Sample Question Paper - 1
Class- IX Session- 2021-22
TERM 2
Subject- Mathematics

Time Allowed: 2 hour **Maximum Marks: 40**

General Instructions :

(i) *The question paper consists of 14 questions divided into 3 sections A, B and C.*
(ii) *All questions are compulsory.*
(iii) *Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in two questions.*
(iv) *Section B comprises of 4 questions of 3 marks each. Internal choice has been provided in one question.*
(v) *Section C comprises of 4 questions of 4 marks each. An internal choice has been provided in one question. It contains two case study based questions.*

Section - A

(2 Marks each)

1. Find the value of the polynomial $p(x) = x^3 - 3x^2 - 2x + 6$ at $x = \sqrt{2}$

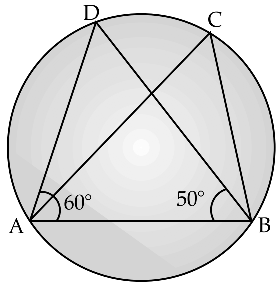
2. Factorize: $64a^3 - 27b^3 - 144a^2b + 108ab^2$

OR

Find the value of k, so that polynomial $x^3 + 3x^2 - kx - 3$ has one factor as $x + 3$.

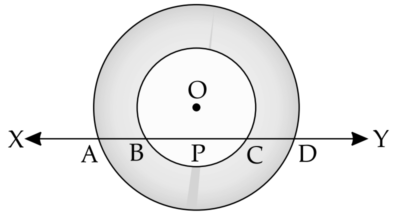
3. In a parallelogram, show that the angle bisectors of two adjacent angles intersect at right angle.

4. In the figure, if $\angle DAB = 60°$, $\angle ABD = 50°$, then find $\angle ACB$.



OR

If a line intersects two concentric circles with common centre O, at A, B, C and D. Prove that AB = CD.



5. A coin is tossed 1200 times with the following outcomes:

Head: 455, Tail: 745

Compute the probability for: (i) getting head, (ii) getting tail.

6. A die is rolled 200 times and its outcomes are recorded as below:

Outcome	1	2	3	4	5	6
Frequency	25	35	40	28	42	30

Find probability of getting:

(i) An even prime

(ii) A multiple of 3.

Section - B

(3 Marks each)

7. If $f(x) = 5x^2 - 4x + 5$, find $f(1) + f(-1) + f(0)$.

8. Construct $\angle POY = 30°$, using compass and ruler.

9. If $ab + bc + ca = 0$, then find the value of $\frac{1}{a^2 - bc} + \frac{1}{b^2 - ca} + \frac{1}{c^2 - ac}$.

10. Find the radius of the base of a right circular cylinder whose curved surface area is $\frac{2}{3}$ of the sum of the surface areas of two circular faces. The height of the cylinder is given to be 15 cm.

OR

The radius and slant height of a cone are in the ratio 4: 7. If its curved surface area is 792 cm^2, find its radius.

Section - C

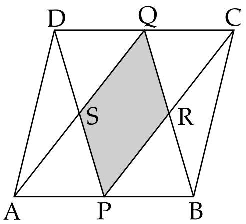
(4 Marks each)

11. In the given figure, ABCD is a parallelogram. P and Q are the mid-points of AB and DC. Show that:

(i) APCQ is a parallelogram.

(ii) DPBQ is a parallelogram.

(iii) PSQR is a parallelogram.



12. What length of tarpaulin 3 m wide will be required to make conical tent of height 8 m and base radius 6 m ? Assume that the extra length of material that will be required for stitching margins and wastage in cutting is approximately 20 cm (Use $\pi = 3.14$).

OR

Twenty-seven solid iron spheres, each of radius r and surface area S are melted to form a sphere with surface area S'. Find the (i) radius R' of the new sphere, (ii) ratio of S' and S.

Case Study-1

13. **Read the following text and answer the following questions on the basis of the same:**

Beti Bachao, Beti Padhao (BBBP) is a personal campaign of the Government of India that aims to generate awareness and improve the efficiency of welfare services intended for girls.

In a school, a group of $(x + y)$ teachers, $(x^2 + y^2)$ girls and $(x^3 + y^3)$ boys organised a campaign on Beti Bachao, Beti Padhao.

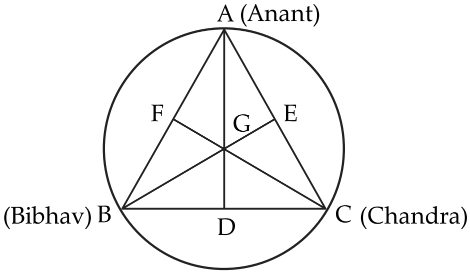
(i) If in the group, there are 10 teachers and 58 girls, then what is the number of boys? **[2]**

(ii) If $x - y = 23$, then find $x^2 - y^2$. **[2]**

<u>Case Study-2</u>

14. Read the following text and answer the following questions on the basis of the same:

A circular park of radius 20 m is situated in a colony. Three boys Anant, Bibhav and Chandra are sitting at equal distances on its boundary, each having a toy telephone in his hands to talk to each other.



Here, A, B and C be the positions of Anant, Bibhav and Chandra and also let D, E and F are the medians of ΔABC and G be its centroid.

(i) What is length of GD? **[2]**

(ii) Find the length of BD. **[2]**

❑❑❑

Solution

Section - A

1. Given, $p(x) = x^3 - 3x^2 - 2x + 6$

Then, $p(\sqrt{2}) = (\sqrt{2})^3 - 3(\sqrt{2})^2 - 2(\sqrt{2}) + 6$ **1**

$= 2\sqrt{2} - 6 - 2\sqrt{2} + 6$

$= 0.$ **1**

2. $64a^3 - 27b^3 - 144a^2b + 108ab^2$

$= (4a)^3 - (3b)^3 - 3 \times (4a)^2 \times (3b) + 3 \times (4a) \times (3b)^2$ **1**

[Using identity, $x^3 - y^3 - 3x^2y + 3xy^2 = (x - y)^3$]

$= (4a - 3b)^3.$ **1**

Commonly Made Error

- While factorizing the sum, the students factorize once and leave the answer without checking.

Answering Tip

- Students should be particular and check whether an expression can be further factorize otherwise they tend to miss one step and thereby deduct their marks.

OR

Let $f(x) = x^3 + 3x^2 - kx - 3$

Since, $(x + 3)$ is a factor of $f(x)$.

Then, $f(-3) = 0$ **1**

or, $(-3)^3 + 3(-3)^2 - k(-3) - 3 = 0$

or, $-27 + 27 + 3k - 3 = 0$

or, $3k - 3 = 0$

or, $k = 1.$ **1**

3. Let ABCD be a parallelogram, then

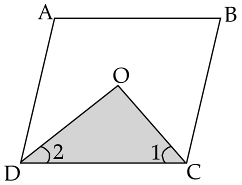
$\angle ADC + \angle BCD = 180°$ ½

[Co-interior angles]

or, $\frac{1}{2}\angle ADC + \frac{1}{2}\angle BCD = 90°$

[Divide by 2]

or $\angle 2 + \angle 1 = 90°$ ½



In ΔODC,

$\angle 1 + \angle 2 + \angle DOC = 180°$

[Angle sum property of a triangle]

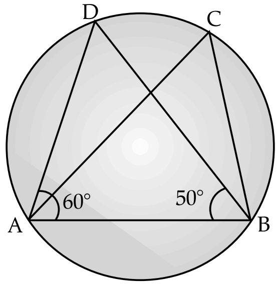
$\therefore$ $\angle DOC = 90°.$ **1**

Hence, the angle bisectors of two adjacent angles intersect at 90°.

4. In ΔADB,

By angle sum property

$\angle ABD + \angle ADB + \angle BAD = 180°$ **1**



$\therefore$ $50° + \angle ADB + 60° = 180°$

$\therefore$ $\angle ADB = 180° - (50° + 60°)$

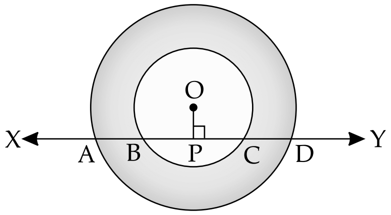
$= 70°$ ½

$\therefore$ $\angle ACB = \angle ADB = 70°.$ ½

[$\because$ angles in the same segment of a circle are equal]

hence, $\angle ACB = 70°$

OR



Draw OP perpendicular to XY from the centre O to a chord BC and bisecting it.

$$OP \perp \text{ to chord } BC. \quad \text{½}$$

or, $BP = PC$ ...(i)

Similarly, $AP = PD$ ...(ii) ½

Subtracting eqn. (i) from eqn. (ii), we get

$$AP - BP = PD - PC$$

or, $AB = CD$ **Hence Proved. 1**

5. **(i)** Number of favorable outcomes $n(A) = 455$

Total outcomes $n(S) = 455 + 745 = 1200$

$$\text{Probability of getting head} = \frac{n(A)}{n(S)} \quad \mathbf{1}$$

$$= \frac{455}{1200} = \frac{91}{240}$$

(ii) Number of favourable outcomes $n(B) = 745$

Total outcomes $n(S) = 1200$

$$\text{Probability of getting tail} = \frac{n(B)}{n(S)}$$

$$= \frac{745}{1200} = \frac{149}{240} \quad \mathbf{1}$$

Commonly Made Error

- Students directly find out the probability without listing the possible and total outcomes.

Answering Tip

- Steps carry marks so students should first list the favourable and total outcomes and then find the probability.

6. **(i)** An even prime number *i.e.*, '2'.

$$\therefore \text{P(getting an even prime number)} = \frac{35}{200}$$

$$= \frac{7}{40} \quad \mathbf{1}$$

(ii) Multiple of 3 *i.e.*, 3 and 6

$$\therefore \quad \text{P(getting multiple of 3)} = \frac{40+30}{200}$$

$$= \frac{70}{200}$$

$$= \frac{7}{20} \quad \mathbf{1}$$

[CBSE Marking Scheme, 2016]

Section - B

7. Given, $f(x) = 5x^2 - 4x + 5$

$\therefore$ $f(1) = 5 - 4 + 5$

$= 6$ **1**

and $f(-1) = 5(-1)^2 - 4(-1) + 5$

$= 5 + 4 + 5 = 14$

and $f(0) = 5$ **1**

$\therefore$ $f(1) + f(-1) + f(0) = 6 + 14 + 5 = 25.$ **1**

8. **Steps of Construction :**

(i) Draw any line OP.

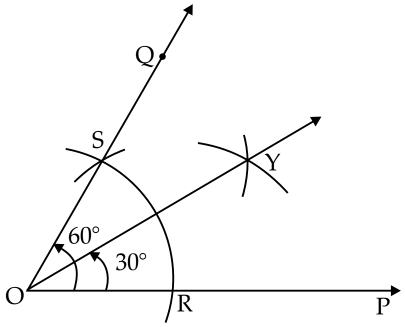
(ii) With O as centre and any suitable radius, draw an arc to meet OP at R.

(iii) With R as centre and same radius (as in step (ii)), draw an arc to intersect the previous arc at S.

(iv) Join OS and produce it to Q, then $\angle POQ = 60°$.

(v) With R as centre and any suitable radius ($> \frac{1}{2}$ RS), draw an arc. Also, with S as centre and same radius draw another arc to intersect the previous arc at Y.

(vi) Join OY. $\angle POY$ is the required angle of 30°. **1**



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Commonly Made Error

- Students have to draw angles using compass and ruler while doing construction. They draw angles with protractor and there by getting less marks.

Answering Tip

- Students should do the practice of basic construction of angles of 60°, 30°, 45° etc.

9. $ab + bc + ca = 0$ ...(i)

$\Rightarrow$ $-bc = ab + ca$ ...(ii)

$-ca = ab + bc$ ...(iii)

and $-ab = bc + ca$ ...(iv) **1**

Now, $\dfrac{1}{a^2 - bc} + \dfrac{1}{b^2 - ca} + \dfrac{1}{c^2 - ab}$

$$= \frac{1}{a^2 + ab + ca} + \frac{1}{b^2 + ab + bc} + \frac{1}{c^2 + bc + ca} \quad \text{½}$$

[Using (i), (iii) & (iv)]

$$= \frac{1}{a(a+b+c)} + \frac{1}{b(a+b+c)} + \frac{1}{c(a+b+c)} \quad \text{½}$$

$$= \frac{1}{a+b+c}\left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right) \quad \text{½}$$

$$= \frac{bc + ca + ab}{abc(a+b+c)}$$ [Using (i)]

$= 0$ ½

10. Let the radius and height of the cylinder be r and h respectively, then

$h = 15$ cm [given]

C.S.A. of the cylinder $= \frac{2}{3}$ (Sum of areas of 2 circular faces) **1**

$$2\pi rh = \frac{2}{3}(2\pi r^2)$$ **1**

$$h = \frac{2}{3}r$$

$$15 = \frac{2}{3}r$$

Or, $r = 22.5$ cm. **1**

OR

Let the radius of cone be $r = 4x$

and slant height $l = 7x$ **1**

$\because$ CSA of a cone $= 792$ cm^2 [given]

$\therefore$ $\pi rl = 792$

or, $\frac{22}{7} \times 4x \times 7x = 792$ ½

$$x^2 = \frac{792 \times 7}{22 \times 4 \times 7} = 9$$ ½

or, $x = 3$

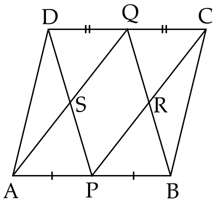
$\therefore$ radius $= 4 \times 3$

$= 12$ cm. **1**

Section - C

11. **(i)** Since, ABCD is a parallelogram

$\therefore$ AB = CD and AB || CD



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or, $\frac{1}{2}$AB $= \frac{1}{2}$CD

i.e., AP = CQ and AP || CQ

Hence, APCQ is a parallelogram.

Proved. 1

(ii) Again,

$\frac{1}{2}$AB $= \frac{1}{2}$CD

[From part (i)]

i.e., PB = DQ and PB || DQ

Hence, DPBQ is a parallelogram.

Proved. 1

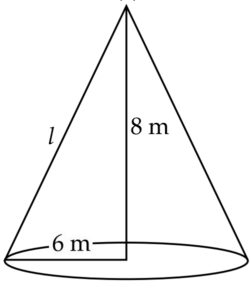
(iii) QS || PR and SP || QR

Hence, PSQR is a parallelogram.

Proved. 1

12. Given, **Conical tent:** height (h) = 8 m

base radius (r) = 6 m



$l^2 = r^2 + h^2$

$l^2 = 8^2 + 6^2$

$l = \sqrt{64+36} = 10$ m **1**

C.S.A of tent $= \pi rl$ unit^2

$= 3.14 \times 6 \times 10$ m^2

$= 188.4$ m^2 **1**

Area of Tarpaulin = C.S.A of tent

width × length of tarpaulin = 188.4 m^2

3 × length of tarpaulin = 188.4 m^2 **1**

length of tarpaulin $= \frac{188.4}{3} = 62.8$ m **1**

Extra length required for stitching and wastage of cutting

= 20 cm = 0.20 m

$\therefore$ Total length of tarpaulin

= 62.8 + 0.2 = 63 m **1**

OR

Given: radius of each sphere $= r$

Volume of 1 solid iron sphere $= \frac{4}{3}\pi r^3$ ½

Volume of 27 solid iron spheres $= \frac{4}{3}\pi r^3 \times 27$

Volume of new sphere $= \frac{4}{3} \times 27\pi r^3$ ½

Let radius of now sphere be R, then according to given condition,

Volume of new sphere made after melting 27 spheres = Volume of 27 spheres

$$\frac{4}{3}\pi R^3 = \frac{4}{3} \times 27\pi r^3$$

$$R^3 = 27r^3$$

(i) $R = 3r$ unit **1**

(ii) Surface area of new sphere $= 4\pi R^2$

$$S' = 4\pi \times (3r)^2$$
$$S' = 4\pi \times 9r^2 \text{ unit}^2$$

Surface area of Sphere (S) $= 4\pi r^2$

Now, $$\frac{S'}{S} = \frac{4\pi \times 9r^2}{4\pi r^2} = \frac{9}{1}$$

$$S' : S = 9 : 1$$ **1**

Case Study-1

13. **(i)** No. of teachers $= x + y = 10$

$\Rightarrow (x + y)^2 = (10)^2$

$\Rightarrow x^2 + y^2 + 2xy = 100$ ...(i)

No. of girls $= (x^2 + y^2) = 58$

$\Rightarrow 58 + 2xy = 100$

...using equation (i)

$\Rightarrow 2xy = 100 - 58$ **1**

$\Rightarrow 2xy = 42$

$\Rightarrow xy = \frac{42}{2}$

$\Rightarrow xy = 21$

Now, since $(x + y)^3 = [x^3 + y^3 + 3xy(x + y)]$

$\Rightarrow (10)^3 = [x^3 + y^3 + 3 \times 21(10)]$

$\Rightarrow 1000 = (x^3 + y^3 + 630)$

$\Rightarrow 1000 - 630 = (x^3 + y^3)$

$\Rightarrow (x^3 + y^3) = 370$ **1**

Hence, no. boys = 370

(ii) Given $x - y = 23$

Also, $x + y = 10$

[Taking from part (i)]

$x^2 - y^2 = (x + y)(x - y)$ **1**

$= 10 \times 23 = 230$

Hence, the value of $x^2 - y^2$ is 230. **1**

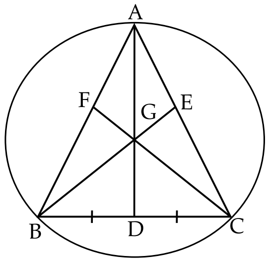
Case Study-2

14. **(i)** Since, the centroid of a triangle divides the median in the ratio 2 : 1, then **1**

$$\frac{GA}{GD} = \frac{2}{1}$$

$\Rightarrow \frac{20}{GD} = \frac{2}{1}$

$\Rightarrow GD = 10$ m **1**



(ii) Here, BG = 20 m [given]

and GD = 10 m

[Proved in part (i)]

$\because$ BD = DC [given]

$\angle BDG = 90°$ [$\because$ G is a centroid] **1**

In right ΔBDG,

$(BG)^2 = (BD)^2 + (GD)^2$

[Using Pythagoras Theorem]

$\Rightarrow (20)^2 = (BD)^2 + (10)^2$

$\Rightarrow BD = \sqrt{400 - 100}$

$= \sqrt{300}$

$= 10\sqrt{3}$ m. **1**

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