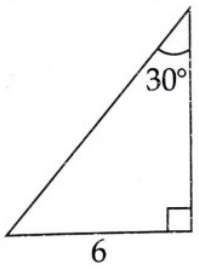
S S L C EXAMINATION , MARCH - 2021

S1635 **MATHEMATICS – ANSWER KEY**

Qn no.	
	For questions from 1 to 5 one score each .
1	Arithmetic sequence with common difference 2 is : [7, 10, 13, ... ; 7, 5, 3, ... 7, 9, 11, ... ; 2, 5, 8, ...]
	Answer . 7 , 9 , 11 , . . .
2	Which is always a cyclic quadrilateral ? [Parallelogram ; Square Trapezium ; Rhombus]
	Answer. **Square** **(opposite angles are supplementary)**
3	Which among the following is a point on the x axis ? [(2, 0); (0, 2); (1, 1); (3, 4)]
	Answer. $(2 , 0)$ **(y - coordinate of any point on the x - axis is zero)**
4	Measure of the smallest angle of a right angled triangle is 30°. Length of its smallest side is 6 centimetres. What is the length of its largest side ? (6, 3, 18, 12) 
	Answer. 12 **(The sides of a triangle of angels** 30^0 , 60^0 , 90^0 **are in the ratio** $1 : \sqrt{3} : 2$ **)**

5

What is the slope of the line passing through the points (2, 5) and (3, 7) ?

(2, 3, 4, 5)

Answer.

$$Slope = \frac{7-5}{3-2} = \frac{2}{1} = 2$$

For questions from 6 to 10 carries 2 scores each .

6

Write the first term and common difference of the arithmetic sequence $3n+2$.

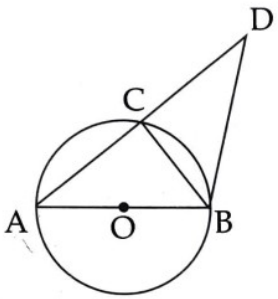
Answer.

First term = 3 + 2 = 5

Common difference = 3

7

In the figure AB is the diameter of the circle. C is a point on the circle. One of the angles ∠ACB and ∠ADB is twice the other.



Write the measures of the angles ∠ACB and ∠ADB.

Answer.

$\angle ACB = 90^0$ **(Angle on a semicircle is right)**

$$\angle ADB = \frac{90}{2} = 45^0$$

8

One is asked to say a natural number less than 10.

(a) What is the probability of it being an odd number ?

(b) What is the probability that it will not be an even number ?

Answer.

Total number of results = 9

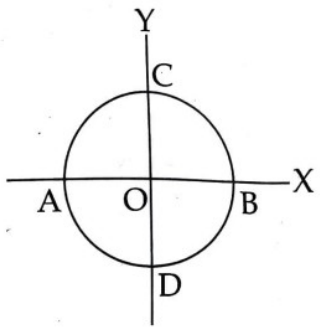
a) Favourable results = 1 , 3 , 5 , 7 , 9

Probability of being an odd number $= \frac{Number\ of\ favourable\ results}{Total\ number\ of\ results} = \frac{5}{9}$

b) Probability that the number will not be an even number =

Probability of being an odd number $= \frac{Number\ of\ favourable\ results}{Total\ number\ of\ results} = \frac{5}{9}$

9



In the figure, AB and CD are diameters of the circle. Coordinates of B are (3, 0). Write the coordinates of O and C.

Answer.

$OA = OB = OC = OD = 3$

a) Coordinates of O = $(0\ ,\ 0)$

b) Coordinates of C = $(0\ ,\ 3)$

10

Write $x^2 - 1$ as the product of two first degree polynomials.

Answer.

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

For questions from 11 to 20 carries 3 scores each .

11

(a) What is the tenth term of the arithmetic sequence $a+1, a+2, a+3, \ldots$?

(b) What is its common difference ?

(c) Write the algebraic form of the above sequence.

Answer.

a) Tenth term = $a + 10$

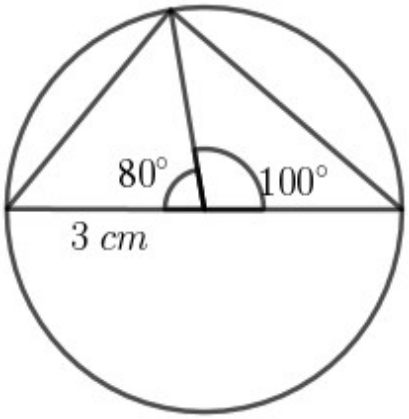
b) Common difference = $a+2-(a+1) = 1$

c) Algebraic form = $a + n$ ($dn + f - d = 1n + a + 1 - 1 = n + a$)

12

Draw a triangle of circumradius 3 centimetres and two of the angles 40° and 50°.

Answer.



13

(a) Write the sequence of even numbers.

(b) One added to the product of two consecutive even numbers gives 289. Form a second degree equation to solve this problem.

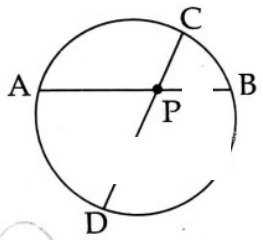
Answer.

a) 2 , 4 , 6 , . . .

b) $x(x+2)+1 = 289 \Rightarrow x^2 + 2x + 1 = 289 \Rightarrow (x+1)^2 = 289$

14

In the figure chords AB and CD intersect at P. AB = 10 centimetres, PB = 4 centimetres and PC = 3 centimetres.



(a) What is the length of PA ?

(b) Find the length of PD.

Answer.

a) $PA = 10 - 4 = 6\ cm$

b) $PA \times PB = PC \times PD \implies 6 \times 4 = 3 \times PD$

$$PD = \frac{6 \times 4}{3} = 8\ cm$$

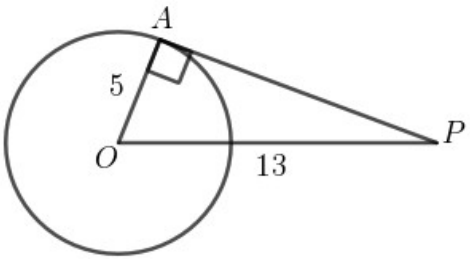
15

P is at a distance of 13 centimetres from the centre of a circle of radius 5 centimetres.

(a) How many tangents can be drawn from the point P to the circle ?

(b) Find the lengths of the tangents.

Answer.



a) 2

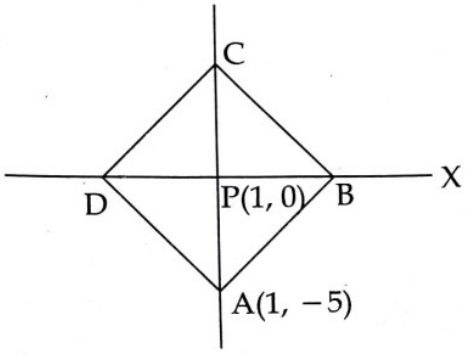
b) $OA^2 + PA^2 = OP^2 \implies 5^2 + PA^2 = 13^2$

$5^2 + PA^2 = 13^2$

$PA^2 = 169 - 25 = 144 \implies PA = \sqrt{144} = 12\ cm$

16

ABCD is a square, coordinates of A are $(1, -5)$. Diagonals of the square intersect at P(1, 0). Write the coordinates of B, C and D.



Answer.

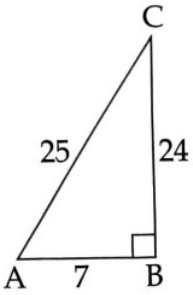
Coordinates of B = $(6\ ,\ 0)$

Coordinates of C = $(1\ ,\ 5)$

Coordinates of D = $(-4\ ,\ 0)$

17

In the figure $\angle B = 90°$, AB = 7 centimetres, BC = 24 centimetres, AC = 25 centimetres.



(a) $\sin A = \frac{24}{K}$, what number is K ?

(b) Write cos C and sin C.

Answer.

a) $\sin A = \frac{Opposite\ side\ of\ \angle A}{hypotenuse} = \frac{24}{k}$ ==> $k = 25$

b) $\cos C = \frac{Adjacent\ side\ of\ \angle C}{hypotenuse} = \frac{24}{25}$

$\sin C = \frac{Opposite\ side\ of\ \angle C}{hypotenuse} = \frac{7}{25}$

18

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

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

(b) Find the radius of the cone.

Answer.

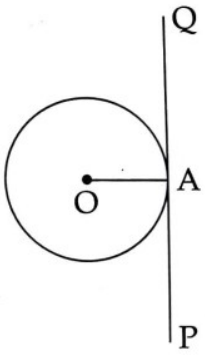
a) Slant height of the cone = Radius of the sector = 12 cm .

b) $\frac{x}{360} = \frac{r}{R}$ ==> $\frac{120}{360} = \frac{r}{12}$

$r = \frac{12 \times 120}{360} = 4\ cm$

19

(a) In the figure OA is the radius of the circle. PQ is the tangent through A. What is the measure of ∠OAP ?

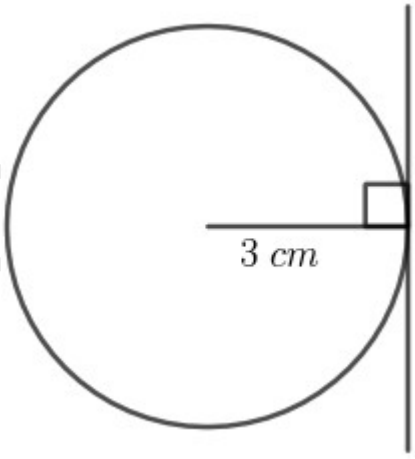


(b) Draw a circle of radius 3 centimetres and mark a point A on it. Draw the tangent through A.

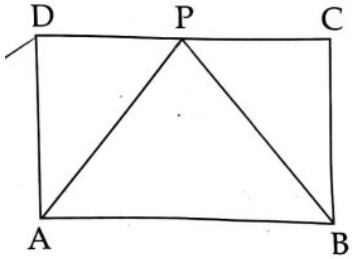
Answer.

a) $\angle OAP = 90^0$

b)



20



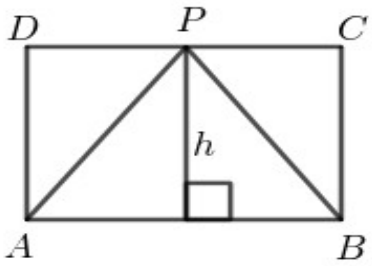
ABCD is a rectangle. P is the mid-point of CD. If we put a dot in the figure without looking into it :

(a) What is the probability that it would be inside triangle APB ?

(b) What is the probability that it would be inside triangle ADP ?

Answer.

$DP = CP$



a) Probability that the dot would be inside the triangle APB =

$$\frac{Area\ of\ triangle\ APB}{Area\ of\ the\ rectangle} = \frac{\frac{1}{2}\times AB\times h}{AB\times AD} = \frac{\frac{1}{2}\times AB\times AD}{AB\times AD} = \frac{1}{2}$$

b) $Area\ of\ triangle\ ADP = \frac{1}{2}\times DP\times AD = \frac{1}{2}\times\frac{CD}{2}\times AD = \frac{1}{2}\times\frac{AB}{2}\times AD$

$$= \frac{1}{4}\times AB\times AD$$

c) Probability that the dot would be inside the triangle ADP =

$$\frac{Area\ of\ triangle\ ADP}{Area\ of\ the\ rectangle} = \frac{\frac{1}{4}\times AB\times AD}{AB\times AD} = \frac{1}{4}$$

For questions from 21 to 30 carries 4 scores each .

21

(a) Write the 20^{th} term of the arithmetic sequence 5, 10, 15, ...

(b) Find the sum of the first 20 terms of the arithmetic sequence 5, 10, 15, ...

(c) What is the sum of the first 20 terms of the arithmetic sequence 4, 9, 14, ...

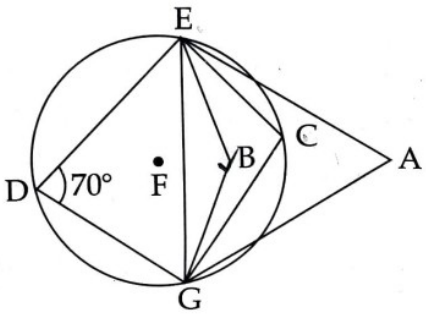
Answer.

a) $x_{20} = f + 19d = 5 + 19\times 5 = 5 + 95 = 100$

b) $S_{20} = \frac{20}{2}(x_1 + x_{20}) = \frac{20}{2}\times(5 + 100) = \frac{20\times 105}{2} = 1050$

c) Sum = $1050 - 20\times 1 = 1030$

22



In the figure C, D, E and G are points on the circle. $\angle D = 70°$. For the angles given in column I choose suitable measures from column II.

Column I	Column II
$\angle ECG$	120°
$\angle EBG$	60°
$\angle EAG$	110°
	180°

Answer.

$<ECG = 110^0$ **(DGCE is cyclic , opposite angles of a cyclic quadrilateral are supplementary**

$<EBG = 120^0$ **(If one vertex of a quadrilateral is inside the circle drawn through the other vertices , then the sum of the angles at this vertex and the opposite vertex is greater than 180^0)**

$<EAG = 60^0$ **(If one vertex of a quadrilateral is outside the circle drawn through the other vertices , then the sum of the angles at this vertex and the opposite vertex is less than 180^0)**

23

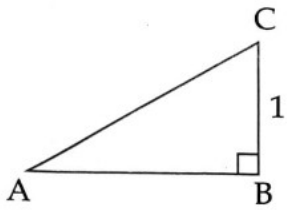
Fill up the empty cells of the given square such that the numbers in each row, each column and both diagonals form arithmetic sequences.

3		13
7		

Answer.

3	8	13
5	10	15
7	12	17

24 In the figure $\angle B = 90°$. BC = 1 centimetre, $\sin A = \frac{1}{2}$.



(a) What is the length of AC ?

(b) Find the length of AB.

(c) What is the measure of $\angle A$?

(d) $\sin 60° =$ _____.

Answer.

a) $\sin A = \frac{1}{2}$ ==> $\frac{\textit{Opposite side of } \angle A}{\textit{hypotenuse}} = \frac{1}{2}$

==> $\frac{BC}{AC} = \frac{1}{2}$ ==> $AC = 2$ ($BC = 1$)

b) $AB^2 + BC^2 = AC^2$ ==> $AB^2 + 1^2 = 2^2$ ==> $AB^2 + 1 = 4$ ==> $AB^2 = 4 - 1 = 3$

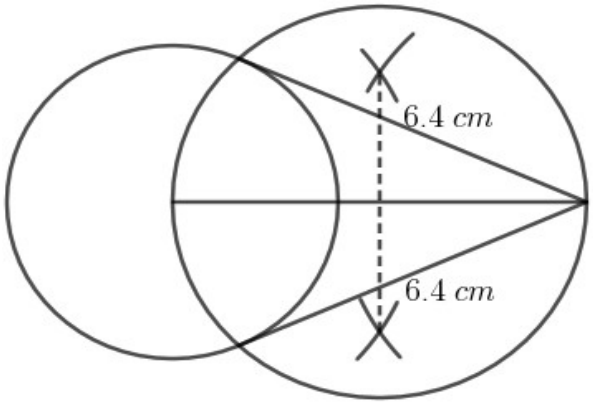
$AB = \sqrt{3}$

c) $\angle A = 30^0$ **(The sides of a triangle of angles** 30^0 , 60^0 , 90^0 **are in the ratio** $1 : \sqrt{3} : 2$ **)**

d) $\sin 60^0 = \frac{\sqrt{3}}{2}$

25 Draw a circle of radius 3 centimetres. Mark a point P outside the circle at a distance 7 centimetres from the centre. Draw tangents from P to the circle. Measure the length of the tangents.

Answer.



26 Scores of 10 students are given below :

11, 32, 33, 35, 39, 41, 45, 47, 48, 49

(a) Find the mean score.

(b) Find the median score.

Answer.

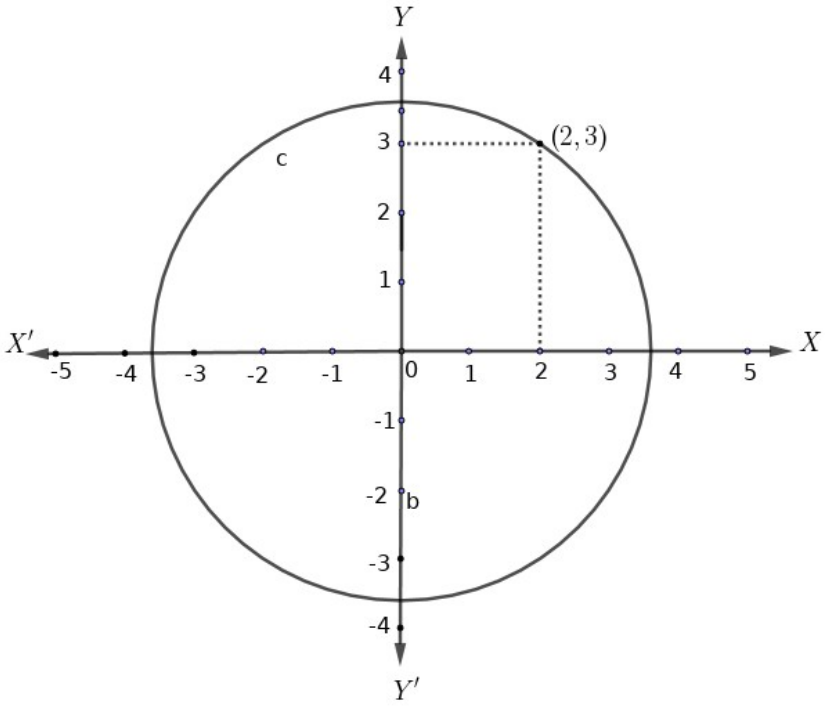
a) $Mean = \frac{11+32+33+35+39+41+45+47+48+49}{10} = \frac{380}{10} = 38$

b) 11 , 32 , 33 , 35 , 39 , 41 , 45 , 47 , 48 , 49

$Median = \frac{39+41}{2} = \frac{80}{2} = 40$

27 Draw the x and y axes. Mark the point (2, 3). Draw a circle with origin as centre and passing through the point (2, 3).

Answer.



28

(a) The perimeter of a rectangle is 40 centimetres. Length of its smaller side is 7 centimetres. What is the length of its larger side ?

(b) Find the sides of a rectangle with perimeter 40 centimetres and area 96 square centimetres.

Answer.

a) *Length of the larger side* $= 20 - 7 = 13\ cm$

a) Perimeter $= 40\ cm \implies$ *Length + breadth* $= \frac{40}{2} = 20$

If length $= 10+x$ **then breadth** $= 10 - x$

$(10 + x)(10 - x)=96 \implies 100 - x^2 = 96 \implies x^2 = 100 - 96 = 4$

$x = \sqrt{4} = 2$

Length $= 10 + 2 = 12\ cm$, **Breadth** $= 10 - 2 = 8\ cm$

29

One is asked to say a two-digit number,

(a) What is the probability of both digits being the same ?

(b) What is the probability of the first digit being twice the second ?

Answer.

a) Total number of two digit numbers $= 90$

Favourable results $= 11 , 22 , 33 , 44 , 55 , 66 , 77 , 88 , 99$

Probability of both digits being the same $= \frac{9}{90}$

b) Favourable results = 21 , 42 , 63 , 84

Probability of the first digit being twice the second $= \frac{4}{90}$

30

(a) $P(x)=x^2-5x+9$, find $P(2)$ and $P(3)$.

(b) Write $P(x)-P(2)$ as the product of two first degree polynomials.

Answer.

a) $p(2) = 2^2-5\times2+9 = 3$

$p(3) = 3^2-5\times3+9 = 3$

b) $p(x) - p(2) = x^2 - 5x + 9 - 3 = x^2 - 5x + 6$

$p(x) - p(2) = (x-2)(x-3)$

For questions from 31 to 45 carries 5 scores each .

31

1

2 3

4 5 6

7 8 9 10

.....

(a) Write the fifth line of the pattern.

(b) How many numbers are there in the tenth line ?

(c) How many numbers are there in the first ten lines altogether ?

(d) What is the first number in the eleventh line ?

Answer.

a) 11 12 13 14 15

b) 10

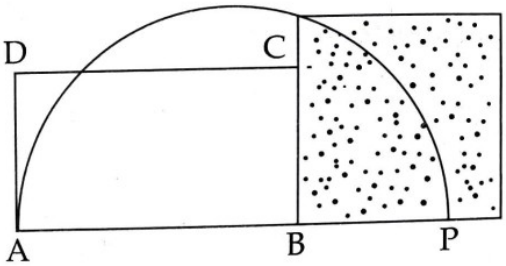
c) $1 + 2 + 3 + \ldots\ldots + 10 = \frac{10 \times 11}{2} = 55$

d) Last number in the tenth line = 55

First number in eleventh line = 55 + 1 = 56

32

(a) In the figure area of the rectangle ABCD is 8 square centimetres and BC = BP.



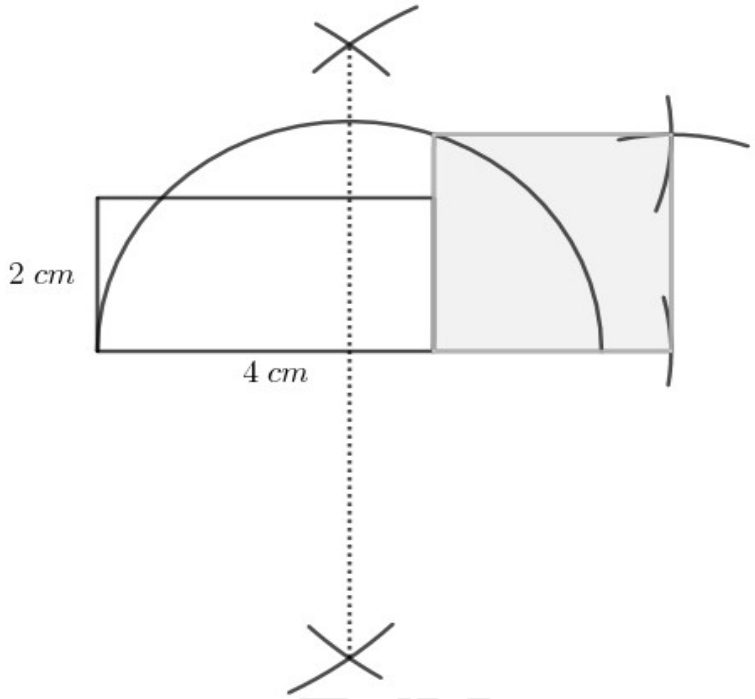
What is the area of the shaded square ?

(b) Draw a rectangle of area 8 square centimetres. Draw a square having the same area of the rectangle.

Answer.

a) $8\ sq.cm$

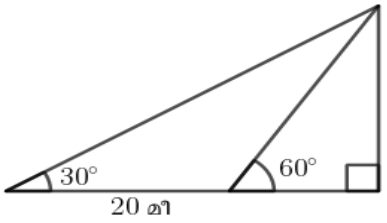
b)



33 A man standing at the edge of a river sees the top of a tree at an elevation of 60°. Stepping 20 metres back he sees it at an elevation of 30°. Draw a rough figure and find the width of the river.

Answer.

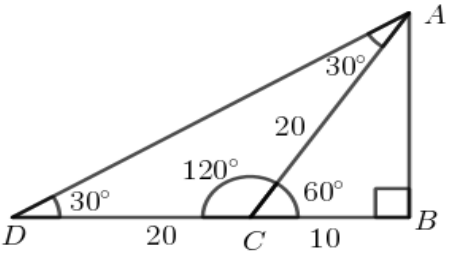
a)



b) Width of the river = BC

$<ACD = 120^0$ **(Linear pair)**

$<CAD = 180 - (120+30) = 180 - 150 = 30^0$



$==>\ CD = AC = 20$ മീ ($<D = <CAD = 30^0$)

In triangle ABC , $BC = 10\ m$ **(The sides of a triangle of angles** 30^0 , 60^0 , 90^0 **are in the ratio** $1 : \sqrt{3} : 2$ **)**

Width of the river = BC = 10 m

34

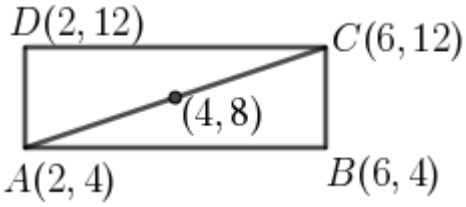
The sides of a rectangle are parallel to the axes. One pair of its opposite vertices are A(2, 4) and C(6, 12).

(a) Write the coordinates of the other two vertices.

(b) Write the coordinates of the mid-point of AC.

(c) x coordinate of a point on AC is 'a'. What is its y coordinate ?

Answer.



a) Coordinates of B = $(6\ ,\ 4)$

Coordinates of D = $(2\ ,\ 12)$

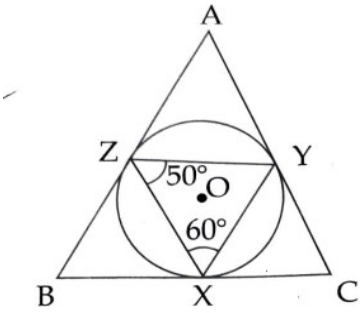
b) Coordinates of the midpoint of AC

$$= \left(\frac{2+6}{2}\ ,\ \frac{4+12}{2}\right) = (4\ ,8)$$

c) $2a$

35

In the figure AB, BC and AC touches the circle at the points Z, X and Y. $\angle ZXY = 60°$ and $\angle XZY = 50°$. Find the measures of $\angle A$, $\angle B$ and $\angle C$.



Answer.

$<AZY = <ZXY = 60^0$ **(In a circle , the angle which a chord makes with the tangent at one end on any side is equal to the angle which it makes on the part of the circle on the other side)**

$<AZY = <AYZ = 60^0$ **(AZ = AY , The tangents to a circle from a point are of the same length)**

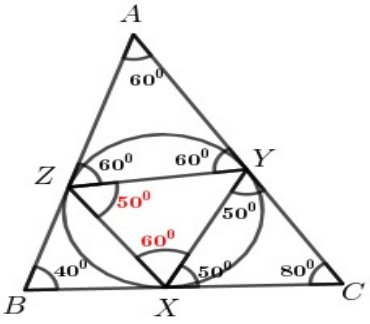
$<A = 180 - (60 + 60) = 60^0$ **(Sum of the angles of a triangle is 180^0)**

$<CXY = <XZY = 50^0$

$<CXY = <CYX = 50^0$

$<C = 180 - (50 + 50) = 80^0$

$<B = 180 - (<A + <C) = 180 - (60 + 80) = 40^0$



36

(a) Radius of a solid metal cone is 5 centimetres, its slant height is 13 centimetres. Find its height.

(b) Find the volume of the cone.

(c) It is melted and recast into small cones of radius 1 centimetre and height one centimetre. How many cones will we get ?

Answer.

a) $r^2 + h^2 = l^2 \implies 5^2 + h^2 = 13^2 \implies 25 + h^2 = 169 \implies h^2 = 169 - 25 = 144$

$h = \sqrt{13^2 - 5^2} = \sqrt{169 - 25} = \sqrt{144} = 12\ cm$

b) Volume of the cone $= \frac{1}{3} \times \pi \times 5^2 \times 12 = 100\pi\ cm^3$

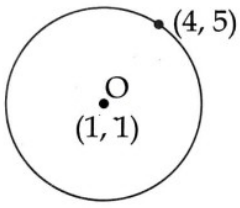
c) Volume of a small cone $= \frac{1}{3} \times \pi \times 1^2 \times 1 = \frac{\pi}{3}\ cm^3$

Number of smaller cones $= \frac{Volume\ of\ larger\ cone}{Volume\ of\ smaller\ cone}$

$= 100\pi \div \frac{\pi}{3} = \frac{100\pi \times 3}{\pi} = 300$

37

A circle is drawn with (1, 1) as centre. (4, 5) is a point on the circle.



(a) Find the radius of the circle.

(b) Write the equation of the circle.

(c) The x coordinate of a point on the circle is 6. What is the y coordinate of that point ?

Answer.

a) Radius = $\sqrt{(4-1)^2+(5-1)^2} = 5$

b) $(x-1)^2+(y-1)^2 = 5^2$

c) $(6-1)^2+(y-1)^2 = 5^2 \Rightarrow 5^2+(y-1)^2 = 5^2 \Rightarrow 25+(y-1)^2 = 25$

$\Rightarrow (y-1)^2 = 25 - 25 = 0 \Rightarrow y-1 = 0 \Rightarrow y = 1$

38 The diameters of two spheres are in the ratio 1 : 2.

(a) What is the ratio of their radii ?

(b) Find the ratio of their surface areas.

(c) If the surface area of the first sphere is 10π square centimetres. What is the surface area of the second sphere ?

Answer.

a) $r_1 : r_2 = 1 : 2$ **(Ratio of the diameters = Ratio of the radii)**

b) $r_1 = 1r$, $r_2 = 2r$

Ratio of the surface areas $= 4\pi r^2 : 4\pi(2r)^2 = 4\pi r^2 : 16\pi r^2$

$$= \frac{4\pi}{16\pi} = \frac{1}{4} = 1 : 4$$

c) Surface area of the second cone $= 4 \times 10\pi = 40\pi \ sq.cm$

39 (a) What is the remainder on dividing the terms of the arithmetic sequence 100, 109, 118, ... by 9 ?

(b) Write the sequence of three digit numbers, which are multiples of 9.

(c) What is the position of 999 in the arithmetic sequence of three digit numbers which are multiples of 9 ?

Answer.

a) 1

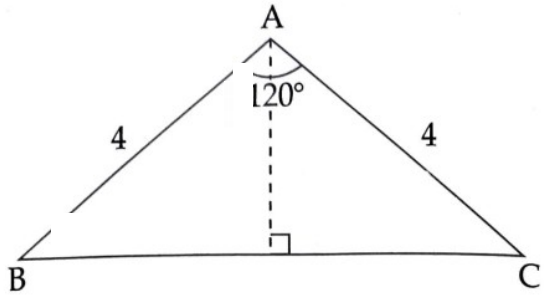
b) 108 , 117 , 126 , . . .

Algebraic form = $dn + f - d = 9n + 108 - 9 = 9n + 99$

` $9n + 99 = 999 \Rightarrow 9n = 999 - 99 = 900$

$$n = \frac{900}{9} = 100$$

40



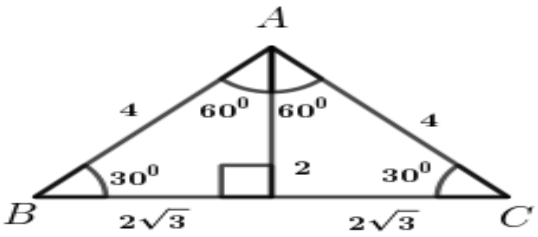
In the figure AB = AC = 4 centimetres, ∠A = 120°.

(a) ∠B = _____.

(b) Find the perpendicular distance from A to BC.

(c) Find the area of the triangle.

Answer.



a) 30^0

b) 2 *cm*

(The sides of a triangle with angles 30^0 , 60^0 , 90^0 **are in the ratio**

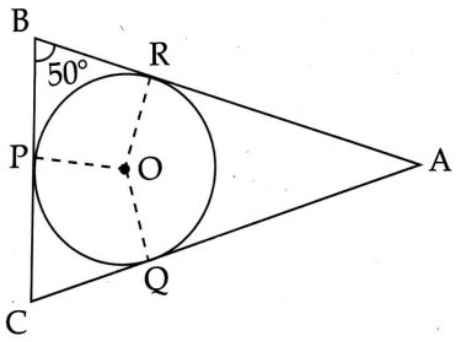
$1 : \sqrt{3} : 2$ **)**

c) $BC = 2\sqrt{3} + 2\sqrt{3} = 4\sqrt{3}\ cm$

Area of the triangle $= \frac{1}{2} \times 4\sqrt{3} \times 2 = 4\sqrt{3}\ sq.cm$

41

(a) In the figure, circle with centre O touches the sides of the triangle ABC at the points P, Q and R. If ∠B = 50°, what is ∠POR ?

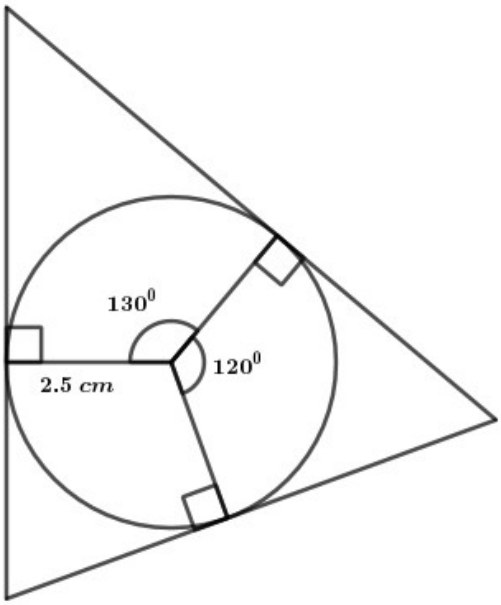


(b) Draw a circle of radius 2.5 centimetres. Draw a triangle of angles 50°, 60°, 70° with all its sides touching the circle.

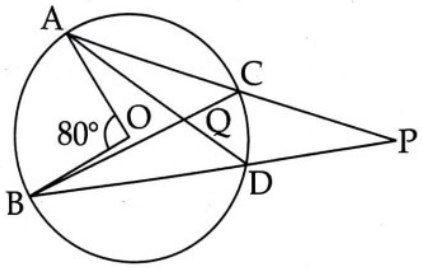
Answer.

a) $<PQR = 180 - 50 = 130^0$ **(In a circle , the angles between the radii through two points and the angle between the tangents at these points are supplementary)**

b)



42 In the figure, O is the centre of the circle. A, B, C and D are points on the circle. $\angle AOB = 80°$.

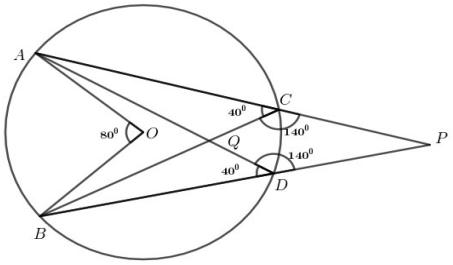


(a) Write the measures of $\angle ACB$, $\angle ADB$ and $\angle ADP$.

(b) Find $\angle CQD + \angle P$.

Answer.

a) $<ACB = 40^0$



$<ADB = 40^0$ **(The angle made by an arc on its alternate arc is half its central angle)**

$<ADP = 140^0$ **(Linear pair)**

b) $<BCP = 140^0$

$<CQD + <P = 360 - (140 + 140) = 360 - 280 = 80^0$

(Sum of the angles of a quadrilateral is 360^0)

43

A box is to be made by cutting off small squares from each corner of a square of thick paper, and bending upwards. The height of the box is to be 10 centimetres and volume 1 litre.

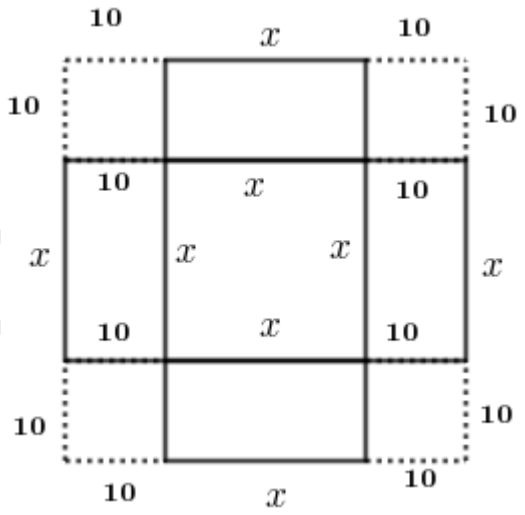
(a) What should be the length of a side of the square cut-off ?

(b) What should be the length of a side of the square, thick paper sheet ?

Answer.

a) 10 *cm*

b)



Volume = 1 *litre* ==> *Base area*$\times$*height* = 1000 cm^3

If the base edge of the box is x ,

$$x^2 \times 10 = 1000 \implies x^2 = \frac{1000}{10} = 100 \implies x = \sqrt{100} = 10$$

Length of a side of a square thick paper sheet = $x + 20 = 10 + 20$

$= 30\ cm$

44

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

Scores	Number of Children
0 - 10	5
10 - 20	8
20 - 30	10
30 - 40	13
40 - 50	9
Total	45

(a) If the children are arranged in the ascending order of their scores, then what will be the assumed score of the 14^{th} child ?

(b) Compute the median score.

Answer.

Score	Number of children
Below 10	**5**
Below 20	**13**
Below 30	**23**
Below 40	**36**
Below 50	**45**

$$\frac{N+1}{2} = \frac{45+1}{2} = 23$$

Median = Score of the 23^{rd} child = x_{23}

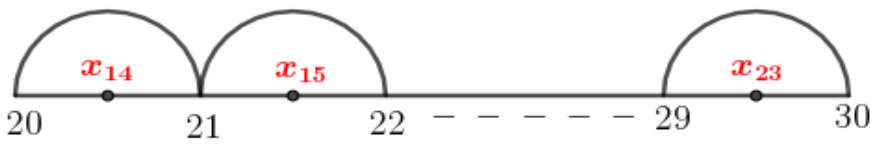
Median comes between 20 and 30 .

There are 10 children in the median class .

Divide the 10 scores between 20 and 30 in to 10 equal parts .

$$Length\ of\ one\ subdivision = \frac{30-20}{10} = \frac{10}{10} = 1 = d$$

Assume that each such subdivision contains one student whose score is the mid value of that subdivision .



a) $x_{14} = \frac{20+21}{2} = \frac{41}{2} = 20.5$

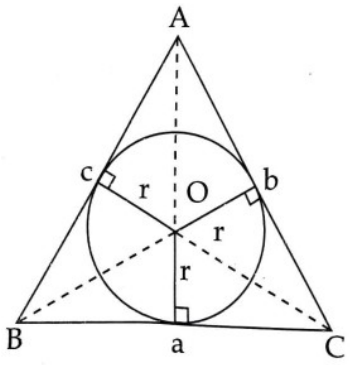
(Scores of the children in the median class are in arithmetic sequence)

b) Median score = $x_{23} = x_{14} + 9d = 20.5 + 9 \times 1 = 29.5$

45

Read the following passage. Understand the mathematical concept in it and answer the questions that follow.

Circle passing through all the three vertices of a triangle is its circumcircle. Like this, the circle touching all the three sides of a triangle is its incircle. The point of intersection of the angle bisectors is the incentre.



Distance from the centre of the circle to the touching point is radius.

Area of triangle ABC is the sum of the areas of the triangles OBC, OAC and OAB. If the radius of the incircle is taken as r and the sides of the triangle as a, b and c.

Then area of triangle ABC $= \frac{1}{2}ar + \frac{1}{2}br + \frac{1}{2}cr$

$= \frac{1}{2}r(a + b + c)$

$= r\frac{(a + b + c)}{2}$

$= r \times s$

Here $s = \frac{a + b + c}{2}$ (half of perimeter)

(a) Circle touching all the three sides of a triangle is :
[circumcircle, incircle, semicircle, ellipse]

(b) Circle passing through all the three vertices of a triangle is :
[circumcircle, incircle, semicircle, ellipse]

(c) If the radius of the incircle is taken as r and the half of the perimeter as s then area of the triangle is :

$\left(r + s, \frac{r}{s}, r \times s, r^2 \times s\right)$

(d) The perimeter of a triangle is 20 centimetres and radius of its incircle is 2 centimetres. What is the area of the triangle ? (in square centimetres)

(40, 20, 10, 5)

(e) Area of a triangle is 24 square centimetres and its perimeter is 24 centimetres. Radius of the incircle is _____ centimetres.

(1, 2, 1.5, 2.5)

Answer.

a) Incircle .

b) Circumcircle .

c) $r \times s$

d) 20

e) 2