CBSE Sample Paper-05 (solved)
SUMMATIVE ASSESSMENT –II
MATHEMATICS
Class – IX

Time allowed: 3 hours Maximum Marks: 90

General Instructions:

a) All questions are compulsory.
b) The question paper consists of 31 questions divided into five sections – A, B, C, D and E.
c) Section A contains 4 questions of 1 mark each which are multiple choice questions, Section B contains 6 questions of 2 marks each, Section C contains 8 questions of 3 marks each, Section D contains 10 questions of 4 marks each and Section E contains three OTBA questions of 3 mark, 3 mark and 4 mark.
d) Use of calculator is not permitted.

Section A

1. The positive solution of the equation $ax+by+c=0$ always lie in the
   (a) 1^{st} quadrant
   (b) 2^{nd} quadrant
   (c) 3^{rd} quadrant
   (d) 4^{th} quadrant
2. ABCD is a quadrilateral whose diagonal AC divides it into two parts, equal in area, then ABCD
   (a) Is a rectangle
   (b) Is always a rhombus
   (c) Is a parallelogram
   (d) None of the above
3. The ratio of the volumes of the two spheres is 1 : 27. The ratio of their radii
   (a) 1:3
   (b) 1:9
   (c) 3:1
   (d) 1:27
4. There are 60 boys and 40 girls in a class. A student is selected at random. Find the probability that the student is a girl.
   (a) $\frac{1}{5}$
   (b) $\frac{2}{5}$
   (c) $\frac{3}{5}$
   (d) $\frac{4}{5}$

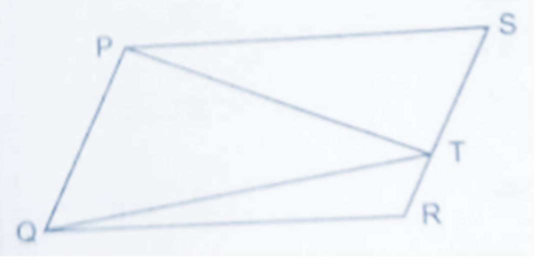
Section B

5. Find at least 3 solutions for the following linear equation in two variables $2x+5y=13$
6. The angles of a quadrilateral are in the ratio 3:5:9:13. Find all the angles of the quadrilateral.

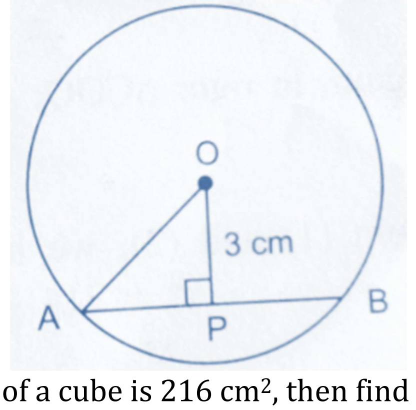
Or

If the diagonals of a parallelogram are equal, then show that it is a rectangle.

7. In the below figure, PQRS is a parallelogram and PQT is a triangle. If area of triangle PQT = 18 cm^2, then find the area of the parallelogram PQRS.



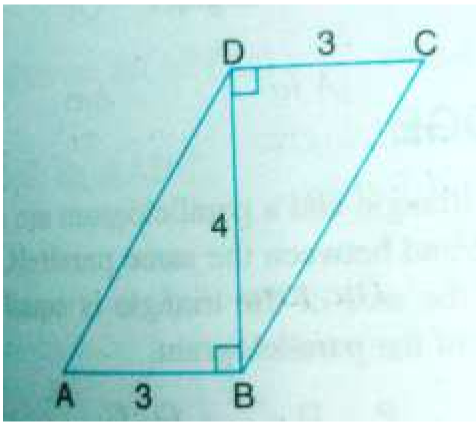
8. From the below figure, O is the centre of the circle. If AB = 8 cm and OP = 3 cm, then find the radius of the circle.



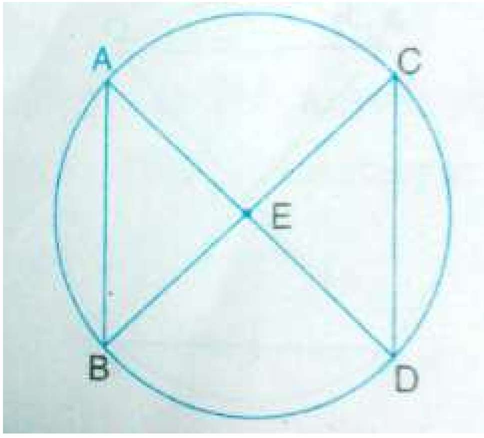
9. If the total surface area of a cube is 216 cm^2, then find the volume.
10. If we throw a die, then the upper face shows 1 or 2; or 3 or 4; or 5 or 6. Suppose we throw a die 150 times and get 2 for 75 times. What is the probability of getting '2'?

Section C

11. Two students contributed Rs. 100 to help the earthquake victims. Write a linear equation which satisfies this data by taking their contributions Rs. and Rs. y. Draw the graph for the same.
12. ABCD is a rhombus and AB produced to E and F such that AE = AB = BF. Prove that ED and FC are perpendicular to each other.
13. ABCD is a quadrilateral and BD is one of its diagonals as shown in the figure. Show that ABCD is a parallelogram and find its area.



14. In the figure given below, AB = CD. Prove that BE = DE and AE = CE, where E is the point of intersection of AD and BC.



15. Construct an angle of 30^0.
16. The curved surface area of a right circular cone is $12320cm^2$. If the radius of its base is 56cm. Find its height.
17. The distance (in km) of 40 female engineers from their residence to their place of work were found as follows:

5	3	10	20	25	11	13	7	12	31
19	10	12	17	18	11	32	17	16	2
7	9	7	8	3	5	12	15	18	3
12	14	2	9	6	15	15	7	6	12

What is the empirical probability that an engineer lives:

a) Less than 7 km from her place of work?

b) More than or equal to 7 km from her place of work?

c) Within $\frac{1}{2}$ km from her place of work?

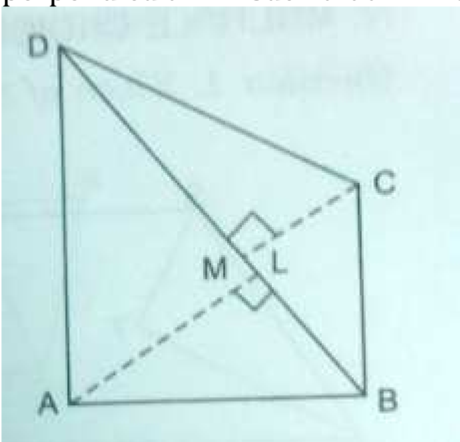
18. ABCD is a parallelogram. The circle through A, B and C intersect CD at E. Prove that AE = AD.

Or

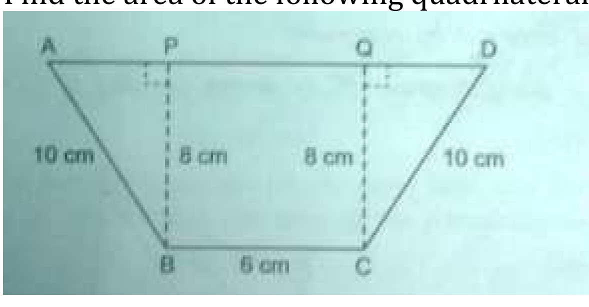
Two congruent circles intersect each other at points A and B. Through A any line segment PAQ is drawn so that P, Q lie on the two circles. Prove that BP = BQ.

Section D

19. Draw the graph of linear equation. From the graph, check whether (-1, -2) is a solution of this equation.
20. Students of class X of the Rama Krishna Mission school plan to have their school bus stand barricaded from the remaining part of the road to avoid inconvenience of the people. For this purpose they use 50 hollow cones made of recycled Plastic material. Each cone has a diameter of 50 cm and height of 1 m.
    They painted outside of each cone. The cost of painting is Rs. 15 per m^2.
    a. Find the cost of painting of all these cones
    b. Which mathematical concept is used in the above problem?
    c. By barricading the school-bus stand using cones of recycled plastic, which skill are depicted by the student of class X of the Rama Krishna Mission School.
21. Two years ago, a man's age was 3 times the square of his son's age. In 3 years' time, his age will be 4 times his son's age. find their present ages.
22. ABCD is a trapezium in which AB || CD and AD = BC. Show that
    a. $\angle A = \angle B$
    b. $\angle C = \angle D$
    c. $\angle ABC = \angle BAD$
    d. Diagonal AC = Diagonal BD
23. In the below figure. ABCD is a quadrilateral in which diagonal BD = 12 cm. If CM perpendicular BD such that AL = 6 cm and CM = 4 cm. find the area of quadrilateral ABCD.



24. Prove that the quadrilateral formed by angle bisectors of a cyclic quadrilateral is also cyclic.
25. Construct the following angles and verify by measuring them by a protractor.
    a. 75^0
    b. 105^0
    c. 135^0
26. Find the area of the following quadrilateral.



27. Twenty seven solid iron spheres, each of radius r and surface area S are melted to form a sphere with surface area S’. Find
    a. Radius r’ of the new sphere
    b. Ratio of S and S’

Or

Find the volume of a sphere whose surface area is 154 cm^2.

28. Prove that the circle drawn with any side of a rhombus as diameter passes through the point of intersection of its diagonals.

Section E

29. OTBA Question for 3 marks from Statistics. Material will be supplied later.
30. OTBA Question for 3 marks from Statistics. Material will be supplied later.
31. OTBA Question for 4 marks from Statistics. Material will be supplied later.

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SOLUTIONS:

Section A

1. (b)
2. (a)
3. (a)
4. (b)

Section B

5. Given $2x+5y=13$

$$\Rightarrow 5y=13-2x$$

$$y=\frac{13-2x}{5}$$

Put x = 0 then $y=\frac{13-2(0)}{5}=\frac{13}{5}$

Put x =1 then $y=\frac{13-2(1)}{5}=\frac{11}{5}$

Put x = 2 then $y=\frac{13-2(2)}{5}=\frac{9}{5}$

Put x = 3 then $y=\frac{13-2(3)}{5}=\frac{7}{5}$

$\therefore \left(0,\frac{13}{5}\right),\left(1,\frac{11}{5}\right),\left(2,\frac{9}{5}\right) and \left(3,\frac{7}{5}\right)$ are the solution of the equation $2x+5y=13$

6. Let ABCD be a quadrilateral in which $\angle A:\angle B:\angle C:\angle D=3:5:9:13$

Sum of the ratios = 3 + 5 + 9 + 13 = 30

$\angle A+\angle B+\angle C+\angle D=360^0$

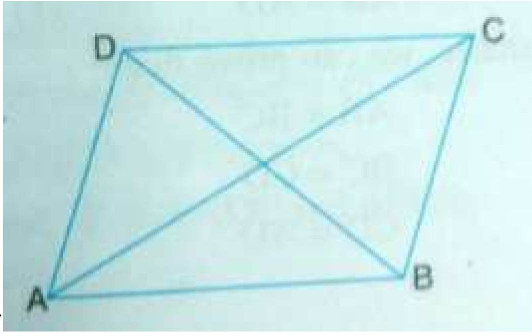
$\angle A=\frac{3}{30}$ x $360^0=36^0$

$\angle B=\frac{5}{30}$ x $360^0=60^0$

$\angle C=\frac{9}{30}$ x $360^0=108^0$

$\angle D = \frac{13}{30}$ x $360^0 = 156^0$

Or

``

In triangle CB and Triangle BDA

AC = BD [Given]

AB = BA

BC = AD

$\therefore \Delta ACB = \Delta DBA$

$\angle ABC = \angle BAD$ (i)

Again AD || BC and transversal AB intersects then

$\therefore \angle BAD + \angle ABC = 180^0$ (ii)

From (i) and (ii)

$\therefore \angle BAD = \angle ABC = 90^0$

$\therefore \angle A = 90^0$

Parallelogram ABCD is a rectangle.

7. Since parallelogram PQRS and Triangle PQT are on the same base PQ and between the same parallels PQ and SR.

   Area of the parallelogram PQRS = $2(ar\Delta PQT)$

   ar(Parallelogram PQRS) = 2(18 cm^2)

   ar(Parallelogram PQRS) = 36 cm^2

   The required area of a parallelogram is 36 cm^2

8. Since OP is perpendicular to AB.

   P is the mid-point of AB.

   $\therefore AP = \frac{1}{2}AB = \frac{1}{2}$ x 8 = 4 cm

   Now in right triangle OPA

   Radius OA = $\sqrt{OP^2 + AP^2} = \sqrt{3^2 + 4^2} = 5cm$

9. Let each side of the cube be x

   Then total surface area = $6x^2$

   $6x^2 = 216$

$$x^2 = \frac{216}{6} = 36$$

$$x = \sqrt{36} = 6cm$$

The volume = $(\text{side})^3 = 6^3 = 216\ cm^3$

10. Let E be the event of getting 2

$$\text{Probability (E)} = \frac{\text{Number of Favourable outcomes}}{\text{Total number of trials}}$$

$$= \frac{75}{150} = 0.5$$

Section C

11. According to the equation,

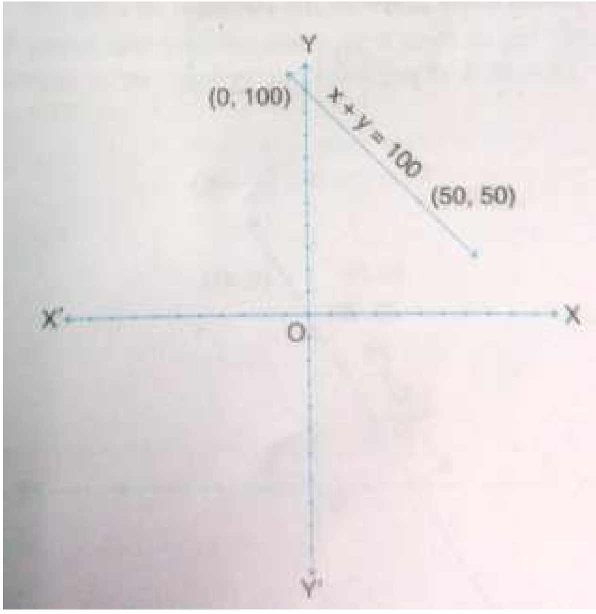
$x + y = 100$

$y = 100 - x$

Table of solutions

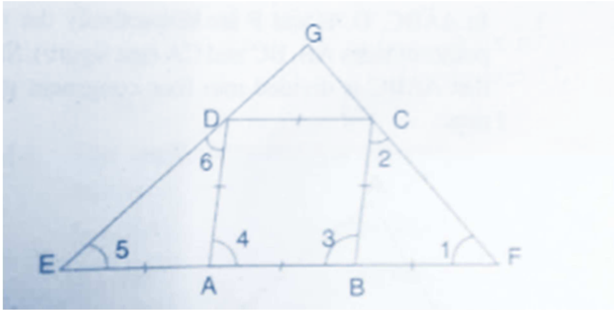
x	0	50
y	100	50

We plot the points (0,100) and (50,50) on the graph paper and join the same to get the line which is the graph of the equation $x + y = 100$.



12. Given: ABCD is a rhombus and AB is produced to E and F such that AE = AB = BF.

To prove: ED $\perp$ FC.



Proof:

AB = BF [by construction]

AB = BC [ABCD is rhombus]

Therefore, BC = EF

So, $\angle 1 = \angle 2$ [Angles opposite sides of triangle are equal]

In Δ BCF,

$Ext.\angle 3 = \angle 1 + \angle 2 = \angle 1 + \angle 1$

$\angle 3 = 2\angle 1$

AB = AE [by construction]

AB = AD [ABCD is rhombus]

Therefore, AD = AE

So, $\angle 5 = \angle 6$ [Angles opposite sides of triangle are equal]

In Δ ADE,

$Ext.\angle 4 = \angle 5 + \angle 6 = \angle 5 + \angle 5$

$\angle 4 = 2\angle 5$

Since, AD ||BC and AB intersects them,

So, $\angle 3 + \angle 4 = 180^0$

13. From the figure, $\angle CDB + \angle ABD = 90^0$

Therefore DC || AB

DC = AB = 3 units

So, ABCD is a parallelogram.

This is because a quadrilateral is a parallelogram if a pair of opposite sides is parallel and is of equal length.

Now, area of parallelogram ABCD = Base x Corresponding altitude

= AB x BD

= 3 x 4 = 12 square units.

14. We know that,

AB = CD, E is the point of intersection of AD and BC.

To prove:

BE = DE and AE = CE

Proof:

In Δ EAB and Δ ECD,

AB = CD and so

$\angle B = \angle D$ [Since angles are in the same segment]

$\angle A = \angle C$ [Since angles are in the same segment]

Thus, $\Delta EAB \cong \Delta ECD$ [ASA]

Therefore, BE = DE and AE = CE by CPCT.

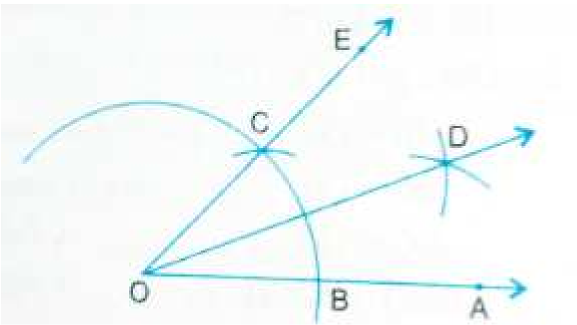
15. Given: A ray OA.

Steps of construction:

a) Taking O as the centre and some radius, draw an arc of a circle intersecting OA at point B.
b) Taking B as the centre and with the same radius, draw an arc intersecting the drawn arc at a point C.
c) Draw the ray OE passing through C, so that $\angle EOA = 60^0$
d) Taking B and C as centres and with radius more than half the radius of BC, draw arcs to intersect each other at D.
e) Draw the ray OD bisecting the angle $\angle EOA$

$$\angle EOD = \angle AOD = \frac{1}{2}\angle EOA$$

$$= \frac{1}{2}(60^0) = 30^0$$



16. Let the height of the right circular cone be 'h' cm, r = 56 cm and curved surface area = 12320cm²

That is

$$\pi rl = 12320$$

$$\pi r\sqrt{r^2 + h^2} = 12320$$

$$\Rightarrow \frac{22}{7} \text{ x } 56 \text{ x} \sqrt{(56)^2 + h^2} = 12320$$

$$\Rightarrow \sqrt{(56)^2 + h^2} = \frac{12320 \text{ x } 7}{22 \text{ x } 56}$$

$$\Rightarrow \sqrt{(56)^2 + h^2} = 70$$

$$\Rightarrow (56)^2 + h^2 = (70)^2$$

$$\Rightarrow h^2 = (70)^2 - (56)^2$$

$$\Rightarrow h^2 = (70 - 56)(70 + 56)$$

$$\Rightarrow h = 42cm$$

17. Total no. of female engineers = 40

a) No. of female engineers whose distance from their residence to the place of work less than 7km=9.

Therefore, the probability that an engineer lives less than 7km from her place of work = $\frac{9}{40}$

b) No. of female engineers whose distance from their residence to the place of work is more than or equal to 7km = 31

Therefore, the probability that an engineer lives less than 7km from her place of work = $\frac{31}{40}$

c) No. of female engineers whose distance from their residence to the place of work is within $\frac{1}{2}$ km = 0

Therefore, the probability that an engineer lives within $\frac{1}{2}$ km= $\frac{0}{40}$ =0

18. Given: ABCD is a parallelogram. The circle through A, B and C intersect CD at E. Prove that AE = AD.

To prove: AE = AD.

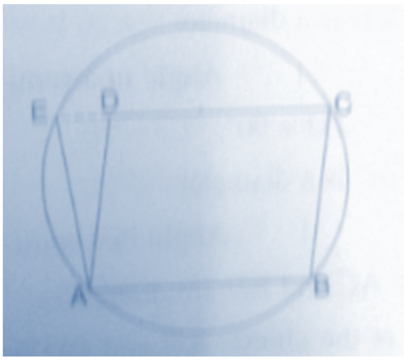
Proof:

In cyclic quadrilateral ABCE,

$\angle AED + \angle ABC = 180^0$[Since opposite angles are supplementary]

Now, $\angle ADE + \angle ADC = 180^0$[Linear Pair Axiom]

But, $\angle ADC = \angle ABC$ [Opposite angles]



Therefore, $\angle AED + \angle ABC = 180^0$

From above, we get

$\angle AED + \angle ABC = \angle ADE + \angle ABC$

$\Rightarrow \angle AED = \angle ADE$

So, in Δ ADE,

AE = AD [Since opposite to equal angles of a triangle are equal].

Or

Given: Two congruent circles intersect each other at points A and B. A line through A meets the circles in P and Q.

To prove: BP = BQ.

Proof:

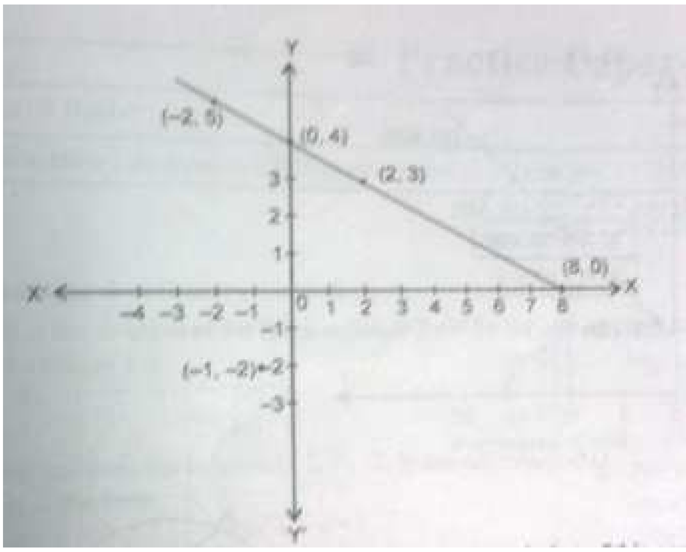
Since AB is a common chord, $\angle APB = \angle AQB$ [Angles subtended by equal chords are equal]

So, BP = BQ [Sides opposite to equal angles are equal].

Section D

19. The equation is $x + 2y = 8$

$$y = \frac{1}{2}(8 - x)$$



(-1, -2) does not lie on the line, therefore it is not a solution of this equation.

20.

a. Diameter of the cone = 50 cm

Therefore the radius (r) = $\frac{50}{2} = 25cm$

$$\frac{25}{100} = 0.25m$$

Height of the cone = 1 m

Slant height of the cone $l = \sqrt{r^2 + h^2}$

$$= \sqrt{(0.25)^2 + (1)^2}$$

$$= \sqrt{0.5 + 1} = \sqrt{1.5}$$

= 1.02 m

Now curved surface area of a cone = πrl

$= 3.14 \text{ x } 0.25 \text{ x } 1.02 \text{ m}^2$

$$= \frac{314}{100} \times \frac{2.5}{10} \times \frac{102}{100} m^2$$

Curved surface area of 50 cone $= 50 \times \frac{314}{100} \times \frac{2.5}{10} \times \frac{102}{100} m^2$

$$= \frac{314}{10} \times \frac{102}{100} m^2$$

Cost of painting is Rs. 15 per m^2

Total cost of 50 cones $= 50 \times 12 \times \left[\frac{314}{10} \times \frac{102}{100}\right]$

$$= \frac{384336}{1000}$$

= Rs. 384.34

b. Surface area and volume

c. Care for the public convenience and betterment of environment.

21. Let the present age of son be x years.

Before two years age of son was (x – 2) years.

It is given that the age of father before two years = $3(x - 2)^2$ years.

Thus, the present age of father $[3(x - 2)^2 + 2]$ years

After three years; the age of son will be (x + 3) years and the age of father will be $[3(x - 2)^2 + 2 + 3]$ years = [3(x – 2)2 + 5] years

It is given that

$3(x - 2)^2 + 5 = 4 (x + 3)$

$\Rightarrow 3(x^2 - 4x + 4) + 5 = 4x + 12$

$\Rightarrow 3x^2 - 16x + 5 = 0$

$\Rightarrow 3x^2 - 15x - x + 5 = 0$

$\Rightarrow 3x (x - 5) - 1 (x - 5) = 0$

$\Rightarrow (3x - 1) (x - 5) = 0$

$\Rightarrow 3x - 1 = 0$ or $x - 5 = 0$

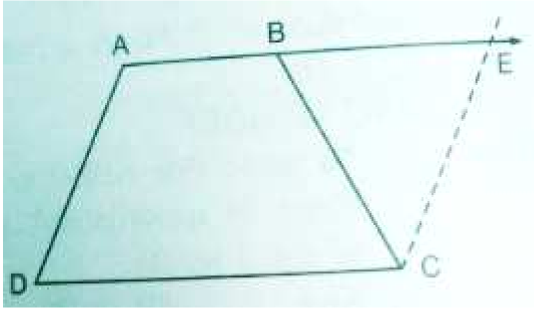
$\Rightarrow x = 1/3$ or 5

If $x = 1/3$, then $x - 2 = -5/3$.

This means the age of son was –5/3 years before two years. This is impossible since age of a person cannot be negative.

If x = 5, the present age of son is 5 years and the present of his father is =3x$(5-2)^2$ + 2 years = 29 years.

22.



Given AB || CD and AD = BC

a. Prove that $\angle A = \angle B$

Produce AB to E and draw CE || AD.

AB || DC

AE || DC

AD || CE

Therefore AECD is a parallelogram

AD = CE

AD = BC

BC = CE

Now in triangle BCE we get

BC = CE

$\angle CBE = \angle CEB$ (i)

Also $\angle ABC = \angle CBE = 180^0$ (ii)

$\angle A = \angle CEB = 180^0$ (iii)

From (ii) and (iii) we get

$\angle ABC = \angle CBE = \angle A + \angle CEB$

$\angle CBE = \angle CEB$

$\angle ABC = \angle A$

$\angle B = \angle A$

$\angle A = \angle B$

b. $\angle C = \angle D$

AB || CD and AD is a transversal.

$\angle A + \angle D = 180^0$

$\angle B + \angle C = 180^0$

$\angle A + \angle D = \angle B + \angle C$

$\angle A = \angle B$

$\angle C = \angle D$

c. Triangle ABC = Triangle BAD

Triangle ABC and Triangle BAD we have

AB = BA

BC = AD

$\angle ABC = \angle BAD$

$\Delta ABC = \Delta BAD$

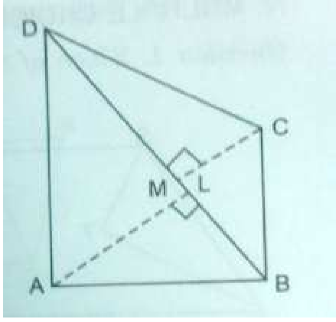
d. Diagonal AC = Diagonal BD

$\Delta ABC = \Delta BAD$

Their corresponding parts are equal

Therefore diagonal AC = Diagonal BD.

23.



The diagonal BD divides the given quadrilateral into two triangles BDC and ABD.

Since area of the triangle = $\frac{1}{2}$ x Base x altitude

Area of $\Delta ABD = \frac{1}{2}$ x BD x AL = $\frac{1}{2}$ x 12 cm x 6 cm

= 36 cm^2

Area of $\Delta BCD = \frac{1}{2}$ x BD x CM = $\frac{1}{2}$ x 12 cm x 4 cm

= 24 cm^2

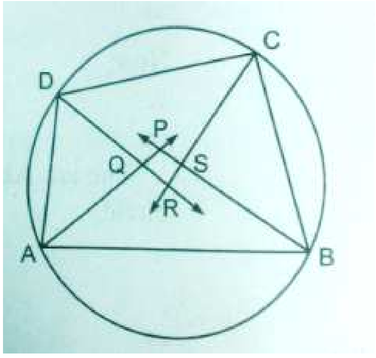
ar(quadrilateral ABCD) = ar(ΔABD) + ar(ΔBCD)

= 36 cm^2 + 24 cm^2

= 60 cm^2

Thus the required area of quadrilateral ABCD = 60 cm^2

24.



Given – cyclic quadrilateral ABCD in which the bisectors $\angle A, \angle B, \angle C$ and $\angle D$ for quadrilateral PQRS.

$\angle PAB + \angle PBA + \angle P = 180^0$

$\frac{1}{2}\angle A + \frac{1}{2}\angle B + \angle P = 180^0$ (i)

From triangle CDR we get

$\angle RCD + \angle RDC + \angle R = 180^0$

$\Rightarrow \frac{1}{2}\angle C + \frac{1}{2}\angle D + \angle R = 180^0$ (ii)

From (i) and (ii) we get

$\Rightarrow \frac{1}{2}\angle A + \frac{1}{2}\angle B + \frac{1}{2}\angle C + \frac{1}{2}\angle D + \angle P + \angle R = 360^0$

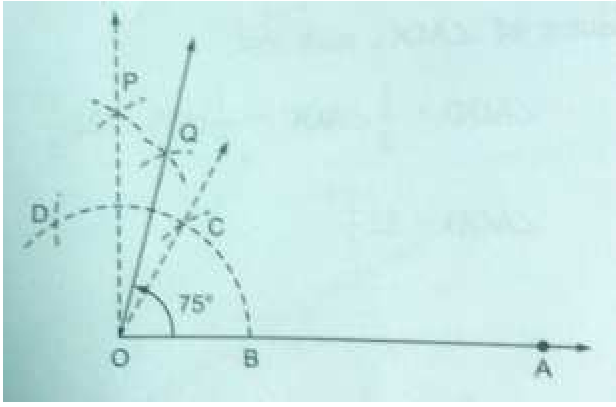
$\frac{1}{2}(\angle A + \angle B + \angle C + \angle D) + \angle P + \angle R = 360^0$

$\frac{1}{2}(360^0) + \angle P + \angle R = 360^0$

$\angle P + \angle R = 360^0 - \frac{1}{2}(360^0) = 180^0$

Similarly $\angle Q + \angle S = 180^0$

25.



a. Steps for construction angle 75^0

i. Draw $\overrightarrow{OA}$

ii. With O as a centre and having a suitable radius. Draw an arc which meets $\overrightarrow{OA}$ at B.

iii. With centre B and keeping the radius same, mark a point C on the previous arc.

iv. With centre C and the same radius, mark another point D on the arc of step ii.

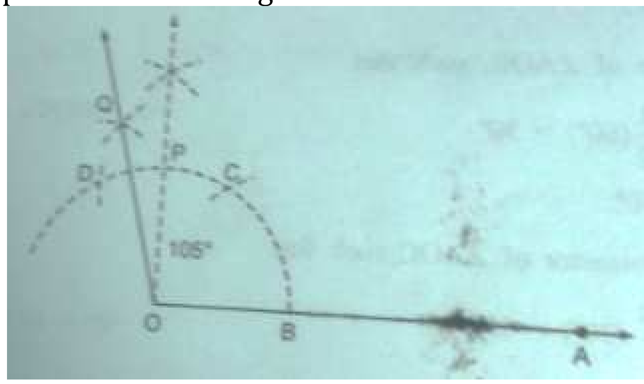
v. Draw $\overrightarrow{OP}$, the bisector ar(CD) such that $\angle COP = \frac{1}{2}(60^0) = 30^0$

vi. Draw $\overrightarrow{OQ}$, the bisector of $\angle COP$ such that $\angle COQ = 15^0$

$\angle BOQ = 60^0 + 15^0 = 75^0$

$\angle AOQ = 75^0$

b. Steps for construct angle 105^0



i. Draw $\overrightarrow{OA}$

ii. With centre O and having a suitable radius, draw an arc which meets OA at B.

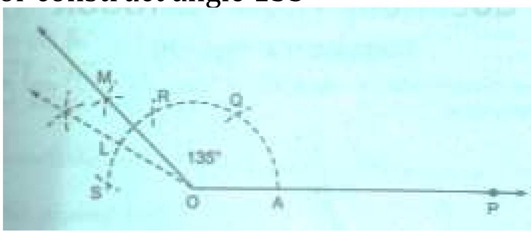
iii. With centre B and keeping the same radius, mark a point C on the arc of step ii.

iv. Draw OP the bisector of ar(CD)

v. Draw PQ the bisector of Ar (PD).

$\angle AOQ = 105^0$

c. Steps for construct angle 135^0



i. Draw an ray $\overrightarrow{OP}$

ii. With centre O and having a suitable radius draw an arc to meet OP at A.

iii. Keeping the same radius and starting from A, mark points Q,R and S on the arc of step ii.

iv. Draw $\overrightarrow{OL}$, the bisector ar (RS)

v. Draw $\overrightarrow{OM}$, the bisector ar(RL)

$\angle POM = 135^0$

26. Since APB is a right triangle

$AB^2 – BP^2 = AP^2$

$10^2 – 8^2 = AP^2$

$100 - 64 = AP^2$

AP = 6 cm

Since $ar(rt\Delta APB) = \frac{1}{2}$ x base x altitude

$ar(rt\Delta APB) = \frac{1}{2}$ x 6 cm x 8 cm = 24 cm^2

Area of the rectangle BCPQ = Length x breath

= 6 x 8 = 48 cm^2

Area of the quadrilateral ABCD = $ar(rt\Delta APB) + ar(\text{rectangle BCQP}) + ar(rt\Delta CQD)$

= 24 cm^2 + 48 cm^2 + 24 cm^2

= 96 cm^2

27.

a. Volume of a solid sphere = $\frac{4}{3}\pi r^3$

Therefore, volume of 27 solid iron sphere = $27\left(\frac{4}{3}\pi r^3\right) = 36\pi r^3$

Thus, the volume of the new sphere = $36\pi r^3$

Let the radius of the new sphere be r'.

Then,

Volume of the new sphere = $\frac{4}{3}\pi r'^3$

Now, $\frac{4}{3}\pi r'^3 = 36\pi r^3$

$r'^3 = \frac{(36\pi r^3)3}{4\pi}$

$\Rightarrow r'^3 = 27r^3$

$\Rightarrow r' = (27r^3)^{1/3}$

$\Rightarrow r' = (3 \text{ x } 3 \text{ x } 3 \text{ x } r^3)^{1/3}$

$\Rightarrow r' = 3r$

b. Ratio of S and S'

S = $4\pi r^2$

S'= $4\pi(3r)^2$

Therefore, $\frac{S}{S'} = \frac{4\pi r^2}{4\pi(3r)^2} = \frac{1}{9}$

The ratio is 1 : 9

Or

Let the radius of the sphere be 'r' cm.

Surface area = 154 cm^2

$$\Rightarrow 4\pi r^2 = 154$$

$$\Rightarrow 4 \text{x} \frac{22}{7} \text{x } r^2 = 154$$

$$\Rightarrow r^2 = \frac{154 \text{ x } 7}{4 \text{ x } 22}$$

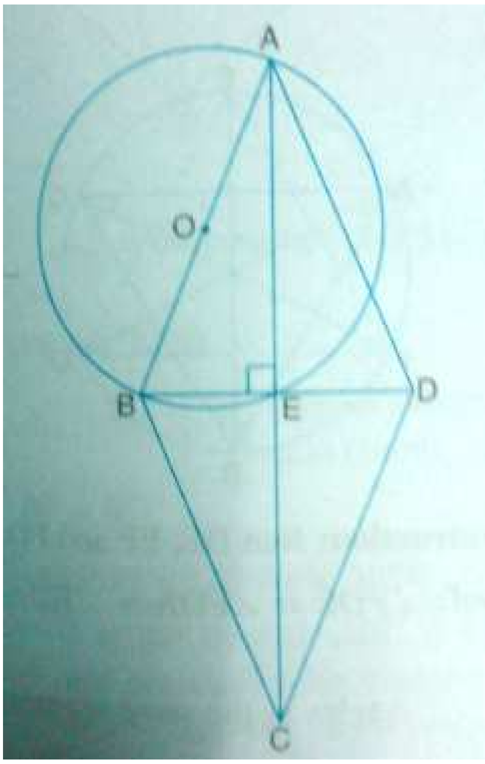
$$\Rightarrow r^2 = \frac{49}{4}$$

$$\Rightarrow r = \frac{7}{2} cm$$

Now, volume of the sphere = $4\pi r^3$

$$\Rightarrow \frac{4}{3} \text{x} \frac{22}{7} \text{x} \left(\frac{7}{2}\right)^3 = \frac{539}{3} = 179\frac{2}{3} cm^3$$

28. Given: E is the mid-point of side BC of an isosceles triangle ABC with AB = AC.



To prove: The circle drawn with either of the equal sides as a sides as a diameter passes through the point D.

Proof:

In Δ AEB and Δ AEC, AB = AC [Angle in semi-circle]

$$\angle BEA + \angle CEA = 180^0$$

$$\Rightarrow 90^0 + \angle CEA = 180^0$$

$$\Rightarrow \angle CEA = 90^0$$

Therefore,

$$\angle BEA + \angle CEA = 90^0$$
$$AE = AE$$
$$\therefore \Delta AEB \cong \Delta AEC$$
$$so, BE = CE$$

E is the mid-point of BC. But the mid-point of BC is D.
Hence the circle drawn with AB as diameter passes through the point E.