SSLC Examination March 2020
Mathematics
English Version Questions and Detailed Solutions.

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Question 1.

(a) Write the 6^{th} term of the arithmetic sequence 1, 25, 49, 73, 97, ...

(b) How many perfect square terms are there in the arithmetic sequence 97, 73, 49, ... ?

Solution.

(a) Given arithmetic sequence

1,25,49,73,97,……

First term (f) = 1 ; d = 25 – 1 = 24.

6^{th} term = f + 5d ; $\Rightarrow$ 1 + 5 $\times$ 24

1 + 120 = 121.

(b) Given arithmetic sequence

97,73,49,…….

We know that the perfect square numbers be 1, 4, 9, 16, …….

Hence the given sequence be 97,73,49, 25,1. From this perfect square

numbers are 49,25,and 1.

∴ Number of perfect square term = 3.

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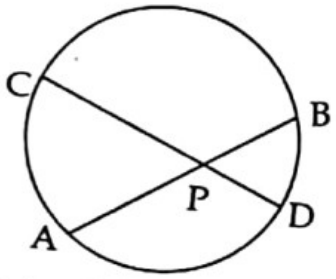
Question 2.

Chords AB and CD are intersecting at P. AB = 10 centimetres, PB = 4 centimetres and PD = 3 centimetres.



(a) What is the length of PA ?

(b) Find the length of PC.

Solution .

Given, AB = 10cm; PB = 4cm;

PD = 3cm.

(a) PA = AB – PB = 10 – 4 = 6cm.

(b) We know that PC × PD = PA × PB

$$\text{PC} = \frac{\text{PA} \times \text{PB}}{PD} = \frac{6 \times 4}{3} \text{ . = 8cm.}$$

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Question 3.

Write the polynomial $p(x) = x^2 - 4$ as the product of two first degree polynomials.

Solution

Given polynomial = p(x) = x^2-4

First degree polynomial x^2-4

= (x + 2) (x – 2)

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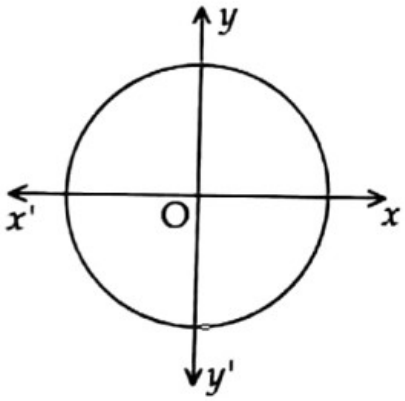
Question 4.

In the figure, O is the centre of the circle and $x^2+y^2=25$ is the equation of the circle.



(a) What is the radius of the circle ?

(b) Write the equation of the circle whose centre is at the origin and radius is 3.

Solution

Given circle - $x^2+y^2=25.$

(a) We know $x^2+y^2=r^{2.}$ ie., $r^2 = 25$;

$r = \sqrt{25} = 5.$ ∴ r = 5.

(b) Given radius = 3

Hence the equation of the circle =

$$x^2+y^2=r^{2.} \Rightarrow x^2+y^2=3^{2.}$$

$\Rightarrow x^2+y^2=9.$

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Question 5.

a) Write the first term and the common difference of the arithmetic sequence whose algebraic expression is $3n+5$.

b) First term of an arithmetic sequence is 8 and the common difference is 5. Write its algebraic form.

Solution

Given $x_n = 3n + 5$.

(a)Put n = 1 get first term

ie., first term = $3\times1+5=3+8=8$

common difference = 3 [∵ coefficient of n be the d]

(b) Given f = 8 ; d = 5

We know x_n = dn + f – d) = 5n + (8 – 5)

= 5n + 3.

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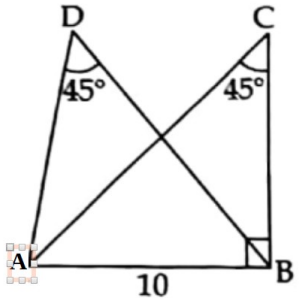
Question 6.

In the figure, $\angle ABC=90°$, $\angle C=\angle D=45°$, $AB=10$ centimetres.



What is the length of AC ?

What is the radius of the circumcircle of triangle ABC ?

What is the radius of the circumcircle of triangle ABD ?

Solution

In right △ ABC ,

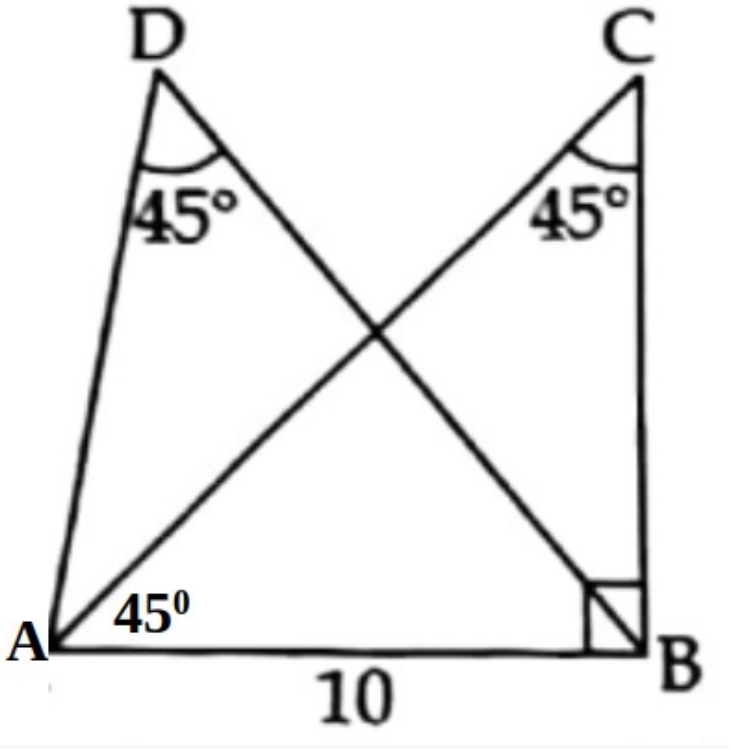
45^0 , 45^0 ,90^0

$\Rightarrow$ 1 : 1: $\sqrt{2}$

$\Rightarrow$ AB : BC : AC

x : x : x $\sqrt{2}$

10 10 $10\sqrt{2}$



(a) The length of AC = $10\sqrt{2}$

(b) Radius of the circumcircle of △ABC

= Half of the hypotenuses AC = $\frac{10\sqrt{2}}{2}$

= $5\sqrt{2}$.

(c) Radius of the circumcircle of △ABD

= Half of the hypotenuses AC = $\frac{10\sqrt{2}}{2}$

$= 5\sqrt{2}$

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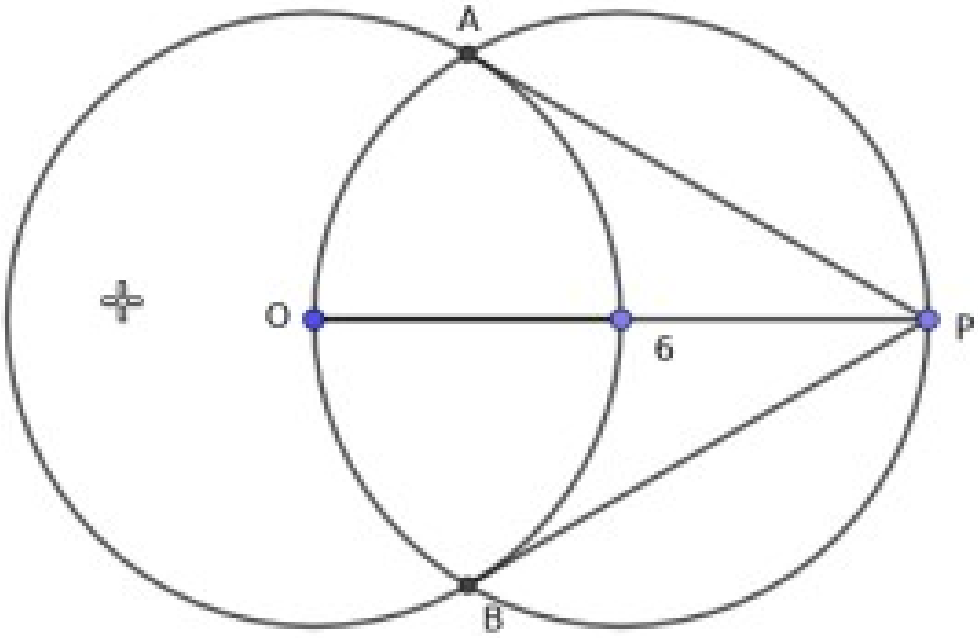
Question7.

Draw a circle radius 3cm. Mark a point P at a distance 6cm from the center of the circle . Draw tangents from P to the circle.

Solution



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Question 8

a) What is the common difference of the arithmetic sequence $x-1$, x, $x+1$, ... ?

b) If $x-1$ is an even number, which is the next even number ?

c) Prove that the product of two consecutive even numbers added to 1 gives a perfect square.

Solution

(a) Given sequence $x - 1, x, x + 1, \ldots\ldots$

$d = x - (x - 1) = x - x + 1 = 1.$

(b) Given even number $= x - 1$

Next even number $= x - 1 + 2 = x + 1.$

(c) Let consecutive two even number be $(x - 1)$ and $(x+ 1)$

By question , the product of two consecutive numbers + 1

ie., $(x - 1)(x+ 1)\,1 = x^1 - 1 + 1 = x^2$.

Here x^2 being a perfect square .

Hence proved.

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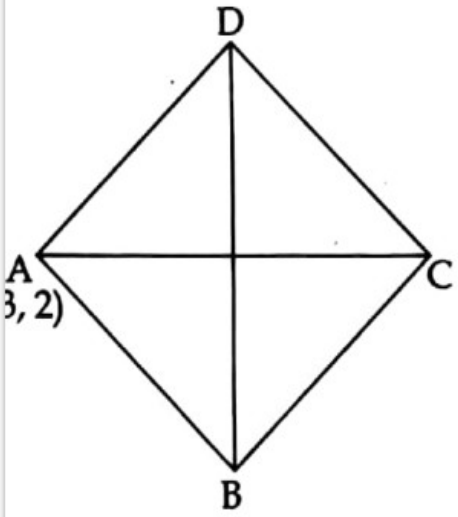
Question 9

ı the figure, ABCD is a square. Its diagonals are parallel to the coordinate axes. AC = 6 and ıe coordinates of A is (3, 2) write the coordinates of the vertices C, B and D.



Solution

Given , coordinates of A = (3, 2)

AC be parallel to to the x-axis

∴ the coordinates of C

= (3+6, 2) = (9, 2)

coordinates of the mid point of AC

= (6,2)

We know that the diagonals are equal in a square.

∴ the coordinates of B =(6, 2 – 3)

= (6,-1) coordinates of D

= (6, 2+3) = (6, 5)

Hence the coordinates of A = (3,2)

Coordinates of B = (6, -1)

Coordinates of C = (9,2)

Coordinates of D = (6,5).

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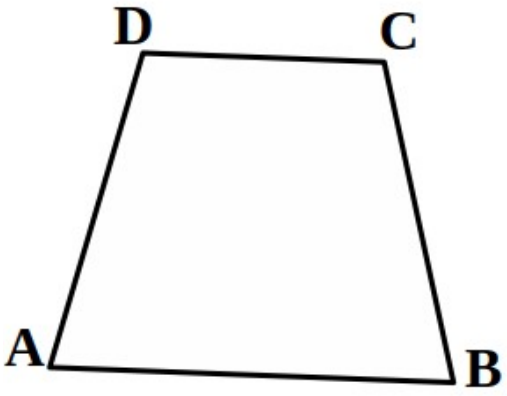
Question 10.

In the figure, ABCD is a cyclic quadrilateral. Also $\angle A + \angle D = 210°$, $\angle D + \angle C = 250°$



(a) What is $\angle A + \angle C$?

(b) Find the measures of $\angle A$ and $\angle C$.

Solution

Given $\angle A + \angle D = 210^0$;

$\angle D + \angle C = 250^0$.

(a) $\angle A + \angle C = 180^0$

(cyclic quadrilateral)

$\angle A + \angle D = 210 \rightarrow (1)$

$\angle D + \angle C = 250 \rightarrow (2)$

Adding (1) + (2)

$\Rightarrow \angle A + \angle C + 2\angle D = 460$

$\Rightarrow 180 + 2\angle D = 460$

$\Rightarrow 2\angle D = 280$

$\angle D = 140^0$.

(b) $\angle A = 210 - 140 = 70^0$

$\angle C = 250 - 140 = 110^0$.

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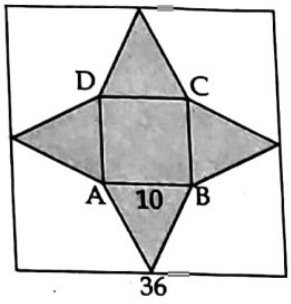
Question 11.

The figure of a square sheet of paper is shown below. Length of one side of the paper sheet is 36 centimetres and AB = 10 centimetres. The shaded portion is cut out and folded into a square pyramid.

(a) What is the length of the base edge of the pyramid ?

(b) What is the slant height of the pyramid ?

(c) Find the lateral surface area of the pyramid.



Solution

Given, Side of the paper sheet

$= 36cm^2$.

AB = 10cm.

(a) Base edge of the pyramid

AB = 10cm.

(b) Slant height of the pyramid

$$\frac{36-10}{2} = 26/2 = 13cm.$$

[∵ a + 2l = 36, side of the larger square]

(c) Lateral surface area = 2al

$= 2 \times 10 \times 13 = 260\ cm^2$.

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Question 12.

(a) What is the sum of the first 5 terms of the arithmetic sequence 1, 3, 5, 7, ... ?

(b) What is the sum of the first n terms of the arithmetic sequence 1, 3, 5, 7, ... ?

(c) Find the sum of the first n terms of the arithmetic sequence $\frac{1}{n}, \frac{3}{n}, \frac{5}{n}, \frac{7}{n}, \ldots\ldots\ldots$

(d) What is the sum of first 2020 terms of the arithmetic sequence $\frac{1}{2020}, \frac{3}{2020}, \frac{5}{2020}, \ldots\ldots\ldots$?

Solution

(a) Given sequence = 1,3,5,7,.....

We know sum = n^2 , **n = 5**

∴ sum of the first 5 terms = $5^2 = 25$.

(b) sum of the first n terms = n^2 .

(c) Given sequence = $\frac{1}{n}, \frac{3}{n}, \frac{5}{n}, \frac{7}{n}$. ----

We know , sum of the first n terms

$$= \frac{n^2}{n} = n \ .$$

(d) Given sequence

$$\frac{1}{2020}, \frac{3}{2020}, \frac{5}{2020} \text{ --------}$$

We know , sum of the first n terms

$$= \frac{n^2}{n} = n$$

ie., , sum of the first 2020 terms

= n = 2020.

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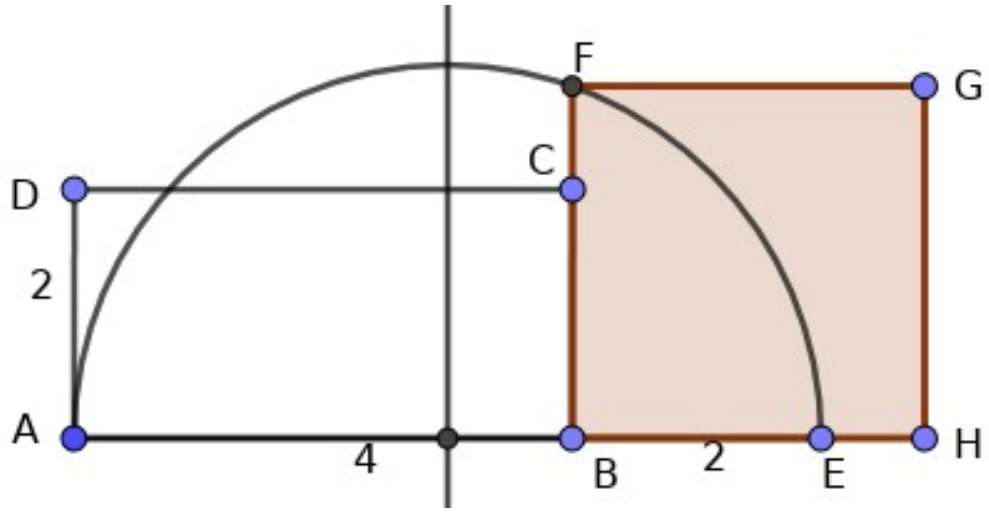
Question 13

Draw a rectangle of length 4 centimetres and breadth 2 centimetres. Draw a square having the same area of the rectangle.

Solution



Contraction.

Contract rectangle ABCD in the given measurement. Extant the line AB to BE , such that BE = BC .Draw a semi circle AE as diameter and draw a parallel line BF through B and then BF as length then draw the square BFGH.

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Question 14.

In a school, the total number of students in 10 A division is equal to the total number of students in 10 B. One student is to be selected from each division. Number of boys in 10 A is 20. The probability of selecting a boy from 10 A is $\frac{2}{5}$ and that of from 10 B is $\frac{3}{5}$.

(a) How many students are there in 10 A ?

(b) What is the probability of selecting a girl from 10 A ?

(c) How many boys are there in 10 B ?

(d) What is the probability of both the selected students being boys ?

Solution

	Class XA	Class XB
Boys	20	30
Girls	30	20
Total	50	50

Given probability of boys in XA = $\frac{2}{5}$

Given probability of boys in XB = $\frac{3}{5}$

(a) Number of boys in XA

$= 20 \times \frac{5}{2} = 50$

(b) Probability of girl from XA

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

(c) Number of boys in X B

$= 50 \times \frac{3}{5} = 10 \times 3 = 30.$

(d) Both being boys = $\frac{2}{5} \times \frac{3}{5} = \frac{6}{25}$

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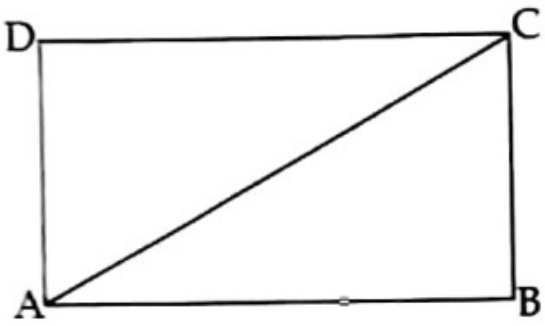
Question 15.

Perimeter of the rectangle in the figure is 36 centimetres. $AC = \sqrt{164}$ centimetres.



(a) What is AB + BC ?

(b) Find the length of AB.

Solution

Given the perimeter = 36cm.

AC = $\sqrt{164}$ cm.

(a) ie., 2(l+b) = 36

$$\therefore \text{AB + BC} = \frac{36}{2} = 18\text{cm.}$$

(b) Let AB = x , BC = 18 – x

In right , Δ ABC by Pythagoras

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

Ie $164 = x^2 + (18 - x)^2$.

$x^2 + 324 - 36x + x^2 = 164$

$2x^2 - 36x = 164 - 324 = -160$

dividing by 2

$x^2 - 18x = -80$ [square completion method]

$x^2 - 18x + 81 = -80 + 81$

ie $(x - 9)^2 = 1$

$x - 9 = \pm 1$

$x - 9 = 1$ or $x - 9 = -1$

x = 10 or = 8 ; AB = 10 cm

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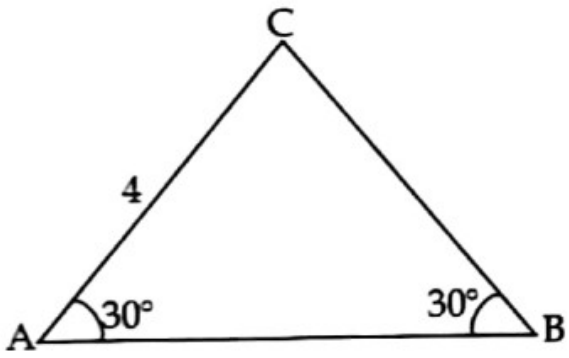
Question 16

In triangle ABC, $\angle A = \angle B = 30°$, AC = 4 centimetres.



(a) What is the length of BC ?

(b) Find the length of AB.

(c) In triangle PQR, PQ = $4\sqrt{3}$ centimetres, $\angle P = \angle Q = 30°$. Draw the triangle.

Solution

Given ,

$\angle A = \angle B = 30^0$.

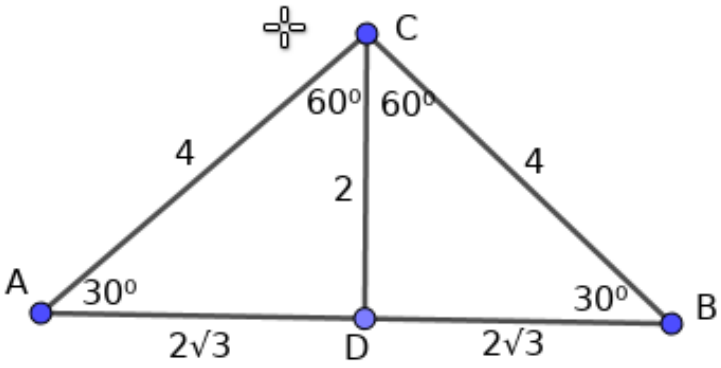
AC = 4cm

Draw CD $\perp$ AB.

In right $\triangle$ ADC,

$30^0 : 60^0 : 90^0$

1 : $\sqrt{3}$: 2



DC : AD : AC

↓ ↓ ↓

x : x√3 : 2x

↓ ↓ ↓

2 : 2√3 : 4

DC = 2 ; AD = 2√3; AC = 4

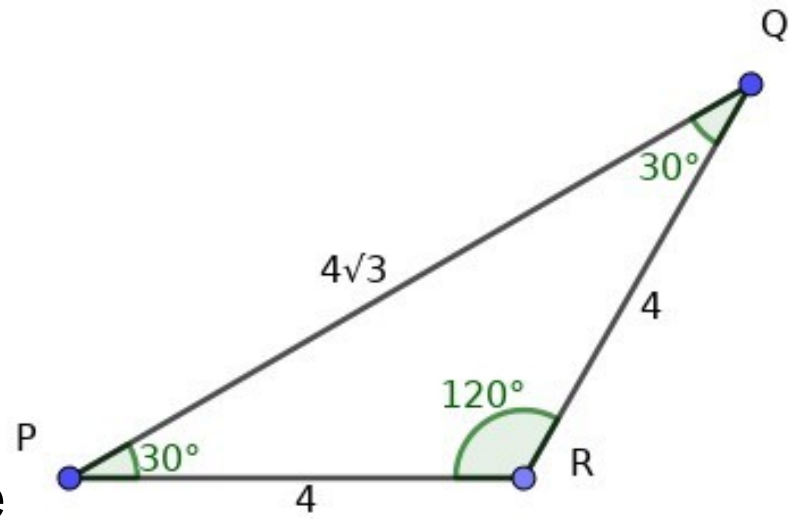
(a) Length of BC = AC = 4cm

(b) Length of AB = AD + DB

= 2√3 + 2√3 = 4√3cm

(c)

Draw PR = 4cm and make ∠R be 120^0 and Joint PQ . △PRQ be the required triangle.



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Question 17.

(a) If $p(x)=x^2-7x+13$, What is p(3) ?

(b) Write the polynomial $p(x)-p(3)$ as the product of two first degree polynomials.

(c) Find the solutions of the equation $p(x)-p(3)=0$.

Solution

(a) Given polynomial

p(x) = $x^2-7x+13$

p(3) = $3^2-7\times 3+13$

= 9 – 21 + 13 = 1.

(b) p(x) – p(3) = $x^2-7x+13$ **- 1**

= $x^2-7x+12$ **= (x – 3) (x – 4)**

Hence the product two first degree polynomial = (x – 3) (x – 4) .

(c) p(x) – p(3) = 0

ie., $x^2-7x+12$ **= 0**

⇒ (x – 3) (x – 4) = 0

⇒ (x – 3) = 0 or (x – 4) = 0

ie., x = 3 or x = 4.

Hence the solution x = 3 and 4.

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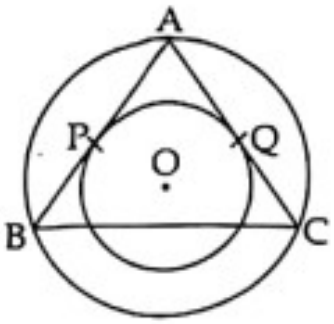
Question 18.

In the figure, O is the centre of both the circles. AB and AC touch the small circle at P and Q. A, B and C are points on the large circle.



(a) If AP = 5 centimetres, then what is the length of AQ ?

(b) Prove that AB = AC.

(c) If AP = 5 centimetres and $\angle A = 90^\circ$, then what is the radius of the small circle ?

Solution

(a) Given AP = 5 cm

Hence the length of AQ = 5cm.

[$\because$ Same tangents from A]

(b) AB and AC are tangents

OP $\perp$ AB and OQ $\perp$ AC.

[$\because$ Chord bisector theorem]

AP = BP and AQ = QC

ie., AB = AC. Hence proved.

(c) Given $\angle A = 90^0$, So we can see that APOQ be a square.

[∵ OP and OQ be radii ∴ $\angle APO = \angle AQO = 90^0$. ie., $\angle POQ = 90^0$]

Hence radius of the small circle

= 5cm.

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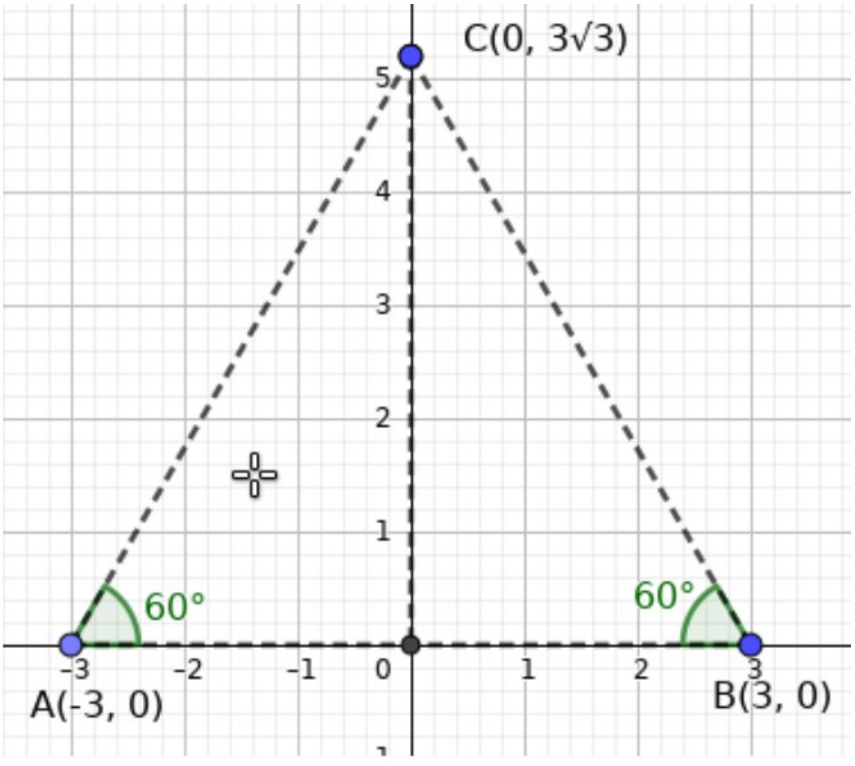
Question 19.

Draw the coordinate axes and mark the points A(−3, 0), B(3, 0) and C(0, $3\sqrt{3}$).

Solution



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Question 20.

A sector of radius 12 centimetres and central angle 120° is rolled up into a cone.

(a) What is the slant height of the cone ?

(b) Find the radius and the height of the cone.

(c) What is the central angle of the sector to be used to make a cone of base radius $\sqrt{2}$ centimetres and height 4 centimetres ?

Solution

(a) Radius of the sector = 12cm

[We know that radius of the sector be the slant height of the cone]

(b) We know $\frac{r}{l} = \frac{x^0}{360} \Rightarrow \frac{r}{12} = \frac{120}{360}$

$\Rightarrow 360r = 12 \times 120 \Rightarrow r = \frac{12 \times 120}{360}$

$\therefore$ **r = 4cm . Radius = 4cm**

$h = \sqrt{l^2 - r^2} = \sqrt{12^2 - 4^2} = \sqrt{144 - 16}$

$= \sqrt{128} = 8\sqrt{2}$. **cm.**

(c) We know that $\frac{r}{l} = \frac{x^0}{360}$

Center angle $(x^0) = \frac{360 \times r}{l}$ **. find 'l'**

l = $\sqrt{h^2+r^2}$ given r = √2 , h = 4cm .

∴ l = $\sqrt{4^2+\sqrt{2^2}}$ = $\sqrt{16+2}$ = $\sqrt{18}$ = 3√2.

∴ Center angle (x^0) = $\frac{360\times r}{l}$

$$= \frac{360\times\sqrt{2}}{3\sqrt{2}} = 120^0 .$$

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Question21.

(a) What is the slope of the line passing through the points (5, 0) and (3, 2) ? Write the equation of the line.

(b) The x coordinate of a point on the line $x-y=5$ is 5. What is the y coordinate of that point ?

(c) Write the coordinates of the point of intersection of the lines $x+y=5$ and $x-y=5$.

Solution

(a) Given points (5,0) and (3,2)

Slope = $\frac{y_2-y_1}{x_2-x_1}$ = $\frac{2-0}{3-5}$ = $\frac{2}{-2}$ = - 1.

Equation of the line =

= $y - y_1 = m(x - x_1)$

= $y - 0 = -1 (x - 5)$

y = -x + 5 ie., x + y – 5 = 0 be the equation.

(b) If x = 5; ie., 5 – y = 5 ; -y = 5 – 5 = 0.

y coordinates = 0.

(c) Given x + y = 5 and x – y = 0.

Intersection of the line , to solve the equation.

ie., x + y = 5 → (1) ; x – y = 0 → (2)

solve (1) and (2) we get

x and y= 5, and 0

So the coordinates = (5, 0) .

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Question 22.

Sum of the first 4 terms of an arithmetic sequence is 72. Sum of the first 9 terms is also 72.

(a) What is the 5^{th} term of the sequence ?

(b) Find the sum of the first five terms.

(c) Write the sequence.

Solution

Given sum of the first 4 term = 72.

sum of the first 9 term = 72.

(a) 5^{th} term $(s_5) = \frac{72}{9} = 8.$

(b) Sum of the first 5 term (s_5)

$= s_4 + x_5 = 72 + 8 = 80.$

(c) $X_3 = 80/5 = 16$

$X_3 + 2d = X_5$

$16 + 2d = 8$

$2d = -8$

$d = -4$

$X_1 = X_3 - 2d = 16 - 2 \times -4 = 24$

Sequence = 24, 20, 16, 12, 8,…..

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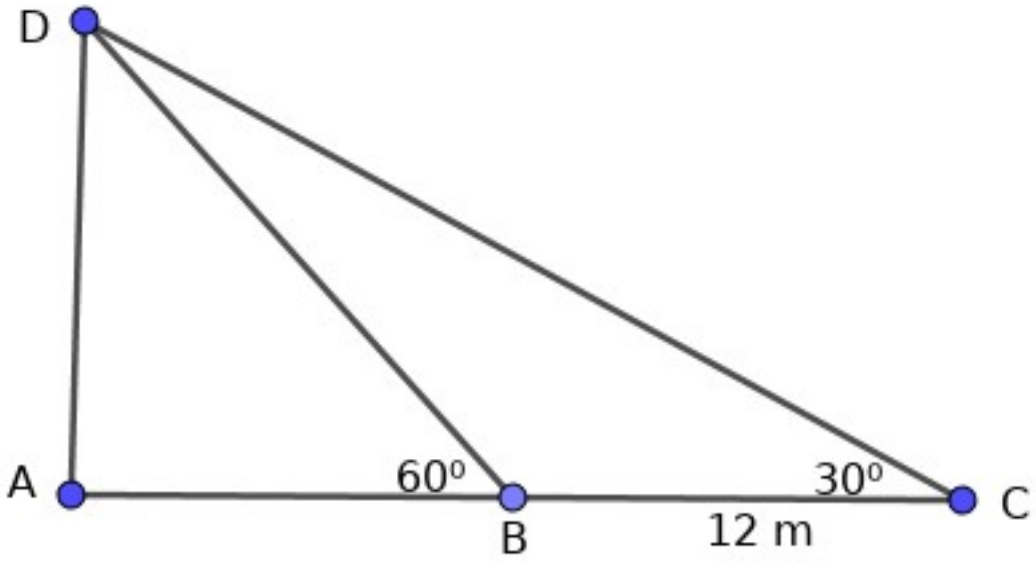
Question 23.

A boy standing at the edge of a canal sees the top of a tree on the other edge at an elevation of 60°. Stepping 12 metres back, he sees it at an elevation of 30°. Find the height of the tree.

Solution



Let AB be the height of the tree.
B be the first position of the boy
C be the second position of the boy.
BC = 12 ; $\angle C = 30^0$; $\angle BPA = 60^0$;
$\angle PBA = 30^0$; $\angle A = 90^0$. [see the figure]
We can see that $\triangle CBD$ be an isosceles.
$\therefore$ BC = BD = 12.
From right $\triangle BAP$, 30^0 ; 60^0 ; 90^0 .

ie., $1 : \sqrt{3} : 2$

$\Rightarrow$ $AD : AB : BD$

$\Rightarrow$ $x : x\sqrt{3} : 2x$

$\Rightarrow$ $6 : 6\sqrt{3} : 12.$

$\therefore AB = 6\sqrt{3}$

Hence the height of the tree

$=6\sqrt{3}$m

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Another method by using tan formula to find the height

$$h = \frac{a\tan A \,.\tan B}{\tan A - \tan B}$$

$$= \frac{12\tan 30^0 \,.\tan 60^0}{\tan 30^0 + \tan 60^0}$$

$$= \frac{12 \times \sqrt{3} \,.\frac{1}{\sqrt{3}}}{\sqrt{3} - \frac{1}{\sqrt{3}}} = \frac{12}{3 - \frac{1}{\sqrt{3}}} = \frac{12}{\frac{2}{\sqrt{3}}}$$

$$= \frac{12\sqrt{3}}{2} = 6\sqrt{3}\ \text{m.}$$

Hence the height = $6\sqrt{3}$ m.

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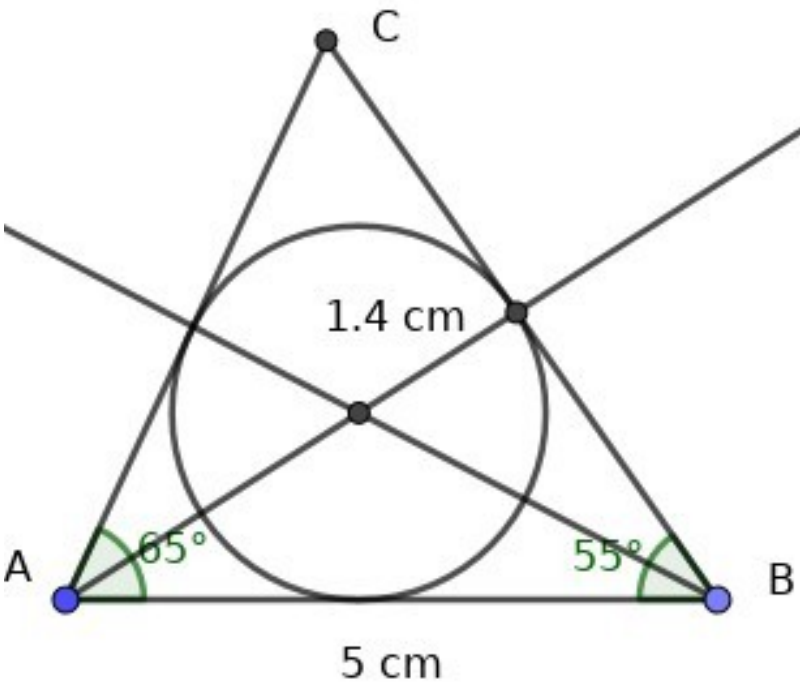
Question 24

In ΔABC, $AB = 5$ centimetres, $\angle A = 65°$, $\angle B = 55°$. Draw the triangle ABC and draw the incircle. Measure the radius of the incircle.

Solution

Radius

= 1.4cm.



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Question25

A circle is drawn with (5, 3) as centre. (5, 6) is a point on the circle.

(a) What is the radius of the circle ?

(b) Write the equation of the circle.

(c) What is the distance from the centre of the circle to the x-axis ?

(d) What is the length of the tangents from the origin to the circle ?

Solution

(a) Radius of the circle = 6 – 3 = 3.

(b) Equation of the circle

$= (x - a)^2 + (y - b)^2 = r^2$

$= (x - 5)^2 + (y - 3)^2 = 3^2$

$= x^2 - 10x + 25 + y^2 - 6y + 9 = 9$

$= x^2 + y^2 - 10x - 6y + 25 = 0$

(c) Distance = radius of the circle

= 3 unit

(d) Length of the tangent = 5 unit

[We know that x-axis be itself as the tangent]

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Question 26.

(a) The radius of a solid sphere is 6 centimetres. Find its volume and surface area.

(b) It is cut into two equal halves. What is the total surface area of each hemisphere ? What is the volume of a hemisphere ?

Solution

(a) Given radius = 6cm;

$$\text{Volume} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi 6^3 = 288\pi \text{ cm}^3 .$$

$$\text{TSA} = 4\pi r^2 = 4\pi \times 6^2 = 144\pi \text{cm}^2 .$$

(b) TSA of hemisphere = $3\pi r^2$

$= 3\pi \times 6^2 = 108\pi cm^2$.

Volume of hemisphere = $\frac{2}{3}\pi r^3$

$= \frac{2}{3}\pi 6^3 = 144\pi cm^3$.

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Question 27

The table below shows, children of a class sorted according to their marks in an examination

Marks	Number of Children
0-10	4
10-20	7
20-30	10
30-40	12
40-50	8
	41

(a) If we arrange the children from the one with the least mark to the one with the greatest, then what will be the assumed mark of the 12^{th} student ?

(b) Compute the median mark.

Solution

Class	Frequency	Marks	cf
0-10	4	< 10	4
10-20	7	< 20	11 F
20-30	10 f	< 30	21 N/2
30-40	12	< 40	33
40-50	8	< 50	41
Total	41		

(a) Assumed mark of the 12th student

$= 20 + \frac{30-20}{10\times 2}$ **= 20 +** $\frac{1}{2}$ **= 20.5.**

(b) $\frac{N}{2} = \frac{41}{2}$ **= 20.5 ,**

Median class = 20-30

l = 20; F = 11; f = 10

Median = $l + \left(\frac{\frac{N}{2} - F}{f}\right) c$

$$= 20 + \frac{20.5 - 11}{10} \times 10$$

$$= 20 + \frac{9.5}{10} \times 10 \quad = \mathbf{20 + 9.5 = 29.5.}$$

∴ Median mark = 29.5

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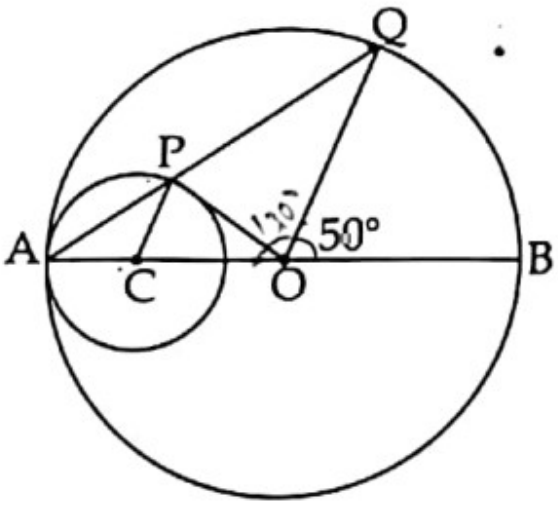
Question 28

In the figure, O is the centre of the large circle. Centre of the small circle is C. OP is a tangent to the small circle. $\angle BOQ = 50°$.



(a) $\angle OAQ =$ .....

(b) $\angle OCP =$ .....

(c) $\angle APO =$ .....

(d) $\angle POQ =$ .....

Solution

Given $\angle BOQ = 50^0$.

(a) In$\triangle$ AOQ be an isosceles ,so their base angles are equal

$$\angle AOQ = 180 - 50 = 130$$

$$\text{ie., } \angle A = \angle Q = \frac{180-130}{2} = \frac{50}{2} = 25^0 .$$

$$\therefore \angle OAQ = 25^0 .$$

$$(b)\ \angle OCP = 25^0 \times 2 = 50^0 .$$

$$(c)\ \angle APO = 25^0 + 90 = 115^0 .$$

$$(d)\ \angle POQ = 180^0 - (50 + \angle AOP)$$

$$= 180 - 50 - 40 = 90^0 .$$

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Question 29.

Read the following Passage. Understand the Mathematical concept in it and answer the questions that follow. Each question carries 1 score. 6

The common difference of the arithmetic sequence 15, 14, 13, 12, ... is $14-15=-1$. First term of the sequence is 15 and the 15^{th} term is $15+14\times-1=15-14=1$.

Similarly the 4^{th} term is 12 and the 12^{th} term is 4.

Its 16^{th} term is, $x_{16}=15+15\times-1=15-15=0$. So the sum of the first 31 terms is also zero. That is if the n^{th} term of an arithmetic sequence with common difference -1 is m, then the m^{th} term is n and the $(m+n)^{th}$ term is zero.

(a) Seventh term of an arithmetic sequence is 10 and the 10^{th} term is 7. What is the common difference ?

(b) What is the 21^{st} term of the arithmetic sequence 21, 20, 19, ... ?

(c) 5^{th} term of an arithmetic sequence is 17 and the 17^{th} term is 5. Which term of the sequence is zero ?

(d) 5^{th} term of an arithmetic sequence is 17 and the 17^{th} term is 5. What is the 44^{th} term ?

(e) First term of an arithmetic sequence is n and the n^{th} term is 1. What is the $(n+1)^{th}$ term ?

(f) The first term of an arithmetic sequence is n and the n^{th} term is 1. Sum of how many terms, starting from the first term, of this sequence is zero ?

Solution

(a) common difference = - 1.

(b) 21^{st} term becomes 1

(c) 22^{nd} term becomes 0

(d) 44^{th} term = 22ne term – 22

ie., 0 – 22 = -22.

(e) (n + 1)th term be 0.

(f) 0 be the sum of 2n + 1th term.

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