RBSE Class 10th Maths Question Paper With Solution 2018

QUESTION PAPER CODE S–09–Mathematics

PART - A

Question 1: Find the value of 31 (1 / 6) * 31 (5 / 6) by using Ekaadhiken Purven Sutra.

Solution:

31 1/6 × 31 5/6

= 31 × 32 / (1 / 6) × (5 / 6)

= 992 / (5 / 36)

= 992 (5 / 36)

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

Solution:

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

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

Solution:

196 is a composite number.

Prime factorization: 196 = 2 × 2 × 7 × 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 50º cosec 40º.

Solution:

$\cos 50^\circ \times \text{cosec } 40^\circ$

$= \cos 50^\circ \times \text{cosec } (90^\circ - 50^\circ)$

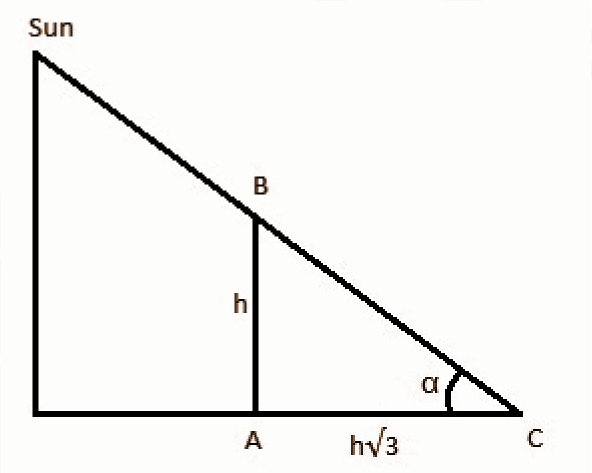
$= \cos 50^\circ \times \sec 50^\circ$

$= \cos 50^\circ \times [1 / (\cos 50^\circ)]$

$= 1$

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

Solution:



In triangle CAB,

$\tan \alpha = BA / CA$

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

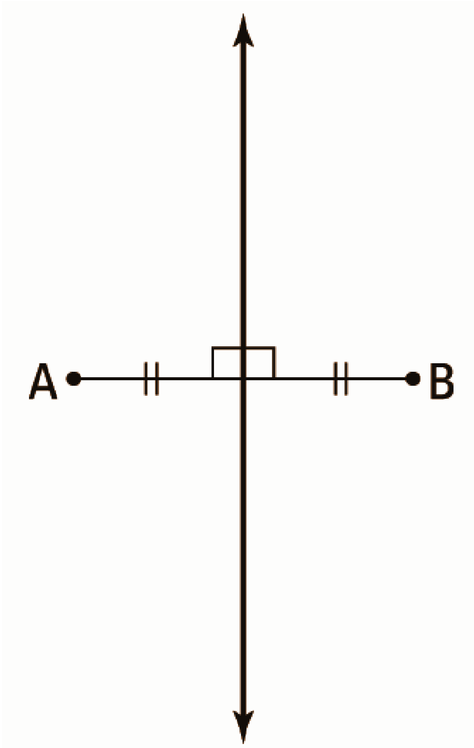
$\tan \alpha = 1 / \sqrt{3}$

$\alpha = 30^\circ$

The elevation angle of the sun is 30º.

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.

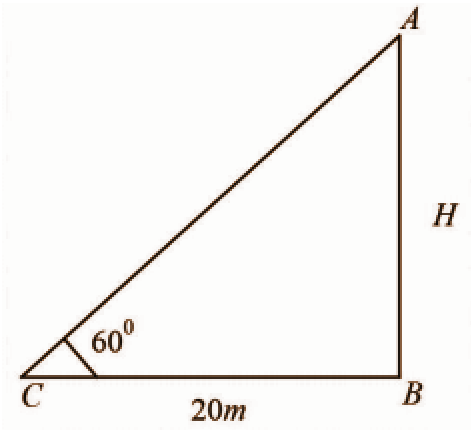
Solution:
Total outcomes that can occur are 1, 2, 3, 4, 5, 6
Number of possible outcomes of a dice = 6
Numbers which are odd = 1, 3, 5
Total numbers which are odd = 3
Probability of getting an odd number
= (Number of outcomes where there is an odd) ÷ (Total number of outcomes)
= 3 / 6
= 1 / 2

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 1^{st} 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 60º, find the height of the pole.

Solution:



tan 60º = AB / BC

$\sqrt{3} = H / 20$

$H = 20\sqrt{3}$ 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 16	6 8	8 9 4 0
	8	3

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

8 * 2 = 16

Step 2: New dividend 48 ÷ 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,
HCF (A, B)* LCM(A, B) = Product of A and B.
5 * LCM = 525
LCM = 525 / 5
LCM = 105

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

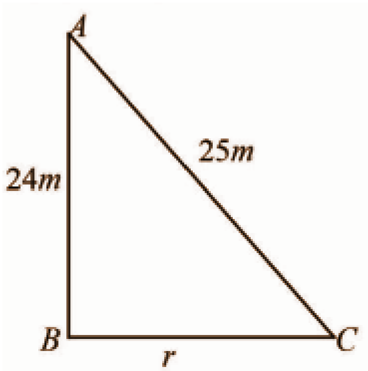
Solution:
The total surface area of the cube is 216 cm^2.
The total surface area of the cube is $6a^2$.
$6a^2 = 216$
=> $a^2 = 216 / 6$
=> $a^2 = 36$
=> a = 6
Therefore, the side of the given cube is 6cm.

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 = 7cm
TSA = 3 * (22 / 7) * (7^2)
= 3 * 22 * 7
= 462 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,

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

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

$= 625 - 576$

$= 49$

$r = 7m$

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

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

$= 22 * 7$

$= 154m^2$

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:

$$P(x) = x^4 - 0x^3 - 3x^2 + 4x - 3$$

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

$$x^2 - x + 1 \overline{\smash{)}\, x^4 + 0x^3 - 3x^2 + 4x - 3}$$

Quotient: $x^2 + x - 3$

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

$$- \; + \quad -$$

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

$$x^3 - x^2 + x$$

$$- \; + \quad -$$

$$-3x^2 + 3x - 3$$

$$-3x^2 + 3x - 3$$

$$+ \quad - \quad +$$

$$0$$

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]

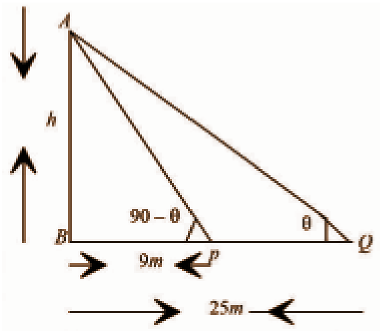
= 10 [2 + 38]

= 400

$S_{20} = 400$

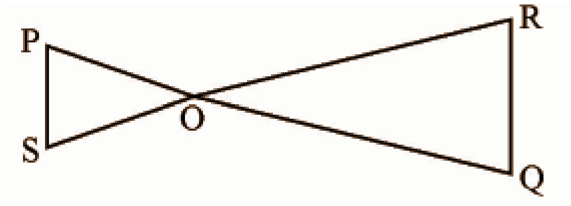
Question 18: The angles of elevation of the top of a tower from two points at a distance of 9 m and 25 m from the base of the tower in the same straight line are complementary. Find the height of the tower.

Solution:



In the triangle ABP,
h / 9 = tan θ ---- (1)
h / 9 = tan (90 - θ) = cot θ
In triangle ABQ,
h / 25 = tan θ ---- (2)
Multiply equation (1) and (2),
[h / 9] [h / 25] = cot θ * tan θ
$h^2 = 9 * 25$
$h^2 = 225$
h = 15m
The height of the tower is h = 15m.

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



Solution:
In the triangle POS and ROQ,
OP / OS = OR / OQ

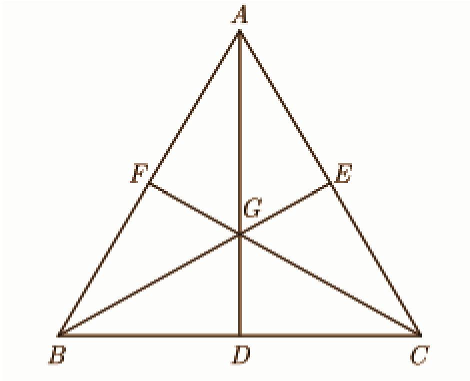
∠POS = ∠ROQ [vertically opposite angles]

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

Therefore, ∠OPS = ∠ORQ and ∠OQR = ∠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 = 6cm

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 = 12.6cm

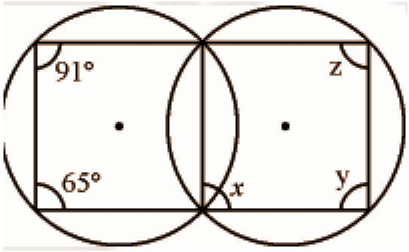
FG / GC = 1 / 2

FG = [1 / 2] GC

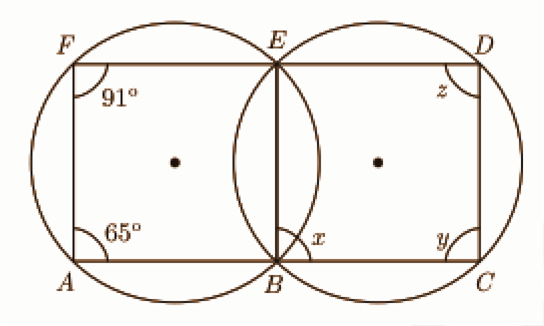
= [1 / 2] * 6

= 3cm

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°

x = 180 - 65

x = 115°

Since, ∠AFE = ∠CBE

91° = x

x + z = 180°

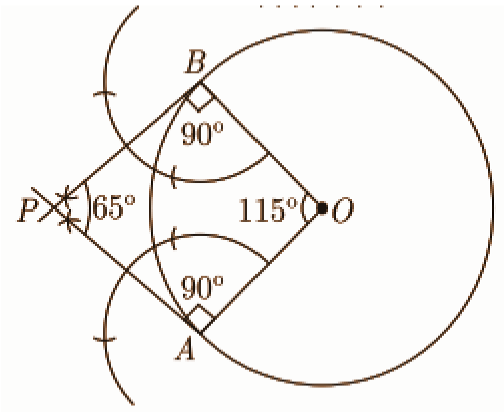
z = 180 - x

= 180 - 91

z = 89°

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 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 m^2

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

= 98.56 - 55.44

= 43.12 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

$= 2\pi rh$
$= 2 \times [22 / 7] \times 0.7 \times 2.5$
$= 11\ m^2$
Area covered by the roller in 10 revolutions = $11 \times 10 = 110\ m^2$.

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

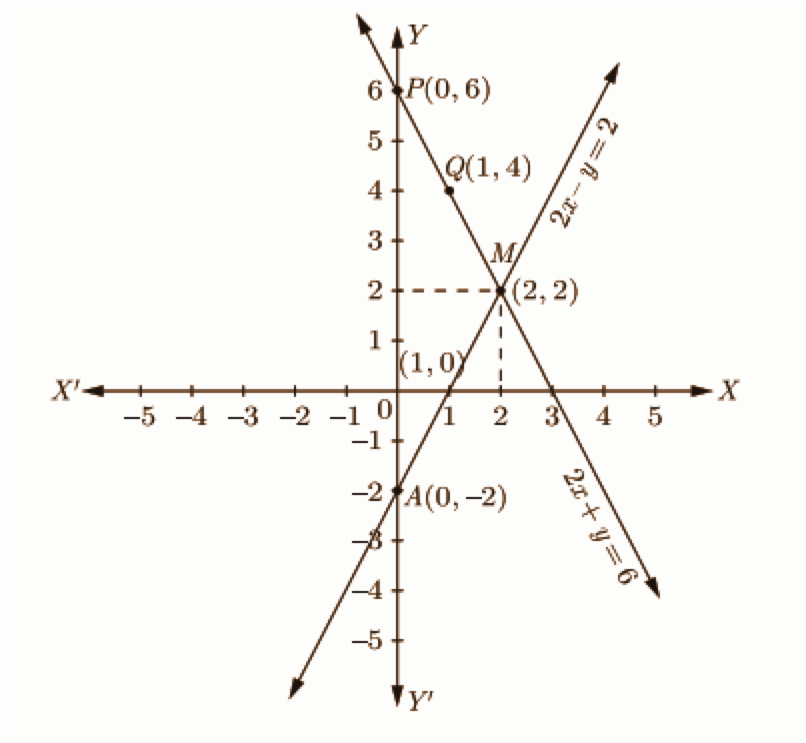
(ii) Number of balls that are not black = 1 + 3 = 4
P(not drawing a black ball) = 4 / 6 = 2 / 3

(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 ---- (1)
2x – y = 2 ---- (2)
4x = 8
x = 2
Put x = 1 in (1),
2 * 2 + y = 6
y = 6 - 4

y = 2
In 6x + 7y = p
6 * 2 + 7 * 2
= 12 + 14
= 26



Question 27: Prove that:

[i] √[1 + cos θ] / [1 − cos θ] = cosec θ + cot θ

[ii] tan θ / [1 - cot θ] + cot θ / [1 - tan θ] = 1 + tan θ + cot θ

OR

[i] If sin θ + cos θ = p and sec θ + cosec θ = 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] √[1 + cos θ] / [1 − cos θ]

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

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

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

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

$$= \text{cosec}\,\theta + \cot\theta$$

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

LHS = $\tan\theta / (1 - \cot\theta) + \cot\theta / (1 - \tan\theta)$

$= \tan\theta / (1 - 1 / \tan\theta) + (1 / \tan\theta) / (1 - \tan\theta)$

$= \tan^2\theta / (\tan\theta - 1) + 1 / \tan\theta (1 - \tan\theta)$

$= \tan^3\theta / (\tan\theta - 1) - 1 / \tan\theta (\tan\theta - 1)$

$= (\tan^3\theta - 1) / \tan\theta (\tan\theta - 1)$

$= (\tan\theta - 1)(\tan^2\theta + 1 + \tan\theta) / \tan\theta (\tan\theta - 1)$

$= (\tan^2\theta + 1 + \tan\theta) / \tan\theta$

$= \tan\theta + \cot\theta + 1$

OR

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

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

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

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

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

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

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

Squaring on both the sides we get

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

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

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

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

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

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

⇒ $2p = q(p^2 – 1)$

[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
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:
[i] 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) = ± 3
If x = 3,
5 - x = 3
5 - 3 = x
x = 2
If x = -3,
5 - (-3) = 3
x = 8

x = 2, 8

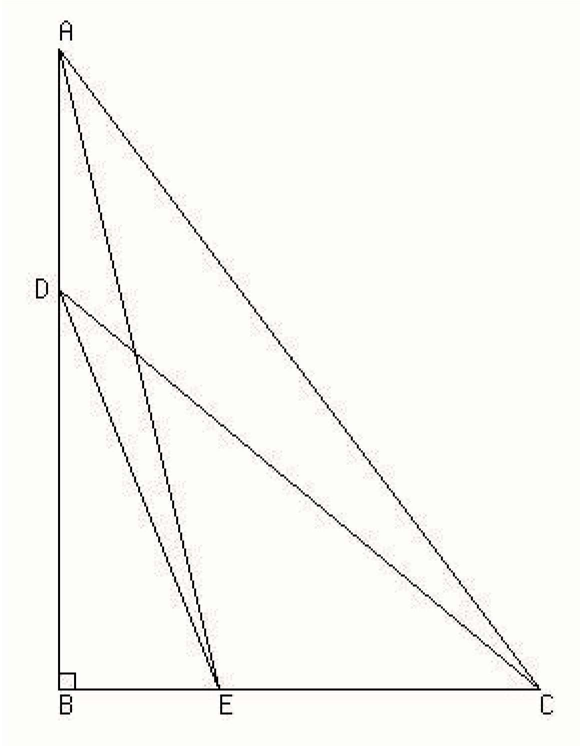
[ii] Let the line divides the points in k:1 ratio according to section formula
(2k + 1 / k + 1, 7k + 3 / k + 1) = (x, y)
It must satisfy the given equation so
3(2k + 1 / k + 1) + (7k + 3 / k + 1) = 9
6k + 3 + 7k + 3 / k + 1 = 9
13k + 6 = 9k + 9
13k - 9k = 9 - 6
4k = 3
k = 3 / 4
Hence, the ratio is 3:4.

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]



ΔABE is a right triangle, right-angled at B

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

ΔDBC 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]

ΔABC is a right triangle,

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

ΔDBE is a right triangle

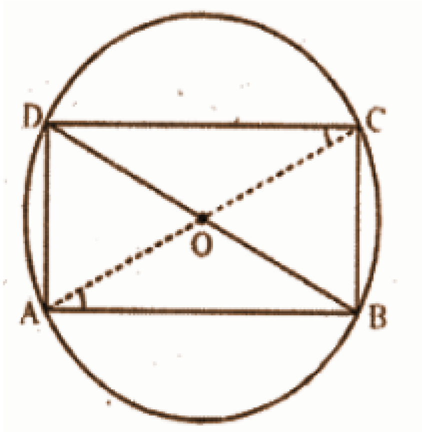
$DB^2 + BE^2 = DE^2$………………(5) (by the Pythagoras theorem)

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

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

OR

[ii]



AB || DC ⇒ ∠DCA = ∠CAB [alternate angles]

Now, chord AD subtends ∠DCA and chord BC subtends ∠CAB at the circumference of the circle.

∠DCA = ∠CAB [proved]

Chord AD = Chord BC or AD = BC

Now in triangle ABC and ADB,

AB = AB [common]

∠ACB = ∠ADB [angles in the same segment]

BC = AD [proved]

By SAS criterion of congruence,

△ACB ≅ △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**

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.

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

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

= 40 + [10 * [42 - 28] / [2 * 42 - 28 - 20]]
= 40 + [3.89]
= 43.89
Hence, the mode is 43.89.