Sample Question Paper - 2
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. Two coins are tossed simultaneously 500 times, following are the outcomes

No head= 100 times

One head = 200 times

Two heads = 200 times

If the two coins are simultaneously tossed again, compute the probability of obtaining:

(i) One Head

(ii) Two Heads

2. Teachers and students are selected at random to make two teams of 30 members each on sports day to participate in the event of "tug of war". The number of volunteers are as follows:

Teachers		**Students**	
Male	Female	Male	Female
12	18	20	10

Find the probability that the person chosen at random

(i) is a male

(ii) is a female student.

OR

In a one-day cricket Match, Sachin played 40 balls and hit 12 sixes and Saurav played 30 balls and hit 9 fours. Find the probability that Sachin will hit a six in the next ball and also find the probability that Saurav will not hit a four in the next ball.

3. A rectangular piece of paper is 22 cm long and 10 cm wide. A cylinder is formed by rolling the paper along its length. Find the volume of the cylinder.

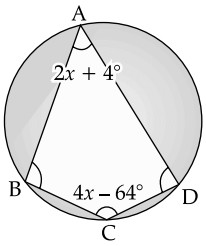
4. The angles of a quadrilateral are $4x°$, $7x°$, $15x°$ and $10x°$. Find the smallest and largest angles of the quadrilateral.

5. If $y = 2$ and $y = 0$ are the zeroes of the polynomial $f(y) = 2y^3 - 5y^2 + ay + b$, find the value of a and b.

6. A chord of length 10 cm is at a distance of 12 cm from the centre of a circle. Find the radius of the circle.

OR

In the given figure, find the value of x.



Section - B

(3 Marks each)

7. Find the value of k, if $x - 2$ is a factor of $f(x) = x^2 + kx + 2k$. Also find the factorise of $f(x)$, when putting the value of k.

8. Verify if -2 and 3 are zeroes of the polynomial $2x^3 - 3x^2 - 11x + 6$. If yes, factorize the polynomials.

9. The total surface area of a solid right circular cylinder is 1540 cm^2. If the height is four times the radius of the base, then find the height of the cylinder.

OR

How much ice-cream can be put into a cone with base radius 3.5 cm and height 12 cm ?

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

Section - C

(4 Marks each)

11. 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.

12. A metal pipe is 77 cm long. The inner diameter of a cross-section is 4 cm, the outer diameter being 4.4 cm. Find its:

(i) inner curved surface area

(ii) outer curved surface area

(iii) total surface area. (use $\pi = \frac{22}{7}$)

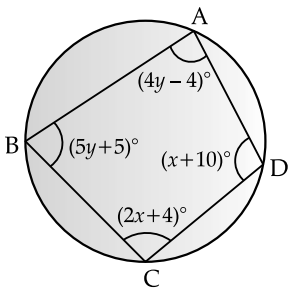
OR

The frame of a lampshade is cylindrical in shape. It has base diameter 28 cm and height 17 cm. It is to be covered with a decorative cloth. A margin of 2 cm is to be given for folding it over top and bottom of the frame. If $\frac{1}{12}$ of cloth is wasted in cutting and pasting, find how much cloth is required to be purchased for covering the frame.

Case Study-1

13. Read the following text and answer the questions given below:

Four boys are playing with a ball in a circular park. The positions of each boy is represented by A, B, C and D in the following diagram.



Give answer the following questions:

(i) Find the values of x and y. **[2]**

(ii) Find $\angle A$ and $\angle B$. Also prove that $\angle A + \angle C = 180°$. **[2]**

Case Study-2

14. Read the following text and answer the questions given below:

National Association for the Blind (NAB) aimed to empower and well-inform visually challenged population of our country, thus enabling them to lead a life of dignity and productivity.

Ravi donated ₹ $\left(x^3+\frac{1}{x^3}\right)$ to NAB. When his cousin asks to tell the amount donated by him, he just gave ,the hint. $x+\frac{1}{x}=10$

(i) Find the amount donated by Ravi. **[2]**

(ii) Find the amount donated by Ravi if $x+\frac{1}{x}=7$. **[2]**

❑❑❑

Solution

Section - A

1. Total number of outcomes, $n(S) = 500$

Let E_1 and E_2 be the events of one head and two heads respectively.

(i) Favourable outcomes $n(E_1) = 200$

Then, $P(\text{one head}) = \dfrac{n(E_1)}{n(S)}$

$P(\text{one head}) = \dfrac{200}{500} = \dfrac{2}{5}$ **1**

(ii) Favourable outcomes $n(E_2) = 200$

Then, $P(\text{Two heads}) = \dfrac{n(E_2)}{n(S)}$

$P(E_2) = \dfrac{200}{500} = \dfrac{2}{5}$ **1**

[CBSE Marking Scheme, 2016]

2. Let E_1 and E_2 be the events of a male (Teachers and students) and a female students.

Teachers		Students	
Male	Female	Male	Female
12	18	20	10

Total number of volunteers *i.e.*, $n(S)$

$= 12 + 18 + 20 + 10 = 60$

(i) Total number of males *i.e.*, $n(E_1)$

$= 12 + 20 = 32$

$P(\text{volunteer is male}) = \dfrac{n(E_1)}{n(S)} = \dfrac{32}{60} = \dfrac{8}{15}$ **1**

(ii) P(volunteer is female student)

$\dfrac{n(E_2)}{n(S)} = \dfrac{10}{60} = \dfrac{1}{6}$ **1**

[CBSE Marking Scheme, 2015]

OR

Total number of balls faced by Sachin = 40

Number of balls on which he hit a six = 12

Let E_1 be the event of hitting a six.

$\therefore$ Number of outcomes = 12

$\therefore \quad P(E_1) = \dfrac{12}{40} = \dfrac{3}{10} = 0.3$ **1**

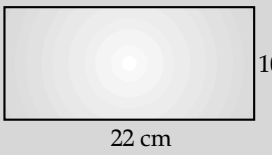
Now, Total number of balls faced by Saurav = 30

Let E_2 be the event of Saurav did not hit a four

Number of outcomes = 30 – 9 = 21

$P(E_2) = \dfrac{21}{30} = \dfrac{7}{10} = 0.7$ **1**

3.



According to question,

$2\pi r = 22$

(Circumference of cylinder)

$2 \times \dfrac{22}{7} \times r = 22$

$r = \dfrac{7}{2}$ **1**

Volume of the cylinder $= \pi r^2 h$

$= \dfrac{22}{7} \times \dfrac{7}{2} \times \dfrac{7}{2} \times 10$

$= 385 \text{ cm}^3$ **1**

[CBSE Marking Scheme, 2013]

4. Sum of the angles of a quadrilateral is 360°.

$\therefore 4x° + 7x° + 15x° + 10x° = 360°$

or, $36x° = 360°$

or, $x° = 10°$ **1**

$\therefore$ Smallest angle $= 4x° = 4 \times 10° = 40°$ ½

Largest angle $= 15x° = 15 \times 10°$

$= 150°$ ½

5. Given, $f(y) = 2y^3 - 5y^2 + ay + b$

$\because$ $y = 2$ is a zero of $f(y)$.

$\therefore$ $f(2) = 2(2)^3 - 5(2)^2 + a(2) + b = 0$

or, $16 - 20 + 2a + b = 0$ **1**

or, $2a + b = 4$ ...(i)

Also, $y = 0$ is a zero of $f(y)$.

$f(0) = b = 0$

From (i), $2a + 0 = 4$

or, $a = 2$

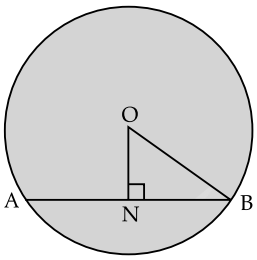
$\therefore$ $a = 2, b = 0$ **1**

[CBSE Marking Scheme, 2016]

6. Let AB be the chord of a circle and ON be the distance of the chord from the centre.

Given, AB = 10 cm

ON = 12 cm



Also, ON $\perp$ AB

and AN = BN **1**

[$\because$ Perpendicular drawn from the centre of the circle to chord of circle bisects the chord]

In ΔONB,

$OB^2 = ON^2 + NB^2$

[By Pythagoras theorem]

$\therefore$ $OB^2 = 12^2 + 5^2$

[$\because$ BN = 5 cm]

$= 144 + 25 = 169$

$\therefore$ OB = 13 cm

Hence, the radius of the circle is 13 cm. **1**

OR

Here, ABCD is a cyclic quadrilateral.

In a cyclic quadrilateral,

$\angle A + \angle C = 180°$

[opposite angles of cyclic quadrilateral are supplementary] **1**

or, $2x + 4° + 4x - 64° = 180°$

or, $6x - 60° = 180°$

or, $6x = 180° + 60° = 240°$

or, $x = \frac{240°}{6}$

$\therefore$ $x = 40°$ **1**

Section - B

7. Given, $(x - 2)$ is a factor of $f(x)$.

$\therefore$ $f(2) = 0$ ½

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

or, $4 + 2k + 2k = 0$

or, $4 + 4k = 0$

or, $k = -1$ **1**

So, $f(x) = x^2 + (-1)x + 2(-1)$

$= x^2 - x - 2$ ½

$= x^2 - 2x + x - 2$

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

$= (x - 2)(x + 1)$. **1**

Commonly Made Error

- Sometimes students are confused between Remainder Theorem and Factor Theorem.

Answering Tip

- Understand the concepts of both the theorems and do adequate practice to solve problems based on them.

8. Let $p(x) = 2x^3 - 3x^2 - 11x + 6$

For, $x = -2$

$p(-2) = 2(-2)^3 - 3(-2)^2 - 11(-2) + 6$

$= -16 - 12 + 22 + 6$

$= -28 + 28 = 0$ **1**

For, $x = 3$

$p(3) = 2(3)^3 - 3(3)^2 - 11(3) + 6$

$= 54 - 27 - 33 + 6$

$= 60 - 60 = 0$ **1**

So, -2 and 3 are zeroes of the given polynomial.

Now, $p(x) = 2x^3 - 3x^2 - 11x + 6$

$(x + 2)(x - 3) = x^2 - x - 6$ is a factor of $p(x)$.

$\therefore$ $2x^3 - 3x^2 - 11x + 6$

$= 2x^3 + 4x^2 - 7x^2 - 14x + 3x + 6$

$= 2x^2(x + 2) - 7x(x + 2) + 3(x + 2)$

$= (x + 2)(2x^2 - 7x + 3)$

$= (x + 2)(2x^2 - 6x - x + 3)$

$= (x + 2)[(2x(x - 3) - 1(x - 3)]$

$= (x + 2)(x - 3)(2x - 1)$ **1**

[CBSE Marking Scheme, 2016]

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

T.S.A. of a cylinder = 1540 cm^2 [given]

$\therefore$ $2\pi r(h + r) = 1540$ cm^2 **1**

Also, $h = 4r$ [given]

$\therefore$ $2\pi r(4r + r) = 1540$

or, $2\pi \times 5r^2 = 1540$

or, $r^2 = \frac{1540 \times 7}{2 \times 5 \times 22}$

or, $r^2 = 49$ **1**

or, $r = 7$ cm

Now $h = 4r$ **1**

Hence, height of the cylinder = 28 cm.

[CBSE Marking Scheme, 2016]

OR

Radius (r) = 3.5 cm, height (h) = 12 cm

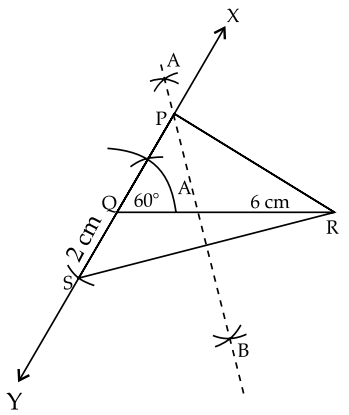
So, volume of a cone = quantity of ice-cream **1**

$\therefore$ Quantity of ice-cream

$= \frac{1}{3}\pi r^2 h$ **1**

$= \frac{1}{3}\times\frac{22}{7}\times 3.5\times 3.5\times 12 = 154 \text{ cm}^3$ **1**

10.



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Steps of Construction :

(i) Draw QR = 6 cm

(ii) Draw $\angle Q = 60°$. Let the line be QX.

(iii) With Q as centre and radius 2 cm, cut an arc on QY, Let the arc intersect QY at S.

(iv) Join RS.

(v) Draw perpendicular bisector AB of RS which intersect QX at point P.

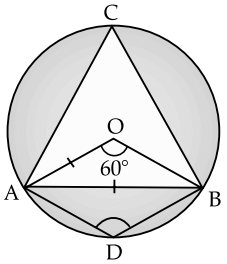
(vi) Join PR.

$\therefore$ ΔPQR is required triangle. **1**

Section - C

11. According to the question,

OA = AB = OB **1**



1

$\therefore$ ΔOAB is an equilateral triangle

i.e., $\angle AOB = 60°$

$\angle ACB = \frac{1}{2}\angle AOB$

[angle subtended by an arc at the circumference is half of the angle at the centre of circle]

$\angle ACB = \frac{1}{2}\times 60°$

$\angle ACB = 30°$ **1**

$\angle ACB + \angle ADB = 180°$

[opposite angles of cyclic quadrilateral are supplementary]

or, $\angle ADB = 180° - \angle ACB$

$\angle ADB = 180° - 30°$

$= 150°$ **1**

Commonly Made Error

- Students fail to identify which angle is subtended by the chord from which arc.

Answering Tip

- A chord has its both ends on the circle.

12. Inner radius (r) = 2 cm

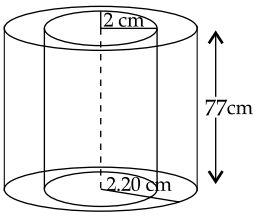
outer radius (R) = 2.2 cm

Height (h) = 77 cm

(i) C.S.A. (Inner) = $2\pi rh$

$= 2 \times \frac{22}{7} \times 2 \times 77$

$= 968 \text{ cm}^2$ ½



½

(ii) C.S.A. (Outer) = $2\pi Rh$

$= 2 \times \frac{22}{7} \times 2.2 \times 77$

$= 1064.8 \text{ cm}^2$. **1**

(iii) Area of top = $\pi(R + r)(R - r)$

$= \frac{22}{7} \times 4.2 \times 0.2$

$= 2.64 \text{ cm}^2$

= Area of the bottom **1**

$\therefore$ T.S.A. = Inner (C.S.A.) + Outer (C.S.A.) + Area of top + Area of bottom

$= 968 + 1064.8 + 2 \times 2.64$

$= 2038.08 \text{ cm}^2$. **1**

OR

Base diameter = 28 m

Base radius = $\frac{28}{2} = 14$ cm

Height of cloth required = 17 + 2 + 2

= 21 cm **1**

Area of cloth required = Curved surface area of cylinder of radius 14 cm and height 21 cm

$= 2\pi rh$

$= 2 \times \frac{22}{7} \times 14 \times 21$

$= 1848 \text{ cm}^2$ **1**

Let A sq. cm of cloth be purchased.

So, wastage of cloth for cutting and pasting

$= \frac{A}{12} \text{ cm}^2$ ½

Area of cloth actually used

$= A - \frac{A}{12} = \frac{11}{12} A \text{ cm}^2$ ½

Area of cloth actually used

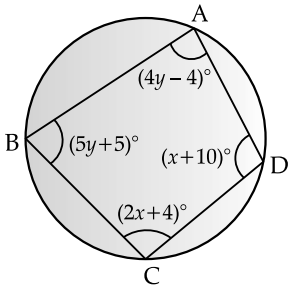
= Area of cloth required

or, $\frac{11}{12} A = 1848$

or, $A = \frac{1848 \times 12}{11} = 2016 \text{ cm}^2$ **1**

Case Study-1

13. (i)



Since, the opposite angles of a cyclic quadrilateral are supplementary.

$\therefore \quad \angle A + \angle C = 180°$

$\Rightarrow \quad 4y - 4 + 2x + 4 = 180°$ **1**

$\Rightarrow \quad x + 2y = 90°$ ...(i)

and $\quad \angle B + \angle D = 180°$

$\Rightarrow \quad 5y + 5 + x + 10 = 180°$

$\Rightarrow \quad x + 5y = 165°$ ...(ii)

On solving, we get $x = 40°$ and $y = 25°$ **1**

(ii) $\angle A = 4y - 4$ [given]

Putting $y = 25$ from part (i), we get

$\angle A = 4 \times 25 - 4 = 96°$ ½

and $\angle B = 5y + 5$ [given]

Putting, $y = 25$, we get

$\angle B = 5 \times 25 + 5 = 130°$ ½

Similarly, $\angle A = 4y - 4 = 96°$ [Proved above]

and $\angle C = 2x + 4$

Putting $x = 40$ from part (i), we get

$\angle C = 2 \times 40 + 4 = 84°$

$\therefore \quad \angle A + \angle C = 96° + 84°$

$= 180°$ **Proved. 1**

Case Study-2

14. (i) $\left(x + \frac{1}{x}\right)^3 = (10)^3$ **1**

$x^3 + \frac{1}{x^3} + 3x \times \frac{1}{x}\left(x + \frac{1}{x}\right) = 1000$

[Use formula : $(a + b)^3 = a^3 + b^2 + 3ab(a + b)$]

$\left(x^3 + \frac{1}{x^3}\right) + 3(10) = 1000$

$\left(x^3 + \frac{1}{x^3}\right) = 1000 - 30 = 970.$

Hence, amount donated by Ravi = ₹970. **1**

(ii) Given: $x + \frac{1}{x} = 7$

Taking cube on both sides, we get

$x^3 + \frac{1}{x^3} + 3x \times \frac{1}{x}\left(x + \frac{1}{x}\right) = 343$ **1**

$\left(x^3 + \frac{1}{x^3}\right) + 3(7) = 343$

$\left(x^3 + \frac{1}{x^3}\right) = 343 - 21 = 322.$ **1**

Hence, amount donated by Ravi = ₹322.

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