Sample Question Paper, 2021-22

(Issued by CBSE Board on 14^{th} January 2022)

Term-II

MATHEMATICS (BASIC)

SOLVED

Time : 2 hours **Max.Marks: 40**

General Instructions :

1. *The question paper consists of 14 questions divided into 3 sections A, B, C.*
2. *Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in two questions.*
3. *Section B comprises of 4 questions of 3 marks each. Internal choice has been provided in one question.*
4. *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 roots of the quadratic equation $3x^2 - 7x - 6 = 0$.

OR

Find the values of k for which the quadratic equation $3x^2 + kx + 3 = 0$ has real and equal roots.

2. Three cubes each of volume 64 cm^3 are joined end to end to form a cuboid. Find the total surface area of the cuboid so formed?

3. An inter house cricket match was organized by a school. Distribution of the runs made by the students is given below. Find the median runs scored.

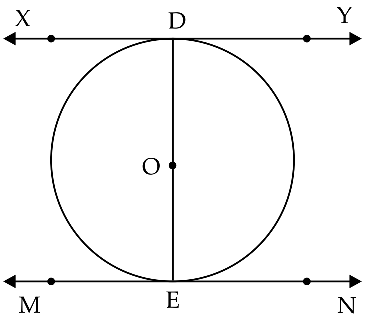
Runs Scored	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of students	4	6	5	3	4

4. Find the common difference of the A. P. 4, 9, 14, ... If the first term changes to 6 and the common difference remains the same then write the new AP.

5. The mode of the following frequency distribution is 38. Find the value of x.

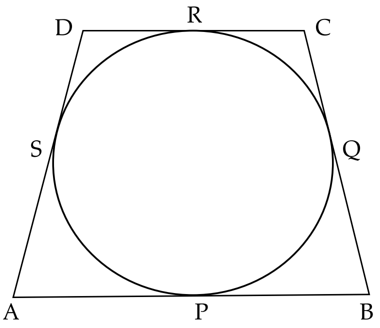
Class Interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70
Frequency	7	9	12	16	x	6	11

6. XY and MN are the tangents drawn at the end points of the diameter DE of the circle with centre O. Prove that $XY \parallel MN$.



OR

In the given figure, a circle is inscribed in the quadrilateral $ABCD$. Given $AB = 6$ cm, $BC = 7$cm and $CD = 4$ cm. Find AD.



Section - B

[3 Marks each]

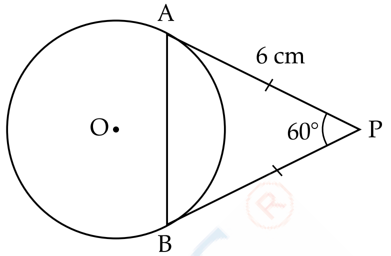
7. An A.P. 5, 8, 11…has 40 terms. Find the last term. Also find the sum of the last 10 terms.

8. A tree is broken due to the storm in such a way that the top of the tree touches the ground and makes an angle of 30° with the ground. Length of the broken upper part of the tree is 8 meters. Find the height of the tree before it was broken.

OR

Two poles of equal height are standing opposite each other on either side of the road 80 m wide. From a point between them on the road the angles of elevation of the top of the two poles are respectively 60° and 30°. Find the distance of the point from the two poles.

9. PA and PB are the tangents drawn to a circle with centre O. If $PA = 6$ cm and $\angle APB = 60°$, then find the length of the chord AB.



10. The sum of the squares of three positive numbers that are consecutive multiples of 5 is 725. Find the three numbers.

Section - C

[4 Marks each]

11. Construct two concentric circles of radii 3 cm and 7 cm. Draw two tangents to the smaller circle from a point P which lies on the bigger circle.

OR

Draw a pair of tangents to a circle of radius 6 cm which are inclined to each other at an angle of 60°. Also find the length of the tangent.

12. The following age wise chart of 300 passengers flying from Delhi to Pune is prepared by the Airlines staff:

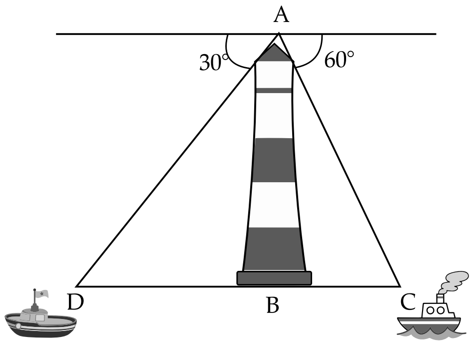
Age	Less than 10	Less than 20	Less than 30	Less than 40	Less than 50	Less than 60	Less than 70	Less than 80
Number of Passengers	14	44	82	134	184	245	287	300

Find the mean age of the passengers.

Case Study-1

13. A lighthouse is a tall tower with light near the top. These are often built on islands, coasts or on cliffs. Lighthouses on water surface act as a navigational aid to the mariners and send warning to boats and ships for dangers. Initially wood, coal would be used as illuminators. Gradually it was replaced by candles, lanterns, electric lights. Now a days they are run by machines and remote monitoring.

Prongs Reef lighthouse of Mumbai was constructed in 1874 – 75. It is approximately 40 meters high and its beam can be seen at a distance of 30 kilometres. A ship and a boat are coming towards the lighthouse from opposite directions. Angles of depression of flash light from the lighthouse to the boat and the ship are 30° and 60° respectively.



(i) Which of the two, boat or the ship is nearer to the light house. Find its distance from the lighthouse? **2**

(ii) Find the time taken by the boat to reach the light house if it is moving at the rate of 2 km per hour. **2**

Case Study-2

14. Krishnanagar is a small town in Nadia District of West Bengal. Krishnanagar clay dolls are unique in their realism and quality of their finish. They are created by modelling coils of clay over a metal frame. The figures are painted in natural colours and their hair is made either by sheep's wool or jute. Artisans make models starting from fruits, animals, God, goddess, farmer, fisherman, weavers to Donald

Duck and present comic characters. These creations are displayed in different national and international museums.

Here are a few images (not to scale) of some clay dolls of Krishnanagar.

Doll-1

Doll-2

Doll-3

Doll-4

The ratio of diameters of red spherical apples in Doll-1 to that of spherical oranges in Doll-2 is 2 : 3. In Doll-3, male doll of blue colour has cylindrical body and a spherical head. The spherical head touches the cylindrical body. The radius of both the spherical head and the cylindrical body is 3 cm and the height of the cylindrical body is 8 cm. Based on the above information answer the following questions:

(i) What is the ratio of the surface areas of red spherical apples in Doll-1 to that of spherical oranges in Doll-2 ? **2**

(ii) The blue doll of Doll-3 is melted and its clay is used to make the cylindrical drum of Doll-4. If the radius of the drum is also 3 cm, find the height of the drum. **2**

■■■

SOLUTION

Section - A

1.

$$3x^2 - 7x - 6 = 0$$

$$\Rightarrow \quad 3x^2 - 9x + 2x - 6 = 0 \quad ½$$

$$\Rightarrow \quad 3x(x-3) + 2(x-3) = 0$$

$$\Rightarrow \quad (x-3)(3x+2) = 0 \quad ½$$

$$\therefore \quad x = 3, -\frac{2}{3} \quad \mathbf{1}$$

Detailed Solution:

$$3x^2 - 7x - 6 = 0 \quad \text{(Given)}$$

Using splitting middle term method,

$$3x^2 - 9x + 2x - 6 = 0 \quad ½$$

$$\Rightarrow \quad 3x(x-3) + 2(x-3) = 0$$

$$\Rightarrow \quad (3x+2)(x-3) = 0 \quad ½$$

Either $3x + 2 = 0$

$$\Rightarrow \quad x = \frac{-2}{3}$$

or $x - 3 = 0$

or $x = 3$

Hence, 3 or $-\dfrac{2}{3}$ are the roots of the quadratic equation. **1**

OR

Since the roots are real and equal,

$$\therefore \quad D = b^2 - 4ac = 0$$

$$\Rightarrow \quad k^2 - 4 \times 3 \times 3 = 0$$

$$(\because a = 3, b = k, c = 3) \quad \mathbf{1}$$

$$\Rightarrow \quad k^2 = 36$$

$$\Rightarrow \quad k = 6 \text{ or } -6 \quad ½+½$$

Detailed Solution:

Given: $3x^2 + kx + 3 = 0$

On comparing it with $ax^2 + bx + c = 0$

$a = 3, b = k, c = 3$ **1**

Since, roots are real and equal.

$$\Rightarrow \quad \text{Discriminant} = 0$$

or $b^2 - 4ac = 0$

or $(k)^2 - 4\,(3)\,(3) = 0$

or $k^2 - 36 = 0$

or $k^2 = 36$

or $k = \pm 6$

i.e., $k = 6$ or -6. ½ + ½

2. Let l be the side of the cube and L, B, H be the dimensions of the cuboid

Since $l^3 = 64 \text{ cm}^3$

$\therefore \quad l = 4$ cm ½

Total surface area of cuboid

$= 2[LB + BH + HL]$,

Where $L = 12$ cm, $B = 4$ cm and $H = 4$ cm ½

$= 2(12 \times 4 + 4 \times 4 + 4 \times 12) \text{ cm}^2$

$= 224 \text{ cm}^2$ **1**

3.

Runs Scored	Frequency	Cumulative Frequency
0 – 20	4	4
20 – 40	6	10
40 – 60	5	15
60 – 80	3	18
80 – 100	4	22

½

Total frequency $(N) = 22$

$\therefore \quad \dfrac{N}{2} = 11;$ ½

So 40 – 60 is the median class.

$$\text{Median} = l + \frac{\left(\frac{N}{2}\right) - cf}{f} \times h \quad ½$$

$$= 40 + \frac{11-10}{5} \times 20$$

$$= 44 \text{ runs} \quad ½$$

4. The common difference is

$9 - 4 = 5$ **1**

If the first term is 6 and common difference is 5, then new AP is, 6, 6 + 5, 6 + 10…

= 6, 11, 16…. **1**

Detailed Solution:

Since 4, 9, 14 ..... is given in A.P.

$\Rightarrow \quad a = 4,$

$d = 2^{nd}$ term – 1^{st} term

$d = 9 - 4 = 5$

Common difference of the given A.P. is 5. **1**

If first term is 6 and common difference = 5

i.e., $\quad a_1 = 6$

$a_2 = a + d = 6 + 5 = 11$

$a_3 = a + 2d = 6 + 2(5) = 16$

$\therefore$ New A.P. will be 6, 11, 16... **1**

5. $\because \quad$ Mode = 38.

$\therefore$ The modal class is 30 – 40. ½

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h \quad ½$$

$$38 = 30 + \frac{16-12}{32-12-x} \times 10 \quad ½$$

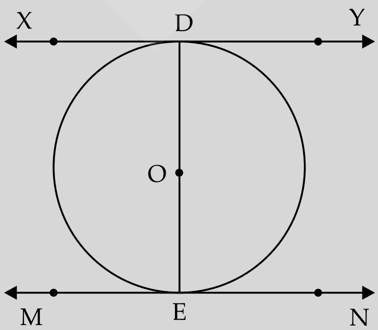
$$\frac{4}{20-x} \times 10 = 8$$

$$8(20 - x) = 40$$

$$20 - x = 5$$

$$x = 15 \quad ½$$

6.



$\because$ XY is the tangent to the circle at the point D

$\therefore \quad OD \perp XY$

$\Rightarrow \quad \angle ODX = 90°$

$\Rightarrow \quad \angle EDX = 90°$ ½

Also, MN is the tangent to the circle at E

$\therefore \quad OE \perp MN$

$\Rightarrow \quad \angle OEN = 90°$

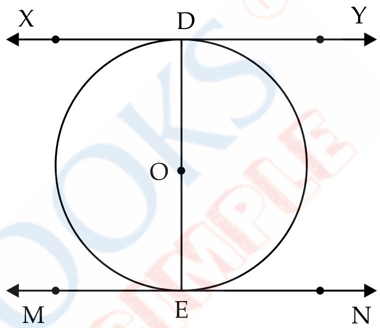
$\Rightarrow \quad \angle DEN = 90°$

$\Rightarrow \quad \angle EDX = \angle DEN$ (each 90°). ½

which are alternate interior angles.

$\therefore \quad XY \parallel MN$ **1**

Detailed Solution:



Given: DE is a diameter of the circle with centre O. XY and MN are tangents to the circle at D and E.

To Prove: $XY \parallel MN$.

Proof: According to the theorems, Radius is always perpendicular to the tangent at point of contact.

$\Rightarrow \quad OD \perp XY \quad$ [OD is the Radius and XY is the tangent]

i.e., $\quad \angle ODX = \angle ODY = 90°.$ ½

Similarly, if OE is the radius and MN is the tangent, then

$OE \perp MN$

i.e., $\quad \angle OEN = \angle OEM = 90°$ ½

$\because \quad \angle ODX = \angle OEN = 90°$

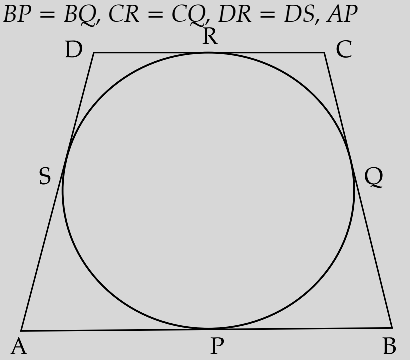
(Alternate Angles)

Hence, $\quad XY \parallel MN.$ **Proved 1**

OR

$\because$ Tangent segments drawn from an external point to a circle are equal

$\therefore$ $BP = BQ, CR = CQ, DR = DS, AP = AS$



$\Rightarrow$ $BP + CR + DR + AP = BQ + CQ + DS + AS$ **1**

$\Rightarrow \quad AB + DC = BC + AD$

$\therefore \quad AD = 10 - 7 = 3$ cm **1**

Section - B

7. First term of the A.P. $(a) = 5$

Common difference $(d) = 8 - 5 = 3$

$$\text{Last term } = a_{40}$$
$$= a + (40 - 1)d$$
$$= 5 + 39 \times 3 = 122 \quad \textbf{1}$$

Also
$$a_{31} = a + 30d$$
$$= 5 + 30 \times 3 = 95 \quad \textbf{1}$$

Sum of last 10 terms

$$= \frac{n}{2}(a_{31} + a_{40})$$
$$= \frac{10}{2}(95 + 122)$$
$$= 5 \times 217 = 1085 \quad \textbf{1}$$

Detailed Solution:

5, 8, 11, ... is given in A.P. which has 40 terms.

So, first term $a = 5$,

and common difference $d = 8 - 5 = 3$

Total terms $n = 40$

Let the last term be n^{th} term,

$$a_n = a + (n - 1)d$$
$$\therefore \quad a_{40} = 5 + (40 - 1)3$$
$$\Rightarrow \quad a_{40} = 5 + (39)3$$
$$\Rightarrow \quad a_{40} = 5 + 117$$
$$\Rightarrow \quad a_{40} = 122 \quad \textbf{1}$$

Now,
$$a_{31} = 5 + (31 - 1)3$$
$$= 5 + (30)3$$
$$= 5 + 90$$
$$= 95 \quad \textbf{1}$$

For last 10 terms,

First term, $a' = a_{31} = 95$

Last term, $l' = a_{40} = 122$

$\therefore$ Sum of last 10 terms

$$S_n = \frac{n}{2}[a' + l']$$
$$S'_{10} = \frac{10}{2}[95 + 122]$$
$$= \frac{10}{2}[217]$$
$$= 5 \times 217$$
$$= 1085. \quad \textbf{1}$$

8. Let, AB be the tree broken at C,

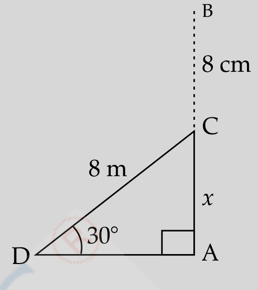
Also let

$$AC = x$$

In Δ CAD,

$$\sin 30° = \frac{AC}{DC} \quad \textbf{1}$$

$$\Rightarrow \quad \frac{1}{2} = \frac{x}{8} \quad \textbf{1}$$



$$\Rightarrow \quad x = 4 \text{ m.} \quad \tfrac{1}{2}$$

$\therefore$ The length of the tree is

$$= 8 + 4 = 12 \text{ m} \quad \tfrac{1}{2}$$

OR

Let AB and CD be two poles of height h meters also let P be a point between them on the road which is x meters away from foot of first pole AB, $PD = (80 - x)$ meters.

In ΔABP, $\tan 60° = \dfrac{h}{x}$

$$\Rightarrow \quad h = x\sqrt{3} \quad \text{....(1)} \quad \textbf{1}$$

In ΔCDP, $\tan 30° = \dfrac{h}{80 - x}$

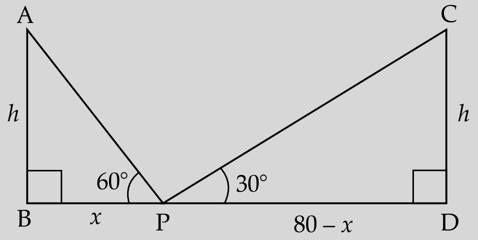
$$\Rightarrow \quad h = \frac{80 - x}{\sqrt{3}} \quad \text{....(2)} \quad \tfrac{1}{2}$$

[$\because$ LHS (1) = LHS (2), So equating RHS]

$$x\sqrt{3} = \frac{80 - x}{\sqrt{3}}$$
$$\Rightarrow \quad 3x = 80 - x$$
$$\Rightarrow \quad 4x = 80$$
$$\Rightarrow \quad x = 20 \text{ m}$$

So, $80 - x = 80 - 20 = 60$ m $\tfrac{1}{2}$

Hence, the point is 20 m from one pole and 60 meters from the other pole.



1

9. $PA = PB$ (tangents drawn to a circle from an external point are equal)

$\therefore$ In ΔAPB, $\angle PAB = \angle PBA$

Also, $\angle APB = 60°$ **1**

In ΔAPB,

$\because$ sum of three angles is 180°

$\angle PAB + \angle PBA = 180° - \angle APB$

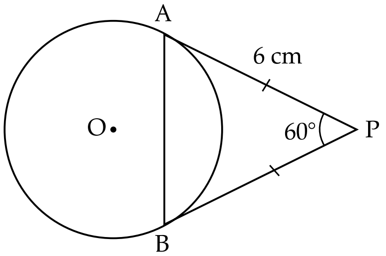
$= 180° - 60° = 120°.$

$\because$ $\angle PAB = \angle PBA = 60°$ $(\because \angle PAB = \angle PBA)$ **1**

$\therefore$ ΔAPB is an equilateral triangle.

Hence, $AB = 6$ cm. **1**

Detailed Solution:



It is given that $PA = 6$ cm and $\angle APB = 60°$

According to the property that tangents drawn from same external point are equal in length.

$\therefore$ $PA = PB = 6$ cm. **1**

$\Rightarrow$ $\angle PAB = \angle PBA$

[Equal sides have equal opposite angles]

In ΔAPB,

According to angle sum property of a triangle.

$\angle PAB + \angle PBA + \angle APB = 180°$

$\angle PAB + \angle PAB + 60° = 180°$

$2\angle PAB = 180° - 60°$

$\angle PAB = \dfrac{120°}{2} = 60°$

$\therefore$ $\angle APB = \angle PAB$ **1**

$= \angle PBA = 60°$

So, ΔAPB is an equilateral triangle. In an equitation triangle all sides are equal.

$\therefore$ $AB = PA = PB = 6$ cm

or $AB = 6$ cm. **1**

10. Let the three consecutive multiples of 5 be $5x$, $5x + 5$, $5x + 10$.

Their squares are $(5x)^2$, $(5x + 5)^2$ and $(5x + 10)^2$.

$(5x)^2 + (5x + 5)^2 + (5x + 10)^2 = 725$ **1**

$\Rightarrow 25x^2 + 25x^2 + 50x + 25 + 25x^2 + 100x + 100 = 725$

$\Rightarrow$ $75x^2 + 150x - 600 = 0$

$\Rightarrow$ $x^2 + 2x - 8 = 0$

$\Rightarrow$ $(x + 4)(x - 2) = 0$

$\Rightarrow$ $x = -4, 2$

$\Rightarrow$ $x = 2$

(ignoring –ve value) **1**

So the numbers are 10, 15 and 20. **1**

Detailed Solution:

Let first consecutive number $= 5x$

Second number $= 5(x + 1) = 5x + 5$

Third number $= 5(x + 2) = 5x + 10$

According to the question,

$(5x)^2 + (5x + 5)^2 + (5x + 10)^2 = 725$ **1**

$\Rightarrow 25x^2 + 25x^2 + 25 + 50x + 25x^2 + 100 + 100x = 725$

$\Rightarrow 75x^2 + 150x + 125 - 725 = 0$

$\Rightarrow$ $75(x^2 + 2x - 8) = 0$

or $x^2 + 2x - 8 = 0$

$\Rightarrow$ $x^2 + 4x - 2x - 8 = 0$

$\Rightarrow$ $x(x + 4) - 2(x + 4) = 0$

$\Rightarrow$ $(x - 2)(x + 4) = 0$

either $x - 2 = 0$

$\Rightarrow$ $x = 2$

or $x + 4 = 0$

$x = -4$ (ignoring –ve value) **1**

$\therefore$ 1st number $= 5x = 5(2) = 10$

2nd number $= 5x + 5 = 5(2) + 5 = 15$

3rd number $= 5x + 10$

$= 5(2) + 10 = 20$ **1**

Section - C

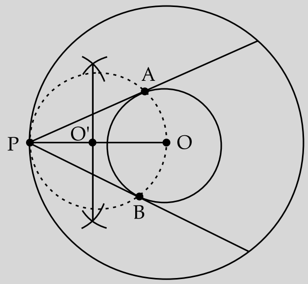
11. Draw two concentric circles with center O and radii 3 cm and 7 cm respectively. **1**

Join OP and bisect it at O',

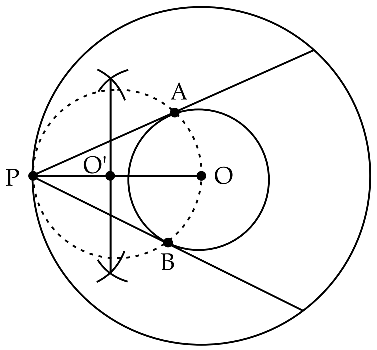
so $PO' = O'O$ **1**

Construct circle with center O' and radius $O'O$ **1**

Join PA and PB. **1**



Detailed Solution:



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Steps of construction:

(i) Draw two concentric circles of radii 3 cm and 7 cm respectively.

(ii) Make a point P on the outer circle and join OP.

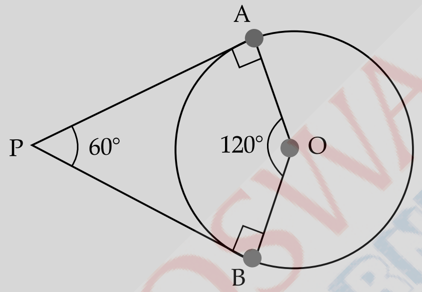
(iii) Draw perpendicular bisector of OP. Let it intersect OP at O'.

(iv) With O' as centre and $O'O$ as radius draw a circle and it should pass through P.

(v) Let this circle intersect inner circle at A and B.

(vi) Join PA and PB. Thus PA and PB are required tangents. 1

OR



Draw a circle of radius 6 cm

Draw OA and construct $\angle AOB = 120°$ 1

Draw $\angle OAP = \angle OBP = 90°$ 1

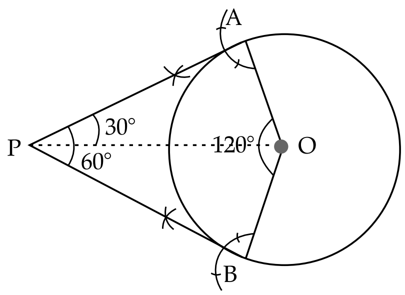
PA and PB are required tangents 1

Join OP and apply

$$\tan \angle APO = \tan 30° = \frac{6}{PA}$$

$\Rightarrow$ Length of tangent $= 6\sqrt{3}$ cm 1

Detailed Solution:



2

Steps of construction:

(i) Draw a circle of radius 6 cm with centre O.

(ii) Draw any radius OA and make an angle of $180° - 60° = 120°$ at O such that $\angle AOB = 120°$.

(iii) Draw $AP \perp OA$ and $BP \perp OB$. Let the two perpendiculars meet at point P.

(iv) Thus PA and PB are the required tangents to the given circle inclined at angle of 60°.

(v) Join OP

$\because$ Tangents are equally is clined to each other.

$\therefore \quad \angle OPA = \angle OPB = 30°$

In right angle ΔOAP,

$$\tan 30° = \frac{OA}{AP}$$

$$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{6}{AP}$$

$$\Rightarrow \quad AP = 6\sqrt{3} \text{ cm}$$ 2

Hence, the length of the tangent is $6\sqrt{3}$ cm.

12. Converting the cumulative frequency table into exclusive classes, we get:

Age	No. of passengers (f_i)	x_i	f_ix_i
0-10	14	5	70
10-20	30	15	450
20-30	38	25	950
30-40	52	35	1820
40-50	50	45	2250
50-60	61	55	3355
60-70	42	65	2730
70-80	13	75	975
	$\Sigma f_i = 300$		$\Sigma f_ix_i = 12600$

$$\text{Mean age} \quad (\bar{x}) = \frac{\Sigma f_ix_i}{\Sigma f_i}$$

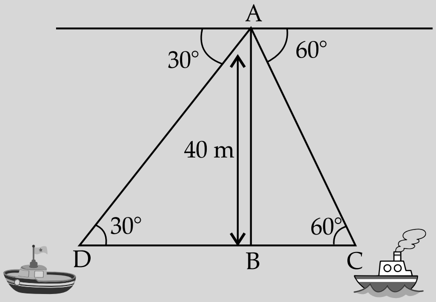
$$= \frac{12600}{300}$$ 1

$$\bar{x} = 42$$ 1

Case Study-1

13. **(i)** The ship is nearer to the lighthouse as its angle of depression is greater.

In ΔACB, $\tan 60° = \dfrac{AB}{BC}$ **1**



$$\Rightarrow \quad \sqrt{3} = \frac{40}{BC}$$

$$\therefore \quad BC = \frac{40}{\sqrt{3}} = \frac{40\sqrt{3}}{3} \text{ m}$$ **1**

(ii) In ΔADB,

$$\tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{40}{DB}$$

$$\therefore \quad DB = 40\sqrt{3} \text{ m}$$ **1**

Time taken to cover this distance

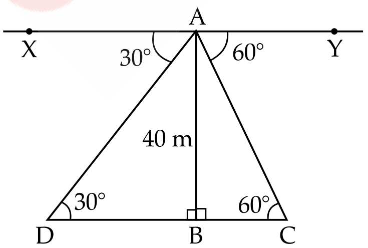
$$= \left(\frac{60}{2000} \times 40\sqrt{3}\right) \text{minutes}$$

$$= \frac{60\sqrt{3}}{50}$$

$$= 2.076 \text{ minutes}$$ **1**

Detailed Solution:

(i)



Let AB is the height of the lighthouse

i.e., $AB = 40$ m

$$\angle XAD = \angle ADB = 30°$$

[$\because$ Angle of depression = Angle of elevation]

Similarly,

$$\angle YAC = \angle ACB = 60°$$

The ship is nearer to the lighthouse as its angle of depression is greater. **1**

In ΔACB, $\angle B = 90°$

$$\tan 60° = \frac{40}{BC}$$

$$\sqrt{3} = \frac{AB}{BC} = \frac{40}{BC}$$

or $$BC = \frac{40}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

or $$BC = \frac{40\sqrt{3}}{3} \text{ m}$$ **1**

(ii) Speed of Boat $= 2$ km/hr

In ΔADB, $\angle B = 90°$

$$\Rightarrow \quad \tan 30° = \frac{AB}{BD} = \frac{40}{BD}$$

$$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{40}{BD}$$

$$\Rightarrow \quad BD = 40\sqrt{3} \text{ m}$$ **1**

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$\text{Distance} = 40\sqrt{3} \text{ m}$$

$$\text{Speed} = 2 \text{ km/hr}$$

$$= \frac{2 \times 1000}{60} = \frac{100}{3} \text{ m/min}$$

$$\left[\because 1 \text{ km/h} = \frac{50}{3} \text{ m/min}\right]$$

Time taken by boat to reach the light house

$$= \frac{40\sqrt{3}}{\frac{100}{3}}$$

$$= 40\sqrt{3} \times \frac{3}{100}$$ **1**

$$= 2.078 \text{ minutes}$$

$$= 2.1 \text{ minutes}$$

Case Study-2

14. **(i)** Let r_1 and r_2 be respectively the radii of apples and oranges

$\therefore \quad 2r_1 : 2r_2 = 2 : 3$

$\Rightarrow \quad r_1 : r_2 = 2 : 3$ ½

$4\pi r_1^2 : 4\pi r_2^2$

$= \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{2}{3}\right)^2 = 4:9$ **1½**

(ii) Let the height of the drum be h.

Volume of the drum = volume of the cylinder + volume of the sphere

$\pi 3^2 h = (\pi 3^2 \times 8 + \frac{4}{3}3^3)\text{cm}^3$ **1**

$\Rightarrow \quad h = (8 + 4)$ cm

$\Rightarrow \quad h = 12$ cm **1**

Detailed Solution:

(i) Let r_1 and r_2 be the radii of apples and oranges respectively.

According to the question.

$$\frac{\text{Diameter of apple}}{\text{Diameter of orange}} = \frac{2r_1}{2r_2} = \frac{r_1}{r_2}$$

But $\quad \frac{r_1}{r_2} = \frac{2}{3}$ (Given)

or $\quad r_1 : r_2 = 2 : 3.$ ½

Total surface Area of sphere = $4\pi r^2$

$$\frac{\text{Total Surface Area of spherical apple}}{\text{Total Surface Area of spherical orange}}$$

$= \frac{4\pi r_1^2}{4\pi r_2^2} = \frac{r_1^2}{r_2^2}$ ½

$= \left(\frac{r_1}{r_2}\right)^2$

$= \left(\frac{2}{3}\right)^2 = \frac{4}{9}$

or $\quad 4 : 9.$ **1**

Detailed Solution:

(ii) Let the drum of height be h cm.

$\Rightarrow$ Radius of cylindrical part in doll-3 = 3 cm

Radius of cylindrical drum in doll-4 = 3 cm

Radius of spherical part in doll-3 = 3 cm

Height of cylindrical part in doll-3 = 8 cm (H)

Blue doll of doll-3 is melted and remade into a cylindrical doll-4.

$\Rightarrow$ Volume of the cylindrical drum for doll-4 = Volume of cylindrical part + volume of serpent in doll-3

$\Rightarrow \quad \pi r^2 h = \pi r^2 H + \frac{4}{3}\pi r^3$ **1**

$\Rightarrow \quad h = H + \frac{4}{3}r$

$\Rightarrow \quad h = 8 + \frac{4}{3} \times 3$

$\Rightarrow \quad h = 12$ cm. **1**

●●●

Solved Paper, 2021-22
MATHEMATICS (BASIC)
Term-I, Set-4

Series : JSK/2

Question Paper Code No. 430/2/4

Time allowed : 90 Minutes **Max. Marks : 40**

General Instructions:

Read the following instructions very carefully and strictly follow them:

(i) *This question paper contains **50** questions out of which **40** questions are to be attempted. **All** questions carry equal marks.*
(ii) *This question paper contains **three** Sections: A, B and C.*
(iii) ***Section A** has **20** questions. Attempt any **16** questions from Q. No **1** to **20**.*
(iv) ***Section B** has **20** questions. Attempt any **16** questions from Q. No. **21** to **40**.*
(v) ***Section C** consists of two Case Studies containing **5** questions is each case. Attempt any **4** questions from Q. No. **41** to **45** and another **4** from Q. No. **46** to **50**.*
(vi) *There is only one correct option for every multiple choice question (MCQ). Marks will not be awarded for answering more than one option.*
(vii) *There is no negative marking.*

SECTION - A

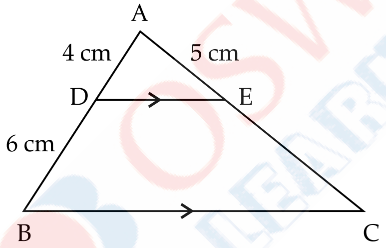
[1 Mark Each]

(In this Section, there are 20 questions. Any 16 are to be attempted.)

1. HCF of 92 and 152 is

(a) 4 (b) 19
(c) 23 (d) 57

2. In ΔABC, $DE \parallel BC$, AD = 4 cm, DB = 6 cm and AE = 5 cm. The length of EC is



(a) 7 cm (b) 6.5 cm
(c) 7.5 cm (d) 8 cm

3. The value of k, for which the pair of linear equations $x + y - 4 = 0$, $2x + ky - 3 = 0$ have no solution, is

(a) 0 (b) 2
(c) 6 (d) 8

4. The value of $(\tan^2 45° - \cos^2 60°)$ is

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$
(c) $\frac{3}{2}$ (d) $\frac{3}{4}$

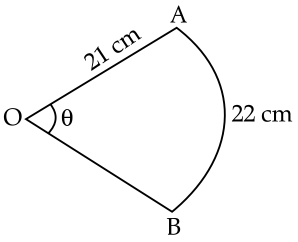
5. A point $(x, 1)$ is equidistant from (0, 0) and (2, 0). The value of x is

(a) 1 (b) 0
(c) 2 (d) $\frac{1}{2}$

6. Two coins are tossed together. The probability of getting exactly one head is

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$
(c) $\frac{3}{4}$ (d) 1

7. A circular arc of length 22 cm subtends an angle θ at the centre of the circle of radius 21 cm. The value of θ is



(a) 90° (b) 50°
(c) 60° (d) 30°

8. A quadratic polynomial having sum and product of its zeroes as 5 and 0 respectively, is

(a) $x^2 + 5x$ (b) $2x(x-5)$
(c) $5x^2 - 1$ (d) $x^2 - 5x + 5$

9. If $P(E)$ = 0.65, then the value of P(not E) is

(a) 1.65 (b) 0.25
(c) 0.65 (d) 0.35

10. It is given that $\Delta DEF \sim \Delta PQR$. $EF : QR = 3 : 2$, then value of ar(DEF) : ar(PQR) is

(a) 4 : 9 (b) 4 : 3
(c) 9 : 2 (d) 9 : 4

11. Zeroes of a quadratic polynomial $x^2 - 5x + 6$ are

(a) $-5, 1$ (b) $5, 1$

(c) $2, 3$ (d) $-2, -3$

12. $\frac{57}{300}$ **is a**

(a) non-terminating and non-repeating decimal expansion.

(b) terminating decimal expansion after 2 places of decimals.

(c) terminating decimal expansion after 3 places of decimals.

(d) non-terminating but repeated decimal expansion.

13. Perimeter of a rectangle whose length (l) is 4 cm more than twice its breadth (b) is 14 cm. The pair of linear equations representing the above information is

(a) $l + 4 = 2b$, $2(l + b) = 14$ (b) $l - b = 4$, $2(l + b) = 14$

(c) $l = 2b + 4$, $l + b = 14$ (d) $l = 2b + 4$, $2(l + b) = 14$

14. $5.\overline{213}$ **can also be written as**

(a) 5.213213213... (b) 5.2131313...

(c) 5.213 (d) $\frac{5213}{1000}$

15. The ratio is which the point (4, 0) divides the line segment joining the points (4, 6) and (4, – 8) is

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

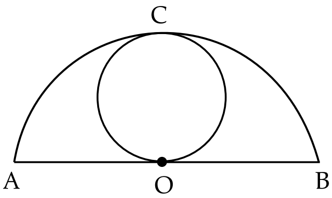
(c) 4 : 3 (d) 1 : 1

16. Which of the following is not defined ?

(a) sec 0° (b) cosec 90°

(c) tan 90° (d) cot 90°

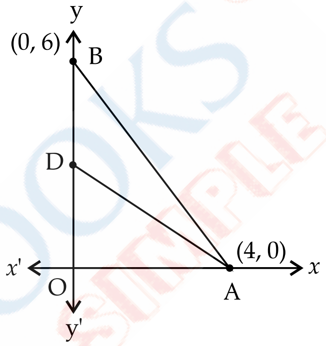
17. In the given figure, a circle is touching a semi-circle at C and its diameter AB at O. If $AB = 28$ cm, what is the radius of the inner circle ?



(a) 14 cm (b) 28 cm

(c) 7 cm (d) $\frac{7}{2}$ cm

18. The vertices of a triangle OAB are O(0, 0), A(4, 0) and B(0, 6). The median AD is drawn on OB. The length AD is



(a) $\sqrt{52}$ units (b) 5 units

(c) 25 units (d) 10 units

19. In a right angled triangle PQR, $\angle Q = 90°$. If $\angle P = 45°$, then value of tan P – cos^2 R is

(a) 0 (b) 1

(c) $\frac{1}{2}$ (d) $\frac{3}{2}$

20. If tan $\theta = \frac{2}{3}$, then the value of sec θ is

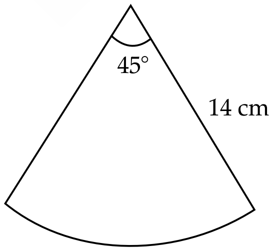
(a) $\frac{\sqrt{13}}{3}$ (b) $\frac{\sqrt{5}}{3}$

(c) $\sqrt{\frac{13}{3}}$ (d) $\frac{3}{\sqrt{13}}$

SECTION - B **[1 mark each]**

(There are 20 questions of 1 mark each. Any 16 are to be attempted.)

21. The perimeter of the sector of a circle of radius 14 cm and central angle 45° is



(a) 11 cm (b) 22 cm

(c) 28 cm (d) 39 cm

22. A bag contains 16 red balls, 8 green balls and 6 blue balls. One ball is drawn at random. The probability that it is blue ball is

(a) $\frac{1}{6}$ (b) $\frac{1}{5}$

(c) $\frac{1}{30}$ (d) $\frac{5}{6}$

23. If sin θ – cos θ = 0, then the value of θ is

(a) 30° (b) 45°

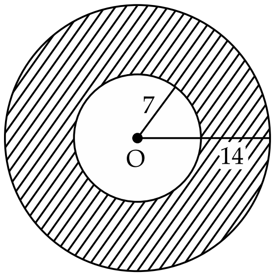
(c) 90° (d) 0°

24. The probability of happening of an event is 0.02. The probability of not happening of the event is

(a) 0.02 (b) 0.80

(c) 0.98 (d) $\frac{49}{100}$

25. Two concentric circles are centred at O. The area of shaded region, if outer and inner radii are 14 cm and 7 cm respectively, is



(a) 462 cm^2 (b) 154 cm^2
(c) 231 cm^2 (d) 308 cm^2

26. $\dfrac{1}{1+\sin\theta}+\dfrac{1}{1-\sin\theta}$ **can be simplified to get**

(a) $2\cos^2\theta$ (b) $\dfrac{1}{2}\sec^2\theta$
(c) $\dfrac{2}{\sin^2\theta}$ (d) $2\sec^2\theta$

27. The origin divides the line segment AB joining the points A(1, – 3) and B(– 3, 9) in the ratio:

(a) 3 : 1 (b) 1 : 3
(c) 2 : 3 (d) 1 : 1

28. The perpendicular bisector of line segment A(– 8, 0) and B(8, 0) passes through a point (0, k). The value of k is

(a) 0 only (b) 0 or 8 only
(c) any real number
(d) any non-zero real number

29. Which of the following is a correct statement ?

(a) Two congruent figure are always similar
(b) Two similar figures are always congruent
(c) All rectangles are similar
(d) The polygons having same number of sides are similar

30. The solution of the pair of linear equations $x = -5$ and $y = 6$ is

(a) (– 5, 6) (b) (– 5, 0)
(c) (0, 6) (d) (0, 0)

31. A circle of radius 3 units is centered at (0, 0). Which of the following points lie outside the circle ?

(a) (– 1, – 1) (b) (0, 3)
(c) (1, 2) (d) (3, 1)

32. The value of k for which the pair of linear equations $3x + 5y = 8$ and $kx + 15y = 24$ has infinitely many solutions, is

(a) 3 (b) 9
(c) 5 (d) 15

33. HCF of two consecutive event numbers is

(a) 0 (b) 1
(c) 2 (d) 4

34. The zeroes of quadratic polynomial $x^2 + 99x + 127$ are

(a) both negative (b) both positive
(c) one positive and one negative
(d) reciprocal of each other

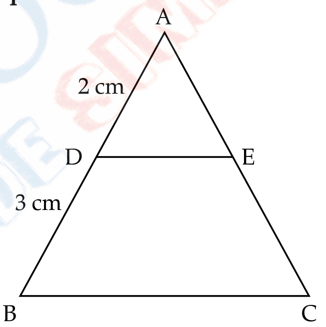
35. The mid-point of line segment joining the points (– 3, 9) and (– 6, – 4) is

(a) $\left(\dfrac{-3}{2}, \dfrac{-13}{2}\right)$ (b) $\left(\dfrac{9}{2}, \dfrac{-5}{2}\right)$
(c) $\left(\dfrac{-9}{2}, \dfrac{5}{2}\right)$ (d) $\left(\dfrac{9}{2}, \dfrac{5}{2}\right)$

36. The decimal expansion of $\dfrac{13}{2\times5^2\times7}$ is

(a) terminating after 1 decimal place
(b) non-terminating and non-repeating
(c) terminating after 2 decimal places
(d) non-terminating but repeating

37. In ΔABC, $DE \parallel BC$, AD = 2 cm, DB = 3 cm, DE : BC is equal to



(a) 2 : 3 (b) 2 : 5
(c) 1 : 2 (d) 3 : 5

38. The (HCF × LCM) for the numbers 50 and 20 is

(a) 1000 (b) 50
(c) 100 (d) 500

39. For which natural number n, 6^n ends with digit zero ?

(a) 6 (b) 5
(c) 0 (d) None

40. (1 +tan^2 A) (1 + sin A) (1 – sin A) is equal to

(a) $\dfrac{\cos^2 A}{\sec^2 A}$ (b) 1
(c) 0 (d) 2

SECTION - C **[1 mark each]**

(Attempt any 4 questions from Q. No. 41 to 45 and another 4 from Q. No. 46 to 50.)

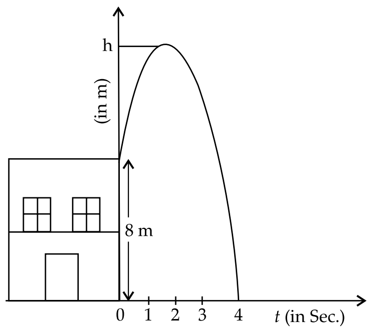
Case Study-I

Sukriti throws a ball upwards, from a rooftop which is 8 m high from ground level. The ball reaches to some maximum height and then returns and hit the ground.

If height of the ball at time t (in sec) is represented by $h(m)$, then equation of its path is given as

$h = -t^2 + 2t + 8$

Based on above information, answer the following:



41. The maximum height achieved by ball is:

(a) 7 m (b) 8 m

(c) 9 m (d) 10 m

42. The polynomial represented by above graph is:

(a) linear polynomial

(b) quadratic polynomial

(c) constant polynomial

(d) cubic polynomial

43. Time taken by ball to reach maximum height is:

(a) 2 second (b) 4 second

(c) 1 second (d) 2 minute

44. Number of zeroes of the polynomial whose graph is given, is

(a) 1 (b) 2

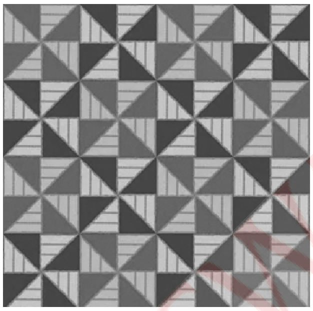
(c) 0 (d) 3

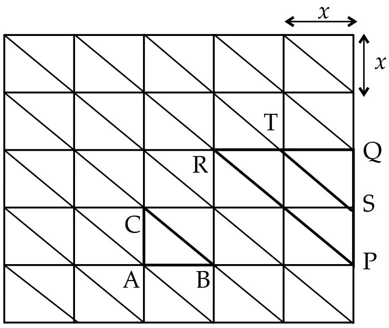
45. Zeroes of the polynomial are:

(a) 4 (b) – 2, 4

(c) 2, 4 (d) 0, 4

Case Study-II





Diagrammatic View

Quilts are available in various colours and design. Geometric design includes shapes like squares, triangles, rectangles, hexagons etc.

One such design is shown above. Two triangles are highlighted, ΔABC and ΔPQR.

Based on above information, answer the following questions:

46. Which of the following criteria is not suitable for ΔABC to be similar to ΔQRP ?

(a) SAS (b) AAA

(c) SSS (d) RHS

47. If each square is of length x unit, then length BC is equal to

(a) $x\sqrt{2}$ unit (b) $2x$ unit

(c) $2\sqrt{x}$ unit (d) $x\sqrt{x}$ unit

48. Ratio BC : PR is equal to

(a) 2 : 1 (b) 1 : 4

(c) 1 : 2 (d) 4 : 1

49. ar(PQR) : ar(ABC) is equal to

(a) 2 : 1 (b) 1 : 4

(c) 4 : 1 (d) 1 : 8

50. Which of the following is not true ?

(a) ΔTQS ~ ΔPQR (b) ΔCBA ~ ΔSTQ

(c) ΔBAC ~ ΔPQR (d) ΔPQR ~ ΔABC

❑❑❑

SOLUTION

SECTION - A

1. (a) 4

Explanation: Prime factorisation of 92

$= 2 \times 2 \times 23$

Prime factorisation of 152 $= 2 \times 2 \times 2 \times 19$

To find HCF, we multiply all the prime factors common to both numbers:

Therefore, HCF $= 2 \times 2 = 4$

2. (c) 7.5 cm

Explanation: Since DE || BC,

$$\frac{AD}{DB} = \frac{AE}{EC}$$ (By Basic Proportionality Theorem)

Since $AD = 4$ cm, $DB = 6$ cm and $AE = 5$ cm

So, $$\frac{4}{6} = \frac{5}{EC}$$

Therefore, $$EC = \frac{6\times5}{4} = \frac{30}{4}$$

$= 7.5$ cm

3. (b) 2

Explanation:

For no solution $\frac{a_1}{a_2} = \frac{b_1}{b_2} \uparrow \frac{c_1}{c_2}$

Here, $a_1 = 1$, $a_2 = 2$, $b_1 = 1$, $b_2 = k$, $c_1 = -4$, $c_2 = -3$

So, $$\frac{1}{2} = \frac{1}{k}$$

Therefore, $$k = \frac{1\times2}{1} = 2$$

4. (d) 3/4

Explanation: We know that,

$$\tan 45° = 1 \text{ and } \cos 60° = \frac{1}{2}$$

$$\text{So, } (\tan^2 45° - \cos^2 60°) = \left\{(1)^2 - \left(\frac{1}{2}\right)^2\right\}$$

$$= \left(1 - \frac{1}{4}\right)$$

$$= \frac{3}{4}$$

5. (a) 1

Explanation: Let the point $(x, 1)$ be A, $(0, 0)$ be B and $(2, 0)$ be C.

According to question, AB = AC

[Using distance formula $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$]

$$\Rightarrow \sqrt{(0-x)^2 + (0-1)^2} = \sqrt{(2-x)^2 + (0-1)^2}$$

Squaring both sides

$$\Rightarrow \left(\sqrt{(0-x)^2 + (0-1)^2}\right)^2 = \left(\sqrt{(2-x)^2 + (0-1)^2}\right)^2$$

$$\Rightarrow (0-x)^2 + (0-1)^2 = (2-x)^2 + (0-1)^2$$

$$\Rightarrow (-x)^2 + (-1)^2 = (4 - 4x + x^2) + (-1)^2$$

$$\{\text{Since, } (a-b)^2 = (a^2 - 2ab + b^2)\}$$

$$\Rightarrow x^2 + 1 = 4 - 4x + x^2 + 1$$

$$\Rightarrow 0 = 4 - 4x$$

$$\Rightarrow 4x = 4$$

$$\Rightarrow x = 1$$

6. (b) $\frac{1}{2}$

Explanation: When two coins are tossed together, the possible outcomes are: HH, HT, TH and TT

Exactly one head is occurring in only two cases (HT and TH) out of the four listed above.

$$\text{So, } P(E) = \frac{\text{Number of favourable outcomes}}{\text{Number of total outcomes}}$$

$$\therefore P(E) = \frac{2}{4}$$

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

7. (c) 60°

Explanation:

$$\text{Length of arc} = \frac{\theta}{360°} \times 2\pi r$$

$$\Rightarrow 22 = \frac{\theta}{360°} \times 2 \times \frac{22}{7} \times 21$$

$$\Rightarrow \theta = \frac{22 \times 360° \times 7}{2 \times 21 \times 22}$$

$$\therefore \theta = 60°$$

8. (b) $2x(x - 5)$

Explanation: Let the zeroes be α and β.

According to question, $\alpha + \beta = 5$ and

$$\alpha\beta = 0$$

Now, $p(x) = k(x^2 - (\alpha + \beta)x + \alpha\beta)$,

where k is any real number

$\Rightarrow$ $p(x) = k(x^2 - 5x + 0)$,

where k is any real number

When $k = 2$

$$\Rightarrow p(x) = 2(x^2 - 5x)$$

$$\therefore p(x) = 2x(x - 5)$$

9. (d) 0.35

Explanation: We know that,

$$P(E) + P(\text{not } E) = 1$$

$$\Rightarrow 0.65 + P(\text{not } E) = 1$$

$$\Rightarrow P(\text{not } E) = 1 - 0.65$$

$$\therefore P(\text{not } E) = 0.35$$

10. (d) 9 : 4

Explanation: Since ΔDEF ~ ΔPQR

$$\Rightarrow \frac{ar(\Delta DEF)}{ar(\Delta PQR)} = \left(\frac{EF}{QR}\right)^2$$

(If two triangles are similar, then the ratio of the area of both triangles is proportional to the square of the ratio of their corresponding sides.)

$$\Rightarrow \frac{ar(\Delta DEF)}{ar(\Delta PQR)} = \left(\frac{3}{2}\right)^2$$

$$\Rightarrow \frac{ar(\Delta DEF)}{ar(\Delta PQR)} = \frac{9}{4}$$

11. (c) 2, 3

Explanation: $p(x) = x^2 - 5x + 6 = 0$

$$\Rightarrow x^2 - 3x - 2x + 6 = 0$$

(splitting the middle term)

$$\Rightarrow x(x - 3) - 2(x - 3) = 0$$

$$\Rightarrow (x - 3)(x - 2) = 0$$

$$\Rightarrow x = 3, 2$$

12. (b) terminating decimal expansion after 2 places of decimals.

Explanation: Here $\frac{57}{300}$ can be written as

$$\frac{57}{2^2 \times 3^1 \times 5^2}$$

Further, it can be written as $\frac{19}{2^2 \times 5^2} = \frac{19}{100}$

$$= 0.19$$

Since, the denominator is of the form $2^m \times 5^n$, the decimal expansion will be terminating.

Therefore, it is terminating decimal expansion after 2 decimal places.

13. (d) $l = 2b + 4$

$2(l + b) = 14$

Explanation: To solve the above question, let us break the statement into parts.

It says that perimeter is 14 cm

$\therefore \quad 2(l + b) = 14$

Also, length is 4 cm more than twice its breadth.

$\Rightarrow \quad \text{Length} = 2 \times \text{Breadth} + 4$

$\therefore \quad l = 2b + 4$

14. (a) 5.213213213...

Explanation: Bar present on 213 in $5.\overline{213}$ means 213 is repeated multiple times.

15. (b) 3 : 4

Explanation: Let the ratio be $k : 1$.

Using section formula,

$$(x, y) = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$

$$\Rightarrow \quad (4, 0) = \left(\frac{k \times 4 + 1 \times 4}{k+1}, \frac{k \times -8 + 1 \times 6}{k+1}\right)$$

$$\Rightarrow \quad (4, 0) = \left(\frac{4k+4}{k+1}, \frac{-8k+6}{k+1}\right)$$

$$\therefore \quad 4 = \frac{4k+4}{k+1}$$

$$\text{and} \quad 0 = \frac{-8k+6}{k+1}$$

$$\Rightarrow \quad 0 = -8k + 6$$

$$\Rightarrow \quad 8k = 6$$

$$\therefore \quad \frac{k}{1} = \frac{6}{8} = \frac{3}{4}$$

Therefore, the required ratio is 3 : 4.

16. (c) tan 90°

Explanation: $\tan 90° = \dfrac{\sin 90°}{\cos 90°} = \dfrac{1}{0}$

= not defined

17. (c) 7 cm

Explanation: Here AB is the diameter of the semicircle, so $AB = 28$ cm

OA is the radius; so, $OA = OC = 14$ cm

But OC is the diameter of the circle and we know that diameter = 2 × radius

$\therefore \quad OC = 2 \times \text{radius}$

$\Rightarrow \quad 14 = 2 \times \text{radius}$

$\therefore \quad \text{radius} = \dfrac{14}{2} = 7 \text{ cm}$

18. (b) 5 units

Explanation: Co-ordinates of D can be found with help of mid-point formula *i.e.*

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$\Rightarrow \quad D = \left(\frac{0+0}{2}, \frac{0+6}{2}\right)$$

$$\Rightarrow \quad D = \left(\frac{0}{2}, \frac{6}{2}\right)$$

$$\therefore \quad D = (0, 3)$$

Now, length of AD can be found using the distance formula, $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$$\Rightarrow \quad AD = \sqrt{(4-0)^2 + (0-3)^2}$$

$$\Rightarrow \quad AD = \sqrt{(4)^2 + (3)^2}$$

$$\Rightarrow \quad AD = \sqrt{16+9}$$

$$\Rightarrow \quad AD = \sqrt{25}$$

$$\Rightarrow \quad AD = 5$$

$\therefore$ Length of AD = 5 units

19. (c) $\dfrac{1}{2}$

Explanation: Since $\angle P = 45°$

$\Rightarrow \quad \angle R = 45°$

$(\angle P + \angle Q + \angle R = 180°)$

Now, $\tan P = \tan 45° = 1$

Also, $\cos R = \cos 45° = \dfrac{1}{\sqrt{2}}$

$$\text{Now,} \quad \tan P - \cos^2 R = 1 - \left(\frac{1}{\sqrt{2}}\right)^2$$

$$= 1 - \frac{1}{2}$$

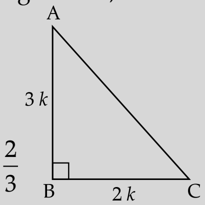
$$= \frac{1}{2}$$

20. (a) $\dfrac{\sqrt{13}}{3}$

Explanation: In ΔABC, right-angled at B,

let $\angle A = \theta$

Given, $\tan \theta = \dfrac{2}{3}$



$$\Rightarrow \quad \tan \theta = \frac{BC}{AB} = \frac{2}{3}$$

Let $BC = 2k$ and $AB = 3k$

By Pythagoras Theorem

$$AC^2 = AB^2 + BC^2$$

$$\Rightarrow \quad AC^2 = (2k)^2 + (3k)^2$$

$$\Rightarrow \quad AC^2 = 4k^2 + 9k^2$$

$$\Rightarrow \quad AC^2 = 13k^2$$

$$\Rightarrow \quad AC = \sqrt{13}k$$

$$\text{Now,} \quad \sec \theta = \frac{AC}{AB} = \frac{\sqrt{13}k}{3k}$$

$$= \frac{\sqrt{13}}{3}$$

SECTION - B

21. **(d)** 39 cm

Explanation: Perimeter of sector of circle

$$= \text{length of arc} + 2 \times \text{radius}$$
$$= \frac{\theta}{360^\circ} \times 2\pi r + 2 \times 14$$
$$= \frac{45}{360^\circ} \times 2 \times \frac{22}{7} \times 14 + 28$$
$$= 11 + 28$$
$$= 39 \text{ cm}$$

22. **(b)** $\frac{1}{5}$

Explanation:

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Number of total outcomes}}$$

Number of blue balls = 6

Total number of balls = 16 + 8 + 6 = 30

$$\therefore \text{ P (getting a blue ball)} = \frac{6}{30} = \frac{1}{5}$$

23. **(b)** 45°

Explanation: Since $\sin\theta - \cos\theta = 0$

$$\Rightarrow \quad \sin\theta = \cos\theta$$
$$\Rightarrow \quad \frac{\sin\theta}{\cos\theta} = 1$$
$$\Rightarrow \quad \tan\theta = 1$$
$$\Rightarrow \quad \tan\theta = \tan 45^\circ$$
$$\therefore \quad \theta = 45^\circ$$

24. **(c)** 0.98

Explanation: We know that, $P(E) + P(\text{not } E) = 1$

Given, $\quad P(E) = 0.02$

So, $\quad 0.02 + P(\text{not } E) = 1$

$$\Rightarrow \quad P(\text{not } E) = 1 - 0.02$$
$$\therefore \quad P(\text{not } E) = 0.98$$

25. **(a)** 462 cm^2

Explanation: Area of shaded region = Area of outer circle – Area of inner circle

(Let R = radius of outer circle and r = radius of inner circle)

$$= \pi R^2 - \pi r^2$$
$$= \pi(R^2 - r^2)$$
$$= \frac{22}{7}\{(14)^2 - (7)^2\}$$
$$= \frac{22}{7}(196 - 49)$$
$$= \frac{22}{7} \times 147$$
$$= 22 \times 21 = 462$$

$\therefore$ Area of shaded region = 462 cm^2

26. **(d)** $2\sec^2\theta$

Explanation: $\dfrac{1}{1+\sin\theta} + \dfrac{1}{1-\sin\theta}$

$$= \frac{1-\sin\theta+1+\sin\theta}{(1+\sin\theta)(1-\sin\theta)} \quad \text{(Taking L.C.M.)}$$
$$= \frac{2}{(1)^2 - \sin^2\theta}$$

$\{$Since, $(a - b)(a + b) = a^2 - b^2\}$

$$= \frac{2}{1 - \sin^2\theta}$$
$$= \frac{2}{\cos^2\theta} \quad (\text{Since, } 1 - \sin^2\theta = \cos^2\theta)$$
$$= 2\sec^2\theta \quad \left(\because \frac{1}{\cos^2\theta} = \sec^2\theta\right)$$

27. **(b)** 1 : 3

Explanation: Let the ratio be $k : 1$

Using section formula,

$$(x, y) = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$
$$\Rightarrow \quad (0, 0) = \left(\frac{k \times -3 + 1 \times 1}{k+1}, \frac{k \times 9 + 1 \times -3}{k+1}\right)$$
$$\Rightarrow \quad (0, 0) = \left(\frac{-3k+1}{k+1}, \frac{9k-3}{k+1}\right)$$
$$\therefore \quad 0 = \frac{-3k+1}{k+1} \text{ and } 0 = \frac{9k-3}{k+1}$$
$$\Rightarrow \quad 0 = -3k + 1 \text{ and } 0 = 9k - 3$$
$$\Rightarrow \quad 3k = 1 \text{ and } 9k = 3$$
$$\therefore \quad \frac{k}{1} = \frac{1}{3} \text{ and } \frac{k}{1} = \frac{3}{9} = \frac{1}{3}$$

Therefore, the required ratio is 1 : 3.

28. **(c)** any real number

Explanation: The points A (-8, 0) and B (8, 0) lie on X-axis.

The mid-point of the line joining these two points can be found with the help of mid-point formula $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$$\Rightarrow \quad O = \left(\frac{-8+8}{2}, \frac{0+0}{2}\right)$$
$$\Rightarrow \quad O = (0, 0)$$

Therefore, the line that bisects AB is the y-axis and it is given that it passes through a point $(0, k)$; so, k is any real number.

29. **(a)** Two congruent figure are always similar

Explanation: Since two figures are congruent, their corresponding sides are equal and thus the ratio of corresponding sides will always be equal to 1 and equal to each other. Therefore, two congruent figures are always similar.

30. **(a)** (– 5, 6)

Explanation: Given that x = –5 and y = 6
The lines drawn for the given equations meet at (–5, 6) and thus (–5, 6) is the solution of the given equations.

31. **(d)** (3, 1)

Explanation: Since the centre of circle lies at (0, 0) and its radius is 3 units.
From the given options, let us calculate the distance of each from the centre using distance formula, $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

For (–1, –1),

$$OA = \sqrt{(-1-0)^2 + (-1-0)^2} = \sqrt{(-1)^2 + (-1)^2} = \sqrt{1+1} = \sqrt{2}$$

Since $\sqrt{2} < 3$, it lies inside the circle.

For (0, 3),

$$OB = \sqrt{(0-0)^2 + (3-0)^2} = \sqrt{(0)^2 + (3)^2} = \sqrt{0+9} = \sqrt{9} = 3$$

Since 3 = 3, it lies on the circle.

For (1, 2),

$$OC = \sqrt{(1-0)^2 + (2-0)^2} = \sqrt{(1)^2 + (2)^2} = \sqrt{1+4} = \sqrt{5}$$

Since $\sqrt{5}$ < 3, it lies inside the circle.

For (3, 1),

$$OD = \sqrt{(3-0)^2 + (1-0)^2} = \sqrt{(3)^2 + (1)^2} = \sqrt{9+1} = \sqrt{10}$$

Since $\sqrt{10} > 3$, so point (3,1) it lies outside the circle.

32. **(b)** 9

Explanation: For infinitely many solutions,

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

Here, $a_1 = 3, a_2 = k, b_1 = 5, b_2 = 15, c_1 = -8,$ $c_2 = -24$

So, $\frac{3}{k} = \frac{5}{15} = \frac{-8}{-24}$

$\Rightarrow \quad \frac{3}{k} = \frac{1}{3}$

$\Rightarrow \quad k = 9$

33. **(c)** 2

Explanation: Let the two consecutive even numbers be $2n$ and $(2n + 2)$.
Prime factorisation of $2n = 2 \times n$
Prime factorisation of $(2n + 2) = 2 \times (n + 1)$
To find HCF, we multiply all the prime factors common to both numbers.
Therefore, HCF = 2

34. **(a)** both negative

Explanation: $p(x) = x^2 + 99x + 127$

Here, sum of zeroes $= \frac{-b}{a} = -99$ and

product of zeroes $= \frac{c}{a} = 127$

Since, product of zeroes is positive and sum is negative, it is possible only when both the zeroes are negative.
Therefore, both the zeroes are negative.

35. **(c)** $\left(\frac{-9}{2}, \frac{5}{2}\right)$

Explanation: The mid-point of the line joining these two points can be found with the help of mid-point formula $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$\Rightarrow \quad$ mid-point, $O = \left(\frac{-3+(-6)}{2}, \frac{9+(-4)}{2}\right)$

$\Rightarrow \quad$ mid-point, $O = \left(\frac{-9}{2}, \frac{5}{2}\right)$

36. **(d)** non-terminating but repeating

Explanation:
The denominator of $\frac{13}{2 \times 5^2 \times 7}$ is not of the form $2^m \times 5^n$, so, its decimal expansion is non-terminating but repeating.

37. **(b)** 2 : 5

Explanation: Since $DE \parallel BC$

$\Rightarrow \quad \angle ADE = \angle ABC$

and $\quad \angle AED = \angle ACB$

$\therefore$ By AA similarity criterion $\Delta ADE \sim \Delta ABC$

By C.P.C.T. $\quad \frac{AD}{AB} = \frac{DE}{BC}$

$\Rightarrow \quad \frac{2}{5} = \frac{DE}{BC} \quad (AB = AD + DB = 2 + 3 = 5 \text{ cm})$

$\therefore \quad DE : BC = 2 : 5$

38. **(a)** 1000

Explanation:
We know that $HCF \times LCM$ = Product of two numbers

$\Rightarrow \quad HCF \times LCM = 20 \times 50$

$\therefore \quad HCF \times LCM = 1000$

39. (d) None

Explanation: Since 6^n is expressed as $(2 \times 3)^n$, it can never end with digit 0 as it does not have 5 in its prime factorisation.

40. (b) 1

Explanation: $(1 + \tan^2 A)(1 + \sin A)(1 - \sin A)$

$$= (1 + \tan^2 A)\{(1)^2 - \sin^2 A\}$$

$$\{\because (a + b)(a - b) = (a^2 - b^2)\}$$

$$= \left(1 + \frac{\sin^2 A}{\cos^2 A}\right)(1 - \sin^2 A)$$

$$= \left(\frac{\cos^2 A + \sin^2 A}{\cos^2 A}\right)(\cos^2 A)$$

$$\{\because 1 - \sin^2 A = \cos^2 A\}$$

$$= \cos^2 A + \sin^2 A$$

$$= 1$$

SECTION - C

Case Study-I

41. (c) 9 m

Explanation: Here, $h = -t^2 + 2t + 8$

It is of the form $ax^2 + bx + c$

So, $t = x$

For a parabola, x-coordinate for maximum height is $x = \frac{-b}{2a}$.

$$\Rightarrow \quad x = \frac{-2}{2(-1)}$$

$$= \frac{-2}{-2} = 1$$

$$\Rightarrow \quad t = 1 \text{ sec}$$

Now, the height covered by ball in 1 second

$$= -(1)^2 + 2(1) + 8$$

$$= -1 + 2 + 8$$

$$= 9 \text{ m}$$

$\therefore$ The maximum height reached by the ball is 9 m.

42. (b) quadratic polynomial

Explanation: The graph of quadratic polynomial is a parabola.

43. (c) 1 second

Explanation: For a parabola, x-coordinate for maximum height is $x = \frac{-b}{2a}$

$$\Rightarrow \quad x = \frac{-2}{2(-1)}$$

$$= \frac{-2}{-2} = 1$$

$$\therefore \quad t = 1 \text{ sec}$$

44. (b) 2

Explanation: Number of zeroes of a quadratic polynomial = 2.

45. (b) – 2, 4

Explanation: Here $h = -t^2 + 2t + 8 = 0$

$$\Rightarrow \quad -t^2 + 2t + 8 = 0$$

$$\Rightarrow \quad -t^2 + 4t - 2t + 8 = 0$$

$$\Rightarrow \quad -t(t - 4) - 2(t - 4) = 0$$

$$\Rightarrow \quad (t - 4)(-t - 2) = 0$$

$$\therefore \quad t = 4, -2$$

Case Study-II

46. (d) RHS

Explanation: RHS is not a similarity criterion.

47. (a) $x\sqrt{2}$ unit

Explanation: Since $AB = AC = x$ units

$$\Rightarrow \quad AB^2 + AC^2 = BC^2$$

(by Pythagoras theorem)

$$\Rightarrow \quad x^2 + x^2 = BC^2$$

$$\Rightarrow \quad BC^2 = 2x^2$$

$$\therefore \quad BC = x\sqrt{2} \text{ units}$$

48. (c) 1 : 2

Explanation: Here $QR = 2x$ and $QP = 2x$

$$\Rightarrow \quad PR^2 = QR^2 + QP^2$$

$$\Rightarrow \quad PR^2 = (2x)^2 + (2x)^2$$

$$\Rightarrow \quad PR^2 = 4x^2 + 4x^2$$

$$\Rightarrow \quad PR^2 = 8x^2$$

$$\Rightarrow \quad PR = 2\sqrt{2}x$$

Now, $BC : PR = \sqrt{2}x : 2\sqrt{2}x = 1 : 2$

49. (c) 4 : 1

Explanation: Since $\frac{AB}{QP} = \frac{BC}{PR} = \frac{CA}{RQ}$

$$\Delta ABC \sim \Delta QPR$$

(by SSS similarity criterion)

$$\Rightarrow \quad \frac{ar(\Delta QPR)}{ar(\Delta ABC)} = \left(\frac{PR}{BC}\right)^2$$

(If two triangles are similar, then the ratio of the area of both triangles is proportional to the square of the ratio of their corresponding sides.)

$$\Rightarrow \quad \frac{ar(\Delta QPR)}{ar(\Delta ABC)} = \left(\frac{2}{1}\right)^2$$

$$\therefore \quad \frac{ar(\Delta QPR)}{ar(\Delta ABC)} = \frac{4}{1}$$

50. (d) $\Delta PQR \sim \Delta ABC$

Explanation: Since $\Delta ABC \sim \Delta QPR$, ΔPQR is not similar to ΔABC. The points A and B are not corresponding to P and Q respectively.

❑❑❑

Term – I

OMR SHEET

Booklet Series

A

Use English Numbers / Letters only. Use Blue / Black Ball Point Pen to write in box.

Booklet Series

Ⓐ Ⓑ Ⓒ Ⓓ

Subject

Roll Number

0	0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9

Name

Test Date

Student's Signature

Invigilator's Signature

Certified that all the entries In this section have been properly filled by the student

Proper Marking

The OMR Sheet will be computer checked Fill the circles completely and dark enough for proper detection, Use ballpen (black or blue) for marking.

Ⓐ Ⓑ ● Ⓓ

Avoid Improper Marking

Partially Filled

Lightly Filled

Test Center Code

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

IMPORTANT

The candidate should check that the Test Book Series printed on the OMR Sheet is the same as printed on the Test Booklet. In case of discrepancy, the candidate should immediately report the matter to the invigilator for replacement of both the Test Booklet and the Answer Sheet.

Darken the circle for each question.

Q.No.	Response	Q.No.	Response	Q.No.	Response	Q.No.	Response
1	Ⓐ Ⓑ Ⓒ Ⓓ	16	Ⓐ Ⓑ Ⓒ Ⓓ	31	Ⓐ Ⓑ Ⓒ Ⓓ	46	Ⓐ Ⓑ Ⓒ Ⓓ
2	Ⓐ Ⓑ Ⓒ Ⓓ	17	Ⓐ Ⓑ Ⓒ Ⓓ	32	Ⓐ Ⓑ Ⓒ Ⓓ	47	Ⓐ Ⓑ Ⓒ Ⓓ
3	Ⓐ Ⓑ Ⓒ Ⓓ	18	Ⓐ Ⓑ Ⓒ Ⓓ	33	Ⓐ Ⓑ Ⓒ Ⓓ	48	Ⓐ Ⓑ Ⓒ Ⓓ
4	Ⓐ Ⓑ Ⓒ Ⓓ	19	Ⓐ Ⓑ Ⓒ Ⓓ	34	Ⓐ Ⓑ Ⓒ Ⓓ	49	Ⓐ Ⓑ Ⓒ Ⓓ
5	Ⓐ Ⓑ Ⓒ Ⓓ	20	Ⓐ Ⓑ Ⓒ Ⓓ	35	Ⓐ Ⓑ Ⓒ Ⓓ	50	Ⓐ Ⓑ Ⓒ Ⓓ
6	Ⓐ Ⓑ Ⓒ Ⓓ	21	Ⓐ Ⓑ Ⓒ Ⓓ	36	Ⓐ Ⓑ Ⓒ Ⓓ		
7	Ⓐ Ⓑ Ⓒ Ⓓ	22	Ⓐ Ⓑ Ⓒ Ⓓ	37	Ⓐ Ⓑ Ⓒ Ⓓ		
8	Ⓐ Ⓑ Ⓒ Ⓓ	23	Ⓐ Ⓑ Ⓒ Ⓓ	38	Ⓐ Ⓑ Ⓒ Ⓓ		
9	Ⓐ Ⓑ Ⓒ Ⓓ	24	Ⓐ Ⓑ Ⓒ Ⓓ	39	Ⓐ Ⓑ Ⓒ Ⓓ		
10	Ⓐ Ⓑ Ⓒ Ⓓ	25	Ⓐ Ⓑ Ⓒ Ⓓ	40	Ⓐ Ⓑ Ⓒ Ⓓ		
11	Ⓐ Ⓑ Ⓒ Ⓓ	26	Ⓐ Ⓑ Ⓒ Ⓓ	41	Ⓐ Ⓑ Ⓒ Ⓓ		
12	Ⓐ Ⓑ Ⓒ Ⓓ	27	Ⓐ Ⓑ Ⓒ Ⓓ	42	Ⓐ Ⓑ Ⓒ Ⓓ		
13	Ⓐ Ⓑ Ⓒ Ⓓ	28	Ⓐ Ⓑ Ⓒ Ⓓ	43	Ⓐ Ⓑ Ⓒ Ⓓ		
14	Ⓐ Ⓑ Ⓒ Ⓓ	29	Ⓐ Ⓑ Ⓒ Ⓓ	44	Ⓐ Ⓑ Ⓒ Ⓓ		
15	Ⓐ Ⓑ Ⓒ Ⓓ	30	Ⓐ Ⓑ Ⓒ Ⓓ	45	Ⓐ Ⓑ Ⓒ Ⓓ		