விளையாட்டுத்துறையும், கணிதத்துறையும் ஒன்று விடா முயற்சி+கடின பயிற்சி= வெற்றி

10

Maths

HINDU HIGHER SECONDARY SCHOOL, ALWARTHIRUNAGARAI.

TIRUCHENDUR EDUCATION DISTRICT.

QUARTERLY MODEL EXAM 2022-2023

Date : 08-Sep-22

Reg.No. :

Exam Time : 03:00:00 Hrs

PART - A

Total Marks : 100

14 x 1 = 14

1) Let f and g be two functions given by

f = {(0,1), (2,0) (3 4), (4,2), (5,7)}

g = {(0,2), (1,0), (2,4), (-4,2), (7,0)} then the range of f o g is

(a) {0,2,3,4,5} (b) {−4,1,0,2,7} (c) {1,2,3,4,5} (d) {0,1,2}

2) Composition of functions is commutative

(a) Always true (b) Never true (c) Sometimes true

3) If the HCF of 65 and 117 is expressib e in the form of 65m - 117 , then the value of m is

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

4) If 6 times of 6th term of an A.P. is equal to 7 times the 7th term, then the 13th term of the A.P. is

(a) 0 (b) 6 (c) 7 (d) 13

5) If A = 2^{65} and B = $2^{64} + 2^{63} + 2^{62} + ... + 2^0$ Which of the following is true?

(a) B is 2^{64} more than A (b) A and B are equal (c) B is larger than A by 1

(d) A is larger than B by 1

6) If (x - 6) is the HCF of $x^2 - 2x - 24$ and $x^2 - kx - 6$ then the value of k is

(a) 3 (b) 5 (c) 6 (d) 8

7) The values of a and b if $4x^4 - 24x^3 + 76x^2 + ax + b$ is a perfect square are

(a) 100, 120 (b) 10, 12 (c) -120, 100 (d) 12, 10

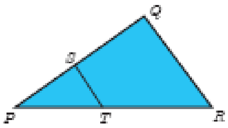
8) If the roots of the equation $q^2x^2 + p^2x + r^2 = 0$ are the squares of the roots of the equation $qx^2 + px + r = 0$, then q, p, r are in ___________.

(a) A.P (b) G.P (c) Both A.P and G.P (d) none of these

9) If in triangles ABC and EDF, $\frac{AB}{DE} = \frac{BC}{FD}$ then they will be similar, when

(a) $\angle B = \angle E$ (b) $\angle A = \angle D$ (c) $\angle B = \angle D$ (d) $\angle A = \angle F$

10) In a given figure ST || QR,PS = 2cm and SQ = 3 cm Then the ratio of the area of △PQR to the a ea △PST is



(a) 25 : 4 (b) 25 : 7 (c) 25 : 11 (d) 25 : 13

11) The straight line given by the equation x = 11 is

(a) parallel to X axis (b) parallel to Y axis (c) passing through the origin

(d) passing through the point (0,11)

12) The slope of the line joining (12, 3) , (4, a) is $\frac{1}{8}$.The value of ‘a’ is

(a) 1 (b) 4 (c) -5 (d) 2

13) (2, 1) is the point of intersection of two lines.

(a) x - y - 3 = 0; 3 x - y - 7 = 0 (b) x + y = 3; 3x + y =7 (c) 3x + y =3; x + y = 7

(d) x + 3y - 3 = 0; x - y - 7 = 0

14) The value of is $sin^2\theta + \frac{1}{1+tan^2\theta}$ equal to

(a) $tan^2\theta$ (b) 1 (c) $cot^2\theta$ (d) 0

PART - B 14 x 2 = 28

Answer any 10 questions Question No. 28 is compulsay

15) Find f o g and g o f when f(x) = 2x + 1 and g(x) = x^2 - 2

16) Check whether the following sequences are in A.P. or not?

x + 2, 2x + 3, 3x + 4, ...

17) Find he 19^{th} term of an A.P. -11, -15, -19,....

18) Find the first term of a G.P. in which S_6 = 4095 and r = 4

19) If the difference between the roots of the equation x^2 - 13x + k = 0 is 17. find k

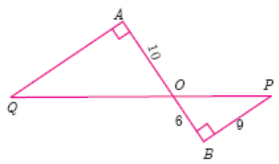
20) If α, β are the roots of the equation $3x^2$ + 7x - 2 = 0, find the values of

$\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$

21) If α and β are the roots of x^2 + 7x + 10 = 0 find the values of

$\alpha^2 + \beta^2$

22) QA and PB are perpendiculars to AB. If AO = 10 cm, BO = 6 cm and PB = 9 cm. Find AQ.



23) Find the equation of a line through the given pair of points $\left(2, \frac{2}{3}\right)$ and $\left(\frac{-1}{2}, 2\right)$

24) Show that the straight lines x - 2y + 3 = 0 and 6x + 3y + 8 = 0 are perpendicular.

25) What is the inclination of a line whose slope is 1

26) Show that the given vertices form a right angled triangle and check whether its satisfies Pythagoras theorem L(0, 5), M(9,12) and N(3,14)

27) prove that $\sqrt{\frac{1+cos\theta}{1-cos\theta}}$ = cosec θ + cotθ

28) prove the following identities

$\sqrt{\frac{1+sin\theta}{1-sin\theta}} + \sqrt{\frac{1+sin\theta}{1-sin\theta}} = 2sec\theta$

PART - C 14 x 5 = 70

Answer any 10 questions. Question No. 42 is compulsay

29) If the function f: R⟶ R defined by

$$f(x) = \begin{cases} 2x+7, x < -2 \\ x^2 - 2, -2 \leq x < 3 \\ 3x - 2, x \geq 3 \end{cases}$$

(i) f(4)

(ii) f(-2)

(iii) f(4) + 2f(1)

(iv) $\frac{f(1)-3f(4)}{f(-3)}$

30) Find the sum to n terms of the series 5 + 55 + 555 +...

31) Find the GCD of the polynomials $x^3 + x^2 - x + 2$ and $2x^3 - 5x^2 + 5x - 3$.

32) Find the square root of the following expressions

$16x^2 + 9y^2 - 24xy + 24x - 18y + 9$

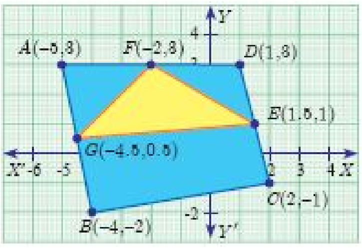
33) Find the square root of the expression $\frac{4x^2}{y^2} + \frac{20x}{y} + 13 - \frac{30y}{x} + \frac{9y^2}{x^2}$

34) The roots of the equation $x^2 + 6x - 4 = 0$ are α, β. Find the quadratic equation whose roots are

α^2 and β^2

35) In trapezium ABCD,AB || DC, E and F are points on non-parallel sides AD and BC respectively, such that EF || AB. Show that AE $\frac{AE}{ED} = \frac{BF}{FC}$

36) In the figure, find the area of triangle AGF



37) If the points A(2, 2), B(−2, −3), C(1, −3) and D(x, y) form a parallelogram then find the value of x and y.

38) Find the equation of the median and altitude of Δ ABC through A where the vertices are A(6, 2), B(-5,-1) and C(1, 9)

39) Prove that $\sin^2 A\cos^2 B + \cos^2 A\sin^2 B + \cos^2 A\cos^2 B + \sin^2 A\sin^2 B=1$

40) if $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$, then prove that $\cos\theta - \sin\theta = \sqrt{2}\sin\theta$

41) If $\frac{\cos\alpha}{\cos\beta}$ = m and $\frac{\cos\alpha}{\sin\beta}$ = n, then prove that $(m^2 + n^2)\cos^2\beta = n^2$

42) if $\frac{\cos\theta}{1+\sin\theta} = \frac{1}{a}$,then prove that $\frac{a^2-1}{a^2+1} = \sin\theta$

PART - D 4 x 8 = 32

Answer any one from 43 & 44 and any one from 45 & 46.

43) Varshika drew 6 circles with different sizes. Draw a graph for the relationship between the diameter and circumference of each circle as shown in the table and use it to find the circumference of a circle when its diameter is 6 cm.

Diameter (**x**)**cm**	1	2	3	4	5
Circumference (**y**)**cm**	3.1	6.2	9.3	12.4	15.5

44) A bus is travelling at a uniform speed of 50 km/hr. Draw the distance-time graph and hence find

(i) the constant of variation

(ii) how far will it travel in $\frac{1}{2}$

(iii) the time required to cover a distance of 300 km from the graph.

45) Construct a triangle similar to a given triangle PQR with its sides equal to $\frac{3}{5}$ of the corresponding sides of the triangle PQR (scale factor $\frac{3}{5} < 1$)

46) Construct a $\triangle$PQR which the base PQ = 4.5 cm,$\angle$R = 35°and the median RG R to PG is 6 cm

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PART - A 14 x 1 = 14

1) (d) {0,1,2}

2) (a) Always true

3) (c) 1

4) (a) 0

5) (d) A is larger than B by 1

6) (b) 5

7) (c) -120, 100

8) (b) G.P

9) (c) $\angle B = \angle D$

10)

(a) 25 : 4

11)

(b) parallel to Y axis

12)

(d) 2

13)

(b) x + y = 3; 3x + y =7

14)

(b) 1

PART - B 14 x 2 = 28

Answer any 10 quest ons. Question No. 28 is compulsay

15)

$f(x) = 2x + 1$, $g(x) = x^2 - 2$

$f \circ g(x) = f(g(x)) = f(x^2 - 2) = 2(x^2 - 2) + 1 = 2x^2 \quad 3$

$g \circ f(x) = g(f(x)) = g(2x + 1) = (2x + 1)^2 - 2 = 4x^2 + 4x - 1$

Thus $f \circ g = 2x^2 - 3$, $g \circ f = 4x^2 + 4x \quad 1$ From the above, we see that $f \circ g \neq g \circ f$

16)

To check that the given sequence is in A.P., it is enough to check if the differences between the consecutive terms are equal or not.

$t_2 - t_1 = (2x + 3) - (x - 2) = x + 1$

$t_3 - t_1 = (3x + 4) - (2x + 3) = x + 1$

$t_2 - t_1 = t_3 - t_2$

Thus, the differences between consecutive terms are equal.

Hence the sequence x + 2, 2x + 3, 3x + 4,..... is in A.P

17)

Given the A.P. - 11, - 15, - 19,....
Here First term a = - 11
Common difference d = t_2 - t_1 = - 15 - (- 11)
= -15 + 11
d = - 4
n^{th} term of an A.P. is t_n = a + (n - 1)d
19^{th} term (t_{19}) = -11 + (19   1) (4)
= -11 + 18 (- 4)
= -11 + (- 72) = -83
19th term of -11,-15, -19,...is - 83.

18)

Common ratio = 4 > 1, sum of first 6 terms S_6 = 4095
Hence , S_6 = $\frac{a(r^n-1)}{r-1} = 4095$
Since, r = 4, $\frac{a(4^6-1)}{4-1}$ = 4095 gives a x $\frac{4095}{3} = 4095$
First term a = 3.

19)

x^2 - 13x + k = 0 here, a = 1, b = -13, c = k
Let α, β be the roots of the equation. Then
α + β = $\frac{-b}{a} = \frac{-(-13)}{1}$ = 13 ...... (1) also α - β = 17 ......(2)
(1) + (2) we get, 2α = 30 gives α = 15
Therefore, 15 + β = 13 (from (1)) gives β = -2
But, αβ = $\frac{c}{a} = \frac{k}{1}$ gives 15 x (-2) = k we get, k = -30

20)

$3x^2$ + 7x - 2 = 0 here, a = 3, b = 7, c = -2
since, α, β are the roots of the equation
α + β = $\frac{-b}{a} = \frac{-7}{3}$, αβ = $\frac{c}{a} = \frac{-2}{3}$

$$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2+\beta^2}{\alpha\beta} = \frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha\beta} = \frac{\left(\frac{-7}{3}\right)^2-2\left(\frac{-2}{3}\right)}{\frac{-2}{3}} = \frac{-61}{6}$$

21)

x^2 + 7x + 10 here, a = -1, b = 7, c =10
if α and β are roots of the equation then,
α + β= $\frac{-b}{a} = \frac{-7}{1}$ = -7; αβ = $\frac{c}{a} = \frac{10}{1}$ = 10
$α^2$ + $β^2$ = $(α + β)^2$ -2αβ = $(-7)^2$ - 2 x 10 = 29

22)

ΔAOQ and $\Delta BOP, \angle OAQ = \angle OBP = 90^0$
$\angle AOQ = \angle BOP$ (Vertically opposite angles)
Therefore, by AA Criterion of similarity,
$\Delta AOQ \sim \Delta BOP$
$\frac{AO}{BO} = \frac{OQ}{OP} = \frac{AQ}{BP}$
$\frac{10}{6} = \frac{AQ}{9}$ gives $AQ = \frac{10\times9}{6} = 15cm$

23)

Given points $\left(2, \frac{2}{3}\right)$ and $\left(-\frac{1}{2}, -2\right)$

Equation of the line passing through (x_1 , y_1) and (x_1 , y_1)

$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$

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

$\frac{3y-2}{-6-2} = \frac{2x-4}{-1-4}$

-5 (3y - 2) = - 8 (2x - 4)

- 15y+ 10 = - 16x + 32

16x - 15y - 22 = 0

24)

Show of the straight lines x - 2y + 3 = 0 is

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

Slope of the straight line 6x + 3y + 8 = 0 is

m_2 = $\frac{-6}{3}$=-2

Now, m_1 x m_2 = $\frac{1}{2}$ x (-2) = -1

Hence, the two straight lines are perpendicular

25)

Slope 'm' = 1

tanθ = 1 = tan 45^0

θ = 45^0

26)

L (0, 9), M (9,12) and N (3, 14)

Slope of a line = $\frac{y_1-y_2}{x_1-x_2}$

Slope of LM = $\frac{5-12}{0-9} = \frac{-7}{-9} = \frac{7}{9}$

Slope of MN = $\frac{12-14}{9-3} = \frac{-2}{6} = \frac{-1}{3}$

Slope of LN = $\frac{5-14}{0-3} = \frac{-9}{-3} = 3$

(Slope of MN) x (slope of LN) = $\left(-\frac{1}{3}\right) \times 3 = -1$

MN is perpendicular to LN.

Hence, the given vertices form a right angled triangle

Distance formula = $\sqrt{\left(x_1 - x_2\right)^2 + \left(y_1 - y_2\right)^2}$

$\mathrm{LM} = \sqrt{(0-9)^2 + (5-12)^2} = \sqrt{81+49} = \sqrt{130}$

LM^2 = 130

$\mathrm{MN} = \sqrt{(9-3)^2 + (12-14)^2} = \sqrt{36+4} = \sqrt{40}$

MN^2 = 40

$\mathrm{LN} = \sqrt{(0-3)^2 + (5-14)^2} = \sqrt{9+81} = \sqrt{90}$

LN^2 = 90

LN^2 + MN^2 = LM^2

Hence, the Pythagoras theorem is satisfied.

27)

$\sqrt{\frac{1+cos\theta}{1-cos\theta}} = \sqrt{\frac{1+cos\theta}{1-cos\theta} \times \frac{1+cos\theta}{1+cos\theta}}$ [multiply numerator and denominator by the conjugate of 1 - $cos\theta$]

$= \sqrt{\frac{(1+cos\theta)^2}{(1-cos\theta)^2}} = \frac{1+cos\theta}{\sqrt{sin^2\theta}}$ [since $sin_{2\theta}$ + $cos_{2\theta}$ = 1]

$= \frac{1+cos\theta}{sin\theta} = cosec\theta + cot\theta$

28)

$\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} = \sec\theta + \tan\theta$

$\textbf{LHS} = \sqrt{\frac{1+\sin\theta}{1-\sin\theta}}$

$= \sqrt{\frac{1+\sin\theta}{1-\sin\theta} \times \frac{1-\sin\theta}{1-\sin\theta}}$

[Multiplying the Numerator and denominator by $\sqrt{1-\sin\theta}$]

$= \sqrt{\frac{1^2-\sin^2\theta}{(1-\sin\theta)^2}} \quad [\because (a+b)(a-b) = a^2 - b^2]$

$= \sqrt{\frac{\cos^2\theta}{(1-\sin\theta)^2}} \quad [\because 1 - \sin^2\theta = \cos^2\theta]$

$= \frac{\cos\theta}{1-\sin\theta}$

$= \frac{\cos\theta}{1-\sin\theta} \times \frac{1+\sin\theta}{1+\sin\theta}$

[Multiplying Numerator and denominator by $1 + \sin\theta$]

$= \frac{\cos\theta(1+\sin\theta)}{1^2-\sin^2\theta} = \frac{\cos\theta(1+\sin\theta)}{\cos^2\theta}$

$[\because (a+b)(a-b) = a^2 - b^2]\ [1 - \sin^2\theta = \cos^2\theta]$

$= \frac{1+\sin\theta}{\cos\theta} = \frac{1}{\cos\theta} + \frac{\sin\theta}{\cos\theta}$

$= \sec\theta + \tan\theta = \text{ RHS}$

PART - C 14 x 5 = 70

Answer any 10 questions. Question No. 42 is compulsay

29)

The function f is defined by three values in intervals I, II, III as shown by the side.

For a given value of x = a, find out the interval at which the point a is located, there after find

f(a) using the particular value defined in that interval.

(i) First, we see that, x = 4 lie in the third interval.

Therefore, f(x) = 3x - 2; f(4) = 3(4) = 10

(ii) x = -2 lies in the second interval

Therefore, f(x) = x^2 - 2; f(-2) = $(-2)^2$ - 2 = 2

(iii) From (i), f(4) =10.

To find f(1) first we see that x = 1 lies in the second interval.

Therefore, f(x) = x^2-2 ⇒ f(1) = 1^2 - 2 = -1

So, f(4) + 2f(1) = 10 + 2(-1) = 8

(iv) We know that f(1) = -1 and f(4) = 10

For finding f(-3), we see that x = −3, lies in the first interval.

Therefore, f(x) = 2x + 7; thus, f(-3) = 2(-3) + 7 = 1

Hence, $\frac{f(1)-3f(4)}{f(-3)} = \frac{-2-3(10)}{1}$ = - 31

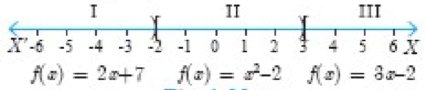


Fig. 1.39

30)

The series is neither Arithmetic nor Geometric series. So it can be split into two series and then find the sum.

5 + 55 + 555 + ... + n terms = 5 [1 + 11 + 111 + ...n terms]

= $\frac{5}{9}$ [9 + 99 + 999 +...+ n terms]

= $\frac{5}{9}$[(10 - 1) + (100 - 1) + (1000 - 1) +...+ n terms]

= $\frac{5}{9}$[10 + 100 + 1000 +...+ n terms)-n]

$= \frac{5}{9}\left[\frac{10(10^n-1)}{(10-1)} - n\right] = \frac{50(10^n-1)}{81} = \frac{5n}{9}$

31)

Let $f(x) = 2x^3 - 5x^2 + 5x - 3$ and $g(x) = x^3 + x^2 - x + 2$

$$\begin{array}{r|l l}
 & \quad 2 & \\
x^3+x^2-x+2 & 2x^3-5x^2+5x-3 & \\
 & 2x^3+2x^2-2x+4 & (-) \\
\hline
 & \quad -7x^2+7x-7 &
\end{array}$$

$$= -7(x^2 - x + 1)$$

$-7(x^2 - x + 1) \neq 0$, note that -7 is not a divisor of g(x)

Now dividing, $g(x) = x^3 + x^2 - x + 2$ by the new remainder $x^2 - x + 1$ (leaving the constant factor), we get

$$\begin{array}{r|l l}
 & x+2 & \\
x^2-x+1 & x^3+x^2-x+2 & \\
 & x^3-x^2+x & (-) \\
\hline
 & \quad 2x^2-2x+2 & \\
 & \quad 2x^2-2x+2 & (-) \\
\hline
 & \quad\quad 0 &
\end{array}$$

Here, we get zero remainder

Therefore, GCD $(2x^3 - 5x^2 + 5x - 3,\ x^3 + x^2 - x + 2) = x^2 - x + 1$.

32)

$$\sqrt{16x^2+9y^2-24xy+24x-18y+9}$$

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

$$= \sqrt{(4x+-3y+3)^2} = |4x - 3y + 3|$$

33)

$$\begin{array}{r|l l}
 & \frac{2x}{y}+5-\frac{3y}{x} & \\
\frac{2x}{y} & \frac{4x^2}{y^2}+\frac{20x}{y}+13-\frac{30y}{x}+\frac{9y^2}{x^2} & \\
 & \frac{4x^2}{y^2} & (-) \\
\hline
\frac{4x}{y}+5 & \quad \frac{20x}{y}+13 & \\
 & \quad \frac{20x}{y}+25 & (-) \\
\hline
\frac{4x}{y}+10-\frac{3y}{x} & \quad\quad -12-\frac{30y}{x}+\frac{9y^2}{x^2} & \\
 & \quad\quad -12-\frac{30y}{x}+\frac{9y^2}{x^2} & (-) \\
\hline
 & \quad\quad\quad 0 &
\end{array}$$

Hence $\sqrt{\frac{4x^2}{y^2}+\frac{20x}{y}+13-\frac{30y}{x}+\frac{9y^2}{x^2}} = \left|\frac{2x}{y}+5-\frac{3y}{x}\right|$

34)

If the roots are given, the quadratic equation is X^2 - (sum of the roots) x + product the roots =0. For the given equation.

$x^2 - 6x - 4 = 0$

$\alpha+\beta=-6$

$\alpha\beta=-4$

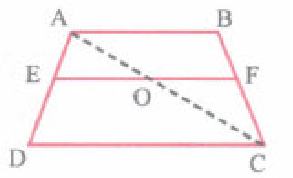
$\alpha^2+\beta^2=(\alpha+\beta)^2-2\alpha\beta$

$=(-6)^2-2(-4)=36+8=44$

$\alpha^2\beta^2=(\alpha\beta)^2=(-4)2=16$

$\therefore$ The requird equation$=x^2-44x+16=0$

35)



G ven: ABCD is a trapezium in which DC ll AB and EF II AB

To prove that $\frac{AE}{ED} = \frac{BF}{FC}$

Construction : join AC meeting EF at G

Proof:

In ADC, we have

EG II DC

$\Rightarrow \frac{AE}{ED} = \frac{AG}{GC}$ [By thales theorem] ...(1)

In ABC , we have

$\frac{AG}{GC} = \frac{BF}{FC}$ [Bv thales theorem] ....(2)

From (1) and (2), we get

$\frac{AE}{ED} = \frac{BF}{FC}$

36)

Area of triangle AGF

Vertices A (- 5,3), G (- 4.5,0.5) and F (- 2,3).

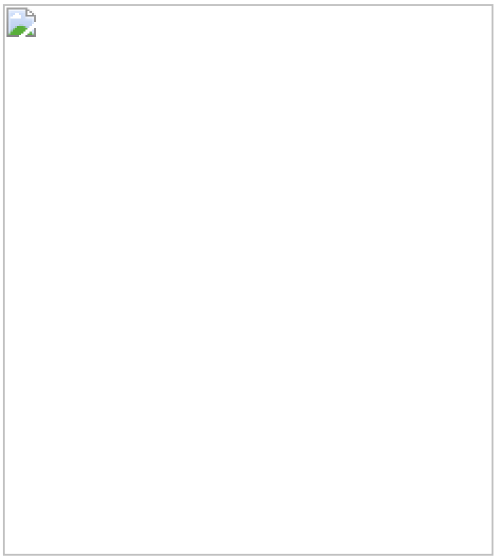
Area of triangle $= \frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$ sq. units

$= \frac{1}{2}[-5(0.5 - 3) - 4.5(3 - 3) - 2(3 - 0.5)]$

$= \frac{1}{2}[12.5 - 5] = \frac{7.5}{2} = 3.75$ sq. units

37)

Given points A (2, 2), B (- 2,- 3), C (1, - 3) and D (x, y)



Slope of a line = $\frac{y_1-y_2}{x_1-x_2}$

Slope of AB = $\frac{2+3}{2+2} = \frac{5}{4}$

Slope of BC = $\frac{-3+3}{-2-1} = 0$

Slope of CD = $-\frac{-3-y}{1-x}$

Slope of AD = $\frac{2-y}{2-x}$

Since, the points form a parallelogram

AB is parallel to CD and BC is parallel to AD

Slope of AB = Slope of CD

$\frac{5}{4} = \frac{-3-y}{1-x}$

5(1 - x) = 4(-3 -y)

5 - 5x = -12 -4y

5x - 4y = 17

Slope of BC = Slope of AD

$0 = \frac{2-y}{2-x}$

2 - y = 0

y = 2

Substituting in (1)

5x - 4(2) = 17

5x = 17 + 8 = 25

$x = \frac{25}{5} = 5$

x = 5,y = 2

38)

Given vertices are A (6, 2), B (- 5, - 1) and C (1, 9)

Median through A :

Let D be the mid point of BC

Mid point of BC $= \mathrm{D}\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$= \mathrm{D}\left(\frac{-5+1}{2}, \frac{-1+9}{2}\right)$

= D (-2 , 4)

Now AD is the median.

Equation of AD $\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$

$\frac{y-2}{4-2} = \frac{x-6}{-2-6}$

$\frac{y-2}{2} = \frac{x-6}{-8}$

- 4y + 8 = x - 6

x + 4y - 14 = 0

Altitude through A

Altitude is passing through 'A and perpendicular to BC.

Now,

Slope of BC = $\frac{y_1-y_2}{x_1-x_2} = \frac{-1-9}{-5-1} = \frac{-10}{-6} = \frac{5}{3}$

Slope of Altitude $= -\frac{3}{5}$

Equation of the altitude which is passing through A (6,2)and having slope $-\frac{3}{5}$ is

y - y_1 = m(x - x_1)

$y - 2 = -\frac{3}{5}(x-6)$

5y- 10 = -3x + 18

3x + 5y - 28 = 0

39)

$\sin^2 A\cos^2 B + \cos^2 A\sin^2 B + \cos^2 A + \cos^2 B + \sin^2 A\sin^2 B$

$= \sin^2 A\cos^2 B + \sin^2 A\sin^2 B + \cos^2 A + \cos^2 B + \sin^2 A\sin^2 B$

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

$= \sin^2 A(1) + \cos^2 A(1)$ (since $\sin^2 B + \cos^2 B = 1$)

$= \sin^2 A + \cos^2 A = 1$

40)

Now, $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$

Squaring both sides,

$(\cos\theta + \sin\theta)^2 = (\sqrt{2}\cos\theta)^2$

$\cos^2\theta + \sin^2\theta + 2\sin\theta\cos\theta = 2\cos^2\theta$

$2\cos^2\theta - \cos^2\theta - \sin^2\theta = 2\sin\theta\cos\theta$

$\cos^2\theta - \sin^2\theta = 2\sin\theta\cos\theta$

$(\cos\theta + \sin\theta)(\cos\theta + \sin\theta) = 2s\ n\theta\cos\theta$

$\cos\theta - \sin\theta = \frac{2sin\theta cos\theta}{cos\theta+sin\theta} = \frac{2sin\theta cos\theta}{\sqrt{2}cos\theta}$ [since $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$]

$= \sqrt{2}\cos\theta$

Therefore $\cos\theta - \sin\theta = \sqrt{2}\cos\theta$

41)

Given

$\frac{\cos\alpha}{\cos\beta} = m$

$\frac{\cos\alpha}{\sin\beta} = n$

$\text{LHS} = (m^2+n^2)\cos^2\beta$

$= \left(\frac{\cos^2\alpha}{\cos^2\beta} + \frac{\cos^2\alpha}{\sin^2\beta}\right)\cos^2\beta$

$= \frac{(\cos^2\alpha\sin^2\beta + \cos^2\alpha\cos^2\beta)}{\cos^2\beta\sin^2\beta}\cos^2\beta$

$= \frac{\cos^2\alpha(\sin^2\beta + \cos^2\beta)}{\sin^2\beta}$

$= \frac{\cos^2\alpha}{\sin^2\beta}(1)$

$= \left(\frac{\cos\alpha}{\sin\beta}\right)^2$

$= n^2$ = RHS

42)

Given $\frac{\cos\theta}{1+\sin\theta} = \frac{1}{a}$

$\therefore a = \frac{1+\sin\theta}{\cos\theta}$

$\text{LHS} = \frac{a^2-1}{a^2+1}$

$= \frac{\left(\frac{1+\sin\theta}{\cos\theta}\right)^2 - 1}{\left(\frac{1+\sin\theta}{\cos\theta}\right)^2 + 1}$

$= \frac{\frac{1^2+\sin^2\theta+2\sin\theta}{\cos^2\theta} - 1}{\frac{1^2+\sin^2\theta+2\sin\theta}{\cos^2\theta} + 1}$

$= \frac{\frac{1+\sin^2\theta+2\sin\theta-\cos^2\theta}{\cos^2\theta}}{\frac{1+\sin^2\theta+2\sin\theta+\cos^2\theta}{\cos^2\theta}}$

$= \frac{(1-\cos^2\theta)+\sin^2\theta+2\sin\theta}{\cos^2\theta} \times \frac{\cos^2\theta}{1+(\sin^2\theta+\cos^2\theta)+2\sin\theta}$

$= \frac{\sin^2\theta+\sin^2\theta+2\sin\theta}{1+1+2\sin\theta}$

$= \frac{2\sin^2\theta+2\sin\theta}{2+2\sin\theta}$

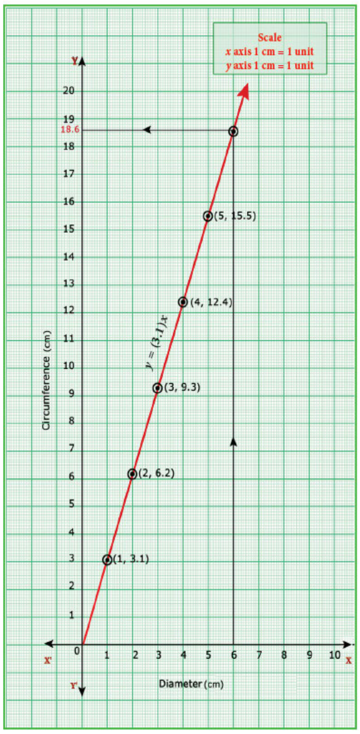
$= \frac{2\sin\theta(\sin\theta+1)}{2(1+\sin\theta)}$

$= \sin\theta$ = RHS

PART - D $\qquad$ 4 x 8 = 32

Answer any one from 43 & 44 and any one from 45 & 46.

43)



From the table, we found that as x increses, y also increases. Thus the variation is a direct variation.

Let y = kx, where k is a constant of proportionality.

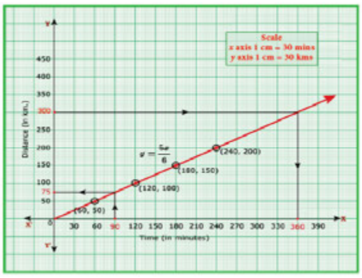
From the given values, we have

$k = \frac{3.1}{1} = \frac{6.2}{2} = \frac{9.3}{3} = \frac{12.4}{4} = \ldots = 3.1$

When you plot the points (1, 3.1) (2, 6.2) (3, 9.3), (4, 12.4), (5, 15.5), you find the relation y = (3.1)x forms a straight-line graph.

Clearly, from the graph, when diameter is 6 cm, its circumference is 18.6 cm.

44)



Let x be the time taken in minutes and y be the distance travelled in km

Time taken **x** (in minutes)	60	120	180	240
Distance **y** (in km)	50	100	150	200

(i) Observe that as time increases, the distance travelled also increases. Therefore, the variation is a direct variation. It is of the form y = kx .

Constant of variation

$k = \frac{y}{x} = \frac{50}{60} = \frac{100}{120} = \frac{150}{180} = \frac{200}{240} = \frac{5}{6}$

Hence, the relation may be given as

$y = kx \Rightarrow y = \frac{5}{6}x$

(ii) From the graph, $y = \frac{5x}{6}$, if x = 90 , then $y = \frac{5}{6} \times 90 = 75 \text{ km}$

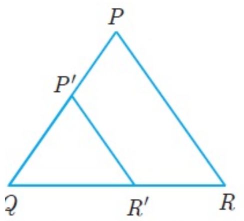
The distance travelled for $1\frac{1}{2}$hours (i.e.,) 90 minutes is 75 km.

(iii) From the graph, $y = \frac{5x}{6}$, if $y = 300$ then $x = \frac{6y}{5} = \frac{6}{5} \times 300 = 360$ minutes (or) 6 hours.

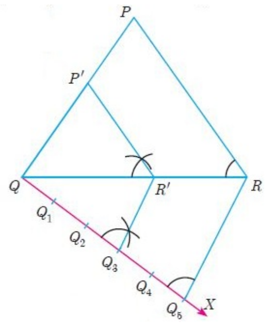
The time taken to cover 300 km is 360 minutes, that is 6 hours.

45)

Given a triangle PQR we are required to construct another triangle whose sides are $\frac{3}{5}$ of the corresponding sides of the triangle PQR.



Rough diagram



Steps of construction

1.Construct a △ PQR with any measurement

2. Draw a ray QX making an acute angle with QR on the side opposite to vertex P.

3. Locate 5 (the greater of 3 and 5 in $\frac{3}{5}$) points.

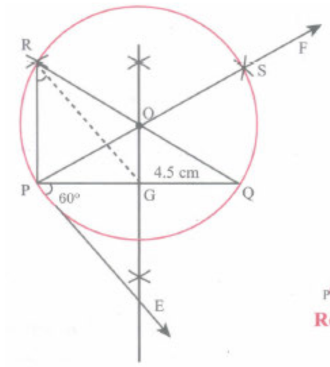
Q_1Q_2, Q_3, Q_4 and Q_5 on QX so that $QQ_1 = Q_1Q_2 = Q\ Q_3 = Q_4Q_5$

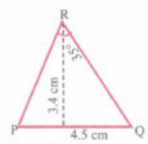
4. Join Q_5R and draw a line through Q_3 (the third point, 3 being smaller of 3 and 5 in $\frac{3}{5}$) parallael to Q_5R to intersect QR at R

5 Draw line through R' pa allel to the line RP to intersect QP at P'.

Then, △P'QR' is the required triangle each of whose sides is three fifths of the corresponding sides of △ PQR.

46)





Rough diagram

Construction:

Step (1) Draw a line segment PQ = 4.5 cm

Step (2) At P, draw PE such that $\angle QPE = 35^0$

Step (3) At P, draw PF such that $\angle EPF = 90^0$

Step (4) Draw ⊥ bisector to PQ which intersects PF at O.

Step (5) With O centre OP as raidus draw a circle.

Step (6) From G, marked arcs of radius 6 cm on the circle marked them as R and S.

Step (7) foined PR and RQ. Then △PQR is the required triangle

Step (8) △PQS is the required triangle