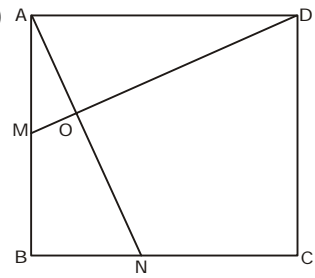
Circum-radius = $\frac{a}{\sqrt{3}}$

\therefore Required ratio

$= \pi \left(\frac{a}{\sqrt{3}}\right)^2 : \pi \left(\frac{a}{2\sqrt{3}}\right)^2$

$= \frac{1}{3} : \frac{1}{12} = 4 : 1$

8. (3)



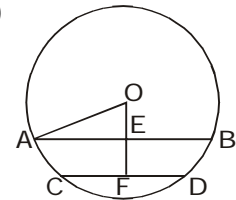
If $AB = 2x$, then $BN = x$

$\therefore AN = \sqrt{4x^2 + x^2} = \sqrt{5}x$

Similarly,

$MD = \sqrt{4x^2 + x^2} = \sqrt{5}x$

9. (1)



Let $OE = x$ cm

$\therefore OF = (x + 1)$ cm

$OA = OC = r$ cm

$AE = 4$ cm; $CF = 3$ cm

From $\triangle OAE$,

$OA^2 = AE^2 + OE^2$

$\Rightarrow r^2 = 16 + x^2$

$\Rightarrow x^2 = r^2 - 16$ (i)

From $\triangle OCF$,

$(x + 1)^2 = r^2 - 9$ (ii)

By equation (ii) - (i),

$(x + 1)^2 - x^2 = r^2 - 9 - r^2 + 16$

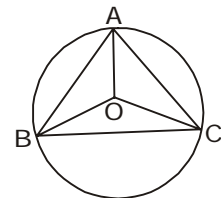
$\Rightarrow 2x + 1 = 7 \Rightarrow x = 3$ cm

\therefore From equation (i),

$9 = r^2 - 16 \Rightarrow r^2 = 25 \Rightarrow r = 5$

10. (3) $\therefore \angle BAC = 85^\circ$

$\therefore \angle BOC = 2 \times 85^\circ = 170^\circ$

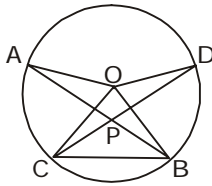


$\therefore \angle OBC = \angle OCB = 5^\circ$

$\therefore \angle OCA = \angle OAC$

$= 75^\circ - 5^\circ = 70^\circ$

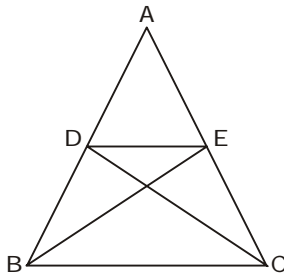
11. (3)



Join CB.
 $\angle AOC + \angle BOD$
 $= 2\angle ABC + 2\angle BCD$
 (Exterior angles of triangle)
 $= 2(\angle ABC + \angle BCD)$
 $= 2\angle BPD$

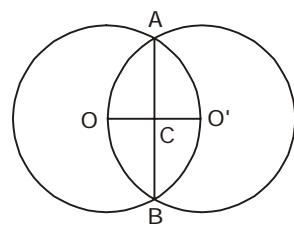
$$\therefore \angle BPD = \frac{1}{2}(50^\circ + 40^\circ) = 45^\circ$$

12. (2)



$\triangle DBC$ AND $\triangle ECB$ lie on the same base and between same parallel lines.

$$\begin{aligned} \therefore \triangle DBC &= \triangle ECB \\ \Rightarrow \triangle ABC - \triangle DBC &= \triangle ABC - \triangle ECB \\ \Rightarrow \triangle ADE &= \triangle ABE = 36 \text{ sq.cm} \end{aligned}$$

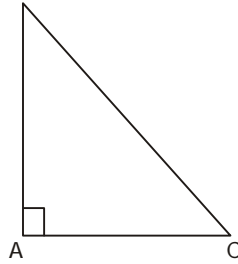


13. (2)

$$\begin{aligned} OC &= 2\text{cm} \\ OA &= 4\text{cm} \\ \therefore AC &= \sqrt{4^2 - 2^2} \\ &= \sqrt{16 - 4} \\ &= \sqrt{12} = 2\sqrt{3} \\ \therefore AB &= 4\sqrt{3} \text{ cm} \end{aligned}$$

14. (2) The largest chord of a circle is its diameter.

15. (1) B



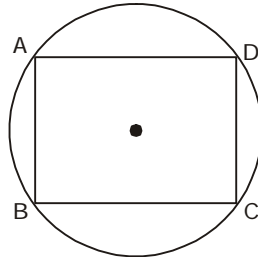
If $AB = x$; $BC = 2x$ units

$$\therefore AC = \sqrt{4x^2 - x^2} = \sqrt{3}x$$

$$\therefore \sin ACB = \frac{AB}{BC} = \frac{1}{2} = \sin 30^\circ$$

$$\therefore \angle ACB = 30^\circ$$

16. (4) A



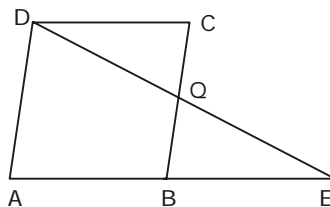
ABCD is a cyclic parallelogram.

$$\begin{aligned} \therefore \angle B + \angle D &= 180^\circ \\ \Rightarrow 2\angle B &= 180^\circ \\ \Rightarrow \angle B &= 90^\circ \end{aligned}$$

17. (2) If the number of sides of regular polygon be n , then

$$\begin{aligned} \frac{(2n - 4)90^\circ}{n} &= \frac{360}{n} \times 3 \\ \Rightarrow 2n - 4 &= 4 \times 3 \\ \Rightarrow 2n &= 12 + 4 = 16 \\ \therefore n &= 8 \end{aligned}$$

18. (2) $AD \parallel BC \Rightarrow AD \parallel BQ$



Point B is the mid-point of AE.

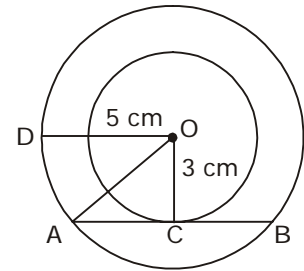
$\therefore Q$ is the mid-point of DE.

In \triangle s DQC and BQE,

$\angle DQC = \angle BQE$
 $\angle DCQ = \angle QBE$
 $\angle CDQ = \angle QEB$
 \therefore Both triangles $\triangle DQC$ and $\triangle BQE$ are similar.

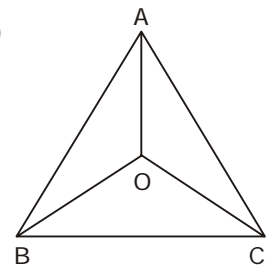
$$\therefore \frac{DQ}{QE} = \frac{CQ}{BQ} = 1 : 1$$

19. (3)



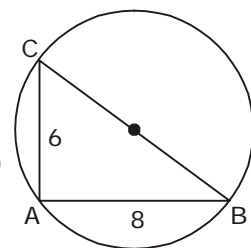
$$\begin{aligned} AC &= \sqrt{AO^2 - OC^2} \\ &= \sqrt{5^2 - 3^2} \\ &= \sqrt{25 - 9} = \sqrt{16} = 4 \text{ cm} \\ \therefore AB &= 2 \times 4 = 8 \text{ cm} \end{aligned}$$

20. (2)



$$\begin{aligned} \angle BOC &= 90^\circ + \frac{1}{2} \angle BAC \\ &= 90^\circ + 15^\circ = 105^\circ \end{aligned}$$

21. (4)



$\angle BAC = 90^\circ$
 $\therefore BC$ is the diameter of the circle.

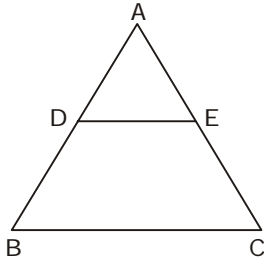
$$\therefore BC = \sqrt{AB^2 + AC^2}$$

$$= \sqrt{8^2 + 6^2} = \sqrt{64 + 36}$$

$$= \sqrt{100} = 10 \text{ cm}$$

∴ Radius of the circle = 5 cm

22. (4)



$$\frac{AD}{AB} = \frac{AE}{AC} = \frac{1}{3}$$

$$\therefore \frac{DE}{BC} = \frac{1}{3}$$

$$\Rightarrow DE = \frac{15}{3} = 5 \text{ cm}$$

23. (3) If the number of sides of the regular polygon be n , then

$$\therefore \left(\frac{2n-4}{n}\right) \times 90$$

$$= 8 \times \frac{4 \times 90^\circ}{n} + 18$$

$$\Rightarrow \left(\frac{2n-4}{n}\right) \times 5 = \frac{160}{n} + 1$$

$$\Rightarrow 10 = n - 20 = 160 + n$$

$$\Rightarrow 10n - n = 180$$

$$\Rightarrow 9n = 180$$

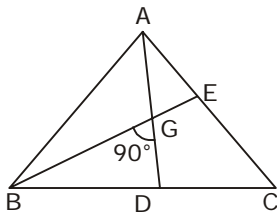
$$\Rightarrow n = 20$$

24. (3) The chord nearer to the centre is larger.

$$\therefore \frac{15}{8} = \frac{x}{16}$$

$$\Rightarrow x = \frac{15 \times 16}{8} = 30 \text{ cm}$$

25. (3)



$$AD = 9 \text{ cm.}$$

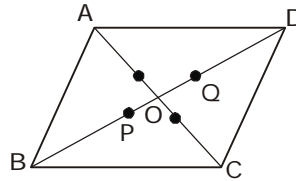
$$\Rightarrow GD = \frac{1}{3} \times 9 = 3 \text{ cm}$$

$$BE = 6 \text{ cm}$$

$$\Rightarrow BG = \frac{2}{3} \times 6 = 4 \text{ cm}$$

$$\therefore BD = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = 5 \text{ cm.}$$

26. (2)



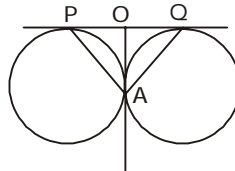
Centroid is the point where medians intersect. Diagonals of parallelogram bisect each other.

$$OP = \frac{1}{3} \times 9 = 3 \text{ cm}$$

$$OQ = \frac{1}{3} \times 9 = 3 \text{ cm}$$

$$\therefore PQ = 6 \text{ cm}$$

27. (2)

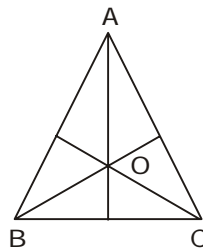


AO is perpendicular to PQ.

$$OA = OP = OQ.$$

$$\angle OPA = \angle OAP = \angle OQA = 45^\circ$$

28. (4)

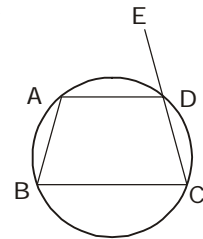


In equilateral triangle centroid, incentre, orthocentre coincide at the same point.

$$\therefore \frac{\text{Height}}{3} = \text{inradius}$$

$$\therefore \text{Height} = \text{Median} = 3 \times 3 = 9 \text{ cm}$$

29. (4)



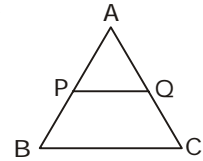
$$\angle ABC + \angle CDA = 180^\circ$$

$$\Rightarrow \angle CDA = 180^\circ - 72^\circ = 108^\circ$$

$$AD \parallel BC$$

$$\angle BCD = \angle ADE = \angle ABC = 72^\circ$$

30. (2)

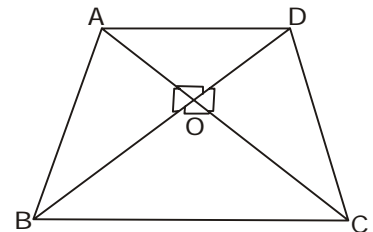


$$\frac{AP}{PB} = \frac{AQ}{QC} = \frac{1}{2}$$

$$\Rightarrow \frac{QC}{AQ} = \frac{2}{1} \Rightarrow \frac{QC + AQ}{AQ} = \frac{3}{1}$$

$$\Rightarrow AC = 3AQ = 9 \text{ cm}$$

31. (2)



$$OB^2 + OC^2 = BC^2$$

$$OC^2 + OD^2 = CD^2$$

$$OD^2 + OA^2 = AD^2$$

$$OA^2 + OB^2 = AB^2$$

$$\therefore 2(OB^2 + OA^2 + OD^2 + OC^2)$$

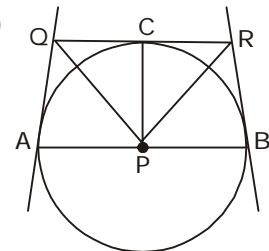
$$= AB^2 + BC^2 + CD^2 + DA^2$$

$$\Rightarrow 2(AB^2 + CD^2)$$

$$= AB^2 + BC^2 + CD^2 + DA^2$$

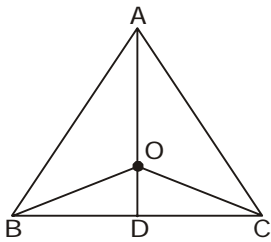
$$\Rightarrow AB^2 + CD^2 = BC^2 + DA^2$$

32. (3)



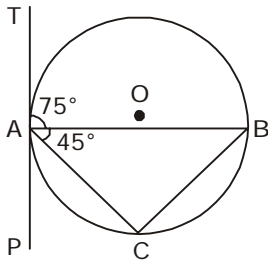
In $\triangle PCR$ and $\triangle RBP$,
 $PC = PB$ (radii)
 $RC = RB$
 PR is common.
 $\therefore \triangle PCR \cong \triangle RBP$
 $\therefore \angle CPR = \angle RPB$
 Similarly, $\angle CPQ = \angle QPA$
 $\therefore \angle QPR = 90^\circ$
 because $\angle APB = 180^\circ$

33. (3)



BO is the internal bisector of $\angle B$
 $\angle ODB = 90^\circ$; $\angle BOD = 15^\circ$
 $\angle OBD = 180^\circ - 90^\circ - 15^\circ = 75^\circ$
 $\angle ABC = 2 \times 75^\circ = 150^\circ$

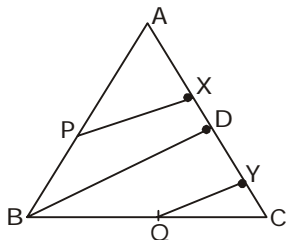
34. (3)



If a line touches a circle and from the point of contact a chord is drawn, the angles which this chord makes with the given line are equal respectively to the angles formed in the corresponding alternate segments.

$\therefore \angle ACB = \angle BAT = 75^\circ$
 $\angle ABC = 180^\circ - 45^\circ - 75^\circ = 60^\circ$

35. (2)

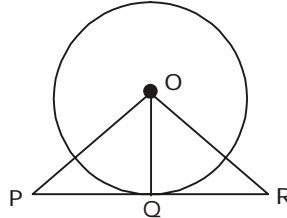


$PX \parallel BD$ and $PX = \frac{1}{2} BD$

$QY \parallel BD$ and $QY = \frac{1}{2} BD$

$\therefore PX : QY = 1 : 1$

36. (4)



$OQ \perp PR$

\therefore From $\triangle OPQ$,

$$PQ = \sqrt{OP^2 - OQ^2}$$

$$= \sqrt{\left(\frac{20}{3}\right)^2 - 4^2}$$

$$= \sqrt{\frac{400}{9} - 16}$$

$$= \sqrt{\frac{400 - 144}{9}}$$

$$= \sqrt{\frac{256}{9}} = \frac{16}{3} \text{ cm}$$

From $\triangle OQR$,

$$QR = \sqrt{OR^2 - OQ^2}$$

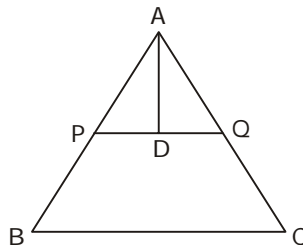
$$= \sqrt{5^2 - 4^2} = \sqrt{25 - 16}$$

$$= \sqrt{9} = 3 \text{ cm}$$

$\therefore PR = PQ + QR$

$$= \frac{16}{3} + 3 = \frac{25}{3} \text{ cm}$$

37. (3)



$PQ \parallel BC$

$\angle APQ = \angle ABC = 60^\circ$

$\angle AQP = \angle ACB = 60^\circ$

$$\therefore \text{Area of } \triangle APQ = \frac{\sqrt{3}}{4} \times (PQ)^2$$

$$= \frac{\sqrt{3}}{4} \times (5)^2 = \frac{25\sqrt{3}}{4} \text{ sq.cm.}$$

38. (2) Each interior angle

$$= \left(\frac{2n - 4}{n}\right) \times 90^\circ$$

$$\therefore \frac{(2n - 4) \times 90^\circ}{n} = 105^\circ$$

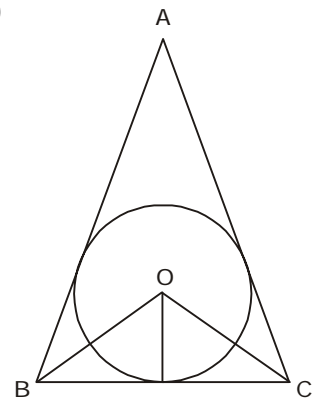
$$\Rightarrow (12n - 4) \times 6 = 7n$$

$$\Rightarrow 12n - 24 = 7n$$

$$\Rightarrow 5n = 24$$

$$\Rightarrow n = \frac{24}{5} \text{ which is impossible.}$$

39. (2)

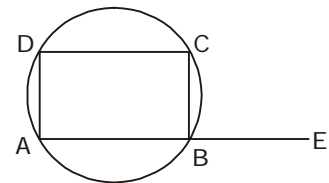


$$\angle BOC = 90^\circ + \frac{A}{2}$$

$$\Rightarrow 110 = 90^\circ + \frac{A}{2}$$

$$\Rightarrow A = 2 \times 20 = 40^\circ$$

40. (3)



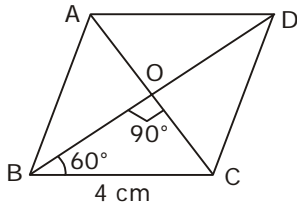
$$\angle ABC + \angle ADC = 180^\circ$$

$$\angle CBE = 50^\circ$$

$$\therefore \angle ABC = 180^\circ - 50^\circ = 130^\circ$$

$$\therefore \angle ADC = 180^\circ - 130^\circ = 50^\circ$$

41. (4)



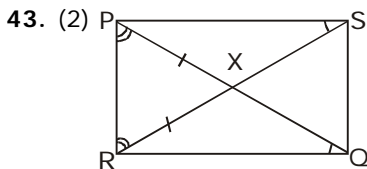
From $\triangle BOC$,
 $\cos 60^\circ = \frac{BO}{4}$

$$\Rightarrow BO = \frac{1}{2} \times 4$$

$$= 2 \text{ cm}$$

$$\therefore BD = 2 \times 2 = 4 \text{ cm}$$

42. (2) at the right angular vertex



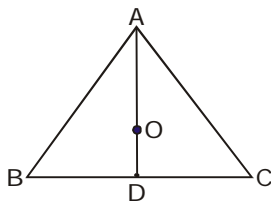
$$XP = XR$$

$$\therefore \angle XPR = \angle XRP$$

If $\angle PSX = \angle RQX$,
 then, $PS = RQ$

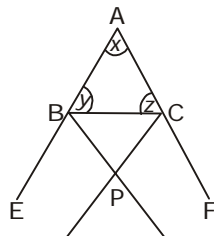
44. (2) D, is the mid-point of side BC.

Point O is the centroid that divides AD in the ratio 2 : 1.



$$\therefore OD = 5 \text{ cm.}$$

45. (3)



In $\triangle ABC$,
 $\angle A = x, \angle B = y, \angle C = z$
 In $\triangle PBC$,

$$\angle PBC + \angle PCB + \angle BPC = 180^\circ$$

$$\Rightarrow \frac{1}{2} \angle EBC + \frac{1}{2} \angle FCB + \angle BPC$$

$$= 180^\circ$$

$$\Rightarrow \angle EBC + \angle FCB + 2\angle BPC$$

$$= 360^\circ$$

$$\Rightarrow (180^\circ - y) + (180^\circ - z) + 2\angle BPC = 360^\circ$$

$$\Rightarrow 360^\circ - (y + z) + 2\angle BPC = 360^\circ$$

$$\Rightarrow 2\angle BPC = y + z$$

$$\Rightarrow 2\angle BPC = 180^\circ - x$$

$$= 180^\circ - \angle BAC$$

$$\therefore \angle BPC = 90^\circ - \frac{1}{2} \angle BAC$$

$$= 90^\circ - 50^\circ = 40^\circ$$

46. (2) Sum of the interior angles of a regular polygon of n sides

$$= (2n - 4) \times 90^\circ$$

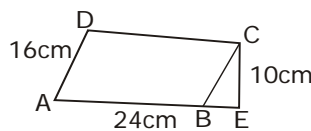
$$\therefore (2n - 4) \times 90^\circ = 1080^\circ$$

$$\Rightarrow 2n - 4 = 1080 \div 90 = 12$$

$$\therefore 2n = 12 + 4 = 16$$

$$\Rightarrow n = 8$$

47. (3)



Area of the parallelogram

$$= \text{Base} \times \text{Height}$$

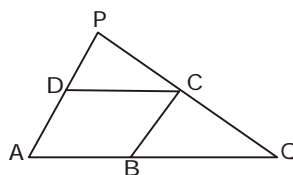
$$= 24 \times 10 = 240 \text{ sq.cm.}$$

If the required distance be x cm, then

$$240 = 16 \times x$$

$$\Rightarrow x = \frac{240}{16} = 15 \text{ cm.}$$

48. (1)



$$AB = BC = CD = DA$$

$$DP = \frac{1}{2} AB = \frac{1}{2} BC = \frac{1}{2} CD$$

$$= \frac{1}{2} DA$$

In $\triangle APQ$ and $\triangle BCQ$,

$$\angle P = \angle QCB; \angle A = \angle QBC; \angle Q = \angle Q$$

$\therefore \triangle APQ$ and $\triangle BCQ$ are similar.

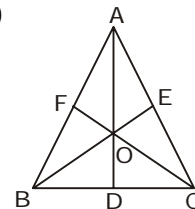
$$\therefore \frac{AB + BQ}{BQ} = \frac{AD + DP}{BC}$$

$$\Rightarrow \frac{AB}{BQ} + 1 = \frac{\frac{3}{2} BC}{BC} = \frac{3}{2}$$

$$\Rightarrow \frac{AB}{BQ} = \frac{3}{2} - 1 = \frac{1}{2}$$

$$\Rightarrow \frac{BQ}{AB} = \frac{2}{1}$$

49. (1)



Let $AB = x$ cm.

$$\therefore BD = \frac{x}{2}$$

$$AD = \sqrt{x^2 - \frac{x^2}{4}} = \frac{\sqrt{3}}{2} x \text{ cm.}$$

$$\therefore OD = \frac{1}{3} \times \frac{\sqrt{3}}{2} x = \frac{x}{2\sqrt{3}} \text{ cm.}$$

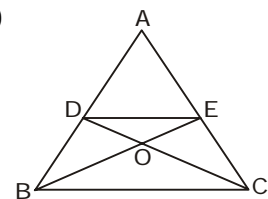
$$OB = \sqrt{BD^2 + OD^2}$$

$$= \sqrt{\frac{x^2}{4} + \frac{x^2}{12}} = \sqrt{\frac{4x^2}{12}} = \frac{x}{\sqrt{3}} \text{ cm.}$$

$$\therefore \frac{x}{\sqrt{3}} = 10 \Rightarrow x = 10\sqrt{3} \text{ cm.}$$

$$\therefore OD = \frac{x}{2\sqrt{3}} = \frac{10\sqrt{3}}{2\sqrt{3}} = 5 \text{ cm.}$$

50. (3)



In Δ s ODE and BOC,

$$\angle BOC = \angle DOE$$

$$\angle DEO = \angle OBC ; \angle ODE = \angle OCB$$

\therefore Both triangles are similar,

$$\therefore \frac{\Delta ODE}{\Delta BOC} = \frac{DE^2}{BC^2}$$

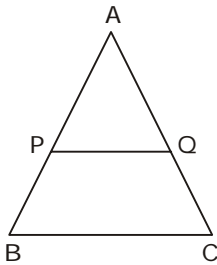
$$DE \parallel BC \text{ and } DE = \frac{1}{2}BC$$

and area of ΔABC
 $= 3 \times \text{Area of } \Delta OBC$

$$\therefore \frac{\Delta ODE}{\Delta ABC} = \frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$$

51. (2) $4x + 5x = 180^\circ$
 $\Rightarrow 9x = 180^\circ \Rightarrow x = 20^\circ$
 $\therefore \angle C = 4x = 80^\circ$

52. (3)



$PQ \parallel BC$

$$\therefore \frac{AP}{AB} = \frac{AQ}{AC}$$

$$\Rightarrow \frac{AB}{AP} = \frac{AC}{AQ}$$

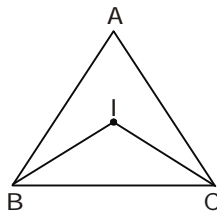
$$\Rightarrow \frac{AP + PB}{AP} = \frac{AQ + QC}{AQ}$$

$$\Rightarrow \frac{PB}{AP} = \frac{QC}{AQ} = \frac{AP}{AQ}$$

$$\Rightarrow AP^2 = PB \cdot AQ = 4 \times 9 = 36$$

$$\therefore AP = 6 \text{ units}$$

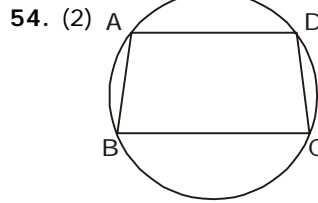
53. (2)



$$\angle IBC = \frac{1}{2} \angle ABC = 30^\circ$$

$$\angle ICB = \frac{1}{2} \angle ACB = 25^\circ$$

$$\therefore \angle BIC = 180^\circ - 30^\circ - 25^\circ = 125^\circ$$

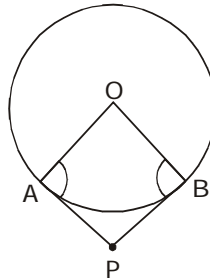


$$\angle ABC + \angle CDA = 180^\circ$$

$$\therefore \angle CDA = 180^\circ - 70^\circ = 110^\circ$$

$$\therefore \angle BCD = 180^\circ - 110^\circ = 70^\circ$$

55. (1)



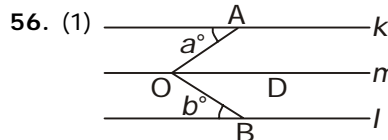
$$\angle OAP = \angle OBP = 90^\circ$$

$$\angle AOB + \angle APB = 180^\circ$$

$$\Rightarrow 5\angle APB + \angle APB = 180^\circ$$

$$\Rightarrow 6\angle APB = 180^\circ$$

$$\Rightarrow \angle APB = 30^\circ$$

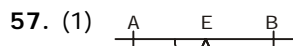


$$k \parallel l \parallel m$$

$$\angle BOA = 45^\circ$$

$$\Rightarrow \angle AOD = a^\circ \text{ and } \angle DOB = b^\circ$$

$$\therefore a^\circ + b^\circ = \angle AOB = 45^\circ$$



$$\angle AEC + \angle CAD + \angle DEB = 180^\circ$$

$$\Rightarrow 37^\circ + 90^\circ + \angle DEB = 180^\circ$$

$$\Rightarrow \angle DEB = 180^\circ - 127^\circ = 53^\circ$$

$EB \parallel CD$

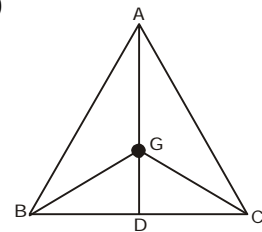
$$\therefore \angle BED = \angle EDC = 53^\circ$$

58. (2) $\frac{\Delta ABC}{\Delta DEF} = \frac{64}{121} = \frac{BC^2}{EF^2}$

$$\Rightarrow \frac{8}{11} = \frac{BC}{EF} \Rightarrow \frac{8}{11} = \frac{BC}{15.4}$$

$$\Rightarrow BC = \frac{8 \times 15.4}{11} = 11.2 \text{ cm}$$

59. (3)



$$AG = BC$$

$$\angle BGC = 90^\circ$$

60. (1) $2x + 3x + 5x = 180^\circ - 45^\circ$
 $= 135^\circ$

$$\Rightarrow 10x = 135^\circ$$

$$\Rightarrow x = \frac{135}{10} = \frac{27}{2}$$

\therefore Largest angle

$$= 5x + 15^\circ = \left(5 \times \frac{27}{2}\right)^\circ + 15^\circ$$

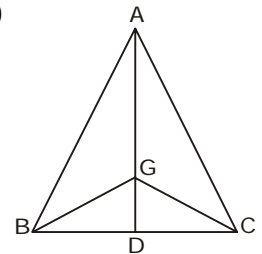
$$= \frac{135 + 30}{2} = \frac{165^\circ}{2}$$

$$\therefore 180^\circ = \pi \text{ radian}$$

$$\therefore \frac{165^\circ}{2} = \frac{\pi}{180} \times \frac{165}{2} = \frac{11\pi}{24}$$

radian

61. (2)



$$AG = \frac{2}{3}AD = \frac{2}{3} \times 12 = 8 \text{ cm}$$