MARKING SCHEME
MATHEMATICS BASIC (430/5/1)

SECTION A

1. The 8^{th} term of an A.P. is 17 and its 14^{th} term is 29. The common difference of this A.P. is :

(a) 3 (b) 2

(c) 5 (d) -2

Ans. (b) 2 1

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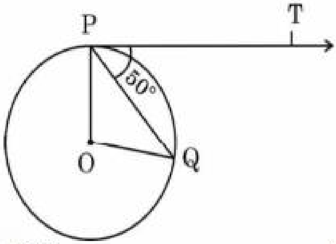
2. In the given figure, O is the centre of a circle, PQ is a chord and the tangent PT at P makes an angle of 50° with PQ. The measure of $\angle POQ$ is :



(a) 130° (b) 100°

(c) 90° (d) 75°

Ans. (b) 100° 1

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3. One card is drawn at random from a well shuffled deck of 52 playing cards. What is the probability of getting '4 of hearts' ?

(a) $\frac{1}{52}$ (b) $\frac{1}{13}$

(c) $\frac{1}{26}$ (d) $\frac{1}{6}$

Ans. (a) $\frac{1}{52}$ 1

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4. The distance between the points A(0, 6) and B(– 6, 2) is :

(a) 6 units (b) $2\sqrt{6}$ units

(c) $2\sqrt{13}$ units (d) $13\sqrt{2}$ units

Ans. (c) $2\sqrt{13}$ units 1

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5. The value(s) of k for which the roots of quadratic equation $x^2 + 4x + k = 0$ are real, is :

(a) $k \geq 4$ (b) $k \leq 4$

(c) $k \geq -4$ (d) $k \leq -4$

Ans. (b) $k \leq 4$ 1

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6. LCM of $(2^3 \times 3 \times 5)$ and $(2^4 \times 5 \times 7)$ is :

(a) 40 (b) 560

(c) 1680 (d) 1120

Ans. (c) 1680 1

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7. If one zero of the quadratic polynomial $kx^2 + 3x + k$ is 2, then the value of k is :

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

(c) $\frac{5}{6}$ (d) $-\frac{5}{6}$

Ans. (a) $-\frac{6}{5}$ 1

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8. If the lines represented by equations $3x + 2my = 2$ and $2x + 5y + 1 = 0$ are parallel, then the value of m is :

(a) $\frac{2}{5}$ (b) $-\frac{5}{4}$

(c) $\frac{3}{2}$ (d) $\frac{15}{4}$

Ans. (d) $\frac{15}{4}$ 1

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9. $\Delta ABC \sim \Delta DEF$ and their perimeters are 32 cm and 24 cm respectively. If AB = 10 cm, then DE equals :

(a) 8 cm (b) 7·5 cm

(c) 15 cm (d) $5\sqrt{3}$ cm

Ans. (b) 7·5 cm 1

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10. The two roots of the equation $3x^2 - 2\sqrt{6}\,x + 2 = 0$ are :

(a) real and distinct

(b) not real

(c) real and equal

(d) rational

Ans. (c) real and equal 1

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11. If $\sin\theta = \frac{a}{b}$, then $\sec\theta$ is equal to $(0 \le \theta \le 90°)$:

(a) $\frac{a}{\sqrt{b^2 - a^2}}$ (b) $\frac{b}{\sqrt{b^2 - a^2}}$

(c) $\frac{\sqrt{b^2 - a^2}}{b}$ (d) $\frac{\sqrt{b^2 - a^2}}{a}$

Ans. (b) $\frac{b}{\sqrt{b^2 - a^2}}$ 1

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12. The sum of the first 100 even natural numbers is :

(a) 10100 (b) 2550

(c) 5050 (d) 10010

Ans. (a) 10100 1

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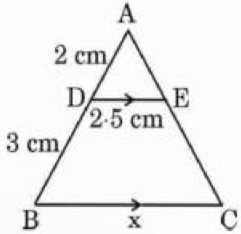
13. In the given figure, AD = 2 cm, DB = 3 cm, DE = 2·5 cm and DE ∥ BC. The value of x is :



(a) 6 cm (b) 3·75 cm

(c) 6·25 cm (d) 7·5 cm

Ans. (c) 6·25 cm 1

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14. A circle is of radius 3 cm. The distance between two of its parallel tangents is :

(a) 12 cm (b) 6 cm

(c) 3 cm (d) 4·5 cm

Ans. (b) 6 cm 1

15. The median class for the data given below is :

Class	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120
Frequency	10	12	14	13	17

(a) 80 – 100 (b) 20 – 40

(c) 40 – 60 (d) 60 – 80

Ans. (d) 60 – 80 1

16. If $\sin\theta = \frac{3}{4}$, then $\frac{(\sec^2\theta - 1)\cos^2\theta}{\sin\theta}$ equals :

(a) $\frac{3}{5}$ (b) $\frac{3}{4}$

(c) $\frac{4}{3}$ (d) $\frac{9}{16}$

Ans. (b) $\frac{3}{4}$ 1

17. In two triangles Δ PQR and Δ ABC, it is given that $\frac{AB}{BC} = \frac{PQ}{PR}$. For these two triangles to be similar, which of the following should be true ?

(a) $\angle A = \angle P$ (b) $\angle B = \angle Q$

(c) $\angle B = \angle P$ (d) CA = QR

Ans. (c) $\angle B = \angle P$ 1

18. Mean and median of some data are 32 and 30 respectively. Using empirical relation, mode of the data is :

(a) 36 (b) 26

(c) 30 (d) 20

Ans. (b) 26 1

*Questions number **19** and **20** are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.*

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A) :* When two coins are tossed together, the probability of getting no tail is $\frac{1}{4}$.

Reason (R) : The probability P(E) of an event E satisfies $0 \leq P(E) \leq 1$.

Ans. (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A). 1

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20. *Assertion (A) :* The surface area of largest sphere that can be inscribed in a hollow cube of side 'a' cm is πa^2 cm^2.

Reason (R) : The surface area of a sphere of radius 'r' is $\frac{4}{3}\pi r^3$.

Ans. (c) Assertion (A) is true, but Reason (R) is false 1

SECTION B

21. Find LCM of 576 and 512 by prime factorization.

Solution. $576 = 2^6 \times 3^2$ $\frac{1}{2}$

$512 = 2^9$ $\frac{1}{2}$

$\text{LCM} = 512 \times 9 = 4608$ 1

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22. (a) Evaluate :

$$\frac{\sin 30^\circ + \tan 45^\circ}{\sec 30^\circ + \cot 45^\circ}$$

Solution. Required value $= \dfrac{\frac{1}{2}+1}{\frac{2}{\sqrt{3}}+1}$ $1\frac{1}{2}$

$= \dfrac{3\sqrt{3}}{2(2+\sqrt{3})}$ $\frac{1}{2}$

OR

(b) **For A = 30° and B = 60°, verify that :**

sin (A + B) = sin A cos B + cos A sin B.

Solution. (b) LHS = sin 90° = 1 $\frac{1}{2}$

$\text{RHS} = \frac{1}{2} \times \frac{1}{2} + \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2}$ 1

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

$\Rightarrow$ LHS = RHS

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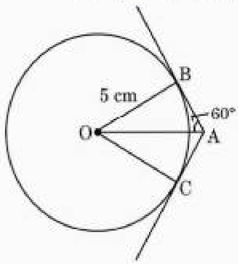
23. **In the given figure, tangents AB and AC are drawn to a circle centred at O. If ∠ OAB = 60° and OB = 5 cm, find lengths OA and AC.**



Solution. $\sin 60° = \frac{5}{OA} \Rightarrow OA = \frac{10\sqrt{3}}{3}$ cm $\frac{1}{2}+\frac{1}{2}$

$\tan 60° = \frac{5}{AB} \Rightarrow AB = \frac{5\sqrt{3}}{3}$ cm= AC $\frac{1}{2}+\frac{1}{2}$

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24. (a) Show that A(1,2),B(5,4),C(3,8) and D(-1,6) are vertices of a parallelogram ABCD.

Solution. Mid point of AC $= \left(\frac{3+1}{2}, \frac{8+2}{2}\right) = (2, 5)$ 1

Mid point of BD= $\left(\frac{5-1}{2}, \frac{4+6}{2}\right)$=(2, 5) $\frac{1}{2}$

$\Rightarrow$ Mid point of AC = Mid point of BD $\frac{1}{2}$

Hence, ABCD is a parallelogram.

OR

(b) Show that the points A(3,0),B(6,4) and C(-1,3) are the vertices of a right angled triangle.

Solution. $AB^2 = 3^2 + 4^2 = 25$ $\frac{1}{2}$

$BC^2 = 7^2 + 1^2 = 50$ $\frac{1}{2}$

$AC^2 = 4^2 + 3^2 = 25$ $\frac{1}{2}$

$\Rightarrow BC^2 = AB^2 + AC^2$ $\frac{1}{2}$

$\therefore \Delta ABC$ is a right-angled triangle.

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25. **Find the sum of the first 15 terms of the A.P. : $\frac{1}{15}, \frac{1}{12}, \frac{1}{10}, \ldots\ldots$.**

Solution. Here $d = \frac{1}{12} - \frac{1}{15} = \frac{1}{60}$ $\frac{1}{2}$

$\therefore S_{15} = \frac{15}{2}\left[\frac{2}{15} + 14 \times \frac{1}{60}\right]$ 1

$= \frac{15}{2} \times \frac{22}{60} = \frac{11}{4}$ $\frac{1}{2}$

SECTION C

26. (a) **Sabina went to a bank ATM to withdraw ₹ 2,000. She received ₹ 50 and ₹ 100 notes only. If Sabina got 25 notes in all, how many notes of ₹ 50 and ₹ 100 did she receive ?**

Solution. Let number of ₹50 notes be x and number of ₹100 notes be y.

ATQ $x + y = 25$ ______(i) 1

and $50x + 100y = 2000$ ________ (ii) 1

Solving (i) and (ii), $x = 10,\ y = 15$ 1

Number of ₹50 notes = 10 and Number of ₹100 notes = 15

OR

(b) Five years ago Amit was thrice as old as Baljeet. Ten years hence, Amit shall be twice as old as Baljeet . What are their present ages?

Solution: Let Amit's present age be x years and Baljeet's present age be y years.

ATQ $(x-5) = 3(y-5) \Rightarrow x - 3y = -10$ 1

and $(x+10) = 2(y+10) \Rightarrow x - 2y = 10$ 1

Solving equations to get $y = 20, x = 50$ 1

Amit's present age = 50 years and Baljeet's present age = 20 years

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27. **Prove that $(7 - 2\sqrt{3})$ is an irrational number, given that $\sqrt{3}$ is an irrational number.**

Solution. Let us assume that $7 - 2\sqrt{3}$ is a rational number

$\Rightarrow 7 - 2\sqrt{3} = \frac{a}{b}$, where a and b are integers, $b \neq 0$ 1

$\Rightarrow \sqrt{3} = \frac{7b - a}{2b}$ 1

RHS is a rational number but LHS is irrational.

$\therefore$ Our assumption is wrong. Hence, $7 - 2\sqrt{3}$ is irrational. 1

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28. **Find mean of the following data :**

Class	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
Frequency	12	15	11	20	16	6

Solution.

Class	x	F	$u = \frac{x - 37\cdot5}{15}$	fu
0 – 15	7·5	12	– 2	– 24
15 – 30	22·5	15	– 1	– 15
30 – 45	37·5	11	0	0
45 – 60	52·5	20	1	20
60 – 75	67·5	16	2	32
75 – 90	82·5	6	3	18
		80		31

For Correct Table: 2 Marks

$$\text{Mean} = a + \frac{\sum fu}{\sum f} \times h$$

$$= 37\cdot5 + 15 \times \frac{31}{80} = 43\cdot3$$ 1

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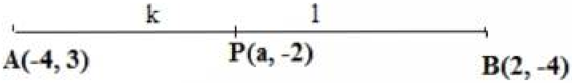
29. (a) Determine the ratio in which the point P(a, – 2) divides the line segment joining the points A(– 4, 3) and B(2, – 4). Also, find the value of 'a'.

Solution.



Let AP : PB = k : 1

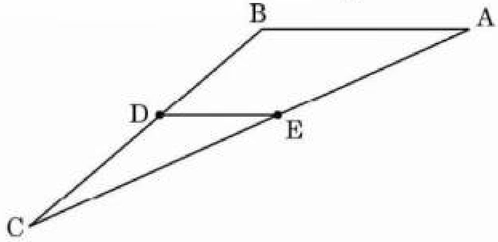
$\therefore \dfrac{-4k+3}{k+1} = -2 \quad \Rightarrow \quad k = \dfrac{5}{2}$ $1+\frac{1}{2}$

So, AP : PB = 5 : 2 $\frac{1}{2}$

Hence, $\dfrac{10-8}{7} = a \quad \Rightarrow \quad a = \dfrac{2}{7}$ 1

OR

(b) In the given figure, in Δ ABC points D and E are mid-points of sides BC and AC respectively. If given vertices are A(4, – 2), B(2, – 2) and C(– 6, – 7), then verify the result $DE = \frac{1}{2}AB$.



Solution: Point D is $\left(-2, \dfrac{-9}{2}\right)$ 1

Point E is $\left(-1, \dfrac{-9}{2}\right)$ 1

$\therefore DE = \sqrt{1^2+0^2} = 1$ and $AB = \sqrt{2^2+0^2} = 2$ $\frac{1}{2}+\frac{1}{2}$

$\therefore DE = \dfrac{1}{2} AB$

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30. Prove that :

$$(\text{cosec } A - \sin A)(\sec A - \cos A) = \frac{1}{\tan A + \cot A}$$

Solution. LHS $= \left(\frac{1}{\sin A} - \sin A\right)\left(\frac{1}{\cos A} - \cos A\right)$ $\frac{1}{2}$

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

$= \frac{\cos^2 A \times \sin^2 A}{\sin A \times \cos A} = \frac{\sin A \times \cos A}{1}$ 1

$= \frac{\sin A \cos A}{\sin^2 A + \cos^2 A}$ $\frac{1}{2}$

$= \frac{1}{\frac{\sin A}{\cos A} + \frac{\cos A}{\sin A}} = \frac{1}{\tan A + \cot A}$ = RHS 1

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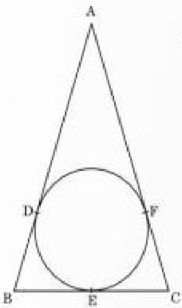
31. ABC is an isosceles triangle with AB = AC, circumscribed about a circle. Prove that BC is bisected at E.

Solution. AD = AF, BD = BE and CE = CF (tangents from external point) 1



$AB = AC \Rightarrow AD + DB = AF + FC$ $\frac{1}{2}$

$\Rightarrow AF + DB = AF + FC$ $\frac{1}{2}$

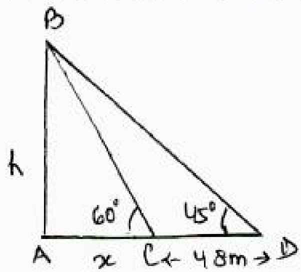
$\Rightarrow DB = FC$ $\frac{1}{2}$

$\Rightarrow BE = EC$ or BC is bisected at E. $\frac{1}{2}$

SECTION D

32. A person walking 48 m towards a tower in a horizontal line through its base observes that angle of elevation of the top of the tower changes from 45° to 60°. Find the height of the tower and distance of the person, now, from the tower. (Use $\sqrt{3} = 1{\cdot}732$)

Solution.



For Figure: 1

In ΔBAD, $\tan 45° = \frac{h}{x+48} \Rightarrow h = x + 48$ ________ (i) *1*

In ΔBAC, $\tan 60° = \frac{h}{x} \Rightarrow h = \sqrt{3}\,x$ ________ (ii) $1+\frac{1}{2}$

Solving (i) and (ii), $x = 24(\sqrt{3} + 1) = 65{\cdot}57$m $\frac{1}{2}+\frac{1}{2}$

and $h = x + 48 = 113{\cdot}57$ m $\frac{1}{2}$

(**Note**: only ½ mark to be deducted for not using $\sqrt{3} = 1.732$)

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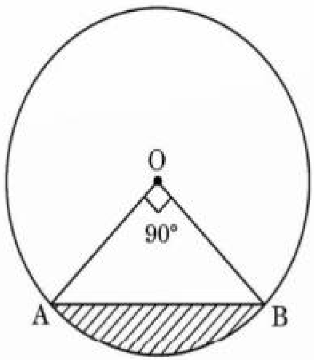
33. (a) In the given figure, AB is a chord of a circle of radius 7 cm and centred at O. Find the area of the shaded region if $\angle AOB = 90°$. Also, find length of minor arc AB.



Solution: Area of sector AOB $= \frac{22}{7} \times 7 \times 7 \times \frac{90}{360}$ *1*

$= \frac{77}{2}$ cm^2 $\frac{1}{2}$

Area of Δ AOB $= \frac{1}{2} \times 7 \times 7 = \frac{49}{2}$ cm^2 *1*

$\therefore$ Shaded area $= \frac{77}{2} - \frac{49}{2} = \frac{28}{2} = 14$ cm^2 *1*

Length of arc AB $= 2 \times \frac{22}{7} \times 7 \times \frac{90}{360} = 11$ cm $1\frac{1}{2}$

OR

(b) AB and CD are arcs of two concentric circles of radii 3·5 cm and 10·5 cm respectively and centred at O. Find the area of the shaded region if $\angle AOB = 60°$. Also, find the length of arc CD.

Solution. Here, OA = 3·5 cm, OC = 10·5 cm

$$\text{Shaded area} = \pi \times \frac{60}{360}(10{\cdot}5^2 - 3{\cdot}5^2) \qquad 2$$

$$= \frac{22}{7} \times \frac{1}{6} \times 98 \qquad 1$$

$$= \frac{154}{3} cm^2 \quad \text{or} \quad 51{\cdot}3 \text{ cm}^2 \qquad \frac{1}{2}$$

$$\text{Length of arc CD} = 2 \times \frac{22}{7} \times 10{\cdot}5 \times \frac{60}{360} \qquad 1$$

$$= 11 \text{ cm} \qquad \frac{1}{2}$$

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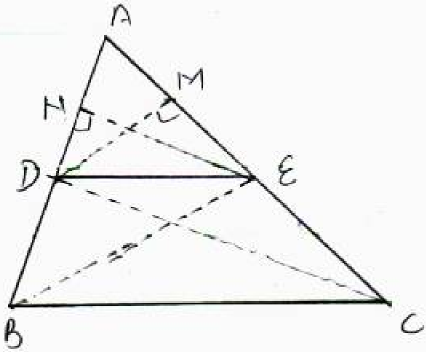
34. If a line is drawn parallel to one side of a triangle to intersect the other two sides at distinct points, then prove that the other two sides are divided in the same ratio.

Solution.



For Figure: 1

Given : In Δ ABC, DE || BC $\frac{1}{2}$

To prove : $\frac{AD}{DB} = \frac{AE}{EC}$ $\frac{1}{2}$

Const.: Join BE, CD. Draw DM $\perp$ AC and EN $\perp$ AB $\frac{1}{2}$

Proof : $\dfrac{ar(\Delta ADE)}{ar(\Delta BDE)} = \dfrac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN} = \dfrac{AD}{DB}$ ________ (i) *1*

Similarly $\dfrac{ar(\Delta ADE)}{ar(\Delta CDE)} = \dfrac{AE}{EC}$ ________ (ii) $\frac{1}{2}$

Δ BDE and Δ CDE are on the same base DE and between the same parallel lines BC and DE.

$\therefore$ ar(Δ BDE) = ar(Δ CDE) ________ (iii) $\frac{1}{2}$

From (i), (ii) and (iii), we get $\dfrac{AD}{DB} = \dfrac{AE}{EC}$ $\frac{1}{2}$

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35. (a) The difference of two numbers is 5 and the difference of their reciprocals is $\frac{1}{10}$. Find the numbers.

Solution. Let the numbers be x and x + 5. $\frac{1}{2}$

$\dfrac{1}{x} - \dfrac{1}{x+5} = \dfrac{1}{10}$ $\left(\dfrac{1}{x+5} < \dfrac{1}{x}\right)$ 1

$\Rightarrow$ $50 = x^2 + 5x$ or $x^2 + 5x - 50 = 0$ 1

$\Rightarrow$ $(x + 10)(x - 5) = 0$ 1

$\Rightarrow$ $x = -10, 5$ $\frac{1}{2}$

The numbers are $-10, -5$ or $5, 10$ *1*

OR

(b) Find all the values of k for which the quadratic equation $2x^2 + kx + 8 = 0$ has equal roots. Also, find the roots.

Solution. For equal roots $k^2 - 64 = 0$ 1

$\Rightarrow$ $k = \pm 8$ 1

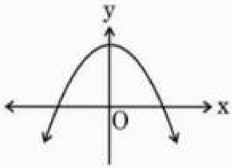
Equations are $2x^2 + 8x + 8 = 0$ and $2x^2 - 8x + 8 = 0$ 1

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

$\Rightarrow$ $x = -2$ or $x = 2$ 1+1

SECTION E

36. Rainbow is an arch of colours that is visible in the sky after rain or when water droplets are present in the atmosphere. The colours of the rainbow are generally, red, orange, yellow, green, blue, indigo and violet. Each colour of the rainbow makes a parabola. We know that any quadratic polynomial $p(x) = ax^2 + bx + c \ (a \neq 0)$ represents a parabola on the graph paper.



Based on the above, answer the following questions :

(i) The graph of a rainbow $y = f(x)$ is shown in the figure. Write the number of zeroes of the curve.

(ii) If the graph of a rainbow does not intersect the x-axis but intersects y-axis at one point, then how many zeroes will it have ?

(iii) (a) If a rainbow is represented by the quadratic polynomial $p(x) = x^2 + (a + 1)x + b$, whose zeroes are 2 and -3, find the value of a and b.

OR

(iii) (b) The polynomial $x^2 - 2x - (7p + 3)$ represents a rainbow. If -4 is a zero of it, find the value of p.

Solution. (i) Two zeroes 1

(ii) 0 or no zero 1

(iii) (a) Getting $2a+b = -6$ and $-3a+b = -6$ $\frac{1}{2}+\frac{1}{2}$

Solving to get $a = 0$ and $b = -6$ $\frac{1}{2}+\frac{1}{2}$

OR

(iii)(b) -4 is a zero of the given polynomial $\Rightarrow$ 21-7p = 0 1

$\Rightarrow$ p = 3 1

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37. Singing bowls (hemispherical in shape) are commonly used in sound healing practices. Mallet (cylindrical in shape) is used to strike the bowl in a sequence to produce sound and vibration.

One such bowl is shown here whose dimensions are :

Hemispherical bowl has outer radius 6 cm and inner radius 5 cm.

Mallet has height of 10 cm and radius 2 cm.

Based on the above, answer the following questions :

(i) What is the volume of the material used in making the mallet ?

(ii) The bowl is to be polished from inside. Find the inner surface area of the bowl.

(iii) (a) Find the volume of metal used to make the bowl.

OR

(iii) (b) Find total surface area of the mallet. (Use $\pi = 3{\cdot}14$)

Solution:. (i) Volume of material = $3{\cdot}14 \times 2 \times 2 \times 10 = 125{\cdot}6 \text{ cm}^3$ 1

(ii) Inner SA of the bowl = $2 \times 3{\cdot}14 \times 25 = 157 \text{ cm}^2$ 1

(iii) (a) Volume of the metal = $\frac{2}{3} \times 3{\cdot}14 \times (6^3 - 5^3)$ 1

$= 190{\cdot}5 \text{ cm}^3$ 1

OR

(iii) (b) Total SA of mallet $= 2 \times 3{\cdot}14 \times 2\,(2 + 10)$ 1

$= 150{\cdot}7 \text{ cm}^2$ 1

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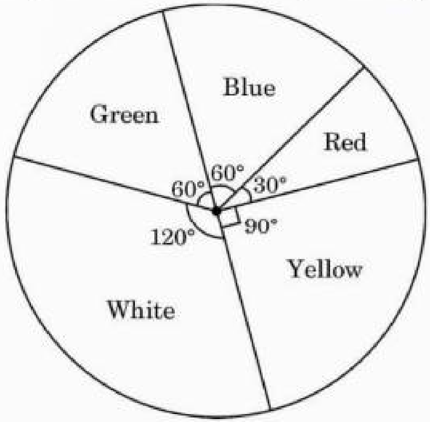
38. Some students were asked to list their favourite colour. The measure of each colour is shown by the central angle of a pie chart given below :



Study the pie chart and answer the following questions :

(i) If a student is chosen at random, then find the probability of his/her favourite colour being white ?

(ii) What is the probability of his/her favourite colour being blue or green ?

(iii) (a) If 15 students liked the colour yellow, how many students participated in the survey ?

OR

(iii) (b) What is the probability of the favourite colour being red or blue ?

Solution. (i) P (favourite colour being white) = $\frac{120}{360}$ or $\frac{1}{3}$ *1*

(ii) P (favourite colour being blue or green) = $\frac{60+60}{360}$ or $\frac{1}{3}$ *1*

(iii) (a) Let total number of students be x

$\Rightarrow \frac{15}{x} = \frac{1}{4}$ $1\frac{1}{2}$

$\Rightarrow$ x = 60 or total 60 students participated in survey. $\frac{1}{2}$

OR

(iii)(b) P (favourite colour being red or blue) = $\frac{60+30}{360} = \frac{1}{4}$ *1+1*