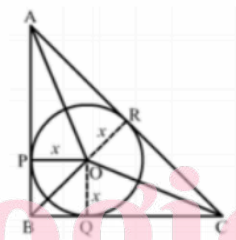
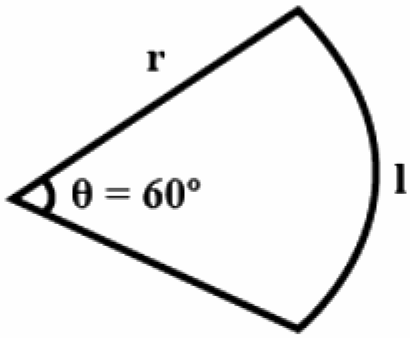
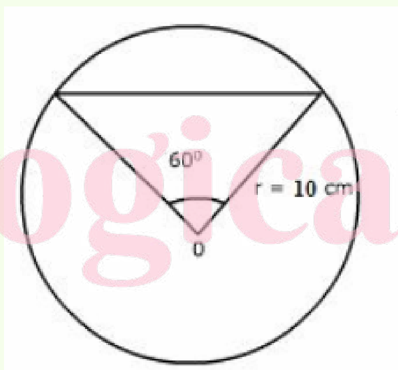
SUBJECT: MATHS

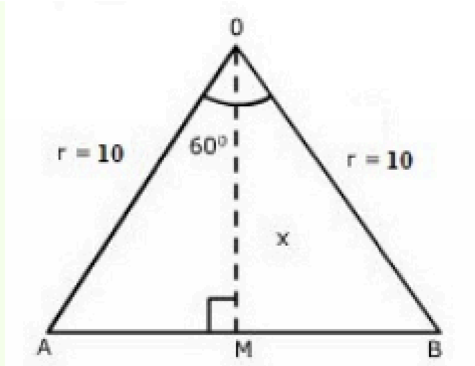
CLASS: X

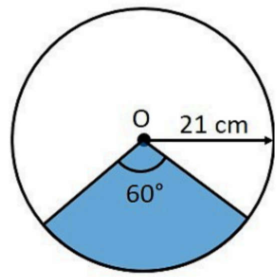
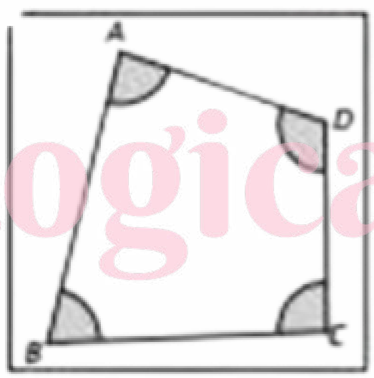
CHAPTER: Mensuration and Probability   No. of PYQs:20

Sl No	QUESTIONS	MARK
1	In a right triangle ABC, right-angled at B, BC = 12 cm and AB = 5 cm. The radius of the circle inscribed in the triangle (in cm) is Solution-  In right triangle ABC By using Pythagoras theorem we have $AC^2 = AB^2 + BC^2$ $= 5^2 + 12^2$ $= 25 + 144$ $= 169$ $\therefore AC^2 = 169$ $\Rightarrow AC = 13\,cm$ Now, $Ar(\Delta ABC) = Ar(\Delta AOB) + Ar(\Delta BOC) + Ar(\Delta AOC)$ $\Rightarrow \frac{1}{2} \times AB \times BC = \frac{1}{2} \times OP \times AB + \frac{1}{2} \times OQ \times BC + \frac{1}{2} \times OR \times AC$ $\Rightarrow 5 \times 12 = x \times 5 + x \times 12 + x \times 13$ $\Rightarrow 60 = 30x$ $\Rightarrow x = 2\,cm$	1

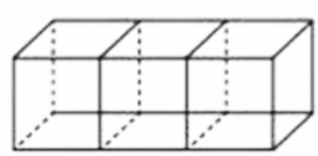
	[CBSE 2014]	
2	A piece of wire 22 cm long is bent into the form of an arc of a circle subtending an angle of 60° at its center. Find the radius of the circle.  Length, l = 22cm θ = 60° 180° = πrad $1^{\circ} = \frac{\pi}{180} rad$ $60^{\circ} = \frac{\pi}{180} \times 60\, rad$ $= \frac{\pi}{3}\, rad$ Arc length = rθ $r = \frac{1}{\theta}$ $= \frac{22}{\left(\frac{\pi}{3}\right)}$ $= \frac{(22\times3)}{\left(\frac{22}{7}\right)}$ r = 3 × 7 r = 21 cm **[CBSE 2020]**	2

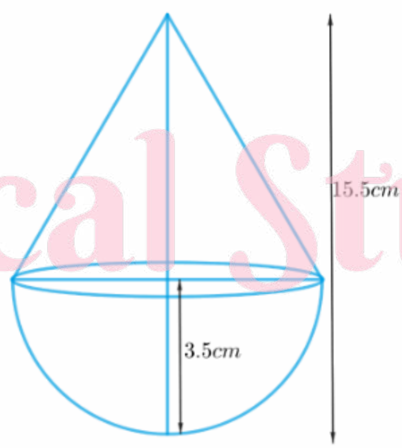
3	A car has two wipers which do not overlap. Each wiper has a blade of length 21 cm sweeping through an angle 120°. Find the total area cleaned at each sweep of the blades. Total area cleaned $= 2\times$ Area of sector $=2 \times \frac{\pi r^2 \theta}{260^\circ}$ $=2 \times \frac{22}{7} \times 21 \times 21 \times \frac{120^\circ}{360^\circ}$ $=924 \text{ cm}^2$ Hence the total area cleaned at each sweep of the blades is 924 cm^2. **[CBSE2019]**	3
4	A chord PQ of a circle of radius 10 cm subtends an angle of 60° at the center of the circle. Find the area of major and minor segments of the circle.  Area of sector formed by the arc $= \frac{\theta}{360} \times \pi r^2$ $= \frac{60}{360} \times \frac{22}{7} \times 10^2$ $= \frac{1100}{21}$ $= 52.38 \text{ cm}^2$	5

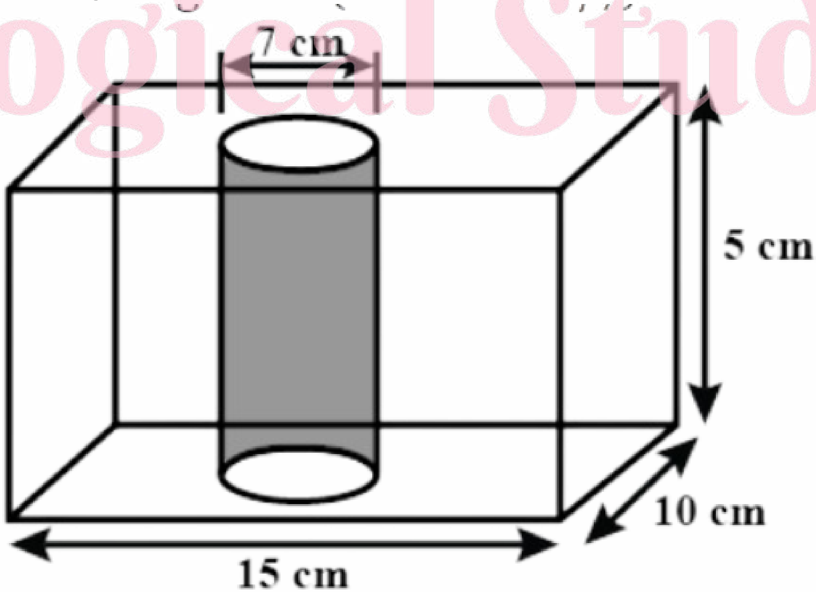
	 In △OAB, let OM be ⊥ bisector of AB, ∠AOM = ∠BOM Let OM be x cm In △OMA, $\frac{OM}{OA} = \cos 30^\circ$ $\frac{x}{10} = \frac{\sqrt{3}}{2}$ $x = 5\sqrt{3}$ = 8.66 cm OM = 8.66 cm In △OMA, $\frac{AM}{OA} = \sin 30^\circ$ $\frac{AM}{10} = \frac{1}{2}$ AM = 5 cm AB = 2 × AM = 2 × 5 = 10 cm Area of △OAB = $\frac{1}{2}$ × OM × AB = $\frac{1}{2}$ × 8.66 × 10 = 43.3 cm^2 Area of minor segment = Area of sector formed by the arc - Area of △OAB = 52.38 − 43.3 = 9.08 cm^2 Area of major segment = Area of circle - Area of minor segment = $\pi r^2 - 9.08$ = 3.14 × 10 × 10 − 9.08 = 314 − 9.08 = 304.92 cm^2 **[CBSE 2017]**	

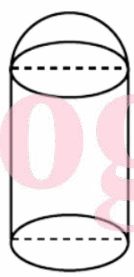
5	In a circle of diameter 42 cm, if an arc subtends an angle of 60° at the center where x = 22/7, then what will be the length of arc? Length of Arc APB = $\frac{\theta}{360} \times (2\pi r)$ } ½ marks $= \frac{60°}{360°} \times 2 \times \frac{22}{7} \times 21$ $= \frac{1}{6} \times 2 \times \frac{22}{7} \times 21$ **= 22 cm** } ½ marks  **[CBSE 2020]**	1
6	In the given figure, arcs have been drawn of radius 7 cm each with vertices A. B. C and D of quadrilateral ABCD as centers. Find the area of the shaded region  [CBSE 2022, 2015]	1
7	The curved surface area of a cone having height 24 cm and radius 7 cm, is	1

	Given, Radius of cone, r = 7cm and Height, h = 24cm. To find slant height l: We know, $l^2 = r^2 + h^2$ $\Rightarrow l^2 = 7^2 + 24^2$ $\Rightarrow l^2 = 625$ $\Rightarrow l = 25$cm. Therefore, curved surface area of cone is = πrl $= \frac{22}{7} \times 7 \times 25$ $= 22 \times 25$ $= 550\text{cm}^2$. **[CBSE 2023]**	
8	A solid spherical ball fits exactly inside the cubical box of side a. The volume of the ball is Given the solid ball is exactly fitted into cubical box of side a Therefore the radius of the solid ball is exactly half of the side of the cubical box $\therefore r = \frac{a}{2}$ Volume of solid ball = $\frac{4}{3}.\pi.r^3 = \frac{4}{3}.\pi.\frac{a^3}{8}$ $\therefore$ Volume of solid ball = $\frac{\pi a^3}{6}$ **[CBSE 2020]**	1

9	The radius of the base and the height of a solid right circular cylinder are in the ratio 2:3 and its volume is 1617 cm³. Find the total surface area of the cylinder. Let r = 2x and h = 3x. $V = \pi r^2 h$ $\Rightarrow \frac{22}{7} \times (4x^2)(3x) = 1617$ $\Rightarrow x^3 = 42.875$ $\Rightarrow x = 3.5\text{cm}$ Hence, r = 7cm and h = 10.5cm Total surface area= $2\pi rh + 2\pi r^2 = 2\pi r(r + h)$ $= 2 \times \frac{22}{7} \times 7(17.5)$ $= 770\text{cm}^2$ **[CBSE 2021]**	3
10	Three cubes 6 cm edge each, are joined as shown in the given figure. Find the total surface area of the resulting cuboid. 	3

	Edge of each cube = 6 cm If 3 cubes are joined end to end, then Length of newly formed cuboid = 3 × 6 = 18 cm Breadth of newly formed cuboid = 6 cm Height of the newly formed cuboid = 6 cm As we know, Total surface area of cuboid = 2 (lb + bh + hl) = 2 (18 × 6 + 6 × 6 + 6 × 18) = 2 (108 + 36 + 108) = 2 × 252 = 504 cm^2 **[CBSE 2021]**	
11	A toy is in the form of a cone of base radius 3.5 cm mounted on a hemisphere of base diameter 7 cm. If the total height of the toy is 15.5 cm, find the total surface area of the toy. We can create the figure of the toy as per the given information  CSA of the cone = πrl, where 'r' and 'l' are the radius and slant height of the cone respectively. Radius of the hemisphere, r = 3.5 cm Height of the hemisphere = radius of the hemisphere, r = 3.5 cm Radius of the cone, r = 3.5 cm Height of the cone = Total height of the toy - height of the hemisphere h = 15.5 cm - 3.5 cm = 12 cm Slant height of the cone, $l = \sqrt{(r^2 + h^2)}$ $l = \sqrt{[(3.5\ cm)^2 + (12\ cm)^2]}$ $l = \sqrt{[12.25\ cm^2 + 144\ cm^2]}$	3

	$l = \sqrt{56.25}$ cm^2 $l = 12.5$ cm Total surface area of the toy = CSA of the hemisphere + CSA of the cone $= 2\pi r^2 + \pi rl$ $= \pi r(2r + l)$ $= 22/7 \times 3.5$ cm $\times$ (2×3.5 cm + 12.5 cm) $= 22/7 \times 3.5$ cm $\times$ (7 cm + 12.5 cm) = 11 cm $\times$ 19.5 cm = 214.5 cm^2 **[CBSE 2015, Sample Paper 2016]**	
12	In the given figure, from a cuboidal solid metallic block, of dimensions 15 cm x 10 cm x 5 cm, a cylindrical hole of diameter 7 cm is drilled out. Find the surface area of the remaining block.  	3

	Surface area of remaining block = Surface area of cuboid + Curved surface area of cylinder - 2× area of base $= A_I + A_{II}$ $A_{II} = 2\pi(3.5)5 - 2\pi(3.5)^2 = 33cm^2$ $A_I = 2(15 \times 10 + 10 \times 5 + 5 \times 15) = 2 \times 275 = 550cm^2$ $A_{total} = 583cm^2$ **[CBSE 2015]**	
13	A room is in the form of a cylinder surmounted by a hemi-spherical dome. The base radius of the hemisphere is $\frac{2}{3}rd$ the height of the cylindrical part. Find total height of the room if it contains $67\frac{1}{21} cube\ meter\ of\ air$. 	3

	Height of building = height of cylinder + height of hemisphere $H = h + r$ r is radius of cylinder and dome diameter of dome = $2/3\times$ height of building $\therefore 2r = \frac{2}{3} \times (h + r)$ $\therefore 6r = 2h + 2r \therefore 3r = h + r$ $\therefore h = 2r$ Volume of air in building = Volume of cylinder+ Volume of dome $\therefore 67\frac{1}{21} = \pi r^2 h + \frac{2}{3}\pi r^3$ $\therefore \frac{1408}{21} = \pi r^2 (h + \frac{2}{3}r)$ $= \pi r^2(2r + 2/3r)$ $= \pi r^2 (\frac{8}{3}r)$ $\therefore \frac{1408}{21} = \frac{8}{3}\pi r^3$ $\therefore \frac{1408}{7} = 8 \times \frac{22}{7} \times r^3$ $\therefore r^3 = \frac{1408}{22 \times 8} = 8$ $\therefore r = 2$ m $\Rightarrow h = 4$ m Height of building = $r + h = 6$ m **[CBSE 2016]**	
14	The largest possible sphere is carved out of a wooden solid cube of 7 cm side. Find the volume of the wood left. Given that, a largest possible sphere is carved out of a wooden solid cube of side $7\ cm$. Diameter of sphere, $d = 7\ cm$. Radius of sphere $= \frac{diameter}{2}$ $\Rightarrow r = \frac{7}{2}cm$ Volume of the sphere, $= \frac{4}{3}\pi r^3$. $[\pi = \frac{22}{7}]$ $\Rightarrow$Volume of the sphere, $= \frac{4}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3$ $\Rightarrow Volume\ of\ the\ sphere = \frac{4}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2} \Rightarrow Volume\ of\ the\ sphere = 179.67cm^3$ Volume of a cube $= a^3$ $\Rightarrow (7)^3 \Rightarrow 7 \times 7 \times 7 \Rightarrow 343cm^3$ Volume of wood left = Volume of a cube - Volume of the sphere. $Volume\ of\ wood\ left\ = 343 - 179.67\ Volume\ of\ wood\ left\ = 163.33cm^3$. **[CBSE 2015, 2016]**	3
15	The curved surface area of a right circular cone is 12320 cm². If the radius of its base is 56 cm, then find its height.	2

	radius of the base of the cone = 56cm We know that curve d surface area of a cone= πrl. Given that curved surface area of a cone= 12320. $\pi rl = 12320$ $\frac{22}{7} * 56 * l = 12320$ $22 * 8 * l = 12320$ $176 * l = 12320$ $l = \frac{12320}{176} = 70.$ We know that height of the cone, $h = \sqrt{l^2 - r^2}$ $= \sqrt{70^2 - 56^2}$ $= \sqrt{4900 - 3136}$ $= \sqrt{1764}$ $= 42.$ Therefore the height of the cone = 42m. **[CBSE 2021-22]**	

16	In a group of 20 people, 5 can't swim. If one person is selected at random, then the probability that he/she can swim, is Solution- Persons who can swim= 20-5=15 Probability who can swim= $\frac{15}{20} = \frac{3}{4}$ **[CBSE 2021, 2017]**	1
17	Two dice are thrown together. The probability of getting the difference of numbers on their upper faces equals to 3 is When two dice are thrown, The sample space (S) = {(1, 1,), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)} ∴ n(S) = 36 Let A: Event of getting the numbers whose difference is 3. Let A: Event of getting the numbers whose difference is 3. ∴ A = {(1, 4), (2, 5), (3, 6), (4, 1), (5, 2), (6, 3)} n(A) = 6 ∴ Required probability = $\frac{n(A)}{n(S)}$ $= \frac{6}{36}$ $= \frac{1}{6}$ **[CBSE 2017]**	1
18	If two different dice are rolled together, the probability of getting an even number on both dice, is	1

	Solve for the favorable outcomes and find the required probability: Possible outcomes of rolling the two dice are: $\{(1,1),(1,2),(1,3),(1,4),(1,5),(1,6),$ $(2,1),(2,2),(2,3),(2,4),(2,5),(2,6),$ $(3,1),(3,2),(3,3),(3,4),(3,5),(3,6),$ $(4,1),(4,2),(4,3),(4,4),(4,5),(4,6),$ $(5,1),(5,2),(5,3),(5,4),(5,5),(5,6),$ $(6,1),(6,2),(6,3),(6,4),(6,5),(6,6)\}$ Total number of outcomes $= 36$ The favorable outcomes are: $\{(2,2),(2,4),(2,6),(4,2),(4,4),(4,6),(6,2),(6,4),(6,6)\}$. Total number of favorable outcomes $= 9$ Probability of getting an even number on both dice $= \frac{9}{36} = \frac{1}{4}$ **Hence, the probability of getting an even number on both dice is $\frac{1}{4}$** **[CBSE 2021, 2014]**	
19	A bag contains 4 red, 3 blue and 2 yellow balls. One ball is drawn at random from the bag. Find the probability that drawn hall is (i) red (ii) yellow Solution- P(red)= $\frac{4}{9}$ p(yellow)=$\frac{2}{9}$ **[CBSE 2015, 2020]**	3
20	Peter throws two different dice together and finds the product of the two numbers obtained. Rina throws a die and squares the number obtained. Who has the better chance to get the number 25. Solution-	5

Let us first write the all possible oucomes when Peter throws two different dice together.

(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6)
(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6)
(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6)
(4, 1), (4, 2), (5, 3), (5, 4), (5, 5), (5, 6)
(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6)
(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)

∴ Total number of outcomes = 36
The favorable outcome for getting the product of numbers on the dice equ
Favourable number of outcomes = 1

∴ Probability that Peter gets the product of numbers as 25

$$= \frac{\text{Favourable number of outcomes}}{\text{Total number of outcomes}} = \frac{1}{36}$$

The outcomes when Rina throws a die are 1, 2, 3, 4, 5, 6

The favorable outcome for getting the product of numbers on the dice equ
Favourable number of outcomes = 1

∴ Probability that Peter gets the product of numbers as 25

$$= \frac{\text{Favourable number of outcomes}}{\text{Total number of outcomes}} = \frac{1}{36}$$

The outcomes when Rina throws a die are 1, 2, 3, 4, 5, 6

∴ Total number of outcomes = 6
Rina throws a die and squares the number, so to get the number 25, the f
5.
Favourable number of outcomes = 1

Favourable number of outcomes = 1
∴ Probability that Rina gets the square of the number as 25

$$\frac{\text{Favourable number of outcomes}}{\text{Total number of outcomes}} = \frac{1}{6}$$

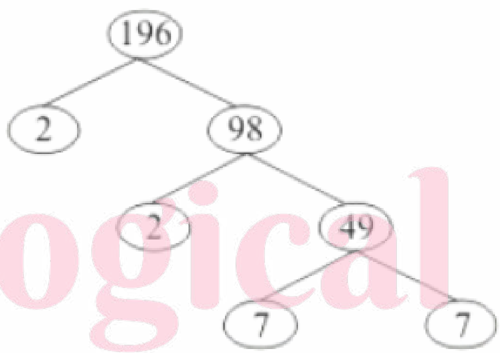
As, 1/6 > 1/36, so Rina has better chance to get the number 25 .

[CBSE 2015]

SUBJECT: Maths

CLASS: X

CHAPTER: Algebra & Real numbers No. of PYQs:20

Sl No	QUESTIONS	MARK
1	The sum of the exponents of the prime factors in the prime factorisation of 196, is Using the factor tree for prime factorization, we have:  Therefore, $196 = 2\times 2\times 7\times 7$ $196 = 2^2 \times 7^2$ The exponents of 2 and 7 are 2 and 2 respectively. Thus the sum of the exponents is $\boxed{4}$ **[CBSE 2018]**	1
2	An army contingent of 612 members is to march behind an army band of 48 members in a parade. The two groups are to march in the same number of columns. What is the maximum number of columns in which they can march?.	2

	An army contingent of 612 members is to march behind an army band of 48 members. Here, HCF of 612 and 48 will give the maximum number of columns in which the two groups can march. So, using Euclid's division algorithm $612=48\times12+36$ $\Rightarrow 48=36\times1+12$ $\rightarrow 36=12\times3+0$ $\therefore$ HCF(612,48)=12 Hence, the maximum no of columns in which they can march is 12 **[CBSE 2023]**	
3	If HCF of 65 and 117 is expressible in the form 65n-117, then find the value of n. $65 = 5 \times 13$ $117 = 3 \times 3 \times 13$ Therefore, HCF of 65 and 117 is 13. So, $65m - 117 = 13$ or, $65m = 130$ Therefore, $m = 2$ **[CBSE 2019,2013]**	2
4	If one zero of $3x^2 + 8x + k$ be the reciprocal of the other then k = Let x and $\frac{1}{x}$ be the zeroes of the polynomial $3x^2+8x+k$. Product of the polynomial$= x.\frac{1}{x} = \frac{k}{3}$ $\Rightarrow 1 = \frac{k}{3}$ $\Rightarrow k = 3$ Thus, $k=3$. **[CBSE 2020]**	2
5	Find the zeros of $2\sqrt{3}x^2 - 5x + \sqrt{3}$ and verify the relationship between the zeros and the coefficients	

	Let $f(x) = 2\sqrt{3}x^2 - 5x + \sqrt{3}$ $=2\sqrt{3}x^2 - 2x - 3x + \sqrt{3}$ $=2x(\sqrt{3}x - 1) - \sqrt{3}(\sqrt{3}x - 1)$ to find the zeroes, Let $f(x) = 0$ $(\sqrt{3}x - 1)$ or $(2x - \sqrt{3}) = 0$ $x = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$ or $x = \frac{\sqrt{3}}{2}$ $x = \frac{\sqrt{3}}{3}$ or $x = \frac{\sqrt{3}}{2}$ Again , Sum of zeroes = $\frac{\sqrt{3}}{3} + \frac{\sqrt{3}}{2} = \frac{5\sqrt{3}}{6} = \frac{5}{2\sqrt{3}} = \frac{-b}{a} = \frac{(-coefficient\ of\ x)}{(coefficient\ of\ x^2)}$ Product of zeroes = $\frac{\sqrt{3}}{3} \times \frac{\sqrt{3}}{2} = \frac{3}{6} = \frac{1}{2} = \frac{c}{a} = \frac{Constant\ term}{coefficient\ of\ x^2}$ **[CBSE 2011,2020]**	
6	If ***α*** and ***β*** are zeroes of the quadratic polynomial $4x^2 + 4x + 1$, then form a quadratic polynomial whose zeroes are 2α and 2β	2

	to solve this lets divide the quadratic equation by 4 such that we have it in the form $x^2 + (\alpha + \beta)x + \alpha\beta$ so after dividing by 4 we have $\frac{4x^2 + 4x + 1}{4}$ $x^2 + x + \frac{1}{4}$ So we have $\alpha + \beta = 1$ ....(1) and $\alpha\beta = \frac{1}{4}$..................(2) So if zeroes to the new quadratic equation are 2α and 2β, then $2\alpha + 2\beta = 2(\alpha + \beta)$ $= 2(1) = 2$ .... Using (1) and, $2\alpha \times 2\beta = 4\alpha\beta$ $= 4 \times \frac{1}{4} = 1$ .... Using (2) So the new quadratic equation with its roots 2α and 2β will be $x^2 + (2\alpha + 2\beta)x + 2\alpha \times 2\beta$ Putting the values, the equation would be, $x^2 + 2x + 1$ **[CBSE 2015]**	
7	The value of k for which the equations $3x - y + 8 = 0$ and $6x + ky = -16$ represent coincident lines, is:	1

	Condition for coincident lines is $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$... (i) Given lines: $3x - y + 8 = 0$ $6x - ky + 16 = 0$ Here, $a_1 = 3, b_1 = -1, c_1 = 8$ $a_2 = 6, b_2 = -k, c_2 = 16$ from Eq. (i) $\frac{3}{6} = \frac{-1}{-k} = \frac{8}{16}$ $\Rightarrow \quad \frac{1}{k} = \frac{1}{2}$ $\therefore \quad k = 2$ **[CBSE 2018,2013]**	
8	Solve: ax + by = a - b & bx - ay = a + b.	2

	$ax + by = a - b$ ----(1) $bx - ay = a + b$ ----(2) Now we multiply both of the equation, $\Rightarrow a^2x + aby = a^2 - ab$ $\Rightarrow b^2x - aby = ab + b^2$ $\Rightarrow (a^2 + b^2)x = a^2 + b^2$ $\Rightarrow x = (a^2 + b^2)/(a^2 + b^2) = 1$ Now we will put the value x in equation (1) $\Rightarrow a(1) + by = a - b$ $\Rightarrow by = a - b - a$ $\Rightarrow y = -1$ **[CBSE 2018,2012,]**	
9	Solve the system of equations graphically: $3x - 4y = 7$ and $5x + 2y = 3$ Shade the region between the lines and the y-axis	2

Now,

$$3x-4y=7$$

$$\Rightarrow \quad 3x-7=4y$$

$$\Rightarrow \quad 4y=3x-7$$

$$\Rightarrow \quad y=\frac{3x-7}{4}$$

When $x=1$, we have

$$y=\frac{3\times1-7}{4}=-1$$

When $x=-3$, we have

$$y=\frac{3\times(-3)-7}{4}=-4$$

Thus, we have the following table:

x	1	-3
y	-1	-4

We have,

$$5x+2y=3$$

$$\Rightarrow \quad 2y=3-5x$$

$$\Rightarrow \quad y=\frac{3-5x}{2}$$

When $x=1$, we have

$$y=\frac{3-5\times1}{2}=-1$$

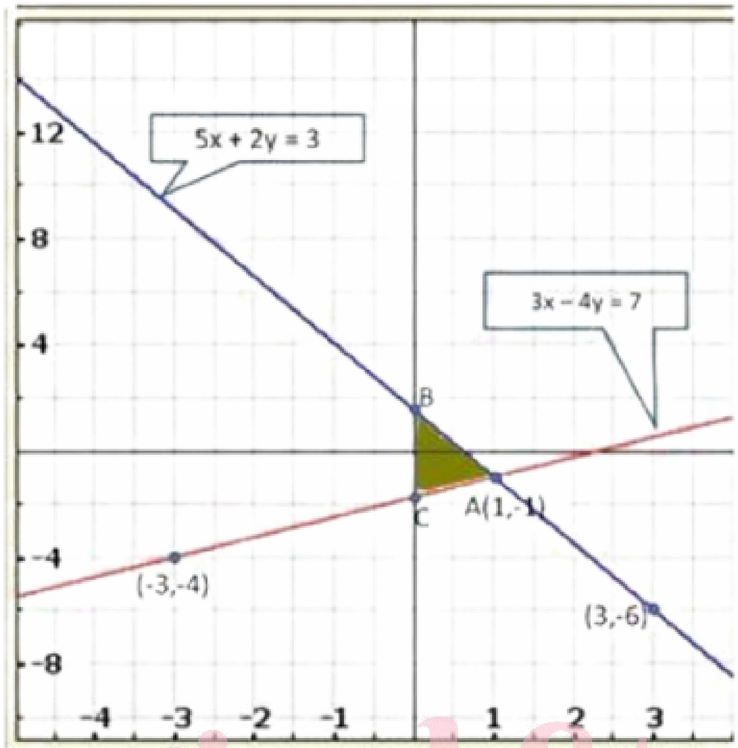
When $x=3$, we have

$$y=\frac{3-5\times3}{2}=-6$$

Thus, we have the following table:

x	1	3
y	-1	-6

Graph of the given system of equations:

	 **[CBSE 2006,2002]**	
10	Solve the following pair of linear equations for x and y: $2(ax - by) + (a + 4b) = 0$; $2(bx + ay) + (b - 4a) = 0$	2

	The given equations may be written as $2ax - 2by = -a - 4b$ ... (i) $2bx + 2ay = 4a - b$ ... (ii) Multiplying (i) by a and (ii) by b and adding , we get $(2a^2 + 2b^2)x = (-a^2 - b^2)$ $\Rightarrow 2(a^2 + b(2))x = -(a^2 + b^2) \Rightarrow x = \frac{-1}{2}$ Putting $x = \frac{-1}{2}$ in (i), we get $2a \times \left(\frac{-1}{2}\right) - 2by = -a - 4b$ $\Rightarrow -a - 2by = -a - 4b$ $\Rightarrow 2by = 4b \Rightarrow y = \frac{4b}{2b} = 2$ Hence, $x = \frac{1}{2}$ and $y = 2$ **[CBSE 2012,2014]**	
11	The discriminant of the quadratic equation $4x^2 - 6x + 3 = 0$	2

	Since we have given that $4x^2 - 6x + 3 = 0$ Here, a= 4 b = -6 c= 3 So, the value of discriminant would be $D = \sqrt{b^2 - 4ac}$ $D = \sqrt{(-6)^2 - 4 \times 4 \times 3}$ $D = \sqrt{36 - 48}$ $D = \sqrt{-12}$ $D = 2\sqrt{3}i$ **[CBSE 2012,2014]**	
12	If the roots of the equation $(b - c)x^2 + (c - a)x + (a - b) = 0$ are equal, then prove that $2b = a + c$	2

	If roots of a quadratic equation are equal, then discriminant of the quadratic equation is 0 $D = b^2 - 4ac = 0$ $(b - c)x^2 + (c - a)x + (a - b) = 0$ Comparing with $ax^2 + bx + c = 0$ Here, $a = (b - c)$, $b = (c - a)$ and $c = (a - b)$ So, $\Rightarrow (c - a)^2 - 4(b - c)(a - b) = 0$ $\Rightarrow c^2 + a^2 - 2ac - 4(ab - b^2 - ac + bc) = 0$ $\Rightarrow c^2 + a^2 - 2ac - 4ab + 4b^2 + 4ac - 4bc = 0$ $\Rightarrow c^2 + a^2 + 2ac + 4b^2 - 4ab - 4bc = 0$ $\Rightarrow (c + a)^2 + 4b^2 - 4b(a + c) = 0$ $\Rightarrow (c + a)^2 + (2b)^2 - 2(c + a)(2b) = 0$ $\Rightarrow [(c + a) - (2b)]^2 = 0$ $\Rightarrow c + a - 2b = 0$ $\Rightarrow 2b = c + a$ **[CBSE 2006,2017]**	
13	A number consisting of two digits is seven times the sum of its digits.When 27 is subtracted from the number,the digits are reversed.Find the number. Let x be the digit at tens place and y be the digit at once place So according to question 7(x+y)=10x+y 3x-6y=0 x-2y=0................(1) Also when 27 is subtracted from number 10x+y-27=10y+x 9x-9y=27 x-y=3.............(2) Subtracting both equations -y=-3 y=3 Putting value of y in eq 2 we get x=6 Putting the value of x= 6 and y=3 in 10x +1y the original	2

	number we have 10 (6) + 1 (3) = 60 + 3= 63 So the number is 63 **[CBSE 2016, 2014]**	
14	If a student had walked 1 km/hr faster, he would have taken 15 minutes less to walk 3 km. Find the rate at which he was walking. Let normal speed of a student be x km/h Distance (d) = 3 km Time = distance/speed = 3/x hours If a student had walk 1 km/h faster then his speed would have been x + 1 km/h. Time = 3/(x+1) $\frac{3}{x} - \frac{3}{x+1} = \frac{15}{60}$ $3\left(\frac{1}{x} - \frac{1}{x+1}\right) = \frac{1}{4}$ $12\left(\frac{x+1-x}{x(x+1)}\right) = 1$ $12 = x^2 + x$ $x^2 + x - 12 = 0$ $(x+4)(x-3) = 0$ $x = -4$ or $x = 3$ $x \neq -4$ hence $x = 3$ km/hour **[CBSE 2015,2018]**	2
15	The 5th term of an AP is 20 and the sum of its 7th and 11th terms is 64. The common difference of the AP is	3

	Let the first term of AP be a and common difference be d, According to question, 5th term is 20 => a + 4d = 20 ....(1) And, a + 6d + a + 10d = 64 => 2a + 16d = 64 => a + 8d = 32 ....(2) From (1) & (2), d = 3, & a = 8 Hence common Difference= 3 **[CBSE 2015,2013]**	
16	Find the sum of all 11 terms of an A.P. whose middle most term is 30 Number of terms are 11, so n = 11 Middle term = $\frac{11+1}{2} = \frac{12}{2} = 6th$term Also, middle term = 30 [Given] $\therefore a_6 = 30$ [Given] $\Rightarrow a + (6-1)d = 30$ $\Rightarrow a + 5d = 30$ ...(i) $\because S_n = \frac{n}{2} 2a + (n-1)d]$ $\Rightarrow S_{11} = \frac{11}{2} [2a + (11-1)d]$	2

	$= \frac{11}{2}[2a + 10d]$ $= \frac{11 \times 2}{2}[a + 5d]$ $= 11 \times 30$ [Using (i)] $\Rightarrow S_{11} = 330$ Hence, the sum of all 11 terms is 330. **[CBSE 2015]**	
17	Find the common difference of an AP whose first term is 5 and the sum of its first four terms is half the sum of the next four terms. Let d is common difference of AP Now first 4 terms are 5, 5 + d, 5 + 2d, 5 + 3d and next 4 terms 5 + 4d, 5 + 5d, 5 + 6d, 5 + 7d Given that, the sum of its first four terms is half the sum of the next four terms. i.e., $5 + 5 + d + 5 + 2d + 5 + 3d = \frac{5 + 4d + 5 + 5d + 5 + 6d + 5 + 7d}{2}$ $20 + 6d = \frac{(20 + 22d)}{2}$ $20 + 6d = 10 + 11d$ $d = 2$ Hence, the common difference of the given A.P. is 2 **[CBSE 2012,2018]**	3
18	Solve the equation for x: 1 + 4 + 7 + 10 + ... + x = 287.	2

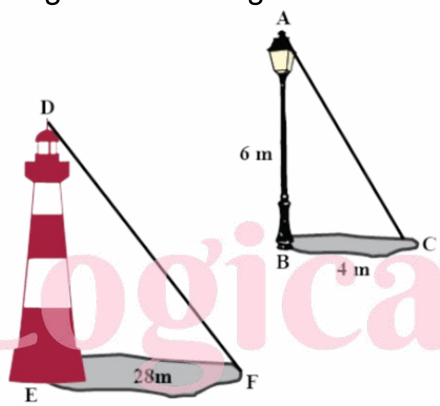
	Here, given $a = 1$ $d = 4 - 1 = 3$ and, $s_n = 287$ Now, $s_n = \frac{n}{2}(2a + (n - 1)d)$ $\Rightarrow 287 = \frac{n}{2}(2 \times 1 + (n - 1)3)$ $\Rightarrow 287 = \frac{n}{2}(2 + 3n - 3)$ $\Rightarrow 574 = n(3n - 1)$ $\Rightarrow 574 = 3n^2 - n$ $\Rightarrow 3n^2 - n - 574 = 0$ on solving the quadratic equaton u sin g formula $n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ We get $n = 14$ & $\frac{-41}{3}$[does not exist] so, $n = 14$ Now, $s_n = \frac{n}{2}(a + 1)$ $\Rightarrow 287 = \frac{14}{2}(1 + x)$ $\Rightarrow 574 = 14(1 + x)$ $\Rightarrow (1 + x) = \frac{574}{14}$ $\Rightarrow 1 + x = 41$ $\Rightarrow x = 41 - 1$ $\therefore x = 40$ $x = 40$ is the solution. **[CBSE 2017,2020]**	
19	If the nth term of an A.P. is pn + q, find its common difference.	1

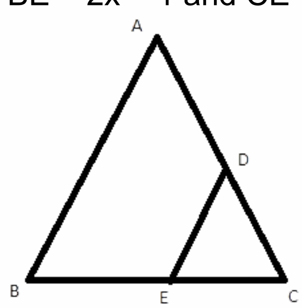
	The first multiple of 4 that is greater than 10 is 12. The next multiple will be 16. Therefore, the series formed as; 12, 16, 20, 24, … All these are divisible by 4 and thus, all these are terms of an AP with the first term as 12 and the common difference as 4. When we divide 250 by 4, the remainder will be 2. Therefore, 250 − 2 = 248 is divisible by 4. The series is as follows. 12, 16, 20, 24, …, 248 Let 248 be the nth term of this AP. First term, a = 12 Common difference, d = 4 $a_n = 248$ As we know, $a_n = a + (n – 1) d$ 248 = 12 + (n – 1) × 4 ⇒ 236/4 = n – 1 ⇒ 59 = n – 1 ⇒ n = 60 **[CBSE 2019]**	
20	Find the number of terms of the A.P.: 293, 285, 277, 53	2

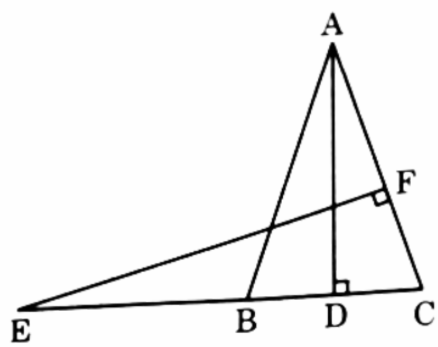
	Let the numbers be $a - d, a, a + d$ so $3a = 27$ $\Rightarrow a = 9$ Also $(a - d)^2 + a^2 + (a + d)^2 = 293.$ $3a^2 + 2d^2 = 293$ $d^2 = 25$ $\Rightarrow d = \pm 5$ therefore numbers are 4, 9, 14. **[CBSE Term II, 2021-22]**	

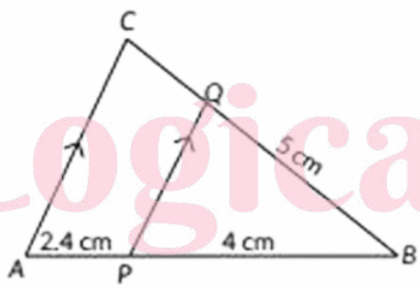
SUBJECT: Maths
CLASS: X

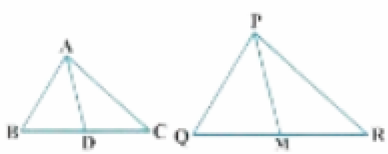
CHAPTER: Geometry and Co-ordinate Geometry — No. of PYQs:20

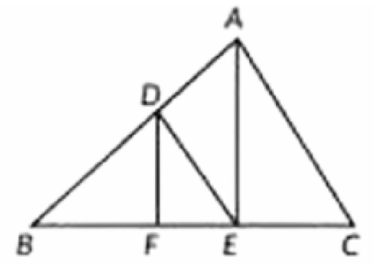
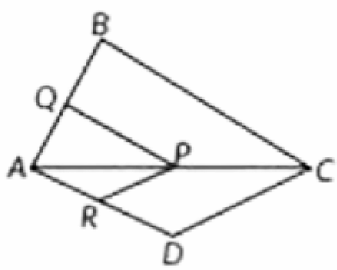
Sl No	QUESTIONS	MARK
1	A vertical pole of length 6 m casts a shadow 4 m long on the ground and at the same time a tower casts a shadow 28 m long. Find the height of the tower. 	1

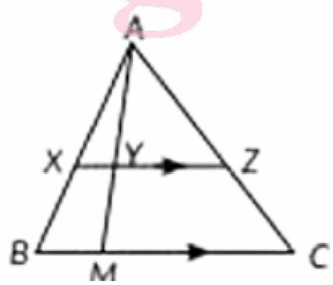
	Height of pole= AB = 6 m Length of shadow of pole = BC = 4 m Length of shadow of tower= EF = 28 m In $\triangle ABC$ and $\triangle DEF$ $\angle B = \angle E = 90^\circ$ both 90° as both are vertical to ground $\angle C = \angle F$ (same elevation in both the cases as both shadows are cast at the same time) $\therefore \triangle ABC \sim \triangle DEF$ by AA similarity criterion We know that if two triangles are similar, ratio of their sides are in proportion So, $\frac{AB}{DE} = \frac{BC}{EF}$ $\Rightarrow \frac{6}{DE} = \frac{4}{28}$ $\Rightarrow DE = 6 \times 7 = 42$ m **[CBSE 2016]**	
2	In the figure of ▲ ABC, the points D and E are on the sides CA, CB respectively such that DE || AB, AD = 2x, DC = x + 3, BE = 2x − 1 and CE = x. Then, find x.. 	2

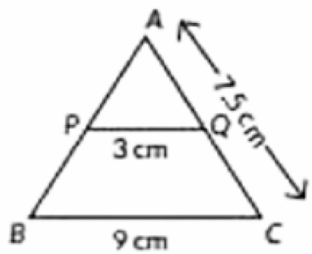
	In $ABC, DE \mid\mid AB$ $\frac{CD}{CA} = \frac{CE}{CB}$ or, $\frac{CD}{CD+AD} = \frac{CE}{CE+BE}$ or, $\frac{x+3}{x+3+2x} = \frac{x}{x+2x-1}$ or, $\frac{x+3}{3x+3} = \frac{x}{3x-1}$ or, $(x+3)(3x-1) = x(3x+3)$ or, $3x^2 - x + 9x - 3 = 3x^2 + 3x$ or, $8x - 3 = 3x$ or, $8x - 3x = 3$ or, $5x = 3$ $\therefore$ $x = \frac{3}{5}$ **[CBSE 2016]**	
3	In the given figure, E is a point on the side CB produced of an isosceles triangle ABC with AB = AC. If AD ⊥ BC and EF ⊥ AC, then prove that ▲ ABD ~ ▲ ECF 	2

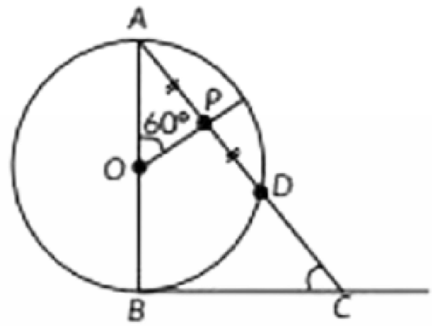
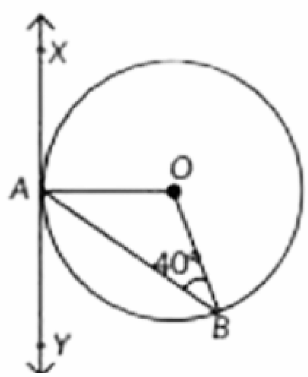
	Given AB = AC ∴ ∠B = ∠C . . . . (1) In △ABD and △ECF ∠B = ∠C (From 1) ∠ADB = ∠EFC = 90° [∵ AD⊥BC and EF⊥AC,] ∴ By AA Criterion of Similarity, △ABD ~ △ECF [hence proved] **[CBSE 2023,2013]**	
4	In the given figure, PQ II AC. If BP = 4 cm, AP = 2.4 cm and BQ= 5 cm, then length of BC is 	2

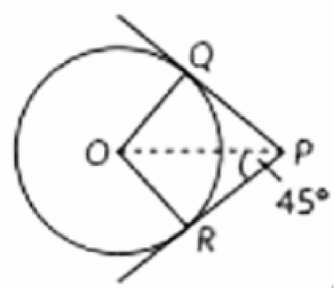
	As PQ || AC by using basic proportionality theorem $\Rightarrow \dfrac{BP}{PA} = \dfrac{BQ}{QC}$ $\Rightarrow \dfrac{4}{2.4} = \dfrac{5}{QC}$ $\Rightarrow QC = \dfrac{5 \times 2.4}{4} = 5 \times 0.6$ $\Rightarrow QC = 3$ cm $\therefore BC = BQ + QC$ $= 5 + 3$ $= 8$ cm **[CBSE 2023]**	
5	If sides AB, BC and median AD of ΔABC are proportional to the corresponding sides PQ, QR and median PM of PQR, show that ΔABC ~ ΔPQR.  Since AD and PM are medians of $\triangle ABC$ and $\triangle PQR$, $\therefore BD = \frac{1}{2}BC$ and $QM = \frac{1}{2}QR$........(1) Given that, $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}$.........(2) $\therefore$ From (1) and (2), $\frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM}$...........(3) In $\triangle ABD$ and $\triangle PQM$ $\frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM}$ $\therefore$ By SSS criterian of proportionality $\triangle ABD \sim \triangle PQM$ $\therefore \angle B = \angle Q$ (Corresponding Sides of Similar Triangles) ....(4) In $\triangle ABC$ and $\triangle PQR$ $\frac{AB}{PQ} = \frac{BC}{QR}$ (From 2) $\angle B = \angle Q$ (From 4) $\therefore$ By SAS criterian of proportionality $\triangle ABC \sim \triangle PQR$ **[CBSE 2011,2020]**	2

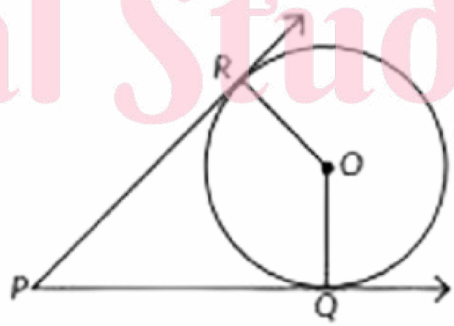
6	In the given figure, DE || AC and DF || AE. Prove that $BF/FE = BE/EC$  In ΔABC DE||AC Line drawn parallel to one side of triangle, insects the other two sides. It divides the other side in same ratio. $\frac{BE}{EC} = \frac{BD}{DA}$ ___(i) In ΔAEB DF||AE Line drawn parallel to one side of triangle, intersects the other sides. It divides the other sides in same ratio. $\frac{BF}{FE} = \frac{BD}{DA}$ ___(ii) From (i) & (ii) $\frac{BE}{EC} = \frac{BF}{FE}$ ∴ Hence proved. **[CBSE 2020]**	2
7	In figure, if PQ || BC and PR || CD, prove that QB/AQ=DR/AR  	1

	(II) In ΔABC, QB/AQ = PC/AP by BPT ... (1) In ΔACD, $\frac{PC}{AP} = \frac{DR}{AR}$ by BPT. ...(2) From (1) & (2) $\frac{QB}{AQ} = \frac{PC}{AP} = \frac{DR}{AR}$ $\therefore \frac{QB}{AQ} = \frac{DR}{AR}$ **It is proved.** **[CBSE 2020,2013]**	
8	In the given figure, XZ is parallel to BC. AZ = 3 cm, ZC = 2 cm, BM = 3 cm and MC = 5 cm. Find the length of XY.  	2

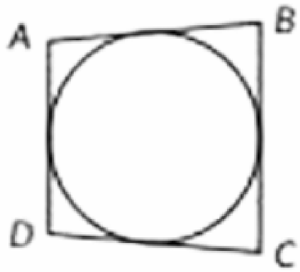
	Ans: Since XZ ‖ BC, Therefore, $\frac{AX}{XB} = \frac{AZ}{AC}$ *(BPT Theorem)* $\therefore \frac{AX}{AB} = \frac{AZ}{AZ+ZC} = \frac{3}{3+2} = \frac{3}{5}$ .... (i) Since XZ ‖ BC, $\therefore$ XY ‖ BM $\angle$ AXY = $\angle$ ABM (Corresponding angles) $\angle$ XAY = $\angle$ BAM (Common angle) $\therefore \Delta$ AXY $\sim \Delta$ ABM (by AA property) $\therefore \frac{AX}{AB} = \frac{XY}{BM}$ Substituting value from equation (i), we get: $\frac{3}{5} = \frac{XY}{3}$ or XY = $\frac{9}{5}$ = 1.8 Therefore, the value of XY is 1.8 cm. **[CBSE 2023,2011,]**	
9	In figure, PQ ‖ BC, PQ = 3 cm, BC = 9 cm and AC = 7.5 cm. Find the length of AQ.  Because PQ parallel to BC so Triangle APQ similar to ABC $\frac{PQ}{BC} = \frac{AQ}{AC}$ $\Rightarrow \frac{3}{9} = \frac{AQ}{7.5}$ $\Rightarrow AQ = 2.5\ cm$ **[CBSE 2020]**	2
10	In Fig. AB is diameter of a circle centered at O. BC is tangent to the circle at B. If OP bisects the chord AD and ZAOP = 60°, then find m∠C.	2

	 Since, OP bisects the chord AD, therefore ∠OPA = 90° ....[∵ The line drawn through the centre of a circle to bisect a chord is perpendicular to the chord] Now, In ΔAOP, ∠A = 180° – 60° – 90° = 120° – 90° = 30° Also, we know that the tangent at any point of a circle is perpendicular to the radius through the point of contact ∴ ∠ABC = 90° Now, In ΔABC, ∠C = 180° – ∠A – ∠B = 180° – 30° – 90° = 150° – 90° = 60° **[CBSE 2021,2013]**	
11	In Fig. XAY is a tangent to the circle centered at O. If ABO = 40°, then find m∠BAY and m∠AOB. 	2

	Given, ∠ABO = 40° ∠XAO = 90° ...(Angle between radius and tangent) OA = OB ...(Radii of same circle) ⇒ ∠OAB = ∠OBA ∴ ∠OAB = 40° Now, applying the linear pair of angles property, we get ∠BAY + ∠OAB + ∠XAO = 180° ⇒ ∠BAY + 40° + 90° = 180° ⇒ ∠BAY + 130° = 180° ⇒ ∠BAY = 180° - 130° ⇒ ∠BAY = 50° Now, In ΔAOB, ∠AOB + ∠OAB + ∠OBA = 180° or, ∠AOB + 40° + 40° = 180° **[CBSE 2021]**	
12	In Figure, PQ and PR are tangents to the circle centered at O. If ∠OPR = 45°, then prove that ORPQ is a square. 	2

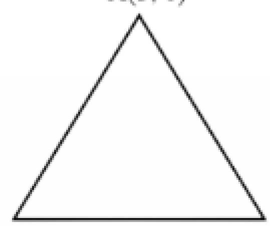
	It is given that $\angle QPR = 90°$ We know that the lengths of the tangents drawn from the outer point to the circle are equal. $PQ = PR$... (1) The radius is Perpendicular to the tangent line at the point of contact. $\therefore \angle PQO = 90°$ and $\angle ORP = 90°$ In quadrilateral OQPR: $\angle QPR + \angle PQO + \angle QOR + \angle ORP = 360°$ $\Rightarrow 90° + 90° + \angle QOR + 90° = 360°$ $\Rightarrow \angle QOR = 360° - 270° = 90°$ $\therefore \angle QPR = \angle PQO = \angle QOR = \angle ORP = 90°$ It can be concluded that $PQOR$ is a square. **[CBSE 2006,2021]**	
13	In Figure. O is the center of the circle. PQ and PR are tangent segments. Show that the quadrilateral PQOR is cyclic.  	2

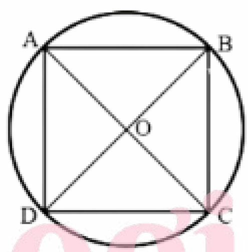
	PR and PQ are the two tangents to the circle from an external point P. We know that the radius of a circle is perpendicular to the tangent at the point of contact. So, OR ⊥ PR and OQ ⊥ PQ ∠ORP = ∠OQP = 90° We know that the sum of all interior angles in a quadrilateral is always equal to 360° Considering quadrilateral PQOR, ∠OQP + ∠QOR + ∠ORP + ∠RPQ = 360° 90° + ∠QOR + 90° + ∠RPQ = 360° 180° + ∠QOR + ∠RPQ = 360° ∠QOR + ∠RPQ = 360° - 180° So, ∠O + ∠P = 180° Here opposite angles are supplementary. Therefore, PQOR is a cyclic quadrilateral. **[CBSE 2016, 2014]**	
14	A train travels at a certain average speed for a distance 63 km and then travels a distance of 72 km at an average speed of 6 km/hr more than the original speed. If it takes 3 hours to complete the total journey, what is its original average speed? Let x represent the train's initial average speed. The time required by the train to travel 63 km at the original speed is equal to 63/x. Time is taken by train to cover 72 km with increased speed = 72/ (x + 6) According to the question it is given: 63/x + 72/ (x + 6) = 3 [63 (x + 6) + 72x]/x (x + 6) = 3 [63x + 378 + 72x]/(x2 + 6x) = 3	2

	In simplification we get the: $378 + 135x = 3x^2 + 18x$ $3x^2 - 117x - 378 = 0$ $x^2 - 39x - 126 = 0$ $x^2 - 42x + 3x - 126 = 0$ Taking common we get: $x(x - 42) + 3(x - 42) = 0$ $(x + 3)(x - 42) = 0$ We get: $x = 42, -3$ Since speed cannot be zero, the initial average speed is 42 km per hour. **[CBSE 2015,2018]**	
15	In figure, a quadrilateral ABCD is drawn to circumscribe a circle. Prove that AB + CD = BC + AD  	3

	We know that , tangents drawn from a point outside the circle are equal in length. So, AS = AP BQ = BP CQ = CR DS = DR On adding the above equations we get, AS + BQ + CQ + DS = AP + BP + CR + DR (AS + DS) + (BQ + CQ) = (AP + BP) + (CR + DR) ⇒ AD + BC = AB + CD. **[CBSE 2015,2013]**	
16	If the distances of P(x, y) from A(5, 1) and B(-1, 5) are equal, then prove that 3x = 2y. **[CBSE 2017]**	2
17	Find the ratio in which the y-axis divides the line segment joining the points (6,-4) and (-2, -7). Also, find the point of intersection. **<u>Given:</u>** Line segment joining the points (6,-4) and (-2,-7) **<u>To find:</u>** 1. The ratio in which the y-axis divides the line segment joining the points. 2. The coordinates of point of intersection. **<u>Formula used:</u>** slope of line = $\frac{y_2 - y_1}{x_2 - x_1}$ **<u>Explanation:</u>** **<u>1. The ratio of line segment.</u>** I have attached a graph below The line can be divide in at y = 0 So length of first segment = 0 - (-2) =2 unit Length of second segment = 6-0 = 6 unit Ratio of first segment and second segment = 2 : 6 = 1 : 3 **Hence, the ratio is 1 : 3.**	3

	2. The coordinates of point of intersection. Slope of line = $\frac{y_2 - y_1}{x_2 - x_1}$ From given line, (6,-4) = (x_1, y_1) (-2,-7) = (x_2, y_2) slope of line = $\frac{-7 - (-4)}{-2-6}$ = 0.375 Slope of line can never be changed. So, now we consider (x_1, y_1) = (6,-4) (x_2, y_2) = (0,y) Slope of line = $\frac{y_2 - y_1}{x_2 - x_1}$ $0.375 = \frac{y-(-4)}{0-6}$ $0.375 = \frac{y+4}{-6}$ y + 4 = 0.375 × (- 6) y + 4 = - 2.25 y = - 2.25 - 4 y = - 2.25 - 4 y = -6.25 **Therefore, the co-ordinates of point of intersection is y = - 6.25.** **[CBSE 2020]**	
18	Prove that the points (3,0), (6, 4) and (-1, 3) are the vertices of a right angled isosceles triangle.	2

	 Length of AB = $\sqrt{(6-3)^2+(4-0)^2}$ $=\sqrt{(3)^2+(4)^2}$ $=\sqrt{9+16}=\sqrt{25}=5$ units Length of BC = $\sqrt{(-1-6)^2+(3-4)^2}$ $=\sqrt{(-7)^2+(-1)^2}$ $=\sqrt{49+1}=\sqrt{50}=5\sqrt{2}$ units. And Length of AC = $\sqrt{(-1-3)^2+(3-0)^2}$ $=\sqrt{(-4)^2+(3)^2}$ $=\sqrt{16+9}=\sqrt{25}=5$ units $\therefore$ AB = AC And $(AB)^2+(AC)^2=(BC)^2$ Hence, Δ ABC is a isosceles, right angled triangle. **[CBSE 2017,2020]**	
19	Find the value(s) of x, if the distance between the points A(0, 0) and B(x, 4) is 5 units. (2019)	1

	The distance between the two points A(0, 0) and B(x, − 4) is 5 units. We know that, The distance between the two points $A(x_1, y_1)$ and $B(x_2, y_2)$ $= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\Rightarrow \sqrt{(x - 0)^2 + (-4 - 0)^2} = 5$ $\Rightarrow \sqrt{x^2 + 16} = 5$ $\Rightarrow x^2 + 16 = 5^2 = 25$ $\Rightarrow x^2 = 25 - 16$ $\Rightarrow x^2 = 9$ $\Rightarrow x = \pm 3$ Hence, the value(s) of x are 3 and − 3. **[CBSE 2019]**	
20	If A(4, 3), B(-1, y) and C(3, 4) are the vertices of a right triangle ABC, right-angled at A, then find the value of y.  Given the triangle ABC,right angled at A. Now, $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $AB = \sqrt{(-1 - 4)^2 + (y - 3)^2}$ $AB = \sqrt{(-5)^2 + (y - 3)^2}$ $AB = \sqrt{25 + (y - 3)^2}$ $AB = \sqrt{25 + y^2 + 9 - 6y}$ $AB = \sqrt{34 + y^2 - 6y}$	2

	$BC = \sqrt{(3-(-1))^2 + (4-y)^2}$ $BC = \sqrt{(4)^2 + (4-y)^2}$ $BC = \sqrt{16 + 16 + y^2 - 8y}$ $BC = \sqrt{32 + y^2 - 8y}$ $AC = \sqrt{(3-4)^2 + (4-3)^2}$ $AC = \sqrt{(-1)^2 + (1)^2}$ $AC = \sqrt{1+1}$ $AC = \sqrt{2}$ units Given, $\triangle ABC$ is a right angled triangle, right angled at A So,by Pythagoras theorem $BC^2 = AC^2 + AB^2$ $(\sqrt{32 + y^2 - 8y})^2 = (\sqrt{2})^2 + (\sqrt{32 + y^2 - 6y})^2$ $32 + y^2 - 8y = 2 + 34 + y^2 - 6y$ $-2y=4$ $y=-2$ Hence,the value of y is -2. **[CBSE Term II, 2021-22]**	

SUBJECT: MATHS

CLASS: X

CHAPTER: Trigonometry & Statistics   No. of PYQs:20

Sl No	QUESTIONS	MARK
1	If 2 tan A = 3, then the value of (4sinA+3cos A) / (4sinA-3cos A) is Solution- Given 2 tan A = 3 tan A = 3/2 sin A = 3/√13 cos A = 2/√13 So (4 sin A + 3 cos A)/(4 sin A - 3 cos A) $(4\times \frac{3}{\sqrt{13}} + 3 \times \frac{2}{\sqrt{13}})/4 \times \frac{3}{\sqrt{13}} - 3 \times \frac{2}{\sqrt{13}}) = 3$ **[CBSE 2023]**	1
2	If tanθ + cotθ = $\frac{4\sqrt{3}}{3}$ then find the value of $\tan^2\theta + \cot^2\theta$? Solution- tanθ + cotθ =$\frac{4\sqrt{3}}{3}$ Squaring both the side, $\tan^2\theta + \cot^2\theta + 2\tan\theta + \cot\theta = \frac{16\times3}{9}$ $\Rightarrow\ tan^2\theta\ +\ cot^2\ \theta\ +\ 2(1)\ =\frac{48}{9}$ $\Rightarrow\ tan^2\theta\ +\ cot^2\ \theta\ =\ \frac{48}{9} - 2 = \frac{30}{9}$ **[CBSE 2021]**	1
3	Given 15 cot A = 8, then find the values of sin A and sec A. Solution- It is given that: 15 cot A = 8 $\Rightarrow cotA\ = \frac{8}{15}$ $\Rightarrow\ cotA\ = \frac{Base}{Perpendicular} = \frac{8}{15}$ Base=8k and Perpendicular= 15k Hypotenuse=$\sqrt{base^2 + perpendicular^2}$ $\Rightarrow H\ = \sqrt{(8k)^2 + (15k)^2}$=17k sinA=$\frac{15k}{17k} = \frac{15}{17}$ secA=$\frac{8k}{17k} = \frac{8}{17}$ **[CBSE2020C]**	2

4	Given sin A =3/5 find the other trigonometric ratios of the angle A. Solution- $sinA = \frac{3}{5}$ $\Rightarrow sinA = \frac{p}{h}, so\, p = 3k \,\&\, h = 5k$ base=$\sqrt{hyp^2 - perpendicular^2}$ $\Rightarrow b = \sqrt{(5k)^2 - (3k)^2}$=4k cosA=b/h=4k/5k= ⅘ tanA=p/b=3k/4k= ¾ cosecA=1/sinA= 5/3 secA=1/cosA=5/4 cotA=1/cotA= 4/3 **[CBSE 2016]**	3
5	[⅝ sec² 60°-tan² 60°+cos² 45°] is equal to Solution- sec60°=$\frac{2}{\sqrt{3}}$, tan60 = $\sqrt{3}$, cos45 = $\frac{1}{\sqrt{2}}$ $\frac{5}{8} \times \frac{4}{3}$ - 3 + $\frac{1}{2}$=$\frac{5}{6} - \frac{5}{2} = -\frac{10}{6} = -\frac{5}{3}$ **[CBSE 2023, 2015]**	1
6	The value of θ for which 2 sin 2θ = 1, is Solution- 2 sin 2θ = 1 $\Rightarrow sin2\theta = \frac{1}{2}$ $\Rightarrow sin2\theta = sin30°$ $\Rightarrow \theta = 15°$ **[CBSE 2021, Sample Paper 2019]**	1
7	If sinx + cosy = 1; x = 30° and y is an acute angle, find the value of y. Solution- sinx + cosy = 1 $\Rightarrow sin\,30 + cosy = 1$ $\Rightarrow \frac{1}{2} + cosy = 1$ $\Rightarrow cosy = \frac{1}{2}$ $\Rightarrow cosy = cos60$ $\Rightarrow y = 60°$ **[CBSE 2019]**	1
8	Evaluate 2sec²θ + 3cosec²θ - 2sinθcosθ if θ=45°? Solution- 2sec²θ + 3cosec²θ - 2sinθcosθ Here, $sec45 = cosec45 = \sqrt{2}$, sin45=$\frac{1}{\sqrt{2}} = cos45$	2

	$= 2 \times (\sqrt{2})^2 + 3(\sqrt{2})^2 - 2\times \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}}$ =4+6-1=9 **[CBSE 2015, 2023]**	
9	Prove that (1+secθ-tanθ)/(1+secθ-tanθ) =(1-sinθ)/cosθ Solution -We have to prove that (1 + secθ - tanθ)/(1 + secθ + tanθ) = (1 - sinθ)/cosθ Considering LHS, LHS : (1 + secθ - tanθ)/(1 + secθ + tanθ) By using , $\sec^2 A - \tan^2 A = 1$ (1 + secθ - tanθ) = secθ - tanθ + ($\sec^2\theta - \tan^2\theta$) = (secθ - tanθ) + [(secθ - tanθ)(secθ + tanθ)] Taking out common term, = (secθ - tanθ)[1 + secθ + tanθ] Now, (1 + secθ - tanθ)/(1 + secθ + tanθ) = (secθ - tanθ)[1 + secθ + tanθ] / (1 + secθ + tanθ) = (secθ - tanθ) We know that sec A = 1/cos A and tan A = sin A/cos A So, (secθ - tanθ) = (1/cosθ - sinθ/cosθ) = (1 - sinθ)/cosθ = RHS LHS = RHS	3

	Therefore, (1 + secθ - tanθ)/(1 + secθ + tanθ) = (1 - sinθ)/cosθ **[CBSE 2020]**	
10	Prove that (cotA + secB)²- (tanB - cosecA)² = 2(cotA.secB + tanB.cosecA) Solution- $(tanA + cosecB)^2 - (cotB-secA)^2$ $= (tan^2A + 2tanAcosecB + cosec^2B) - (cot^2B - 2cotBsecA + sec^2A)$ $= tan^2A + cosec^2B + 2tanAcosecB - cot^2B - sec^2A + 2cotBsecA$ Substituting ($tan^2A = sec^2A - 1$) and ($cosec^2B = 1 + cot^2B$) in the above step: $(sec^2A - 1) + (1 + cot^2B) + 2tanAcosecB - cot^2B - sec^2A + 2cotBsecA$ = 2tanAcosecB + 2cotBsecA = 2(tanAcosecB + cotBsecA) RHS, 2tanAcotB(cosecA + secB) = 2tanAcotB((1 / sinA) + (1 / cosB)) = 2(tanA / sinA)cotB + 2tanA(cot B / cosB) = 2(sinA / (cosAsinB))cotB + 2tanA(cosB / (sinBcosB)) = 2(1 / cosA)cotB + 2 tanA(1 / sinB) = 2secAcotB + 2tanAcosecB = 2(secAcotB + tanAcosecB) **[CBSE 2013, 2017]**	4
11	If the mean of the first n natural number is 15, then find n. a unique country? Solution- $\frac{1+2+3......}{n}=15$ $\Rightarrow \frac{\frac{n(n+1)}{2}}{n}=15$ $\Rightarrow n + 1 = 15 \times 2$ $\Rightarrow n = 29$ **[CBSE 2015, Sample Paper 2020]**	1
12	If the mean of 5 observations x, x + 2, x+4, x+6 and x +8 is 11, then find the value of x. Solution - $\frac{x+x+2+x+4+x+6+x+8}{5} = 11$ $\Rightarrow 5x + 20 = 55$ $\Rightarrow x = 7$	1

<table>
<tr><td></td><td>[CBSE 2015]</td><td></td></tr>
<tr><td>13</td><td>The mean weight of 150 students in a class is 60 kg. The mean weight of boys is 70 kg while that of girls is 55 kg. Find the number of boys and girls in the class.
Solution - Let the number of boys be denoted by b and number of girls be denoted by g
We know that,
Sum of all observations = Mean of observations × No. of obs.
Therefore,
Sum of weight of boys =70b
Sum of weight of girls =55g
Total weight of all students =60×150
Therefore,
(bx70) + (g×55) = (b + g)60
70b + 55g = 150 x 60
70b + 55g = 9000 ...(i)
Also. b + g = 150 or b = 150 - g...(ii)
Solving (1) and (2),
we get, 70(150g) + 55g = 9000
10500-70g + 55g = 9000
1500 = 15g ∴ g = 100
Hence, b = 150-100 = 50
[CBSE 2016]</td><td>3</td></tr>
<tr><td>14</td><td>If the mean of the following frequency distribution is 10.8, then find the value of p:
<table>
<tr><td>Class</td><td>0-4</td><td>4-8</td><td>8-12</td><td>12-16</td><td>16-20</td></tr>
<tr><td>f</td><td>3</td><td>p</td><td>5</td><td>8</td><td>2</td></tr>
</table>
Solution -
⇒ $Here,$
$\frac{3+p+5+8+2}{5}$ = 10.8
18 + p = 54
Thus, p = 36.
[CBSE 2014, 2016]</td><td>2</td></tr>
<tr><td>15</td><td>The arithmetic mean of the following frequency distribution is 53. Find the value of k.</td><td>3</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>Class</td><td>0-20</td><td>20-40</td><td>40-60</td><td>60-80</td><td>80-100</td></tr>
<tr><td>f</td><td>12</td><td>15</td><td>32</td><td>k</td><td>13</td></tr>
</table>
Solution-

$\Rightarrow\ Here,$
$\frac{3+p+5+8+2}{5}$= 10.8
18 + p = 54
Thus, p = 36
[CBSE 2021-22]
</td><td></td></tr>
<tr><td>16</td><td>Write the empirical relationship between the three measures of central tendency.
Solution - 2 Mean = 3 Median – Mode
[CBSE 2021, 2017]</td><td>1</td></tr>
<tr><td>17</td><td>Find the mean of the data, using an empirical formula, when it is given that mode = 50.5 and median = 45.5.
Solution - 2 Mean= 3M-Z
$\Rightarrow\ 2\bar{x}$= 3× $45.5 - 50.5$
$\Rightarrow\ 2\bar{x}$ =86
$\Rightarrow\ \bar{x} = 43$
[CBSE 2017]</td><td>1</td></tr>
<tr><td>18</td><td>For the following frequency distribution, find the median:

<table>
<tr><td>Class</td><td>1400-1550</td><td>1550-1700</td><td>1700-1850</td><td>1850-2000</td></tr>
<tr><td>f</td><td>6</td><td>13</td><td>25</td><td>10</td></tr>
</table>

Solution:-
<table>
<tr><td>C-I</td><td>f</td><td>c.f.</td></tr>
<tr><td>1400-1550</td><td>6</td><td>6</td></tr>
<tr><td>1550-1700</td><td>13</td><td>19</td></tr>
<tr><td>1700-1850</td><td>25</td><td>44</td></tr>
<tr><td>1850-2000</td><td>10</td><td>54</td></tr>
</table>
N/2= 54/2=27
The cumulative frequency greater than or equal to 27 is 44
the class interval 1700-1850 so median class is 1700-1850</td><td>3</td></tr>
</table>

[CBSE 2021, 2014]

19

The median of the following data is 16. Find the missing frequencies a and b, if the total of the frequencies is 70.

C-I	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
f	12	a	12	15	b	6	6	4

Solution-

C-I	f	c.f.
0-5	12	12
5-10	a	12+a
10-15	12	24+a
15-20	15	39+a
20-25	b	39+a+b
25-30	6	45+a+b
30-35	6	51+a+b
35-40	4	55+a+b

N=70 =a+b+55

So , a+b= 15

Median is 16, which lies in 15-20. So the median class is 15-20 .

Therefore, l = 15, h= 5, N= 70, f = 15, and cf = 24+a

M=l+$\frac{\frac{N}{2}-c}{f} \times h$

$\Rightarrow 16 = 15 + \frac{35-24-a}{15} \times 5$

After solving , a=8 so b=7

[CBSE 2015, 2020]

Marks: 3

20

If the difference of Mode and Median of a data is 24, then the difference of median and mean is

Solution- Mode - Median = 24

$\therefore$

Mode = 24 + median

But mode = 3 median - 2 mean

$\therefore$

3 median - 2 mean = 24 + median

Marks: 1

	3 median - median - 2 mean = 24 ⇒ 2 median - 2 mean = 24 ⇒ Median - Mean = 12 **[CBSE 2022]**	