

RBSE Class 10th Maths Question Paper With Solution 2018

QUESTION PAPER CODE S-09-Mathematics

PART - A

Question 1: Find the value of $31 \frac{1}{6} \times 31 \frac{5}{6}$ by using Ekaadhiken Purven Sutra.

Solution:

$$\begin{aligned} & 31 \frac{1}{6} \times 31 \frac{5}{6} \\ &= 31 \times 32 / (1 / 6) \times (5 / 6) \\ &= 992 / (5 / 36) \\ &= 992 (5 / 36) \end{aligned}$$

Question 2: Solve $1 / [x - 3] + 1 / [x - 7] = 1 / [x - 1] + 1 / [x - 9]$.

Solution:

$$\begin{aligned} & 1 / [x - 3] + 1 / [x - 7] = 1 / [x - 1] + 1 / [x - 9] \\ & [x - 7 + x - 3] / [x - 3] [x - 7] = [x - 9 + x - 1] / [x - 1] [x - 9] \\ & [2x - 10] / [x^2 - 10x + 21] = [2x - 10] / [x^2 - 10x + 9] \\ & (2x - 10) (x^2 - 10x + 9) = (2x - 10) (x^2 - 10x + 21) \\ & (2x - 10) (x^2 - 10x) + (2x - 10) 9 = (2x - 10) (x^2 - 10x) + (2x - 10) 21 \\ & 18x - 90 = 42x - 210 \\ & 24x = 120 \\ & x = 5 \end{aligned}$$

Question 3: Write the sum of powers of prime factors of 196.

Solution:

196 is a composite number.

Prime factorization: $196 = 2 \times 2 \times 7 \times 7$

$$196 = 2^2 \times 7^2$$

The sum of the exponents in the prime factorization is $2 + 2 = 4$.

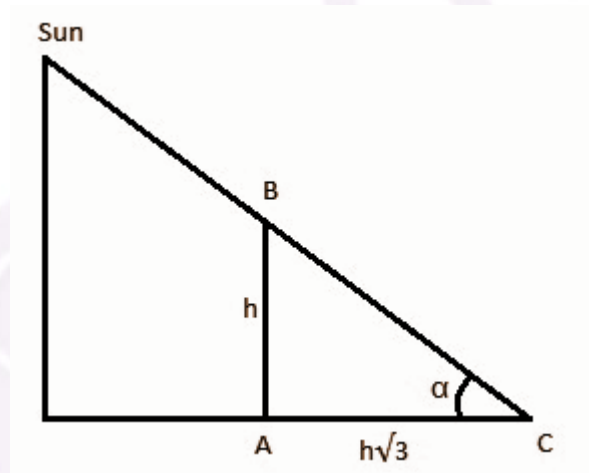
Question 4: Write the value of $\cos 50^\circ \operatorname{cosec} 40^\circ$.

Solution:

$$\begin{aligned}\cos 50^\circ \times \operatorname{cosec} 40^\circ &= \cos 50^\circ \times \operatorname{cosec} (90^\circ - 50^\circ) \\ &= \cos 50^\circ \times \sec 50^\circ \\ &= \cos 50^\circ \times [1 / (\cos 50^\circ)] \\ &= 1\end{aligned}$$

Question 5: If the ratio of the length of a vertical bar to its shadow is $1 : \sqrt{3}$, then find the elevation angle of the sun.

Solution:



In triangle CAB,

$$\tan \alpha = BA / CA$$

$$\tan \alpha = h / h\sqrt{3}$$

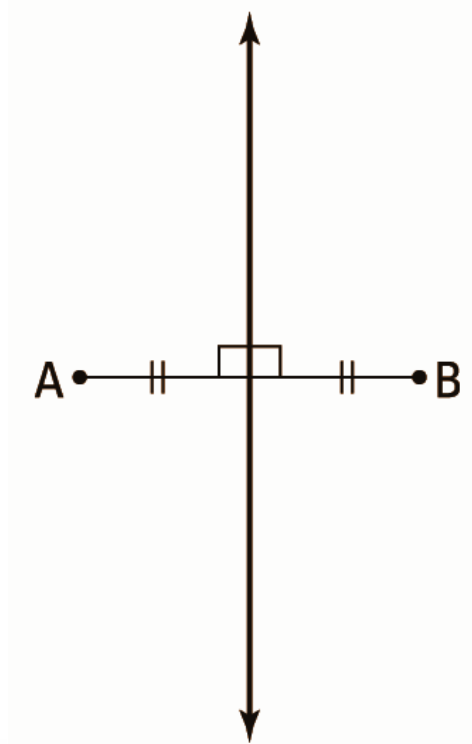
$$\tan \alpha = 1 / \sqrt{3}$$

$$\alpha = 30^\circ$$

The elevation angle of the sun is 30° .

Question 6: Write the locus of the points equidistant from the two given points.

Solution:



The locus of points equidistant from two given points is the perpendicular bisector of the segment that joins the two points.

Question 7: Find the ratio between the chords which are equidistant from the centre of a circle.

Solution:

The chords are equidistant from the centre are equal.

Let the chords be AB, CD

Centre of the circle O.

Let the midpoints of chords be X, Y.

Now, $OX = a$, $OY = b$.

Also, $AB = c$, $CD = d$.

Given, $OX = OY$

So, $a = b$.

If $a = b$, $AB = CD$

That is $c = d$.

From the question,

$$AB / CD = c / d = c / c = d / d = 1$$

Therefore, the ratio of chords which are equidistant from the centre is 1.

Question 8: A dice is thrown once. Find the probability of getting an odd number.

Solution:

Total outcomes that can occur are 1, 2, 3, 4, 5, 6

Number of possible outcomes of a dice = 6

Numbers which are odd = 1, 3, 5

Total numbers which are odd = 3

Probability of getting an odd number

$$= (\text{Number of outcomes where there is an odd}) \div (\text{Total number of outcomes})$$

$$= 3 / 6$$

$$= 1 / 2$$

Question 9: In a city, the fare of a taxi for the first kilometre is Rs. 5 and after that, it is Rs. 3. If the distance covered is x km and fare is Rs. y , then express it in the form of the equation.

Solution:

Total distance covered is x .

Fare for 1st kilometer = Rs. 5

Fare for the rest of the distance = Rs. $(x - 1) 3$

Total fare = Rs. $5 + [x - 1]3$

$$y = 5 + 3x - 3$$

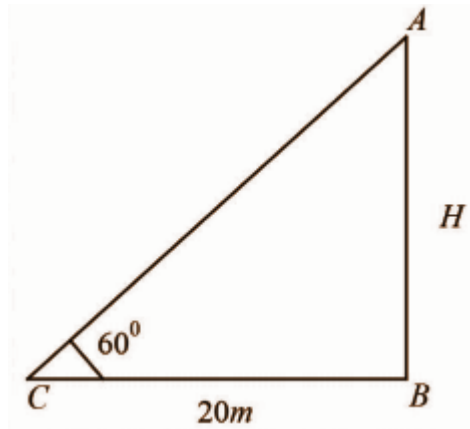
$$y = 3x + 2$$

$$3x - y + 2 = 0$$

Hence, the value of the equation is $3x - y + 2 = 0$.

Question 10: If the elevation angle of a camera situated at the top of a pole from a point 20 metre away from the base of the pole is 60° , find the height of the pole.

Solution:



$$\tan 60^\circ = AB / BC$$

$$\sqrt{3} = H / 20$$

$$H = 20\sqrt{3} \text{ m}$$

PART - B

Question 11: Find the square root of 6889 by using Dwandwa Yoga Method.

Solution:

Simplify the expression,

Using the Dwandwa yoga method,

8	68	89
16		40
	8	3

Step 1: First square root 8 and remainder = $68 - 64 = 4$.

$$8 * 2 = 16$$

Step 2: New dividend $48 \div 16 = 3$, remainder = 0.

Implement dividend $9 - 3^2 = 0$.

Hence, the value is 83.

Question 12: If the product of two numbers is 525 and their H.C.F. is 5, then find their L.C.M.

Solution:

Simplify the expression,

$\text{HCF}(A, B) * \text{LCM}(A, B) = \text{Product of A and B.}$

$$5 * \text{LCM} = 525$$

$$\text{LCM} = 525 / 5$$

$$\text{LCM} = 105$$

Question 13: The total surface area of a cube is 216 square metre. Find the side of the cube.

Solution:

The total surface area of the cube is 216 cm^2 .

The total surface area of the cube is $6a^2$.

$$6a^2 = 216$$

$$\Rightarrow a^2 = 216 / 6$$

$$\Rightarrow a^2 = 36$$

$$\Rightarrow a = 6$$

Therefore, the side of the given cube is 6cm.

Question 14: The radius of a semi-sphere is 7 cm, find the total surface area of it.

Solution:

The total surface area of a semi-sphere is $3\pi r^2$.

Radius $r = 7\text{cm}$

$$\text{TSA} = 3 * (22 / 7) * (7^2)$$

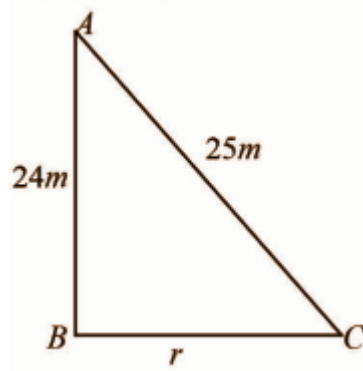
$$= 3 * 22 * 7$$

$$= 462 \text{ cm}^2$$

Hence, the total surface area of the semi-sphere is 462cm^2 .

Question 15: A CCTV camera is placed on the top of a 24 m high pole in such a way that traffic can be seen beyond 25 metres of the line of sight of it. Find the area of the Green patch around the pole.

Solution:



Using Pythagoras theorem,

$$25^2 = 24^2 + r^2$$

$$r^2 = 25^2 - 24^2$$

$$= 625 - 576$$

$$= 49$$

$$r = 7\text{m}$$

Area of the green patch around the pole = πr^2

$$= (22 / 7) * (7^2)$$

$$= 22 * 7$$

$$= 154\text{m}^2$$

Question 16: By using the division algorithm method find quotient and remainder when polynomial $P(x) = x^4 - 3x^2 + 4x - 3$ is divided by $g(x) = x^2 + 1 - x$.

Solution:

$$\begin{array}{r}
 P(x) = x^4 - 0x^3 - 3x^2 + 4x - 3 \\
 g(x) = x^2 - x + 1 \\
 \begin{array}{r}
 x^2 - x + 1 \overline{) x^4 + 0x^3 - 3x^2 + 4x - 3} \\
 \underline{x^4 - x^3 + x^2} \\
 x^3 - 4x^2 + 4x \\
 \underline{x^3 - x^2 + x} \\
 -3x^2 + 3x - 3 \\
 \underline{-3x^2 + 3x - 3} \\
 0
 \end{array}
 \end{array}$$

$$p(x) = g(x) * q(x) + r(x)$$

$$x^4 - 3x^2 + 4x - 3 = [x^2 + 1 - x] [x^2 + x - 3] + 0$$

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

Hence, $x^4 - 3x^2 + 4x - 3$ and remainder 0.

Question 17: If the second and third terms of an Arithmetic Progression are 3 and 5 respectively, then find the sum of the first 20 terms of it.

Solution:

Simplify the A.P expression,

Second and third terms of an Arithmetic Progression are 3 and 5.

$$a = 3$$

$$d = 5 - 3 = 2$$

$$n = 20$$

$$d = a_2 - a_1$$

$$2 = 3 - a_1$$

$$2 - 3 = -a_1$$

$$-1 = -a_1$$

$$a_1 = 1$$

$$S_n = [n / 2] (2a + [n - 1]d)$$

$$= [20 / 2] [2 * 1 + [20 - 1] * 2]$$

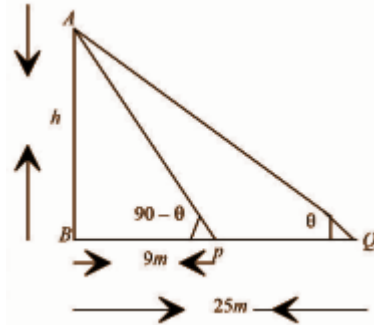
$$= 10 [2 + 38]$$

$$= 400$$

$$S_{20} = 400$$

Question 18: The angles of elevation of the top of a tower from two points at a distance of 9 m and 25 m from the base of the tower in the same straight line are complementary. Find the height of the tower.

Solution:



In the triangle ABP,

$$h / 9 = \tan \theta \text{ ---- (1)}$$

$$h / 9 = \tan (90 - \theta) = \cot \theta$$

In triangle ABQ,

$$h / 25 = \tan \theta \text{ ---- (2)}$$

Multiply equation (1) and (2),

$$[h / 9] [h / 25] = \cot \theta * \tan \theta$$

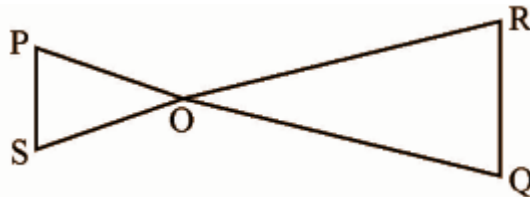
$$h^2 = 9 * 25$$

$$h^2 = 225$$

$$h = 15\text{m}$$

The height of the tower is $h = 15\text{m}$.

Question 19: In the given figure if $OP * OQ = OR * OS$, then show that $\angle OPS = \angle ORQ$ and $\angle OQR = \angle OSP$.



Solution:

In the triangle POS and ROQ,

$$OP / OS = OR / OQ$$

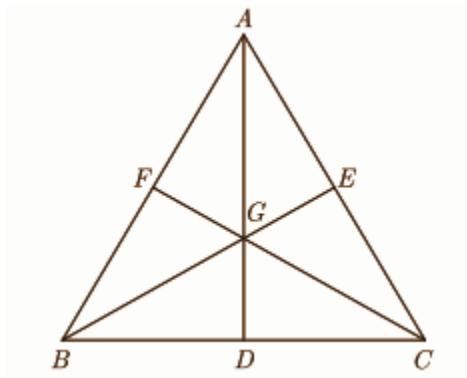
$\angle POS = \angle ROQ$ [vertically opposite angles]

So, POS and ROQ are congruent triangles by SAS and their corresponding angles are equal.

Therefore, $\angle OPS = \angle ORQ$ and $\angle OQR = \angle OSP$.

Question 20: In a triangle ABC, the medians AD, BE and CF pass-through point G. If $AD = 9$ cm, $GE = 4.2$ cm and $GC = 6$ cm, then find the values of the lengths of AG, BE and FG.

Solution:



$$AG / GD = 2 / 1$$

$$GD / AG = 1 / 2$$

$$[GD / AG] + 1 = [1 + 2] / 2$$

$$9 / AG = 3 / 2$$

$$AG = [9 * 2] / 3 = 6\text{cm}$$

$$BG / GE = 2 / 1$$

$$[BG / GE] + 1 = [2 / 1] + 1$$

$$[BG + GE] / GE = [2 + 1] / 1$$

$$BE / GE = 3 / 1$$

$$BE = 3 * GE = 3 * 4.2 = 12.6\text{cm}$$

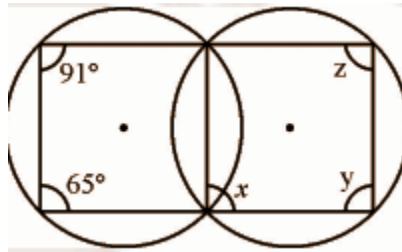
$$FG / GC = 1 / 2$$

$$FG = [1 / 2] GC$$

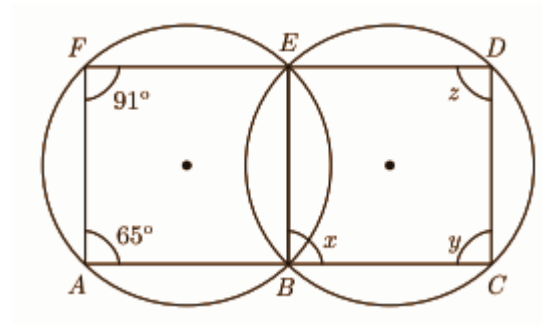
$$= [1 / 2] * 6$$

$$= 3\text{cm}$$

Question 21: In the given figure some angles are represented by x, y and z. Find the values of these angles.



Solution:



$$65 + x = 180^\circ$$

$$x = 180 - 65$$

$$x = 115^\circ$$

Since, $\angle AFE = \angle CBE$

$$91^\circ = x$$

$$x + z = 180^\circ$$

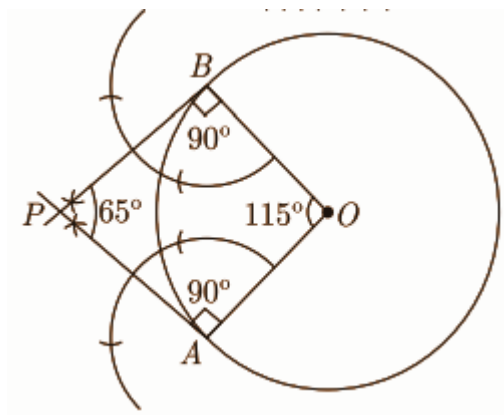
$$z = 180 - x$$

$$= 180 - 91$$

$$z = 89^\circ$$

Question 22: Draw two tangents PA and PB from an external point P to a circle of radius 4 cm, where the angle between PA and PB is 65° .

Solution:



Question 23: The radius of a circular park is 4.2 m. A path of 1.4 m width is made around the circular park. Find the area of the path.

Solution:

Radius (R) of circular park = 4.2 m

Area of the circular park = πr^2

$$= [22 / 7] * 4.2 * 4.2$$

$$= 55.44 \text{ m}^2$$

Width (r) of the circular path = 1.4 m

Area of the circular park including the circular path = $\pi(R + r)^2$ sq.m

$$= [22 / 7] * (4.2 + 1.4)^2$$

$$= [22 / 7] * 5.6 * 5.6$$

$$= 98.56 \text{ m}^2$$

Area of Path = Area of the park incl. path - Area of the park

$$= 98.56 - 55.44$$

$$= 43.12 \text{ m}^2$$

Question 24: The length and diameter of a roller are 2.5 m and 1.4 m respectively. How much area will be planned by roller in 10 revolutions?

Solution:

Diameter of the roller = 1.4 m

Radius of the roller = 0.7m

Length of the roller = 2.5 m

Area covered by the roller in 1 revolution = Curved surface area of the roller

$$= 2\pi rh$$

$$= 2 \times [22 / 7] \times 0.7 \times 2.5$$

$$= 11 \text{ m}^2$$

Area covered by the roller in 10 revolutions = $11 \times 10 = 110 \text{ m}^2$.

Question 25: In a bag one white ball, two black balls and three red balls of the same size are placed.

A ball is drawn at random from this bag. Find the probability:

(i) the ball is white

(ii) the ball is not black

(iii) the ball is red

Solution:

Total number of all possible outcomes = $1 + 2 + 3 = 6$

(i) Number of white ball = 1

P(getting a white ball) = $1 / 6$

(ii) Number of balls that are not black = $1 + 3 = 4$

P(not drawing a black ball) = $4 / 6 = 2 / 3$

(iii) Number of red balls = 3

P(drawing a red ball) = $3 / 6 = 1 / 2$

Question 26: Solve the following pair of linear equations by graphical method:

$2x + y = 6$, $2x - y = 2$. Thus find the value of p in the relation $6x + 7y = p$.

Solution:

$$2x + y = 6 \text{ ---- (1)}$$

$$2x - y = 2 \text{ ---- (2)}$$

$$4x = 8$$

$$x = 2$$

Put $x = 2$ in (1),

$$2 * 2 + y = 6$$

$$y = 6 - 4$$

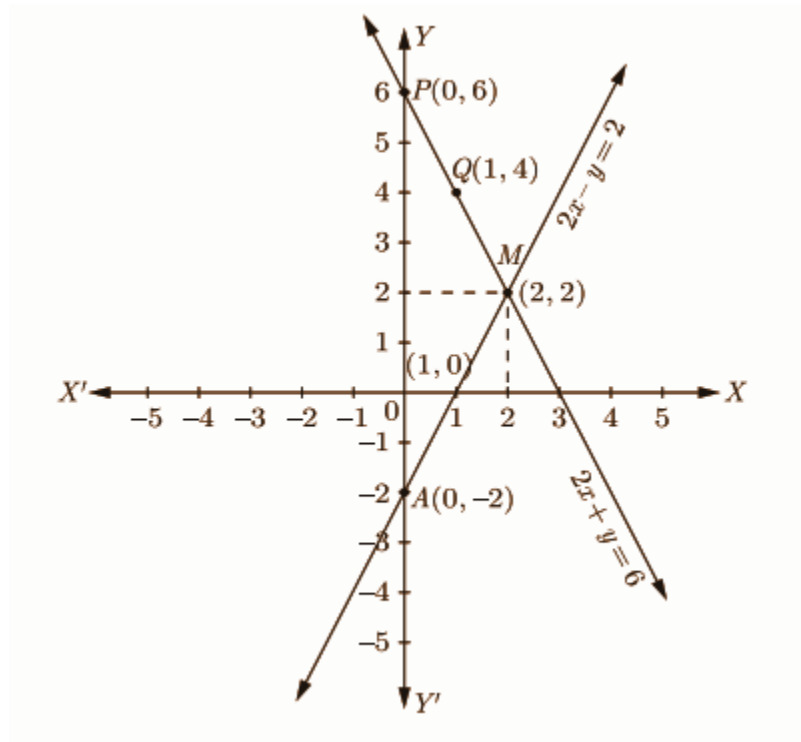
$$y = 2$$

$$\text{In } 6x + 7y = p$$

$$6 * 2 + 7 * 2$$

$$= 12 + 14$$

$$= 26$$



Question 27: Prove that:

[i] $\sqrt{[1 + \cos \theta] / [1 - \cos \theta]} = \operatorname{cosec} \theta + \cot \theta$

[ii] $\tan \theta / [1 - \cot \theta] + \cot \theta / [1 - \tan \theta] = 1 + \tan \theta + \cot \theta$

OR

[i] If $\sin \theta + \cos \theta = p$ and $\sec \theta + \operatorname{cosec} \theta = q$, then prove that $q(p^2 - 1) = 2p$.

[ii] Prove that:

$$\cos A / [1 - \tan A] + \sin A / [1 - \cot A] = \sin A + \cos A$$

Solution:

[i] $\sqrt{[1 + \cos \theta] / [1 - \cos \theta]}$

$$\begin{aligned}
 \sqrt{\frac{1+\cos\theta}{1-\cos\theta}} &= \sqrt{\frac{1+\cos\theta}{1-\cos\theta} \times \frac{1+\cos\theta}{1+\cos\theta}} \\
 &= \sqrt{\frac{(1+\cos\theta)^2}{1-\cos^2\theta}} \\
 &= \sqrt{\frac{(1+\cos\theta)^2}{\sin^2\theta}} \\
 &= \frac{1+\cos\theta}{\sin\theta} \\
 &= \operatorname{cosec}\theta + \cot\theta
 \end{aligned}$$

$$[\text{ii}] \tan \theta / [1 - \cot \theta] + \cot \theta / [1 - \tan \theta] = 1 + \tan \theta + \cot \theta$$

$$\begin{aligned}
 \text{LHS} &= \tan\theta / (1 - \cot\theta) + \cot\theta / (1 - \tan\theta) \\
 &= \tan\theta / (1 - 1/\tan\theta) + (1/\tan\theta) / (1 - \tan\theta) \\
 &= \tan^2\theta / (\tan\theta - 1) + 1 / \tan\theta (1 - \tan\theta) \\
 &= \tan^3\theta / (\tan\theta - 1) - 1 / \tan\theta (\tan\theta - 1) \\
 &= (\tan^3\theta - 1) / \tan\theta (\tan\theta - 1) \\
 &= (\tan\theta - 1)(\tan^2\theta + 1 + \tan\theta) / \tan\theta (\tan\theta - 1) \\
 &= (\tan^2\theta + 1 + \tan\theta) / \tan\theta \\
 &= \tan\theta + \cot\theta + 1
 \end{aligned}$$

OR

[i] If $\sin \theta + \cos \theta = p$ and $\sec \theta + \operatorname{cosec} \theta = q$, then prove that $q(p^2 - 1) = 2p$.

Consider, $\sec \theta + \operatorname{cosec} \theta = q$

$$\Rightarrow [(1/\sin\theta) + (1/\cos\theta)] = q$$

$$\Rightarrow [(\sin\theta + \cos\theta) / \sin\theta \cos\theta] = q$$

$$\Rightarrow [p / \sin\theta \cos\theta] = q$$

$$\Rightarrow \sin\theta \cos\theta = p / q \rightarrow (1)$$

Consider, $\sin\theta + \cos\theta = p$

Squaring on both the sides we get

$$(\sin\theta + \cos\theta)^2 = p^2$$

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

$$\Rightarrow 1 + 2(p/q) = p^2 \text{ [From (1)]}$$

$$\Rightarrow (q + 2p) / q = p^2$$

$$\Rightarrow (q + 2p) = p^2 q$$

$$\Rightarrow 2p = p^2 q - q$$

$$\Rightarrow 2p = q(p^2 - 1)$$

$$[\text{ii}] \cos A / [1 - \tan A] + \sin A / [1 - \cot A] = \sin A + \cos A$$

$$\cos A / (1 - \tan A) + \sin A / (1 - \cot A) = \sin A + \cos A$$

$$\text{LHS} = \cos A / (1 - \tan A) + \sin A / (1 - \cot A)$$

$$= \cos A / (\cos A - \sin A) + \sin A / (\sin A - \cos A)$$

$$= \cos A / (\cos A - \sin A) - \sin A / (\cos A - \sin A)$$

$$= (\cos A - \sin A) / (\cos A - \sin A)$$

$$= (\cos A + \sin A) (\cos A - \sin A) / (\cos A - \sin A)$$

$$= (\cos A + \sin A)$$

Question 28:

[i] If the distance between points (x, 3) and (5, 7) is 5, then find the value of x.

[ii] Find the ratio in which the line $3x + y = 9$ divides the line segment joining the points (1, 3) and (2, 7).

Solution:

$$[\text{i}] \text{ Let } (x_1, y_1) = (x, 3)$$

$$(x_2, y_2) = (5, 7)$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$5 = \sqrt{(5 - x)^2 + (7 - 3)^2}$$

$$d = 5$$

On squaring of both sides,

$$25 = (5 - x)^2 + 16$$

$$25 - 16 = (5 - x)^2$$

$$9 = (5 - x)^2$$

$$(5 - x) = \pm 3$$

$$\text{If } x = 3,$$

$$5 - x = 3$$

$$5 - 3 = x$$

$$x = 2$$

$$\text{If } x = -3,$$

$$5 - (-3) = 3$$

$$x = 8$$

$$x = 2, 8$$

[ii] Let the line divides the points in $k:1$ ratio according to section formula

$$(2k + 1 / k + 1, 7k + 3 / k + 1) = (x, y)$$

It must satisfy the given equation so

$$3(2k + 1 / k + 1) + (7k + 3 / k + 1) = 9$$

$$6k + 3 + 7k + 3 / k + 1 = 9$$

$$13k + 6 = 9k + 9$$

$$13k - 9k = 9 - 6$$

$$4k = 3$$

$$k = 3 / 4$$

Hence, the ratio is 3:4.

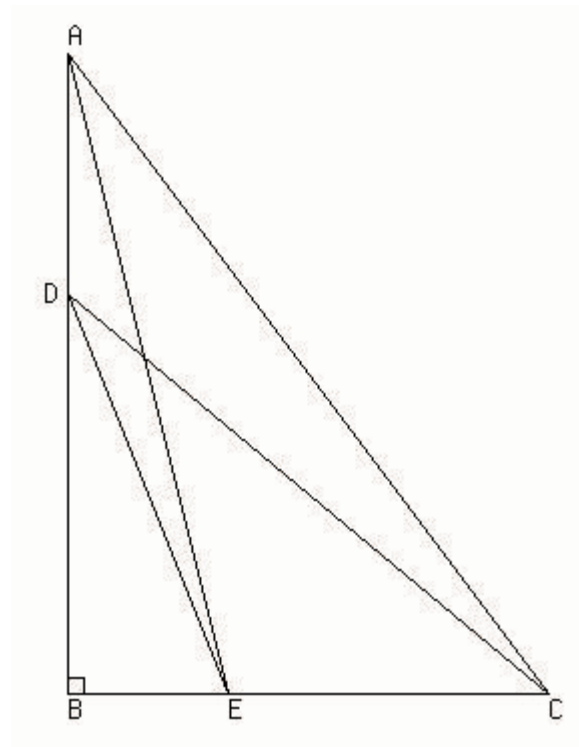
Question 29: [i] ABC is a right-angled triangle whose angle B is a right angle. If points D and E are situated on the sides AB and BC respectively, then prove that $AE^2 + CD^2 = AC^2 + DE^2$.

OR

[ii] If two sides of a cyclic quadrilateral are parallel, then prove that other sides are equal and its diagonals are also equal to each other.

Solution:

[i]



$\triangle ABE$ is a right triangle, right-angled at B

$AB^2 + BE^2 = AE^2$(1) (by the Pythagoras theorem)

$\triangle DBC$ is a right triangle, right-angled at B

$DB^2 + BC^2 = CD^2$(2) (by the Pythagoras theorem)

Adding equations 1 & 2

$AE^2 + CD^2 = (AB^2 + BE^2) + (BD^2 + BC^2)$

$AE^2 + CD^2 = (AB^2 + BC^2) + (BE^2 + BD^2)$(3) [Rearranging the terms]

$\triangle ABC$ is a right triangle,

$AB^2 + BC^2 = AC^2$(4) (by the Pythagoras theorem)

$\triangle DBE$ is a right triangle

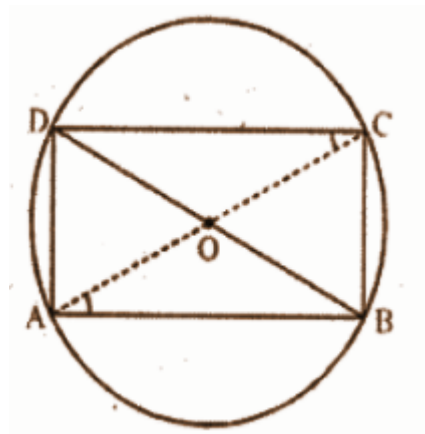
$DB^2 + BE^2 = DE^2$(5) (by the Pythagoras theorem)

$AE^2 + CD^2 = (AB^2 + BC^2) + (BE^2 + BD^2)$

$AE^2 + CD^2 = AC^2 + DE^2$

OR

[ii]



$AB \parallel DC \Rightarrow \angle DCA = \angle CAB$ [alternate angles]

Now, chord AD subtends $\angle DCA$ and chord BC subtends $\angle CAB$ at the circumference of the circle.

$\angle DCA = \angle CAB$ [proved]

Chord AD = Chord BC or $AD = BC$

Now in triangle ABC and ADB,

$AB = AB$ [common]

$\angle ACB = \angle ADB$ [angles in the same segment]

$BC = AD$ [proved]

By SAS criterion of congruence,

$\triangle ACB \cong \triangle ADB$ [SAS postulate]

The corresponding parts of the congruent triangles are congruent.

$AC = BD$

Question 30: Find the mean and mode of the following frequency distribution:

Score	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70
Number of Students	4	28	42	20	6

Solution:

Score	Number of students	Mid value	$(f_i * x_i)$
20 - 30	4	25	100

30 - 40	28	35	980
40 - 50	42	45	1890
50 - 60	20	55	1100
60 - 70	6	65	390
	N = 100		4460

$$\text{Mean} = 4460 / 100$$

$$= 44.6$$

Hence, the mean is 44.6.

As the lifetime (in hours) 40 - 50 has a maximum frequency, so it is the modal lifetime in hours.

$$x_k = 40, h = 10, f_k = 42, f_{k-1} = 28, f_{k+1} = 20$$

$$\text{Mode, } M_0 = x_k + \left\{ h \times \frac{(f_k - f_{k-1})}{(2f_k - f_{k-1} - f_{k+1})} \right\}$$

$$= 40 + [10 * [42 - 28] / [2 * 42 - 28 - 20]]$$

$$= 40 + [3.89]$$

$$= 43.89$$

Hence, the mode is 43.89.