CBSE-X-2017 EXAMINATION

MATHEMATICS

Paper & Solution

Time: 3 Hrs. Max. Marks: 90

General Instructions :

(i) ***All*** *questions are compulsory.*

(ii) The question paper consists of ***31*** *questions divided into four sections - A, B, C and D.*

(iii) Section A contains ***4*** *questions of* ***1*** *mark each. Section B contains* ***6*** *questions of* ***2*** *marks each, Section C contains* ***10*** *questions of* ***3*** *marks each and Section D contains* ***11*** *questions of* ***4*** *marks each.*

(iv) Use of calculators is ***not*** *permitted.*

SECTION – A

Question numbers 1 to 4 carry 1 mark each.

1. What is the common difference of an A.P. in which $a_{21} - a_7 = 84$?

Solution:

Given

$a_{21} - a_7 = 84$ ....(1)

In an A.P a_1, a_2, a_3, a_4 ....

$a_n = a_1 + (n - 1)d$ where d = common difference

$a_{21} = a_1 + 20\,d$ ....(2)

$a_7 = a_1 + 6d$ ....(3)

substituting (2) & (3) in (1)

$a_1 + 20d - a_1 - 6d = 84$

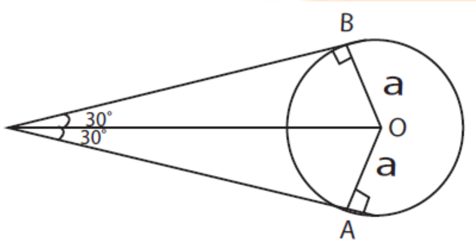
$14d = 84$

$d = 6$

$\therefore$ common difference = 6

2. If the angle between two tangents drawn from an external point P to a circle of radius a and centre O, is 60 , then find the length of OP.

Solution:



Given that $\angle BPA = 60^\circ$

OB = OA = a [radii]

PA = PB [length of tangents Equal]

OP = OP

$\therefore \Delta PBO$ and ΔPAO are congruent.

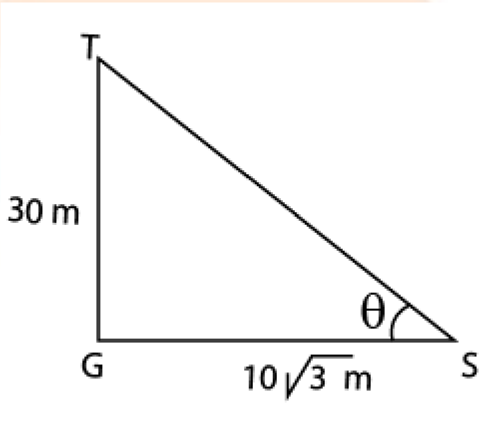
$\therefore \angle BPO = \angle OPA = \frac{60^\circ}{2} = 30^\circ$

In a $\Delta PBO \sin 30^\circ = \frac{a}{OP}$

OP = 2a

3. If a tower 30 m high, casts a shadow $10\sqrt{3}$ m long on the ground, then what is the angle of elevation of the sun ?

Solution:



Angle of equation of sun = $\angle GST = \theta$

Height of tower TG = 30m

Length of shadow GS = $10\sqrt{3}$ m

ΔTGS is a right angled triangle

$\therefore \tan\theta = \frac{30}{10\sqrt{3}}$

$\tan\theta = \sqrt{3}$

$\theta = 60^\circ$

4. The probability of selecting a rotten apple randomly from a heap of 900 apples is 0·18. What is the number of rotten apples in the heap ?

Solution:

Probability of selecting rotten apple = $\dfrac{\text{Number of rotten apples}}{\text{Total number of apples}}$

$$\therefore 0.18 = \frac{\text{No. of rotten apples}}{900}$$

No. of rotten apples = $900 \times 0.18 = 162$

SECTION B

Question numbers 5 to 10 carry 2 marks each.

5. Find the value of p, for which one root of the quadratic equation $px^2 - 14x + 8 = 0$ is 6 times the other.

Solution:

Given Quadratic Equation $px^2 - 14x + 8 = 0$

Also, one root is 6 times the other

Lets say one root = x

Second root = 6x

From the equation : Sum of the roots = $+\dfrac{14}{p}$

Product of roots = $\dfrac{8}{p}$

$$\therefore x + 6x = \frac{14}{p}$$

$$x = \frac{2}{p}$$

$$\Rightarrow 6x^2 = \frac{8}{p}$$

$$\Rightarrow 6\left(\frac{2}{p}\right)^2 = \frac{8}{p}$$

$$\frac{6 \times 4}{p^2} = \frac{8}{p}$$

$$p = 3$$

6. Which term of the progression $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, ...$ is the first negative term ?

Solution:

Given progression 20, $19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, ...$

This is an Arithmetic progression because

Common difference (d) = $19\frac{1}{4} - 20 = 18\frac{1}{2} - 19\frac{1}{4} = ...$

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

Any n^{th} term a_n = 20 + $(n-1)\left(\frac{-3}{4}\right) = \frac{83-3n}{4}$

Any term an < 0 when 83 < 3n

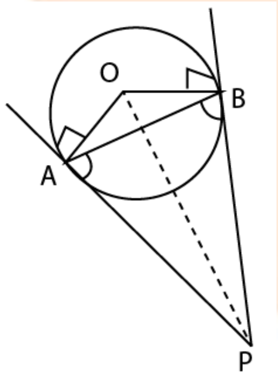
This is valid for n = 28 and 28^{th} term will be the first negative term.

7. Prove that the tangents drawn at the end points of a chord of a circle make equal angles with the chord.

Solution:

Need to prove that

$\angle BAP = \angle ABP$



AB is the chord

We know that OA = OB (radii)

$\angle OBP = \angle OAP = 90°$

Join OP and OP = OP

By RHS congruency

$\Delta OBP \cong \Delta OAP$

$\therefore By\ CPCT \quad BP = AP$

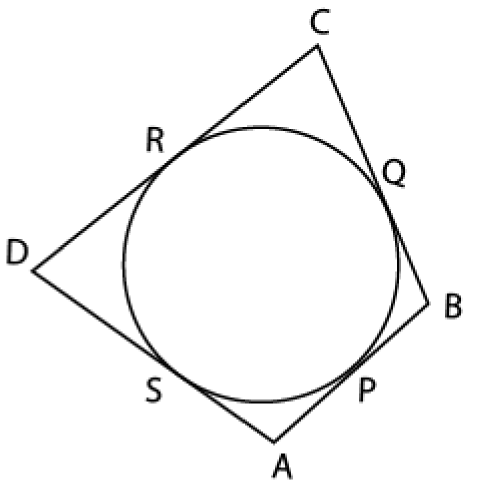
In $\Delta ABP \quad BP = AP$

Angles opposite to equal sides are equal

$\therefore \angle BAP = \angle ABP$

Hence proved.

8. A circle touches all the four sides of a quadrilateral ABCD. Prove that AB + CD = BC + DA
Solution:



ABCD is the Quadrilateral

Circle touches the sides at P, Q, R,S points

For the circle AS & AP are triangles

$\therefore AS = AP$...............(1)

In the similar way

BP = BQ........(2)

CQ = CR............(3)

RD = DS ....(4)

Now AB + CD = AP + PB + CR + RD

BC + AD = BQ + QC + DS + AS

Using (1), (2), (3), (4) in above equation BC + AD = BP + CR + RD + AP

∴ AB + CD = BC + AD

Hence proved

9. A line intersects the y-axis and x-axis at the points P and Q respectively. If (2, -5) is the mid-point of PQ, then find the coordinates of P and Q.
Solution:

Equation of a line: $\frac{x}{a}+\frac{y}{b}=1$

Where a =x-intercept

b = y-intercept

Given that line intersects y-axis at P

∴ P lines on y-axis and P = (0, b)

Line intersects x-axis at Q

∴ Q lines on x-axis and Q = (a, 0)

Midpoint of PQ = (2, -5)

$$\left(\frac{a}{2},\frac{b}{2}\right)=(2,-5)$$
$$\frac{a}{2}=2, \frac{b}{2}=-5$$
$$a=4 \ \& \ b=-10$$
$$\therefore P=(0,-10)$$
$$Q=(4,0)$$

10. If the distances of P(x, y) from A(5, 1) and B(-1, 5) are equal, then prove that 3x = 2y.
Solution:

Given that

PA = PB

P(x, y), A(5, 1), B(-1, 5)

$$PA=\sqrt{(x-5)^2+(y-1)^2}$$
$$PB=\sqrt{(x+1)^2+(y-5)^2}$$
$$\sqrt{(x-5)^2+(y-1)^2}=\sqrt{(x+1)^2+(y-5)^2}$$

Squaring on both sides

$x^2+25-10x+y^2-2y+1=x^2+2x+1+y^2-10y+25$
$-10x-2y=2x-10y$
$8y=12x$
$\therefore 3x=4y$

SECTION C

Question numbers 11 to 20 carry 3 marks each.

11. If ad $\neq$ bc, then prove that the equation
$(a^2 + b^2) x^2 + 2 (ac + bd) x + (c^2 + d^2) = 0$ has no real roots.

Solution:

Given $ad \neq bc$ for the equation $(a^2+b^2)x^2+2(ac+bd)x+(c^2+d^2)=0$

For this equation not to have real roots its discriminant < 0

$D = 4(ac + bd)^2 – 4(a^2 + b^2)(c^2 + d^2)$

$D = 4a^2c^2 + 4b^2d^2 + 8acbd – 4a^2c^2 – 4b^2d^2 – 4b^2c^2 – 4a^2d^2$

$D=-4(a^2d^2+b^2c^2-2acbd)$
$D=-4(ad-bc)^2$

Given $ad \neq bc$

$\therefore D<0$

Quadratic equation has no real roots

12. The first term of an A.P. is 5, the last term is 45 and the sum of all its terms is 400. Find the number of terms and the common difference of the A.P.

Solution:

First term (a) = 5

Last term (l) = 45

Sum of all the terms = 400

$400=\frac{n}{2}(a+l)$

$\frac{800}{50}=n$

$n=16$

No. of terms = 16

l = 45 (16^{th} term)

$a+(n-1)d=45$

$5+15d=45$

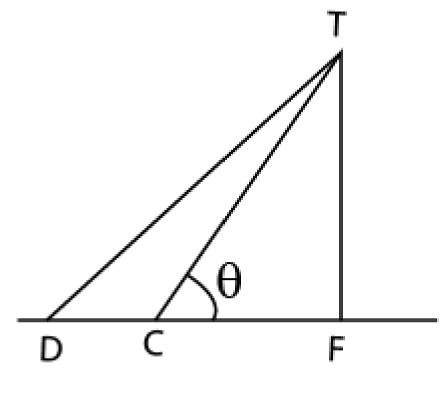
$d=\frac{40}{15}$

$d=\frac{8}{3}$

Common difference $=\frac{8}{3}$

13. On a straight line passing through the foot of a tower, two points C and D are at distances of 4 m and 16 m from the foot respectively. If the angles of elevation from C and D of the top of the tower are complementary, then find the height of the tower.

Solution:



Given CF = 4m

DF = 16m

$\angle TCF+\angle TDF=90°$

Lets say $\angle TCF=\theta$

$\angle TDF=90-\theta$

In a right angled triangle TCF

$\tan\theta=\frac{TF}{CF}=\frac{TF}{4}$

$TF=4\tan\theta$ ....(1)

In ΔTDF

$\tan\theta(90-\theta)=\frac{TF}{16}$

$TF=16\cot\theta$..............(2)

Multiply (1) & (2)

$(TF)^2 = 64 \Rightarrow TF = 8mt$

$\Rightarrow$ Height of lower = 8mt

14. A bag contains 15 white and some black balls. If the probability of drawing a black ball from the bag is thrice that of drawing a white ball, find the number of black balls in the bag.
Solution:

Bag contains 15 white balls

Lets say there are x black balls

Probability of drawing a black ball

P(B) = $\frac{x}{15+x}$

Probability of drawing a white ball

P(W) = $\frac{15}{15+x}$

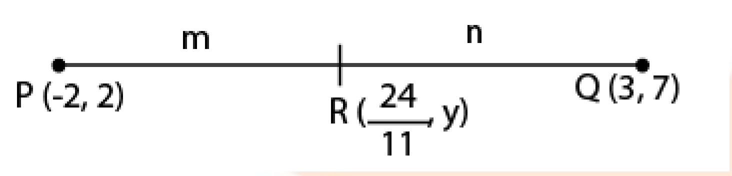
Given that P(B) = 3P(A)

$\therefore \frac{x}{15+x} = \frac{3\times 15}{15+x}$
$x = 45$

No. of black balls = 45

15. In what ratio does the point $\left(\frac{24}{11}, y\right)$ divide the line segment joining the points P(2, -2) and Q(3, 7) ?

Also find the value of y.
Solution:



Lets say ratio is m + n

Then

$$\left(\frac{24}{11}, y\right) = \left(\frac{3m+2n}{m+n}, \frac{7m-2n}{m+n}\right)$$

$$\frac{24}{11} = \frac{3m+2n}{m+n}, y = \frac{7m-2n}{m+n}$$

$$\therefore 24(m+n) = 11(3m+2n)$$

$$24m + 24n = 33m + 22n$$

$$2n = 9m$$

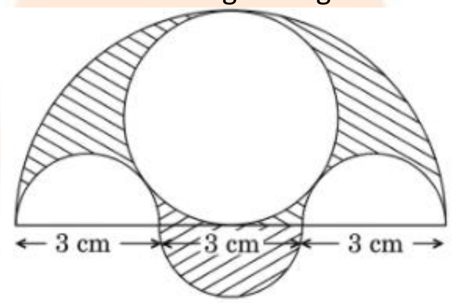
$$\therefore \frac{m}{n} = \frac{9}{2} \Rightarrow \text{ratio} = 9:2$$

$$m = 9, n = 2$$

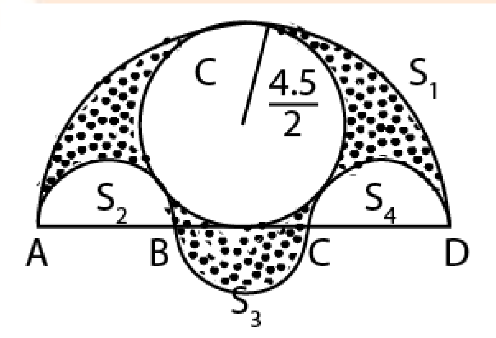
$$y = \frac{7\times 9 - 2\times 2}{11}$$

$$y = \frac{59}{11}$$

16. Three semicircles each of diameter 3 cm, a circle of diameter 4·5 cm and a semicircle of radius 4·5 cm are drawn in the given figure. Find the area of the shaded region.



Solution:



Given that AB = BC = CD = 3 cm

Circle c has diameter = 4.5 cm

Semicircle s_1 has diameter = 9cm

Area of shaded region

= Area of s_1 – Area of (s_2+s_4) – Area of c + Area of s_3

Area of shaded region

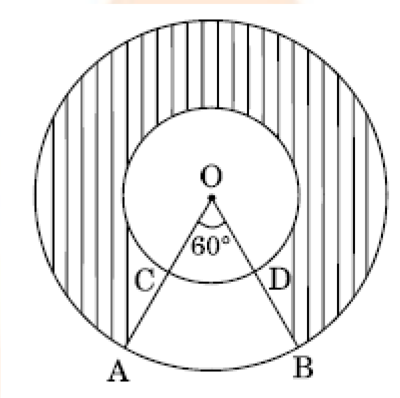
$$=\frac{\pi}{2}\left(\frac{9}{2}\right)^2-\frac{\pi}{2}\left(\frac{3}{2}\right)^2-\frac{\pi}{2}\left(\frac{3}{2}\right)^2-\pi\left(\frac{4.5}{2}\right)^2+\frac{\pi}{2}\left(\frac{3}{2}\right)^2$$

$$=\frac{\pi\times 81}{16}-\frac{\pi\times 9}{8}$$

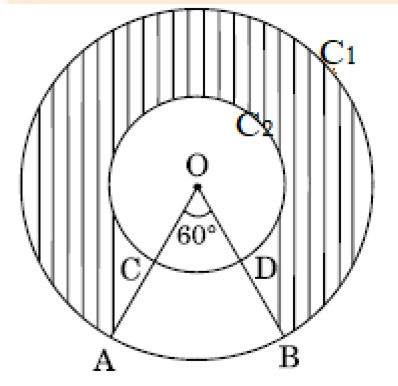
$$=12.36\,cm^2$$

17. In the given figure, two concentric circles with centre O have radii 21 cm and 42 cm. If $\angle$AOB = 60 , find the area of the shaded region.

$$\left[\text{Use } \pi=\frac{22}{7}\right]$$



Solution:



Given OC = OD = 21 cm

OA = OB = 42 cm

Area of ACDB region

= Area of sector OAB – Area sector OCD

$$=\frac{60^\circ}{360^\circ}\times\pi(42)^2-\frac{60^\circ}{360^\circ}\times\pi\times(21)^2$$

Area of ACDB region = $\frac{1}{6}\times\frac{22}{7}\times21\times63$

$=11\times63=693\,cm^2$

Area of shaded region= area of c_1 – Area of c_2 – Area of ACDB region

$=\pi(42)^2-\pi(21)^2-693$

$=\frac{22}{7}\times21\times63-693$

$=3,465\,cm^2$

18. Water in a canal, 5·4 m wide and 1·8 m deep, is flowing with a speed of 25 km/hour. How much area can it irrigate in 40 minutes, if 10 cm of standing water is required for irrigation ?

Solution:

Given canal width = 5.4 mt

Depth = 1.8 mt

Water flow speed = 25 km/hr

Distance covered by water in 4 onion

$=\frac{25\times40}{60}$

$=\frac{100}{3}km$

Volume of water flows through pipe = $\frac{100}{3}\times5.4\times1.8\times1000$

$=324\times10^3\,m^3$

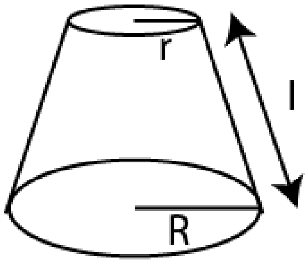
Area irrigate with 10mt of water standing

$=\frac{324\times10^3}{10\times10^{-2}}$

$=324\times10^4\,m^2$

19. The slant height of a frustum of a cone is 4 cm and the perimeters of its circular ends are 18 cm and 6 cm. Find the curved surface area of the frustum.

Solution:



Given:

$2\pi r = 6cm$
$2\pi R = 18cm$
$l = 4cm$

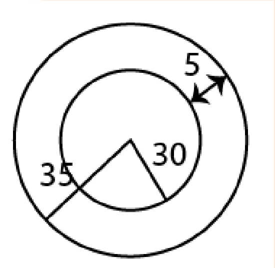
Curved surface area of frustum of a cone

$= \frac{1}{2}(2\pi R + 2\pi r) \times l$
$= \frac{1}{2}(6+18)4$
$= 48cm^2$

20. The dimensions of a solid iron cuboid are 4·4 m × 2·6 m × 1·0 m. It is melted and recast into a hollow cylindrical pipe of 30 cm inner radius and thickness 5 cm. Find the length of the pipe.
Solution:

Volume of cuboid = $4.4 \times 2.6 \times 1$

$11.44m^3$



length = l

Inner radius = 30 cm

outer radius = 35 cm

Volume of cuboid = volume of cylindrical pipe

$$11.44 = \frac{\pi \times l \times (35^2 - 30^2)}{100 \times 100 \times 100}$$

$$l = 10.205 \times 10^4 \ cm$$

$$l = 102.05 \, km$$

SECTION D

Question numbers 21 to 31 carry 4 marks each.

21. Solve for x :

$$\frac{1}{x+1} + \frac{3}{5x+1} = \frac{5}{x+4}, x \neq -1, -\frac{1}{5}, -4$$

Solution:

$$\frac{1}{x+1} + \frac{3}{5x+1} = \frac{5}{x+4}; x \neq -1, \frac{-1}{5}, -4$$

Take L.C.M. on the left hand side of equation

$$\frac{5x+1+3(x+1)}{(x+1)(5x+1)} = \frac{5}{x+4}$$

$$(x+4)(8x+4) = 5(5x+1)(x+1)$$

$$8x^2 + 4x + 32x + 16 = 25x^2 + 5 + 5x + 25x$$

$$17x^2 - 6x - 11 = 0$$

$$17x^2 - 17x + 11x - 11 = 0$$

$$17x(x-1) + 11(x-1) = 0$$

$$(x-1)(17x+11) = 0$$

$$\therefore x = \frac{-11}{17}, 1$$

22. Two taps running together can fill a tank in $3\frac{1}{13}$ hours. If one tap takes 3 hours more than the other to fill the tank, then how much time will each tap take to fill the tank ?

Solution:

Two taps when run together fill the tank in $3\frac{1}{13}$hrs

Say taps are A, B and

A fills the tank by itself in x hrs

B fills tank in (x+3) hrs

Portion of tank filled by A (in 1hr) = $\frac{1}{x}$

Portion of tank filled by B (in 1hr) = $\frac{1}{x+3}$

Portion of tank filled by A & B (both in 1hr) = $\frac{13}{40}$

$$\therefore \frac{1}{x}+\frac{1}{x+3}=\frac{13}{40}$$
$$(x+3+x)40=13(x)(x+3)$$
$$80x+120=13x^2+39x$$
$$13x^2-41x-120=0$$
$$x=5$$

$\therefore$ A fills tank in 5hrs

B fills tank in 8hrs

23. If the ratio of the sum of the first n terms of two A.Ps is (7n + 1) : (4n + 27), then find the ratio of their 9^{th} terms.

Solution:

Given two A.P's with n terms each

A.P $_I$ = first term = a_1

A.P$_{II}$ = first term = a_2

Common difference = d_2

Sum of first n terms for A.P$_I$ = S_1

$$S_1=\frac{n}{2}\left[2a_1+(n-1)d_1\right]$$

Similarly $S_2=\frac{n}{2}\left[2a_2+(n-1)d_2\right]$

$$\frac{S_1}{S_2}=\frac{7n+1}{4n+27}$$

$$\Rightarrow \frac{a_1+\frac{(n-1)}{2}d_1}{a_2+\frac{(n-1)}{2}d_2}=\frac{7n+1}{4n+27}$$

Ratio of their 9[th] terms $=\dfrac{a_1+8d_1}{a_2+8d_2}$

Comparing

$$\frac{a_1+\frac{(n-1)}{2}d_1}{a_2+\frac{(n-1)}{2}d_2}\ \&\ \frac{a_1+8d_1}{a_2+8d_2}$$

Upon comparing

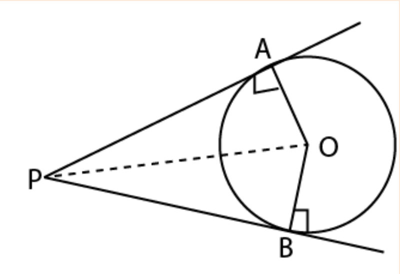
$$\frac{n-1}{2}=8$$

$\Rightarrow (n=17)$ substituting n value

$$\therefore \frac{a_1+8d_1}{a_2+8d_2}=\frac{a_1+\frac{(n-1)}{2}d_1}{a_2+\frac{(n-1)}{2}d_2}=\frac{7n+1}{4n+27}=\frac{7(17)+1}{4(17)+27}=\frac{120}{95}$$

$\text{ratio}=60:19$

24. Prove that the lengths of two tangents drawn from an external point to a circle are equal.
Solution:



PA & PB are the length of the tangents drawn from an external point P to circle C with radius r

$OA=OB=r$

$OA\perp PA$

$OB\perp PB$

Join O & P

In the triangles OAP & OBP

OA = OB (radii)

OP = OP (common side)

$\angle OAP=\angle OBP=90^\circ$ (Right angle)

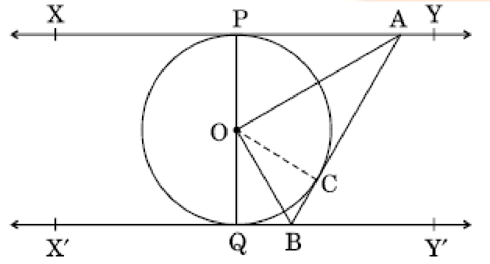
By RHS congruency

$\Delta OAP \cong \Delta OBP$

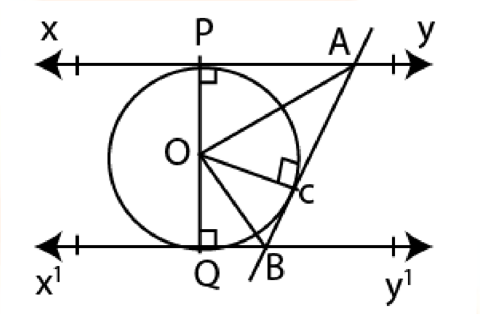
$\therefore$ By CPCT

PA = PB

25. In the given figure, XY and X'Y' are two parallel tangents to a circle with centre O and another tangent AB with point of contact C, is intersecting XY at A and X'Y' at B. Prove that $\angle$AOB = 90 .



Solution:



Prove that $\angle AOB = 90°$

In ΔAOC and ΔAOP

OA = OA (hypotenuse)

OP = OC (radii)

$\angle ACO = \angle APO$ (right angle)

$\therefore \Delta AOC \cong \Delta AOP$ By RHS congruency

By CPCT $\angle AOC = \angle AOP$ .....(1)

Similarly In $\Delta BOC \; \& \; \Delta BOQ$

OC = OQ

OB = OB

$\angle BCO = \angle BQO = 90°$

By RHS congruency $\Delta BOC \cong \Delta BOQ$

By CPCT $\angle BOC = \angle BOQ$ .....(2)

PQ is a straight line

$\therefore \angle AOP + \angle AOC + \angle BOC + \angle BOQ = 180^\circ$

From equations (1) and (2)

$2(\angle AOC + \angle BOC) = 180^\circ$

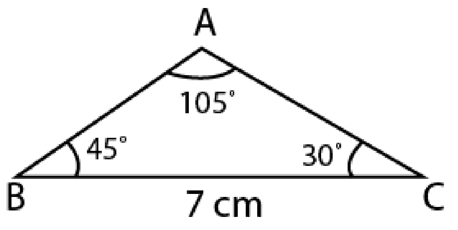
$\angle AOB = \frac{180^\circ}{2}$

$\therefore \angle AOB = 90^\circ$

26. Construct a triangle ABC with side BC = 7 cm, ∠B = 45 , ∠A = 105 .

Then construct another triangle whose sides are $\frac{3}{4}$ times the corresponding sides of the ΔABC.

Solution:



In the $\Delta ABC, \angle A + \angle B + \angle C = 180^\circ$

$\therefore \angle C = 30^\circ$

To construct the similar triangle first we need to construct ΔABC

For ΔABC

1). Draw $\overline{BC} = 7cm$ with help of a ruler

2) Take a protractor measure angle 45 from point B and draw a ray $\overrightarrow{BX}$

3) From point c, mark 30 with help of protractor & draw a ray $\overrightarrow{CY}$

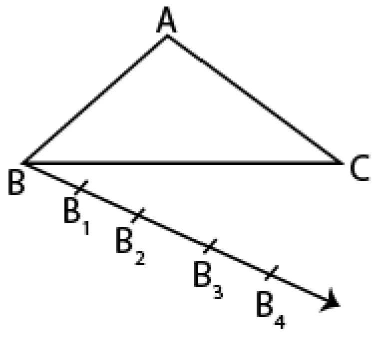
4) Now both $\overrightarrow{BX}$ and $\overrightarrow{BY}$ intersect at a point and this point is A

Now we have ΔABC

To construct similar triangle with corresponding sides $\frac{3}{4}$ of the sides of ΔABC

Step 1: Draw any raw making an acute angle with BC

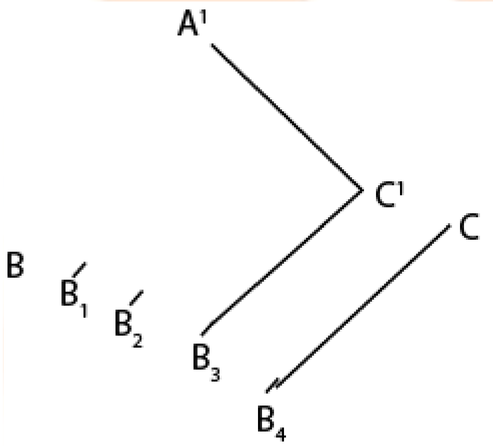
Step 2: Along the ray BZ mark 4 points B_1, B_2, B_3, B_4 such that $BB_1 = B_1B_2 = B_2B_3 = B_3B_4$



Step 3: Now join B_4 to C and draw a line parallel to B_4C from B_3 intersecting the line BC line BC at C'

Step 4: Draw a line through C' parallel to CA which intersects BA at A'

A'BC' is the required tri



Justification:

$\because C'A' || CA$ By construction

$\therefore \Delta A'BC' \sim \Delta ABC$ [using AA similarity]

$\therefore \frac{A'B}{AB} = \frac{BC'}{BC} = \frac{A'C'}{AC}$ [corresponding sides ratio will be proportional

$B_4C || B_3C'$ [By construction]

$\therefore \Delta BB_4C \sim \Delta BB_3C'$ [By AA similarity]

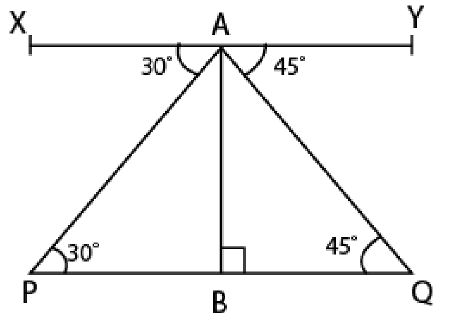
$\frac{BC'}{BC} = \frac{BB_3}{BB_4}$ [By BPT]

But we know $\frac{BB_3}{BB_4} = \frac{3}{4}$

$\therefore \frac{A'B}{AB} = \frac{BC'}{BC} = \frac{A'.C'}{AC} = \frac{3}{4}$

27. An aeroplane is flying at a height of 300 m above the ground. Flying at this height, the angles of depression from the aeroplane of two points on both banks of a river in opposite directions are 45 and 60 respectively. Find the width of the river. [Use $\sqrt{3}$ = 1·732]

Solution:



Given aeroplane is at height pf 300m

$\therefore AB = 300m$ and $XY || PQ$

Angles of depression of the two points P & Q are 30 and 43

$\angle XAP = 30° \ \& \ \angle YAQ = 45°$

$\angle XAP = \angle APB = 30°$
$\angle YAQ = \angle AQB = 45°$ [Alternative Interior angles]

In ΔPAB

$\tan 30° = \frac{AB}{PB}$

$PB = 300\sqrt{3}\ mt$

In ΔBAQ

$\tan 45° = \frac{AB}{BQ}$

$BQ = 300m$

$\therefore$ Width of the river = PB + BQ

$= 300(1+\sqrt{3})mt$

28. If the points A(k + 1, 2k), B(3k, 2k + 3) and C(5k - 1, 5k) are collinear, then find the value of k.

Solution:

Given $A(k+1, 2k), B(3k, 2k+3), C(5k-1, 5k)$ are collinear.

If three points are collinear then the area of the triangle will be zero. For any 3 points (x_1, y_1), (x_2, y_2), (x_3, y_3) Area will be

$$\Rightarrow A = \frac{1}{2}\left|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\right|$$

$$\therefore O = \frac{1}{2}\left|(k+1)(2k+3-5k) + 3k(5k-2k) + (5k-1)(2k-2k-3)\right|$$

$$O = \left|(k+1)(3-3k) + 3k(3k) - 15k + 3\right|$$

$\left|-3k^2-3+9k^2+3-15k\right|=0$

$\left|6k^2-15k\right|=0$

$k=0,\frac{5}{2}$

29. Two different dice are thrown together. Find the probability that the numbers obtained have
(i) even sum, and
(ii) even product.
Solution:

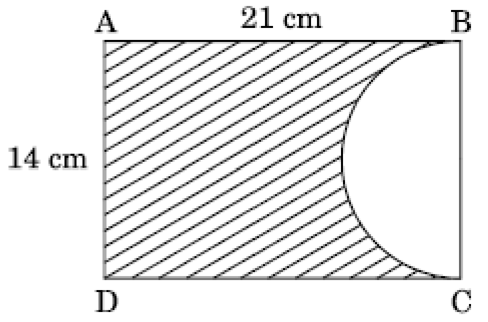
Two dice are through together total possible outcomes $=6\times6=36$
(i) Sum of outcomes = even
This can be possible when
$\Rightarrow$ Both outcomes are even
$\Rightarrow$ Both outcomes are odd
For both outcomes to be Even number of cases = 3×3 = 9
Similarly
Both outcomes odd = 9 cases
Total favourable cases = 9 + 9 =18
Probability that $=\frac{18}{36}$

Sum of the outcomes is even $=\frac{1}{2}$

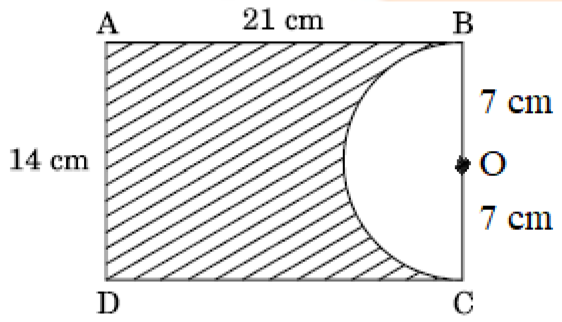
(ii) Product of outcomes is even
This is possible when
$\Rightarrow$ Both outcomes are even
$\Rightarrow$ first outcome even & the other odd
$\Rightarrow$ first outcome odd & the other even
Number of cases where both outcomes are even = 9
Number of cases for first outcome odd = 9
and the other Even
No. of cases for first outcome odd & the other even = 9
Total favourable cases = 9 + 9 + 9 = 27
Probability = $\frac{27}{36}$

$=\frac{3}{4}$

30. In the given figure, ABCD is a rectangle of dimensions 21 cm $\times$ 14 cm. A semicircle is drawn with BC as diameter. Find the area and the perimeter of the shaded region in the figure.



Solution:



Area of shaded region = Area of rectangle – Area of semicircle

$$= 21 \times 14 - \frac{\pi(7)^2}{2}$$

$$= 217\,\text{cm}^2$$

Perimeter of shaded region

= AB + AD + CD + length of arc BC

$$= 21 + 14 + 21 + 7 \times \frac{180°}{360°}$$

$$= 59.5\,\text{cm}$$

31. In a rain-water harvesting system, the rain-water from a roof of 22 m × 20 m drains into a cylindrical tank having diameter of base 2 m and height 3·5 m. If the tank is full, find the rainfall in cm. Write your views on water conservation.

Solution:

Water from the roof drains into cylindrical tank

Volume of when from roof flows into the tank of the rainfall is x cm and given the tank is full we can write volume of water collected on roof = volume of the tank

$$\frac{22 \times 20 \times x}{100} = \pi\left(\frac{2}{2}\right)^2 \times 3.5$$

$$x = 5\,cm$$

$\therefore$ rainfall is of 5cm