SUPER 10

CBSE Class 10

MATHEMATICS (STANDARD)

2021-22 Term I Sample Papers

with **OMR Sheets**

disha
Publication Inc

Highlights

- 10 Fully Solved Sample Papers with Marking Scheme
- CBSE Sample [illegible] 2021-22 with Solutions
- Objective Qns. & Solns. CBS[illegible] 202[illegible]21
- Objective Qns. & [illegible] 202[illegible]
- Objective Qns. & [illegible] CBS[illegible]
- Latest Revised CB[illegible] 2021-22 (issued on 28-07-2021)
- Covers all new variety [illegible] Case base & MCQs etc.
- Separate OMR Answer Sheet for each Sample Paper

Based [illegible] the Patt[illegible] of [illegible] issued by CBSE on 2nd Sep. 2021

Corporate Office

DISHA PUBLICATION
45, 2nd Floor, Maharishi Dayanand Marg,
Corner Market, Malviya Nagar, New Delhi - 110017
Tel : 49842349 / 49842350

By

Raghvendra Kumar Sinha

Brajendra Kumar Dubey

Typeset by Disha DTP Team

CONTENTS OF FREE SAMPLE BOOK

This sample book is prepared from the book **"Super 10 CBSE Class 10 Mathematics (Standard) 2021-22 Term I Sample Papers with OMR Sheets".**

ISBN - 9789390711987

MRP- 170/-

In case you like this content, you can buy the **Physical Book** or **E-book** using the ISBN provided above.

The book & e-book are available on all leading online stores.

CONTENTS OF COMPLETE BOOK

Sample Paper 1

Time : 90 Minutes **Max Marks : 40**

General Instructions

1. *The question paper contains three parts A, B and C.*
2. *Section A consists of 20 quesions of 1 mark each. Any 16 quesitons are to be attempted.*
3. *Section B consists of 20 quersions of 1 mark each. Any 16 quesions are to be attempted.*
4. *Section C consists of 10 quesions based two Case Studies. Attempt any 8 questions.*
5. *There is no negative marking.*

SECTION-A

Section A consists of 20 questions of 1 mark each. Any 16 quesions are to be attempted.

1. Two isosceles triangles have their corresponding angles equal and their areas are in the ratio 25 : 36. The ratio of their corresponding height is

(a) 25 : 35 (b) 36 : 25 (c) 5 : 6 (d) 6 : 5

2. Two dice are thrown at a time, then find the probability that the difference of the numbers shown on the dice is 1.

(a) $\frac{3}{16}$ (b) $\frac{5}{18}$ (c) $\frac{7}{36}$ (d) $\frac{7}{18}$

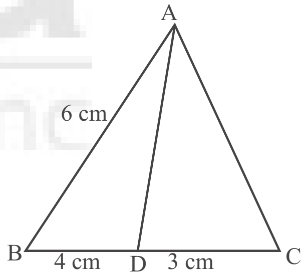
3. $(\cos^4 A - \sin^4 A)$ is equal to

(a) $1 - 2\cos^2 A$ (b) $2\sin^2 A - 1$ (c) $\sin^2 A - \cos^2 A$ (d) $2\cos^2 A - 1$

4. The coordinates of the point which is reflection of point (–3, 5) in x-axis are

(a) (3, 5) (b) (3, –5) (c) (–3, –5) (d) (–3, 5)

5. In the given figure, AD is the bisector of ∠A. If BD = 4 cm, DC = 3 cm and AB = 6 cm, determine AC



(a) 4.5 cm

(b) 3.5 cm

(c) 4.8 cm

(d) 3.2 cm

6. If $b \tan\theta = a$, the value of $\frac{a\sin\theta - b\cos\theta}{a\sin\theta + b\cos\theta}$ is

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

7. If the sum of the ages (in years) of a father and his son is 65 and twice the difference of their ages (in years) is 50, what is the age of the father?

(a) 45 years (b) 40 years (c) 50 years (d) 55 years

8. If the point P(6, 2) divides the line segment joining A(6, 5) and B(4, y) in the ratio 3 : 1, then the value of y is

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

9. ΔABC is an isosceles triangle right angled at B. Similar triangles ACD and ABE are constructed on sides AC and AB. Ratio between the areas of ΔABE and ΔACD is

(a) 1 : 4 (b) 2 : 1 (c) 1 : 2 (d) 4 : 3

10. If $x = p \sec\theta$ and $y = q \tan\theta$, then

(a) $x^2 - y^2 = p^2q^{2z}$ (b) $x^2q^2 - y^2p^2 = pq$ (c) $x^2q^2 - y^2p^2 = \frac{1}{p^2q^2}$ (d) $x^2q^2 - y^2p^2 = p^2q^2$

11. If $f(x) = 2x^3 - 6x + 4x - 5$ and $g(x) = 3x^2 - 9$, then the value of $f(1) + g(-2)$ is

(a) –3 (b) –2 (c) 3 (d) 2

12. A book containing 100 pages is opened at random. Find the probability that a doublet page is found.

(a) $\frac{8}{25}$ (b) $\frac{9}{100}$ (c) $\frac{7}{100}$ (d) $\frac{11}{100}$

13. $\sin^2\theta + \text{cosec}^2\theta$ is always

(a) greater than 1 (b) less than 1 (c) greater than or equal to 2(d) equal to 2

14. Find area of minor segment made by a chord which subtends right-angle at the centre of a circle of radius 10 cm.

(a) 24.5 cm^2 (b) 25.5 cm^2 (c) 24.5 cm^2 (d) 28.5 cm^2

15. Points *A* and *B* are 90 km. apart from each other on a highway. A car starts from *A* and another from *B* at the same time. If they go in the same direction, they meet in 9 hrs and if they go in opposite directions, they meet in 9/7 hrs. Find their speeds.

(a) 40 km/hr, 30 km/hr (b) 10 km/hr, 20 km/hr
(c) 20 km/hr, 30km/hr (d) 50 km/hr, 40km/hr

16. Identify polynomials from the following:

(a) $\frac{2}{x^2} - 3x + 2$ (b) $2x^2 + 3 - 4x$ (c) $\frac{1}{3}x^{-2} - 3$ (d) $\sqrt{x} - 6$

17. The two consecutive odd positive integers, the sum of whose squares is 290 are

(a) 9, 11 (b) 11, 13 (c) 13, 15 (d) 15, 17

18. If the sum of first n even natural numbers is equal to k times the sum of first n odd natural numbers, then k =

(a) $\frac{1}{n}$ (b) $\frac{n-1}{n}$ (c) $\frac{n+1}{2n}$ (d) $\frac{n+1}{n}$

19. Determine the value of k for which the following system of equations becomes consistent :
$7x - y = 5,\ 21x - 3y = k$.

(a) k = 15 (b) k = 11 (c) k = 4 (d) $k = \frac{11}{2}$

20. The product of two numbers is 4107. If the H.C.F. of these numbers is 37, then find the greater number.

(a) 111 (b) 137 (c) 37 (d) 311

SECTION-B

Section B consists of 20 questions of 1 mark each. Any 16 quesions are to be attempted.

21. Which among the following is correct?

(a) The ratios of the areas of two similar triangles is equal to the ratio of their corresponding sides.
(b) The areas of two similar triangles are in the ratio of the corresponding altitudes.
(c) The ratio of area of two similar triangles are in the ratio of the corresponding medians.
(d) If the areas of two similar triangles are equal, then the triangles are congruent.

22. If the system of equations 2x + 3y = 7 and 2ax + (a + b)y = 28 represents coincident lines, which of the conditions holds true?

(a) b = 2a (b) a = 2b (c) 2a + b = 0 (d) a + 2b = 0

23. Solve the following system of linear equations :
$2(ax - by) + (a + 4b) = 0$
$2(bx + ay) + (b - 4a) = 0$

(a) x = 0, y = 1 (b) x = –1/2, y = 2 (c) x = 1, y = 2 (d) x = 1/2, y = –1/2

24. Find α and β if $x + 1$ and $x + 2$ are factors of $p(x) = x^3 + 3x^2 - 2\alpha x + \beta$

(a) 3, –1 (b) –1, 0 (c) 0, –3 (d) 5, 6

25. If one zero of the quadratic polynomial $2x^2 - 8x - m$ is $\frac{5}{2}$, then the other zero is

(a) $\frac{2}{3}$ (b) $-\frac{2}{3}$ (c) $\frac{3}{2}$ (d) $\frac{-15}{2}$

26. If $x = 2$ and $x = 0$ are roots of the polynomials $f(x) = 2x^3 - 5x^2 + ax + b$. Then values of a and b respectively are

(a) 2, 0 (b) 1, 2 (c) – 1, 1 (d) 0, 3

27. If $\cos A = \frac{3}{5}$, find the value of $9\cot^2 A - 1$.

(a) 1 (b) $\frac{16}{65}$ (c) $\frac{65}{16}$ (d) 0

28. Which of the following statement is false?

(a) All isosceles triangles are similar. (b) All equilateral triangles are similar.
(c) All circles are similar. (d) None of the above

29. If one root of the equation $px^2 - 14x + 8 = 0$ is six times the other, then p is equal to

(a) 2 (b) 3 (c) 1 (d) none of these

30. Determine the values of a and b for which the following system of linear equations has infinitely many solutions:
$3x - (a + 1)y = 2b - 1$, $5x + (1 - 2a)y = 3b$

(a) a = 8, b = 5 (b) a = 4, b = 6 (c) a = 7, b = 1 (d) a = 5, b = 3

31. If $\sin\theta = \frac{a^2 - b^2}{a^2 + b^2}$, then find cosec θ + cot θ.

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

32. Degree of polynomial $y^3 - 2y^2 - \sqrt{3}y + \frac{1}{2}$ is

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

33. If α, β are the roots of the equation $x^2 + x\sqrt{\alpha} + \beta = 0$, then value of α and β are

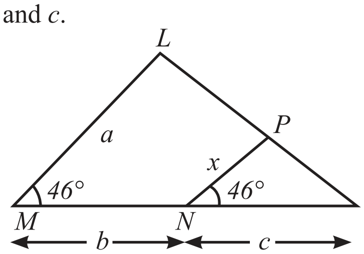
(a) α = 1, β = – 1 (b) α = 1, β = – 2 (c) α = 2, β = 1 (d) α = 2, β = – 2

34. Solve the following system of equations
$ax + by = c$; $bx - ay = c$

(a) $x = \frac{a}{a^2 + b^2}, y = \frac{b}{a^2 + b^2}$ (b) $x = \frac{1}{a}, y = \frac{1}{b}$

(c) $x = \frac{2ab}{(a+b)^2}, y = \frac{2ab}{(a-b)^2}$ (d) $x = \frac{c(a+b)}{a^2 + b^2}, y = -\frac{c(a-b)}{a^2 + b^2}$

35. In the given figure, express x in terms of a, b and c.



(a) $x = \frac{ab}{a+b}$ (b) $x = \frac{ac}{b+c}$ (c) $x = \frac{bc}{b+c}$ (d) $x = \frac{ac}{a+c}$

36. Evaluate : $\frac{\sec\theta . \operatorname{cosec}\theta(90° - \theta) - \tan\theta \cot(90° - \theta) + \sin^2 55° + \sin^2 35°}{\tan 10° \tan 20° \tan 60° \tan 70° \tan 80°}$

(a) $\frac{2}{\sqrt{3}}$ (b) $\frac{\sqrt{3}}{2}$ (c) 0 (d) None of these

37. If $x = \frac{4}{3}$ is a root of the polynomial $f(x) = 6x^3 - 11x^2 + kx - 20$, then find the value of k.

(a) 10 (b) 19 (c) – 5 (d) 3

38. The decimal expansion of $\frac{21}{45}$ is :

(a) terminating (b) non-terminating and repeating
(c) non-terminating and non-repeating (d) none of these

39. A boat goes 12 km. upstream and 40 km downstream in 8 hours. It can go 16 km upstream and 32 km downstream in the same time. Find the speed of the boat in still water and the speed of the stream.

(a) 4 km/hr, 5 km/hr (b) 3 km/hr, 1 km/hr (c) 6 km/hr, 2 km/hr (d) 7 km/hr, 2 km/hr

40. Find the value of a if $(\sin A + \operatorname{cosec} A)^2 + (\cos A + \sec A)^2 = a + \tan^2 A + \cot^2 A$

(a) 5 (b) 4 (c) 0 (d) 7

SECTION-C

Case Study Based Questions:

Section C consists of 10 quesions of 1 mark each. Any 8 quesions are to be attempted.

Q 41. - Q 45 are based on case study-I

Case Study-I

HCF of natural numbers is the largest factor which is common to all the number and LCM of natural numbers is the smallest natural number which is multiple of all the numbers.

41. If p and q are two co-prime natural numbers, then their HCF is equal to

(a) p (b) q (c) 1 (d) pq

42. The LCM and HCF of two rational numbers are equal, then the numbers must be

(a) prime (b) co-prime (c) composite (d) equal

43. If two positive integers a and b are expressible in the form $a = pq^2$ and $b = p^3q$; p, q being prime number, then LCM (a, b) is

(a) pq (b) p^3q^3 (c) p^3q^2 (d) p^2q^2

44. The largest number which divides 285 and 1249 leaving remainders 9 and 7 respectively, is

(a) 46 (b) 6 (c) 12 (d) 138

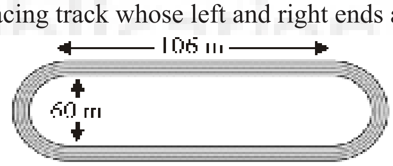
45. The largest number which exactly divides 2011and 2623 leaving remainders 9 and 5 respectively is

(a) 11 (b) 22 (c) 154 (d) 13

Q 46 - Q 50 are based on case study-II

Case Study-II

On school sport day, a sport teacher make a racing track whose left and right ends are semicircular shown in figure.



The distance between the two inner parallel line segments is 60 m and they are each 106 m long. If the track is 10 m wide then answer the following questions.

46. Find the radius of inner semicircular end.

(a) 30 m (b) 60 m (c) 10 m (d) 40 m

47. Find the radius of outer semicircular end

(a) 30 m (b) 50 m (c) 40 m (d) 70 m

48. The distance around the track along its inner edge is:

(a) 423.57 m (b) 400.57 m (c) 400.32 m (d) 400 m

49. The distance around the track along its outer edge is:

(a) 462.43 m (b) 461.43 m (c) 463 m (d) 463.43 m

50. Find the area of the track.

(a) 4320 m^2 (b) 4230 m^2 (c) 2340 m^2 (d) 4120 m^2

OMR ANSWER SHEET

Sample Paper No – [ ]

- ✶ Use Blue / Black Ball pen only.
- ✶ Please do not make any atray marks on the answer sheet.
- ✶ Rough work must not be done on the answer sheet.
- ✶ Darken one circle deeply for each question in the OMR Answer sheet, as faintly darkend / half darkened circle might by rejected.

Start time : ____________________ End time ____________________ Time taken ____________________

1. Name (in Block Letters)

2. Date of Exam

3. Candidate's Signature

SECTION-A

1.	a	b	c	d	9.	a	b	c	d	17.	a	b	c	d
2.	a	b	c	d	10.	a	b	c	d	18.	a	b	c	d
3.	a	b	c	d	11.	a	b	c	d	19.	a	b	c	d
4.	a	b	c	d	12.	a	b	c	d	20.	a	b	c	d
5.	a	b	c	d	13.	a	b	c	d					
6.	a	b	c	d	14.	a	b	c	d					
7.	a	b	c	d	15.	a	b	c	d					
8.	a	b	c	d	16.	a	b	c	d					

SECTION-B

21.	a	b	c	d	29.	a	b	c	d	37.	a	b	c	d
22.	a	b	c	d	30.	a	b	c	d	38.	a	b	c	d
23.	a	b	c	d	31.	a	b	c	d	39.	a	b	c	d
24.	a	b	c	d	32.	a	b	c	d	40.	a	b	c	d
25.	a	b	c	d	33.	a	b	c	d					
26.	a	b	c	d	34.	a	b	c	d					
27.	a	b	c	d	35.	a	b	c	d					
28.	a	b	c	d	36.	a	b	c	d					

SECTION-C

41.	a	b	c	d	45.	a	b	c	d	49.	a	b	c	d
42.	a	b	c	d	46.	a	b	c	d	50.	a	b	c	d
43.	a	b	c	d	47.	a	b	c	d					
44.	a	b	c	d	48.	a	b	c	d					

No. of Qns. Attempted		Correct		Incorrect		Marks	

Page for Rough Work

Sample Paper 1

ANSWERKEY																			
1	(c)	2	(b)	3	(d)	4	(c)	5	(a)	6	(d)	7	(a)	8	(d)	9	(c)	10	(d)
11	(b)	12	(b)	13	(c)	14	(d)	15	(a)	16	(b)	17	(b)	18	(d)	19	(a)	20	(a)
21	(d)	22	(a)	23	(b)	24	(b)	25	(c)	26	(a)	27	(c)	28	(a)	29	(b)	30	(a)
31	(d)	32	(c)	33	(b)	34	(d)	35	(b)	36	(a)	37	(b)	38	(b)	39	(c)	40	(d)
41	(c)	42	(d)	43	(c)	44	(d)	45	(c)	46	(a)	47	(c)	48	(b)	49	(d)	50	(a)

SOLUTIONS

1. **(c)** Here, the two triangles are similar.

Ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding altitudes.

So, $\frac{h_1^2}{h_2^2} = \frac{25}{36}$

$\therefore \quad \frac{h_1}{h_2} = \frac{5}{6}$

2. **(b)** n(S) = 6 × 6 = 36

E= {(1, 2), (2, 1), (2, 3), (3, 2), (3, 4), (4, 3), (4, 5), (5, 4), (5, 6), (6, 5)}

n(E) = 10

$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{10}{36} = \frac{5}{18}$

3. **(d)** $(\cos^4 A - \sin^4 A) = (\cos^2 A)^2 - (\sin^2 A)^2$

$= (\cos^2 A - \sin^2 A)(\cos^2 A + \sin^2 A)$

$= (\cos^2 A - \sin^2 A)(1) = \cos^2 A - (1 - \cos^2 A)$

$= 2\cos^2 A - 1$

4. **(c)** For reflection of a point with respect to x-axis change sign of y-coordinate and with respect to y-axis change sign of x-coordinate.

5. **(a)** It is given that AD is the bisector of ∠A.

$\frac{AB}{AC} = \frac{BD}{DC} \Rightarrow AC = \frac{6 \times 3}{4} = 4.5$ cm

6. **(d)** Given, $\tan\theta = \frac{a}{b}$

$\therefore \quad \frac{a\sin\theta - b\cos\theta}{a\sin\theta + b\cos\theta} = \frac{a\tan\theta - b}{a\tan\theta + b} = \frac{a^2 - b^2}{a^2 + b^2}$

7. **(a)** Let the age of father be 'x' years and the age of son be 'y' years

According to question, $x + y = 65$ ...(i)

and $2(x - y) = 50 \Rightarrow x - y = 25$ ...(ii)

Adding eqs. (i) and (ii), we get, $2x = 90 \Rightarrow x = 45$

Hence, the age of father = 45 years

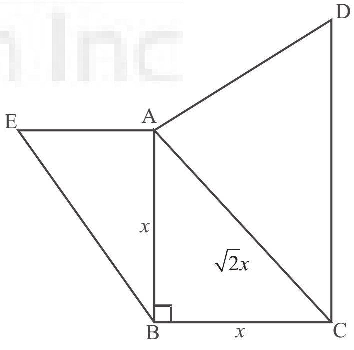
8. **(d)** $P(6, 2) = \left(\frac{4\times3+1\times6}{3+1}, \frac{3\times y+1\times5}{3+1}\right)$

$\because \quad 6 \neq \frac{18}{4}$ (Question is wrong)

$2 = \frac{3y+5}{4} \Rightarrow 3y + 5 = 8$

$3y = 3 \Rightarrow y = 1$

9. **(c)**



Let AB = BC = x.

Since, ΔABC is right-angled with ∠B = 90°

$\therefore \quad AC^2 = AB^2 + BC^2 = x^2 + x^2 = 2x^2$

$\Rightarrow \quad AC = \sqrt{2}x$

Since, $\Delta ABE \sim \Delta ACD$

$$\therefore \quad \frac{\text{Area}(\Delta ABE)}{\text{Area}(\Delta ACD)} = \frac{AB^2}{AC^2} = \frac{x^2}{2x^2} = \frac{1}{2}.$$

Thus, $\frac{\text{Area }(\Delta ABE)}{\text{Area }(\Delta ACD)} = \frac{1}{2}$

Thus, required ratio is 1 : 2.

10. **(d)** We know that $\sec^2\theta - \tan^2\theta = 1$ and $\sec\theta = \frac{x}{p}$, $\tan\theta = \frac{y}{q}$

$\therefore \quad x^2q^2 - p^2y^2 = p^2q^2$

11. **(b)** Substitute $x = 1$ in $f(x)$ and $x = -2$ in $g(x)$, and add

$f(1) = 2(1) - 6(1) + 4(1) - 5 = -5 \Rightarrow g(-2) = 3(4) - 9 = 3$

$f(1) + g(-2) = -2$

12. **(b)** S = {1, 2, 3, ..., 100}

n(S) = 100

E = {11, 22, 33, 44, 55, 66, 77, 88, 99}

n(E) = 9

$\therefore \quad P(E) = \frac{9}{100}$

13. **(c)**

14. **(d)** Let AB be the chord of circle such that $\angle AOB = 90°$

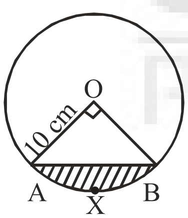
Let OA = 10 cm

$\therefore \ AB = 10\sqrt{2}$ cm

Area of minor segment A X B

= Area of the sector AOB – Area of ΔAOB

$$= \frac{90°}{360°} \times \pi(10)^2 - \frac{1}{2} \times 10 \times 10$$



$= 25\,\pi - 50 = 25 \times 3.14 - 50 = 78.5 - 50 = 28.5\ \text{cm}^2$.

15. **(a)** Let the speeds of the cars starting from A and B be x km/hr and y km/hr respectively

According to problem,

$9x - 90 = 9y$ .... (i)

$\frac{9}{7}x + \frac{9}{7}y = 90$ .... (ii)

Solving we get $x = 40$ km/hr, $y = 30$ km/hr,

speed of car A = 40 km/hr

& speed of car B = 30 km/hr

16. **(b)** Polynomial should not have terms with variables whose powers are negative integers or fractions.

17. **(b)** Given $(x)^2 + (x + 2)^2 = 290$

$\Rightarrow \ x^2 + x^2 + 4x + 4 = 290$

$\Rightarrow \ 2x^2 + 4x - 286 = 0$

$\Rightarrow \ x^2 + 2x - 143 = 0$

$\Rightarrow \ x^2 + 13x - 11x - 143 = 0$

$\Rightarrow \ (x + 13)(x - 11) = 0$

$\Rightarrow \ x = -13, \ x = 11$

x cannot be negative, discard $x = -13$, so $x = 11$

Hence the two consecutive positive integers are 11, 13

18. **(d)** $1 + 3 + 5 + ... + (2n - 1)$

$1 = 1^2$

$1 + 3 = 4 = 2^2$

$1 + 3 + 5 = 9 = 3^2$

$1 + 3 + 5 + 7 = 16 = 4^2$

$1 + 3 + 5 + ... + (2n - 1) = n^2$

Thus the sum of first n odd natural numbers $= n^2$

$2 + 4 + 6 + ... + 2n$

$2 = 1(1 + 1)$

$2 + 4 = 6 = 2(2 + 1)$

$2 + 4 + 6 = 12 = 3(3 + 1)$

$2 + 4 + 6 + 8 = 20 = 4(4 + 1)$

$2 + 4 + 6 + ... + 2n = n(n + 1)$

Thus, the sum of first 'n' even natural numbers $= n(n + 1)$

According to given condition

$n(n + 1) = n^2.k$

$$\Rightarrow k = \frac{n(n+1)}{n^2} = \frac{n+1}{n}$$

19. **(a)** Given equations are :

$7x - y = 5$ and $21x - 3y = k$

Here $a_1 = 7, b_1 = -1, c_1 = 5$

$a_2 = 21, b_2 = -3, c_2 = k$

We know that the equations are consistent with unique solution

if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

Also, the equations are consistent with many solutions

if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$$\therefore \frac{7}{21} = \frac{-1}{-3} = \frac{5}{k} \Rightarrow \frac{1}{3} = \frac{5}{k} \Rightarrow k = 15$$

Hence, for $k = 15$, the system becomes consistent.

20. **(a)** Let the numbers be 37a and 37b. Then

$37a \times 37b = 4107 \Rightarrow ab = 3$

Now, co-primes with product 3 are (1, 3)

So, the required numbers are

$(37 \times 1, 37 \times 3)$ i.e., (37, 111).

$\therefore$ Greater number = 111

21. **(d)** If two similar triangles have equal area then triangles are necessarily congruent.

22. **(a)** Here, the two lines are 2x + 3y = 7 and 2ax + (a + b) y = 28. The above lines are coincident.

Two lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are coincident if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

So, $\frac{2}{2a} = \frac{3}{a+b} = \frac{-7}{28}$

$\Rightarrow$ a = 4, b = 8

$\therefore$ b = 2a

23. **(b)** $2ax - 2by + a + 4b = 0$ .... (i)

and $2bx + 2ay + b - 4a = 0$ .... (ii)

Multiplying eq. (i) with b and eq. (ii) with a, we get

$2abx - 2b^2y + ab + 4b^2 = 0$ .... (iii)

and $2abx + 2a^2y + ab - 4a^2 = 0$ .... (iv)

Subtracting (iv) from (iii), we get

$-(2b^2 + 2a^2)\, y + 4b^2 + 4a^2 = 0$

$\Rightarrow -(2b^2 + 2a^2)\, y = -4b^2 - 4a^2 \Rightarrow y = 2$

Substituting y = 2 in eq. (1), we get

$2ax - 2b \times 2 + a + 4b = 0$

$\Rightarrow x = -1/2 \qquad \therefore x = -1/2,\; y = 2$

24. **(b)** Put $x + 1 = 0$ or $x = -1$ and $x + 2 = 0$ or $x = -2$ in $p(x)$

Then, $p(-1) = 0$ and $p(-2) = 0$

$\Rightarrow p(-1) = (-1)^3 + 3(-1)^2 - 2\alpha(-1) + \beta = 0$

$\Rightarrow -1 + 3 + 2\alpha + \beta = 0 \Rightarrow \beta = -2\alpha - 2$ .... (i)

$p(-2) = (-2)^3 + 3(-2)^2 - 2\alpha(-2) + \beta = 0$

$\Rightarrow -8 + 12 + 4\alpha + \beta = 0 \Rightarrow \beta = -4\alpha - 4$ .... (ii)

By equalising both of the above equations, we get

$-2\alpha - 2 = -4\alpha - 4$

$\Rightarrow 2\alpha = -2 \Rightarrow \alpha = -1$

put $\alpha = -1$ in eq. (i)

$\Rightarrow \beta = -2(-1) - 2 = 2 - 2 = 0$

Hence, $\alpha = -1,\; \beta = 0$

25. **(c)** Let α, β be two zeroes of $2x^2 - 8x - m$, where $\alpha = \frac{5}{2}$.

$\therefore \alpha + \beta = \frac{(-\text{Coefficient of } x)}{\text{Coefficient of } x^2}$

$\Rightarrow \frac{5}{2} + \beta = \frac{8}{2}$

$\Rightarrow \beta = \frac{8}{2} - \frac{5}{2} = \frac{3}{2}.$

26. **(a)** Let $f(x) = 2x^3 - 5x^2 + ax + b$

$f(2) = 2(2)^3 - 5(2)^2 + a(2) + b = 0$

$\Rightarrow 16 - 20 + 2a + b = 0 \Rightarrow 2a + b = 4$

$f(0) = 2(0)^3 - 5(0)^2 + a(0) + b = 0 \Rightarrow b = 0$

$\Rightarrow 2a = 4 \Rightarrow a = 2, b = 0$

27. **(c)** $\cos A = \frac{3}{5} \Rightarrow \sin A = \sqrt{1 - \frac{9}{25}} = \frac{4}{5}$

consider

$$9\cot^2 A - 1 = \frac{9\cos^2 A}{\sin^2 A} - 1 = \frac{9\cos^2 A - \sin^2 A}{\sin^2 A}$$

$$= \frac{9\left(\frac{9}{25}\right) - \left(\frac{16}{25}\right)}{\frac{16}{25}} = \frac{(81-16)}{25} \times \frac{25}{16} = \frac{65}{16}$$

28. **(a)** All isosceles triangles are not similar.

29. **(b)** Let α and 6α be roots of equation.

Sum of roots : $\alpha + 6\alpha = \frac{14}{p}$

$\Rightarrow 7\alpha = \frac{14}{p} \Rightarrow p = \frac{2}{\alpha}$

Product of roots : $(\alpha)(6\alpha) = \frac{8}{p} \Rightarrow p = \frac{4}{3\alpha^2}$

$\Rightarrow \frac{2}{\alpha} = \frac{4}{3\alpha^2}$

$\Rightarrow \alpha = \frac{2}{3}$

Therefore, $p = \frac{2}{\alpha} = 3$

30. **(a)** The equations $3x - (a + 1)\, y = 2b - 1$

$5x + (1 - 2a)\, y = 3b$

The system will have infinite number of solutions

if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Here, $a_1 = 3,\; b_1 = -(a + 1),\; c_1 = 2b - 1$

$a_2 = 5,\; b_2 = 1 - 2a,\; c_2 = 3b$

$\therefore \frac{3}{5} = \frac{-(a+1)}{1-2a} = \frac{2b-1}{3b}$

Taking I and II

$\frac{3}{5} = \frac{-(a+1)}{1-2a}$

$\Rightarrow -5a - 5 = 3 - 6a$

$\Rightarrow -5a + 6a = 3 + 5$

$a = 8$

Taking I and III

$\frac{3}{5} = \frac{2b-1}{3b}$

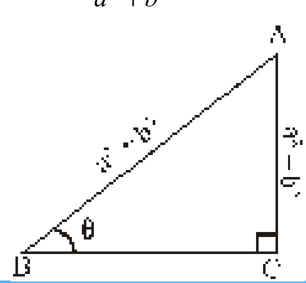
$\Rightarrow 10b - 5 = 9b$

$\Rightarrow 10b - 9b = 5$

$b = 5$

$\therefore a = 8, b = 5$

31. **(d)** $\sin\theta = \frac{a^2 - b^2}{a^2 + b^2}$



Since, $\sin\theta = \frac{\text{perpendicular}}{\text{base}}$

$\therefore \frac{AC}{AB} = \frac{a^2 - b^2}{a^2 + b^2}$

Now in ΔABC,

$\angle B = \theta$ and $\angle C = 90°$

$(a^2 + b^2)^2 = BC^2 + (a^2 - b^2)^2$

$\therefore BC = 2ab$

$\text{cosec}\,\theta = \frac{a^2 + b^2}{a^2 - b^2}$,

$\cot\theta = \frac{BC}{AC} = \frac{2ab}{a^2 - b^2}$

$$\text{cosec}\,\theta + \cot\theta = \frac{a^2 + b^2}{a^2 - b^2} + \frac{2ab}{a^2 - b^2} = \frac{a+b}{a-b}$$

32. **(c)** 3, because it is the exponent of the highest degree term in the polynomial $y^3 - 2y^2 - \sqrt{3}y + \frac{1}{2}$.

33. **(b)** Since α, β are roots of $x^2 + x\sqrt{a} + \beta = 0$

$\Rightarrow \alpha^2 + \alpha\sqrt{\alpha} + \beta = 0$ ...(i)

and $\beta^2 + \beta\sqrt{\alpha} + \beta = 0$ ...(ii)

Multiply equation (*i*) by β and equation (*ii*) by α and subtract

$\alpha^2\beta + \alpha\beta\sqrt{\alpha} + \beta^2 = 0$

$\alpha\beta^2 + \alpha\beta\sqrt{\alpha} + \alpha\beta = 0$

(–) (–) (–)

$\alpha\beta(\alpha - \beta) + \beta(\beta - \alpha) = 0$

$\Rightarrow (\alpha\beta - \beta)(\alpha - \beta) = 0$

$\Rightarrow \alpha\beta - \beta = 0$

($\because \alpha - \beta = 0 \Rightarrow \alpha = \beta$ which is not possible)

$\Rightarrow (\alpha - 1)\beta = 0$

$\Rightarrow \alpha - 1 = 0$

$\Rightarrow \alpha = 1$

Put $\alpha = 1$ in (i) $\Rightarrow \beta = -2$

34. **(d)** $ax + by = c, \ bx - ay = c$

Using the cross-multiplication method,

$$\frac{x}{-ac - bc} = \frac{y}{ac - bc} = \frac{1}{-a^2 - b^2}$$

$$\Rightarrow x = \frac{-ac - bc}{-a^2 - b^2} = \frac{-c(a+b)}{-(a^2 + b^2)} = \frac{c(a+b)}{a^2 + b^2}$$

and

$$y = \frac{ac - bc}{-a^2 - b^2} = \frac{c(a-b)}{-(a^2 + b^2)} = -\frac{c(a-b)}{a^2 + b^2}$$

Therefore, $x = \frac{c(a+b)}{a^2 + b^2}, \ y = -\frac{c(a-b)}{a^2 + b^2}$

35. **(b)** In ΔKPN and ΔKLM, we have

$\angle KNP = \angle KML = 46°$

$\angle K = \angle K$ (Common)

$\therefore \Delta KNP \sim \Delta KML$

(By A-A criterion of similarity)

$$\Rightarrow \frac{KN}{KM} = \frac{NP}{ML} \Rightarrow \frac{c}{b+c} = \frac{x}{a}$$

36. **(a)**

$$\frac{\sec\theta.\text{cosec}\,\theta(90° - \theta) - \tan\theta\cot(90° - \theta) + \sin^2 55° + \sin^2 35°}{\tan 10°\tan 20°\tan 60°\tan 70°\tan 80°}$$

$$= \frac{\sec\theta.\sec\theta - \tan\theta.\tan\theta + \sin^2(90° - 35°) + \sin^2 35°}{\tan 10°\tan 20°.\sqrt{3}.\tan(90° - 20°)\tan(90° - 10°)}$$

[Using $\text{cosec}\,(90° - \theta) = \sec\theta, \ \cot(90° - \theta) = \tan\theta$]

$$= \frac{(\sec^2\theta - \tan^2\theta) + (\cos^2 35° + \sin^2 35°)}{\sqrt{3}\tan 10°\tan 20°\cot 20°\cot 10°}$$

[Using $\sin(90° - \theta) = \cos\theta, \ \tan(90° - \theta) = \cot\theta$]

$$= \frac{1+1}{\sqrt{3}.(\tan 10°\cot 10°)(\tan 20°\cot 20°)}$$

[Using $\sec^2\theta - \tan^2\theta = 1, \ \sin^2\theta + \cos^2\theta = 1$]

$$= \frac{2}{\sqrt{3}\times 1\times 1} = \frac{2}{\sqrt{3}}$$ [Using $\tan\theta.\cot\theta = 1$]

37. **(b)** Let $f(x) = 6x^3 - 11x^2 + kx - 20$

$$f\left(\frac{4}{3}\right) = 6\left(\frac{4}{3}\right)^3 - 11\left(\frac{4}{3}\right)^2 + k\left(\frac{4}{3}\right) - 20 = 0$$

$$\Rightarrow 6.\frac{64}{27} - 11.\frac{16}{9} + \frac{4k}{3} - 20 = 0$$

$\Rightarrow 128 - 176 + 12k - 180 = 0$

$\Rightarrow 12k + 128 - 356 = 0 \Rightarrow 12k = 228$

$\Rightarrow k = 19$

38. **(b)** $\frac{21}{45} = \frac{21}{9\times 5} = \frac{21}{3^2\times 5}$.

Clearly, 45 is not of the form $2^m \times 5^n$. So the decimal expansion of $\frac{21}{45}$ is non-terminating and repeating.

39. **(c)** Let the speed of the boat in still water be x km/hr and the speed of the stream be y km/hr then speed of boat in downstream is $(x + y)$ km/hr and the speed of boat upstream is $(x - y)$ km/hr.

Ist case : Distance covered upstream = 12 km

$\therefore$ time $= \frac{12}{x - y}$ hr

Distance covered downstream = 40 km

$\therefore$ time $= \frac{40}{x + y}$ hr

Total time is 8 hr $\therefore \frac{12}{x-y}+\frac{40}{x+y}=8$ ...(i)

IInd case :
Distance covered upstream = 16 km

$\therefore$ time = $\frac{16}{x-y}$ hr

Distance covered downstream

= 32 km $\therefore$ time = $\frac{32}{x+y}$ hr

Total time taken = 8 hr

$\therefore \frac{16}{x-y}+\frac{32}{x+y}=8$ ...(ii)

Solving (i) and (ii), we get,
x = speed of boat in still water = 6 km/hr,
y = speed of stream = 2 km/hr

40. (d) $(\sin A + \text{cosec} A)^2 + (\cos A + \sec A)^2$

$\Rightarrow \sin^2 A + \text{cosec}^2 A + 2\sin A \text{ cosec } A + \cos^2 A + \sec^2 A + 2 \sec A \cos A$

$\Rightarrow (\sin^2 A + \cos^2 A) + \text{cosec}^2 A + 2 + \sec^2 A + 2$

$\Rightarrow 1 + 4 + 1 + \cot^2 A + 1 + \tan^2 A$

$\Rightarrow 7 + \cot^2 A + \tan^2 A$

$\therefore (\sin A + \text{cosec} A)^2 + (\cos A + \sec A)^2$

$= 7 + \cot^2 A + \tan^2 A$

Hence, a = 7

41. (c), 42. (d), 43. (c), 44. (d), 45. (c)

46. (a) Radius of inner semicircular end

$= \frac{60}{2} = 30$ m

47. (c) Radius of outer semicircular end

= 30 + 10 = 40 m

48. (b) The distance arounded the track along its inner edge

$= 106 \times 2 + 2 \times \pi r$

$= 212 + 2 \times \frac{22}{7} \times 30 = 212 + 188.57$

= 400.57 m

49. (d) The distance arounded the track along its outer edge

$= 106 \times 2 + 2 \times \pi r$

$= 212 + 2 \times \frac{22}{7} \times 40 = 212 + 251.43$

= 463.43 m

50. (a) The area of the track

= 2 × Area of ractangle + 2 × Area of semicircular ring.

$= 2(10 \times 106) + 2 \times \frac{1}{2} \times \frac{22}{7} \times (40^2 - 30^2)$

$= 2120 + 2200 = 4320 \text{ m}^2$