CBSE Class 9 Maths Sample Paper SA 2 with Solutions

SECTION – A

1. Find the total surface area of a cone whose radius is $2r$ and slant height is $\frac{l}{2}$.

Sol. Total surface area of cone $= \pi \times 2r\left(\frac{l}{2} + 2r\right) = \pi r\,(l + 4r)$ sq. units.

2. If $\bar{x}_1, \bar{x}_2, \bar{x}_3, \ldots, \bar{x}_n$ are the means of n groups with $n_1, n_2, n_3, \ldots, n_n$ number of observations respectively, then find the mean $\bar{x}$ of all the groups taken together.

Sol. Combined mean $(\bar{x}) = \dfrac{\bar{x}_1 n_1 + \bar{x}_2 n_2 + \bar{x}_3 n_3 + \ldots + \bar{x}_n n_n}{n_1 + n_2 + n_3 + \ldots + n_n}$

3. Find the radius of largest sphere that is carved out of the cube of side 7 cm.

Sol. The largest sphere can be carved out from a cube, if we take diameter of the sphere equal to edge of the cube.

Diameter of the sphere $= 7$ cm

Thus, radius of the sphere $= \frac{7}{2} = 3.5$ cm

4. A dice is thrown once, what is the probability of getting odd primes ?

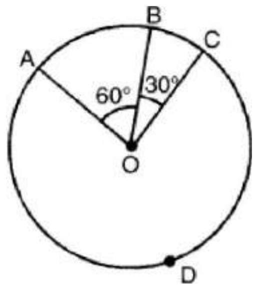
Sol. Number of possible outcomes, when a dice is thrown is 6, {1, 2, 3, 4, 5, 6}

Number of odd primes = 2 *i.e.*, 3, 5

$\therefore$ P(getting odd primes) $= \frac{2}{6} = \frac{1}{3}$

SECTION – B

5. A, B and C are three points on a circle with centre O such that $\angle BOC = 30°$ and $\angle AOB = 60°$. If D is another point on the circle other than the arc ABC, find $\angle ADC$.



Sol.

$$\angle AOC = \angle AOB + \angle BOC$$
$$= 60^\circ + 30^\circ = 90^\circ$$

Now, $\angle AOC$ and $\angle ADC$ are angles subtended by an arc ABC at the centre and at the remaining part of the circle.

$$\therefore \angle ADC = \frac{1}{2}\angle AOC = \frac{1}{2} \times 90^\circ = 45^\circ$$

Hence, degree measures of angle ADC is 45°.

6. A capsule of medicine is in the shape of a sphere of diameter 3.5 mm. How much medicine (in mm^3) is needed to fill this capsule ?

Sol. Radius of the sphere $= \frac{3.5}{2}$ mm

Volume of sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{3.5}{2} \times \frac{3.5}{2} \times \frac{3.5}{2} = 22.46 \text{ mm}^3$

Hence, the volume of the medicine required to fill one capsule is 22.46 mm^3.

7. The mean of the following distribution is 50.

x	f
10	**17**
30	**$5a + 3$**
50	**32**
70	**$7a - 11$**
90	**19**

Find the value of a and hence the frequencies of 30 and 70.

Sol. Mean $= \dfrac{10\times17+30(5a+3)+50(32)+70(7a-11)+90\times19}{17+5a+3+32+7a-11+19}$

$\Rightarrow \quad 50 = \dfrac{170+150a+90+1600+490a-770+1710}{12a+60}$

$\Rightarrow \quad 50(12a + 60) = 2800 + 640a$

$\Rightarrow \quad 600a + 3000 = 2800 + 640a$

$\Rightarrow \quad 40a = 200$

$\Rightarrow \quad a = 5$

Hence, value of a is 5, frequencies of 30 and 70 are 28 and 24 respectively.

8. Find the surface area of a sphere of radius 10.5 cm.

Sol. Here radius of the sphere $(r) = 10.5$ cm

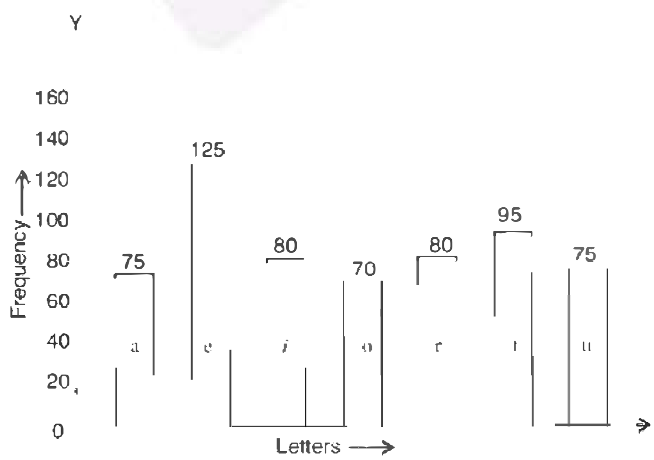
Surface area of the sphere $= 4\pi r^2 = 4 \times \dfrac{22}{7} \times 10.5 \times 10.5 = 1386 \text{ cm}^2$

9. The following table gives the frequencies of most commonly used letters *a, e, i, o, r, t, u* from a page of a book :

Letters	Frequency
a	75
e	125
i	80
o	70
r	80
t	95
u	75

Represent the information above by a bar graph.

Sol. The required bar graph is as given below :



10. A godown measures 40 m × 25 m × 10 m. Find the maximum number of wooden crates each measuring 1.5 m × 1.25 m × 0.5 m that can be stored in the godown.

Sol Volume of the godown $= 40 \times 25 \times 10 \text{ m}^3$

Volume of each wooden crate $= 1.5 \times 1.25 \times 0.5 \text{ m}^3$

Maximum number of wooden crates $= \dfrac{40\times25\times10}{1.5\times1.25\times0.5} = \dfrac{400}{15} \times \dfrac{2500}{125} \times \dfrac{100}{5}$

$= 10666.67$

Hence, the maximum number of wooden crates to be occupied are 10666.

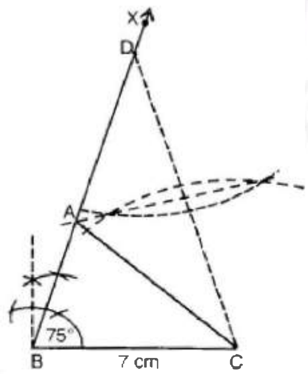
SECTION-C

11. Construct a ΔABC in which BC = 7 cm, ∠B = 75° and AB + AC = 13 cm.

Sol. Steps of Construction :

1. Draw a line segment BC = 7 cm.
2. At B, construct an ∠CBX = 75°.
3. From ray BX, cut off BD = 13 cm.
4. Join DC.
5. Draw the perpendicular bisector of DC meeting BD in A.
6. Join AC.

Thus, ΔABC is the required triangle.



12. Prove that equal chords of a circle subtends equal angles at the centre.

Sol. Given : A circle C (O, r) and its two chords AB and CD, such that AB = CD

To Prove : ∠AOB = ∠COD

Proof : In ΔAOB and ΔCOD

AB = CD [given]

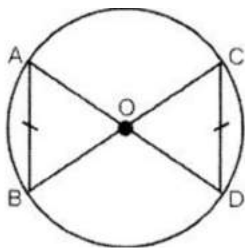
OA = OC = r

OB = OD = r

So by using SSS congruence axiom, we have

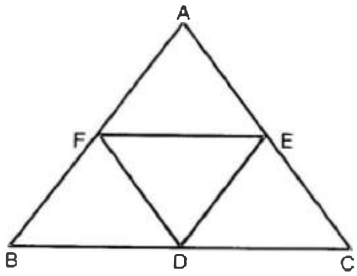
ΔAOB ≅ ΔCOD

Thus ∠AOB = ∠COD [c.p.c.t.]



13. D, E and F are the mid-points of the sides BC, CA and AB, respectively of an equilateral triangle ABC. Show that ΔDEF is also an equilateral triangle.

Sol. Here, D, E and F are the mid-points of BC, CA and AB respectively.



Since the line segment joining the mid-points of any two sides of a triangle is half of the third side.

$$DE = \frac{1}{2}AB \quad ...(i)$$

Similarly, $$EF = \frac{1}{2}BC \quad ...(ii)$$

$$FD = \frac{1}{2}CA$$

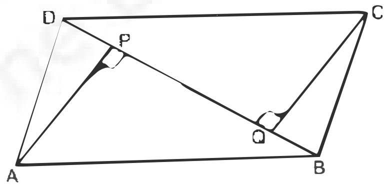
But $AB = BC = CA$ [$\because$ ΔABC is an equilateral]

$$\frac{1}{2}AB = \frac{1}{2}BC = \frac{1}{2}CA$$

$\Rightarrow$ $DE = EF = FD$ [using (*i*), (*ii*) and (*iii*)]

Hence, ΔDEF is an equilateral triangle.

14. ABCD is a parallelogram and AP and CQ are perpendiculars from A and C to the diagonal BD. Show that AP = CQ.



Sol. Since ABCD is a parallelogram.

$AB \parallel DC$.

Now, $AB \parallel DC$ and BD is a transversal

$\angle ABD = \angle CDB$ [alt. int. $\angle s$]

Now, in ΔAPB and ΔCQD

$AB = CD$ [opp. sides of a $||^{gm}$]

$\angle APB = \angle CQD = 90°$

$\angle ABP = \angle CDQ$ [proved above]

So, by using AAS congruence axiom, we have

$\Delta APB \cong CQD$

Thus, $AP = CQ$ [c.p.c.t.]

15. **1500 families with 2 children were selected randomly and the following data were recorded**

Number of Girls in a family	2	1	0
Number of Families	475	814	211

Compute the probability of a family, chosen at random, having :

(*i*) 2 girls

(*ii*) 1 girl

(*iii*) no girl

Sol. (*i*) P (having 2 girls) $\frac{475}{1500}$ $\frac{19}{60}$

(*ii*) P (having 1 girl) $= \frac{814}{1500}$ $\frac{407}{750}$

(*iii*) P (having no girl) $\frac{211}{1500}$

16. **Convert the given frequency distribution into a continuous grouped frequency distribution**

Class-Intervals	Frequency
150 – 153	7
154 – 157	7
158 – 161	15
162 – 165	10
166 – 169	5
170 – 173	6

In which intervals would 153.5 and 157.5 be included ?

Sol. Here, the frequency distribution is not continuous. So, convert it into continuous frequency distribution. The difference between the lower limit of a class and the upper limit of the preceding class is 1 *i.e.*, $d = 154 - 153 = 1$

$\therefore$ Adjustment factor $= \frac{1}{2} = 0.5$

Subtract 0.5 from each lower limit and add 0.5 to each upper limit to convert it into continuous distribution.

Class-Intervals	Frequency
149.5 – 153.5	7
153.5 – 157.5	7
157.5 – 161.5	15
161.5 – 165.5	10
165.5 – 169.5	5
169.5 – 173.5	6

153.5 is included in the class-interval 153.5 – 157.5 and 157.5 is included in the class-interval 157.5 – 161.5.

17. A hollow cylindrical pipe is 56 cm long. Its outer and inner radii are 20 cm and 16 cm respectively. Find the volume of the iron used in making the pipe.

Sol. Length of cylindrical pipe (h) = 56 cm

Outer radius (R) = 20 cm

Inner radius (r) = 16 cm

Volume of the iron used in making the pipe $= \pi R^2 h - \pi r^2 h$

$= \pi h (R^2 - r^2)$

$= \frac{22}{7} \times 56 (20^2 - 16^2)$

$= 22 \times 8 \times 144$

$= 25344 \text{ cm}^3$

18. Rinku has built a cuboidal water tank in his house. The top of the water tank is covered with an iron lid. He wants to cover the inner surface of the tank including the base with tiles of size 10 cm by 8 cm. If the dimensions of the water tank are 180 cm × 120 cm × 60 cm and cost of tiles is ₹ 480 per dozen, then find the total amount required for tiles. *(CBSE March 2012)*

Sol. Total inner surface area of the water tank including the base without top

$= 2(l + b) \times h + l \times b$

$= 2(180 + 120) \times 60 + 180 \times 120$

$= 36000 + 21600 = 57600 \text{ cm}^2$

Area of each tile $= 10 \times 8 = 80 \text{ cm}^2$

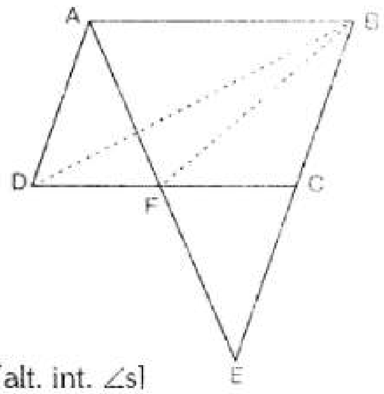
Number of tiles required $= \frac{57600}{80} = 720$

Total amount required for 720 tiles at the rate of ₹ 480 per dozen = ₹ $\frac{480}{12} \times 720$ = ₹ 28800

SECTION-D

19. **ABCD is a parallelogram in which BC is produced to E such that CE = BC (figure). AE intersects CD at F.**

If ar(ΔDFB) = 3 cm^2, find the area of the parallelogram ABCD.



[alt. int. ∠s]

Sol. In ΔADF and ΔECF, we have

$$\angle ADF = \angle ECF \quad \text{[alt. int. } \angle s]$$
$$AD = EC \quad [\because AD = BC \text{ and } BC = EC]$$
$$\angle DFA = \angle CFE \quad \text{[vert. opp. } \angle s]$$

∴ By AAS congruence rule,

$$\Delta ADF \cong \Delta ECF$$
$$\Rightarrow \quad DF = CF$$
$$\Rightarrow \quad ar(\Delta ADF) = ar(\Delta ECF)$$

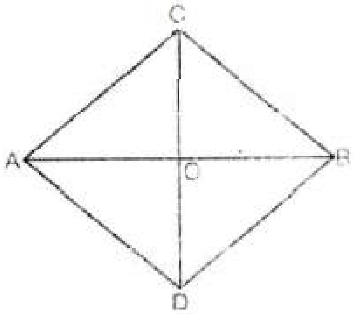
Now, $DF = CF$

$\Rightarrow$ BF is a median in ΔBDC

$\Rightarrow \quad ar(\Delta BDC) = 2\, ar(\Delta DFB) = 2 \times 3 = 6\text{ cm}^2$

Thus $ar(\|^{gm} ABCD) = 2\, ar(\Delta BDC) = 2 \times 6 = 12\text{ cm}^2$

20. In the figure, ABC and ABD are two triangles on the same base AB. If line segment CD is bisected by AB at O, show that ar (ΔABC) = ar (ΔABD).



Sol. Since line segment CD is bisected by AB at O.

$\therefore$ O is the mid-point of CD.

Now, in ΔACD, AO is the median

$$\text{ar}(\Delta ACO) = \text{ar}(\Delta ADO) \quad \ldots(i)$$

Again, in CBD, BO is the median

$$\text{ar}(\Delta COB) = \text{ar}(\Delta DOB) \quad \ldots(ii)$$

Adding (i) and (ii), we have

$$\text{ar}(\Delta ACO) + \text{ar}(\Delta COB) = \text{ar}(\Delta ADO) + \text{ar}(\ DOB)$$

$$\text{ar}(\Delta ABC) = \text{ar}(ABD)$$

21. A chord of a circle is equal to the radius of the circle. Find the angle subtended by the chord at a point on the minor arc and also at a point on the major arc.

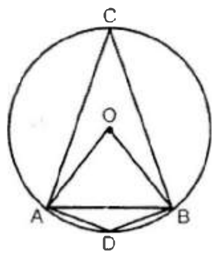
Sol. Let AB be a chord of the circle with centre O, such that OA = OB = AB

Clearly, in ΔAOB

$$OA = OB = AB$$

$\Rightarrow$ ΔAOB is an equilateral or equiangular.

$\therefore$ $\angle AOB = 60^\circ$



Now, $\angle$AOB and $\angle$ACB are angles subtended by an arc AB at the centre and at the remaining part of the circle.

$\therefore$ $\angle ACB = \frac{1}{2}\angle AOB = \frac{1}{2} \times 60^\circ = 30^\circ$

Consider arc ACB.

Clearly, arc ACB subtends angle of measure $360^\circ - 60^\circ$ *i.e.*, 300° at the centre O.

$$\angle ADB = \frac{1}{2} \times \text{reflex } \angle AOB = \frac{1}{2} \times 300^\circ = 150^\circ$$

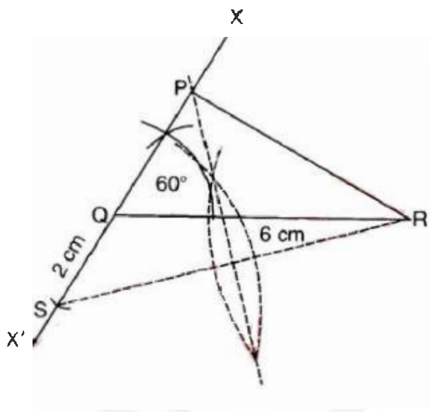
Hence, angle subtended by the chord AB at a point D on the minor arc is 150° and at a point C on the major arc is 30°.

22. Construct a ΔPQR, in which $QR = 6$ cm, $\angle Q = 60°$ and $PR - PQ = 2$ cm.

Sol. Steps of Construction :

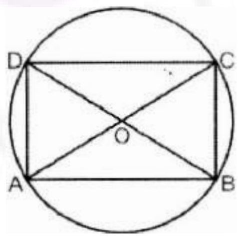
1. Draw any line segment $QR = 6$ cm.
2. At Q, construct $\angle RQX = 60°$ and produce XQ to form the line XQX′.
3. From QX′, cut off $QS = 2$ cm.
4. Join SR.
5. Draw perpendicular bisector of line segment SR and let it intersect XQX′ in P.
6. Join PR.

Thus, ΔPQR is the required triangle.



23. If diagonals of a cyclic quadrilateral are diameters of the circle through the vertices of the quadrilateral, prove that it is a rectangle.

Sol. Let ABCD is a cyclic quadrilateral such that its diagonals AC and BD are the diameters of the circle through the vertices A, B, C and D.



Since AC is a diameter and angle in a semi-circle is a right angle.

$\therefore$ $\angle ABC = 90°$ and $\angle ADC = 90°$

Similarly, BD is a diameter.

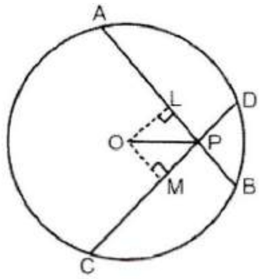
$\therefore$ $\angle DAB = 90°$ and $\angle BCD = 90°$

Thus, $\angle ABC = \angle BCD = \angle CDA = \angle DAB = 90°$

Now, in cyclic quadrilateral ABCD, each angle is a right angle.

Hence, ABCD is a rectangle.

24. If two equal chords of a circle intersect within the circle, then prove that the line joining the point of intersection to the centre makes equal angles with the chords.



Sol. Join OP, draw OL $\perp$ AB and OM $\perp$ CD, thus L and M are the mid-points of AB and CD respectively.

Also, equal chords are equidistant from the centre

OL = OM

Now, in right-angled Δs OLP and OMP

OL = OM [given]

OP = OP [common]

$\angle$OLP = $\angle$OMP [each = 90°]

So, by RHS congruence axiom, we have

$\Delta OLP \cong \Delta OMP$

Hence, $\angle$OPL = $\angle$OPM [c.p.c.t.]

25. A heap of wheat is in the form of a cone whose diameter is 10.5 m and height is 3 m. Find its volume. The heap is to be covered by canvas to protect it from rain. Find the area of the canvas required.

Sol. Diameter of cone = 10.5 m

Radius of cone (r) = 5.25 m

Height of cone (h) = 3 m

Volume of cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 5.25 \times 5.25 \times 3 = 86.625 \text{ m}^3$

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

$= \sqrt{(5.25)^2 + 3^2}$

$= \sqrt{27.5625 + 9}$

$= \sqrt{36.5625}$

$= 6.047 = 6.05$ m

Area of the canvas required = C.S.A. of cone

$= \pi r l = \frac{22}{7} \times 5.25 \times 6.05 = 99.825 \text{ m}^2$

Hence, the volume of the heap of wheat is 86.625 m^3 and area of the canvas required is 99.825 m^2.

26. **An insurance company selected 1800 drivers at random in a particular city to find a relationship between age and accidents. The data obtained are given in the following table**

Age of Drivers (in years)	Accidents in one year				
	0	1	2	3	over 3
18 – 29	390	155	100	40	28
30 – 50	486	120	68	14	8
Above 50	308	40	30	8	5

Find the probability of the following events for a driver chosen at random from the city

(a) Having exactly 2 accidents in one year.

(b) Being 30-50 years of age group and having no accident in a year.

(c) To avoid accidents on roads. What should one do ?

Sol. (a) Total number of drivers having exactly 2 accidents in one year = 100 + 68 + 30 = 198

Required probability $= \frac{198}{1800} = \frac{11}{100}$

(b) Total number of drivers in the age group (30-50) years having no accident in one year = 486

Required probability $= \frac{486}{1800} = \frac{27}{100}$

(c) To avoid accidents one should obey the traffic rules as life is very precious.

27. **A cubical box has each edge 10 cm and another cuboidal box is 12.5 cm, 10 cm wide and 8 cm high.**

(i) Which box has the greater lateral surface area and by how much ?

(ii) Which box has the smaller total surface area and by how much ?

Sol. Here, side of cubical box = 10 cm

Its lateral surface area $= 4\,(\text{side})^2$

$= 4(10)^2$

$= 400\ \text{cm}^2$

Total surface area $= 6\,(\text{side})^2$

$= 6(10)^2$

$= 600 \text{ cm}^2$

Also, dimensions of the cuboidal box are 12.5 cm by 10 cm by 8 cm.

Lateral surface area $= 2\,(l + b)\,h$

$= 2\,(12.5 + 10)\,8$

$= 2 \times 22.5 \times 8$

$= 360 \text{ cm}^2$

Total surface area $= 2\,(lb + bh + hl)$

$= 2\,(12.5 \times 10 + 10 \times 8 + 8 \times 12.5)$

$= 2(125 + 80 + 100)$

$= 610 \text{ cm}^2$

(*i*) Cubical box has greater lateral surface area and by 400 – 360 *i.e.*, 40 cm^2.

(*ii*) Cubical box has smaller total surface area and by 610 – 600 *i.e.*, 10 cm^2.

28. Find mean, mode and median for the following data : 10, 15, 18, 10, 10, 20, 10, 20, 15, 21, 15 and 25

Sol. Mean, $\bar{x} = \dfrac{10+15+18+10+10+20+10+20+15+21+15+25}{12} = \dfrac{189}{12}$

$x = 15.75$

Frequency of 10 is 4 which is maximum

Mode $= 10$

Arrange the data in ascending order : 10, 10, 10, 10, 15, 15, 15, 18, 20 20, 21, 25

Here, $n = 12$ (an even number)

$$\text{Median} = \frac{\left(\frac{n}{2}\right)^{th} \text{value} + \left(\frac{n}{2}+1\right)^{th} \text{value}}{2}$$

$$= \frac{\left(\frac{12}{2}\right)^{th} \text{value} + \left(\frac{12}{2}+1\right)^{th} \text{value}}{2}$$

$$= \frac{6^{th} \text{ value} + 7^{th} \text{ value}}{2}$$

$$= \frac{15+15}{2} = 15$$