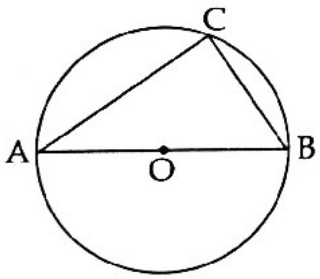
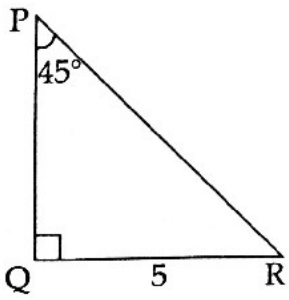
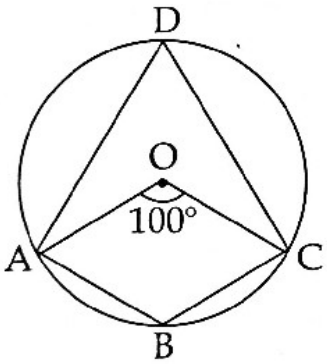
SSLC MODEL EXAMINATION , MARCH - 2021

ME 927 MATHEMATICS – DETAILED ANSWER KEY

Qn no.	Key
	For questions from 1 to 5 one score each .
1	What is the common difference of the arithmetic sequence 4, 10, 16, ... ? [4, 5, 6, 10]
	Answer. $10-4 = 6$
2	In the figure O is the centre of the circle. Write the measure of $\angle ACB$. [30°, 60°, 90°, 100°] 
	Answer. 90^0
3	In triangle PQR, $\angle Q = 90°$, $\angle P = 45°$, QR = 5 centimetres. What is the length of PR ? $\left[10\sqrt{2}, 5\sqrt{2}, 10, \frac{5}{\sqrt{2}}\right]$ 
	Answer. $5\sqrt{2}$

4	Which of the following is a point on the x-axis ? $[(3, 0), (0, 3), (-3, 2), (0, -2)]$
	Answer. $(3,0)$
5	Which of the following is the midpoint of the line joining (6, 2) and (12, 2) ? $[(8, 2), (10, 2), (2, 8), (9, 2)]$
	Answer. $(9,2)$ $\quad [\ (\frac{6+12}{2}, \frac{2+2}{2}) = (\frac{18}{2}, \frac{4}{2})\ ]$
	For questions from 6 to 10 carries 2 scores each .
6	Algebraic form of an arithmetic sequence is $3n+2$. (a) What is its first term ? (b) Find its 10^{th} term.
	Answer. **a) First term** = $3\times1+2=3+2=5$ **b)** $x_{10} = 3\times10+2 = 30+2 = 32$
7	A, B, C and D are points on the circle with centre O. $\angle AOC = 100°$.  (a) What is the measure of $\angle ADC$? (b) Find $\angle ABC$.

Answer.

a) $\angle ADC = \frac{100}{2} = 50^0$ **(The angle made by an arc on its alternate arc is half its central angle)**

b) $\angle ABC = 180 - 50 = 130^0$ **(opposite angles of a cyclic quadrilateral are supplementary)**

8 One is asked to say a natural number from 1 to 20.

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

(b) What is the probability of it being a multiple of 5 ?

Answer.

a) Favourable results = 2 , 4 , 6 , 8 , 10 , 12 , 14 , 16 , 18 , 20

Probability of the number being an even number= $\frac{number\ of\ favourable\ resuts}{total\ number\ of\ results} = \frac{10}{20}$

b) Favourable results = 5 , 10 , 15 , 20

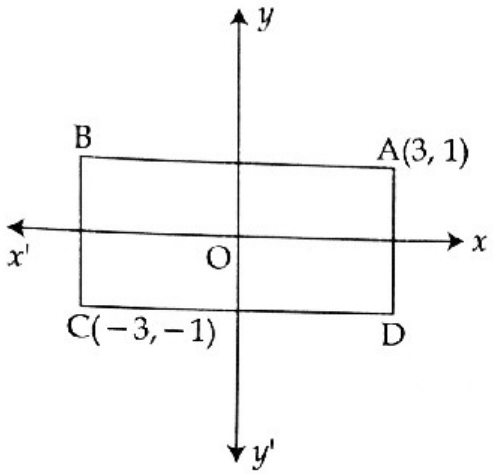
Probability of the number being an multiple of 5 = $\frac{number\ of\ favourable\ resuts}{total\ number\ of\ results} = \frac{4}{20}$

9 Write the second degree polynomial $x^2 - 16$ as the product of two first degr polynomials.

Answer.

$x^2 - 16 = x^2 - 4^2 = (x+4)(x-4)$

10 In the figure, the sides of the rectangle ABCD are parallel to the axes. Two of its vertices are A(3, 1) and C(−3, −1). Write the coordinates of B and D.



Answer.

Coordinates of B = $(-3,1)$

Coordinates of D = $(3,-1)$

For questions from 11 to 20 carries 3 scores each .

11 The 5th term of an arithmetic sequence is 20 and the 8th term is 32.

(a) What is the common difference of this sequence ?

(b) Find its 11th term.

Answer.

a) $common\,difference = \frac{term\,difference}{position\,difference} = \frac{32-20}{8-5} = \frac{12}{3} = 4$

b) $x_{11} = x_5 + 6d = 20 + 6\times 4 = 20 + 24 = 44$ **or** $x_{11} = x_8 + 3d = 32 + 3\times 4 = 32 + 12 = 44$

12 x is a natural number.

(a) What number should be added to x^2+2x to get a perfect square ?

(b) If $x^2+2x=15$. Find the natural number represented by x.

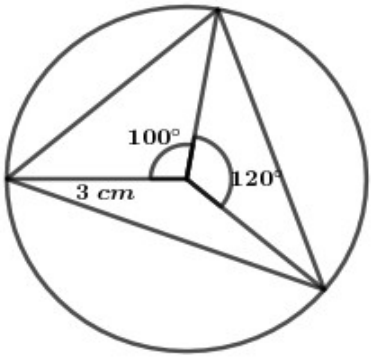
Answer.

a) 1 $\quad (\ x^2+2x+1=(x+1)^2\ )$

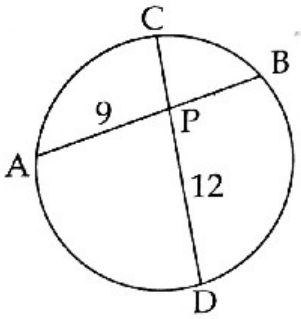
b) $x^2+2x+1=15+1$ ==> $(x+1)^2=16$ ==> $x+1=\sqrt{16}=4$ ==> $x=4-1=3$

13 The vertices of a triangle are points on a circle of radius 3 centimetres. If two angles of this triangle are 50° and 60°, draw the triangle.

Answer.



14 The chords AB and CD intersect at P. AB = 17 centimetres, PA = 9 centimetres, PD = 12 centimetres.



(a) What is the length of PB ?

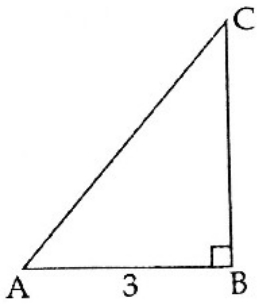
(b) Find the length of PC.

Answer.

a) $PB = 17 - 9 = 8\ cm$

b) $PC \times PD = PA \times PB \implies PC \times 12 = 9 \times 8 \implies PC = \frac{9 \times 8}{12} = 6\ cm$

15 In triangle ABC, $\angle B = 90°$, AB = 3 centimetres, $\cos A = \frac{3}{5}$.



(a) What is the length of AC ?

(b) Find sinA.

Answer.

A) $\cos A = \frac{opposite\ side\ of\ \angle A}{hypotenuse} = \frac{3}{5} \implies \frac{AB}{AC} = \frac{3}{5}$

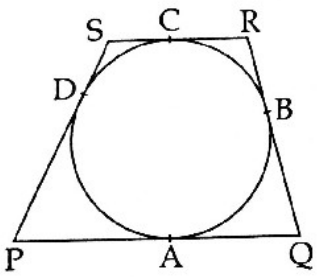
$AB = 3\ cm \implies AC = 5\ cm$

b) $BC = \sqrt{5^2 - 3^2} = \sqrt{25 - 9} = \sqrt{16} = 4\ cm$

$\sin A = \frac{opposite\ side\ of\ \angle A}{hypotenuse} = \frac{BC}{AC} = \frac{4}{5}$

16

In the figure, the circle touches the sides of the quadrilateral PQRS at A, B, C and D. PA = 5 centimetres, QB = 4 centimetres, RC = 3 centimetres, SD = 2 centimetres.



(a) What is the length of PD ?

(b) Find the perimeter of the quadrilateral PQRS.

Answer.

a) $PD = PA = 5\ cm$ **(The tangents to a circle from a point are of the same length)**

b) $QA = QB = 4\ cm$

$RB = RC = 3\ cm$

$SC = SD = 2\ cm$ ==> $PQ = 5+4 = 9\ cm$, $QR = 4+3 = 7\ cm$

$RS = 3+2 = 5\ cm$, $PS = 5+2 = 7\ cm$

Perimeter of the quadrilateral PQRS = $PQ+QR+RS+PS = 9+7+5+7 = 28\ cm$

17

The base radius and slant height of a cone are 6 centimetres and 10 centimetres respectively.

(a) What is its height ?

(b) Find its volume.

Answer.

a) $Height = \sqrt{10^2-6^2} = \sqrt{100-36} = \sqrt{64} = 8\ cm$

b) $Volume = \frac{1}{3}\times\pi\times r^2\times h = \frac{1}{3}\times\pi\times 6^2\times 8 = 96\,\pi\ cu.cm$

18

(3, 4) is a point on a circle with centre at the origin.

(a) Find its radius.

(b) Write the coordinates of the points where the circle cuts the x-axis.

Answer.

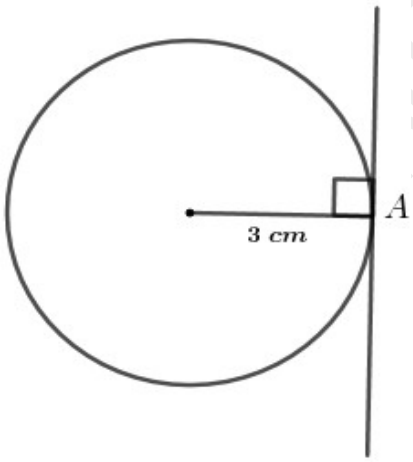
a) $radius = \sqrt{(3-0)^2+(4-0)^2} = \sqrt{3^2+4^2} = \sqrt{9+16} = \sqrt{25} = 5$

b)Coordinates of the points where the circle cuts the x-axis = $(5,0),(-5,0)$

19

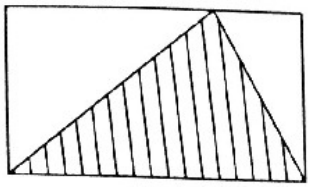
Draw a circle of radius 3 centimetres. Mark a point A on the circle and draw tangent through A.

Answer.



20

In the figure, the area of the rectangle is 40 square centimetres.



(a) What is the area of the shaded triangle ?

(b) If a dot is put in the figure without looking into it. What is the probability of it being inside the shaded triangle ?

Answer.

a) Area of the shaded triangle = $\frac{40}{2} = 20\ sq.cm$

b) Probability of the dot being inside the triangle = $\frac{Area\ of\ the\ triangle}{Area\ of\ the\ rectangle} = \frac{20}{40} = \frac{1}{2}$

For questions from 21 to 30 carries 4 scores each .

21

The 10^{th} term of an arithmetic sequence is 20 and its 20^{th} term is 10.

(a) What is its common difference ?

(b) What is its 30^{th} term ?

(c) Which is the first negative term of this sequence ?

Answer.

a) $common\,difference = \frac{term\,difference}{position\,difference} = \frac{10-20}{20-10} = \frac{-10}{10} = -1$

b) $x_{30} = x_{20} + 10\,d = 10 + 10 \times -1 = 10 - 10 = 0$

or $x_{30} = x_{10} + 20\,d = 20 + 20 \times -1 = 20 - 20 = 0$

c) $0 - 1 = -1$

22

1, 3, 5, ... is an arithmetic sequence.

(a) What is its 20^{th} term ?

(b) Find the sum of first 20 terms of this sequence.

(c) What is the sum of first 20 terms of the arithmetic sequence 6, 8, 10, ... ?

Answer.

a) $x_{20} = x_1 + 19\,d = 1 + 19 \times 2 = 1 + 38 = 39$

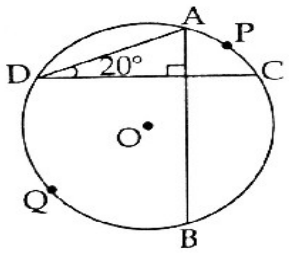
b) $S_{20} = \frac{20}{2} \times (x_1 + x_{20}) = \frac{20}{2} \times (1 + 39) = \frac{20}{2} \times 40 = 400$

c) $400 + 20 \times 5 = 400 + 100 = 500$

(5 added to each term of the arithmetic sequence 1 , 3 , 5 , ... gives the sequence 6 , 8 , 10 , ...)

23

In the figure, O is the centre of the circle. AB and CD are two perpendicular chords. $\angle D = 20°$.



(a) Write the measure of $\angle A$.

(b) What is the central angle of arc BQD ?

(c) What is the central angle of arc APC ?

Answer.

a) $\angle A = 90 - 20 = 70^0$

b) Central angle of arc BQD = $2 \times \angle BAD = 2 \times 70 = 140^0$ **(Central angle of an arc is double the angle made by it on the alternate arc)**

c) Central angle of arc APC = $2 \times \angle ADC = 2 \times 20^0 = 40^0$

24

(a) Perimeter of a rectangle is 40 centimetres. Write a pair of numbers that can be the measures of its sides.

(b) Perimeter of a rectangle is 40 centimetres and its area is 84 square centimetres. Find the lengths of its sides.

Answer.

a) $12, 8$ **or any pair of numbers with sum 20 .**

b) Shorter side = $10 - x$ **, Longer side** = $10 + x$ **(or any other method)**

$$(10+x)(10-x) = 84 \quad \Longrightarrow \quad 10^2 - x^2 = 84$$

$$100 - x^2 = 84 \quad \Longrightarrow \quad x^2 = 100 - 84 = 16 \quad \Longrightarrow \quad x = \sqrt{16} = 4$$

Shorter side = $10 - 4 = 6\,cm$

Longer side = $10 + 4 = 14\,cm$

25

A box contains 6 black beads and 4 white beads. Another box contains 5 black beads and 3 white beads. If we take one bead from each box without looking :

(a) What is the total number of pairs ?

(b) What is the probability that both are black ?

(c) Find the probability of one being black and the other being white.

Answer.

a) Total number of pairs = $10 \times 8 = 80$

b) Probability that both are black = $\frac{6 \times 5}{80} = \frac{30}{80} = \frac{3}{8}$

c) Probability of one being and the other being white black =

$$\frac{6 \times 3 + 4 \times 5}{80} = \frac{18 + 20}{80} = \frac{38}{80} = \frac{19}{40}$$

26

(a) $P(x) = x^2 - 5x + 10$. What number is P(2) ?

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

Answer.

a) $p(2) = 2^2 - 5\times 2 + 10 = 4 - 10 + 10 = 4$

b) $p(x) - p(2) = x^2 - 5x + 10 - 4 = x^2 - 5x + 6$

$x - 2$ **is a factor of** $p(x) - p(2)$

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

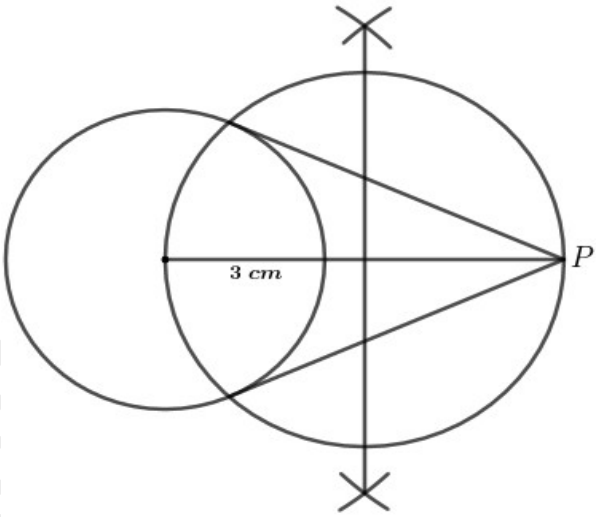
27

(a) Draw a circle of radius 3 centimetres.

(b) Mark a point P at a distance of 7 centimetres from its centre.

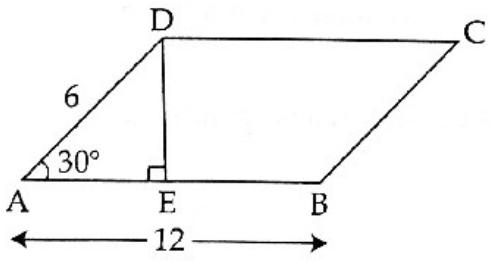
(c) Draw tangents from P to this circle.

Answer.



28

In the figure, ABCD is a parallelogram, $\angle A = 30°$, AB = 12 centimetres, AD = 6 centimetres.



(a) Find the length of DE.

(b) Find the area of the parallelogram ABCD.

Answer.

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

b) Area of the parallelogram ABCD = $AB \times DE = 12 \times 3 = 36\ sq.cm$

29

The marks got by 6 students in an examination are given below.

26, 21, 32, 38, 45, 48

(a) Find the mean of the marks.

(b) What is the median mark ?

Answer.

a) Mean = $\frac{26+21+32+38+45+48}{6} = \frac{210}{6} = 35$

b) 21 , 26 , 32 , 38 , 45 , 48

Median = Half the sum of marks 3rd and 4th students .

$= \frac{32+38}{2} = \frac{70}{2} = 35$

30

A circle with centre at the origin cuts the y-axis at the point (0, 5).

(a) Write the coordinates of other two points on this circle.

(b) What is the radius of this circle ?

(c) Verify whether the point (4, 4) lies on this circle.

Answer.

a) $(0,-5)$, $(5,0)$ **or** $(5,0)$, $(-5,0)$

b) Radius = 5

c) $\sqrt{(4-0)^2+(4-0)^2} = \sqrt{32}$ **(** $\sqrt{32}$ **is larger than** $5 = \sqrt{25}$ **)**

Since the distance from the centre of the circle to the point $(4,4)$ **is more than the radius ,** $(4,4)$ **is outside the circle . That is** $(4,4)$ **does not lie on the circle .**

For questions from 31 to 45 carries 5 scores each .

31 Look at the following number pattern.

```
                1
            2   3   4
        5   6   7   8   9
    --------------------
  ------------------------
```

(a) Write the next line of this pattern.

(b) Write the sequence of last numbers in each line.

(c) What will be the last number in the 9th line ?

(d) Write the first and last numbers of the 10th line.

Answer.

a) 10 , 11 , 12 , 13 , 14 , 15 , 16

b) 1 , 4 , 9 , 16 , 25 , . . .

c) Last number in the 9th line = $9^2 = 81$

d) First number in the 10th line = $81+1 = 82$

Last number in the 10th line = $10^2 = 100$

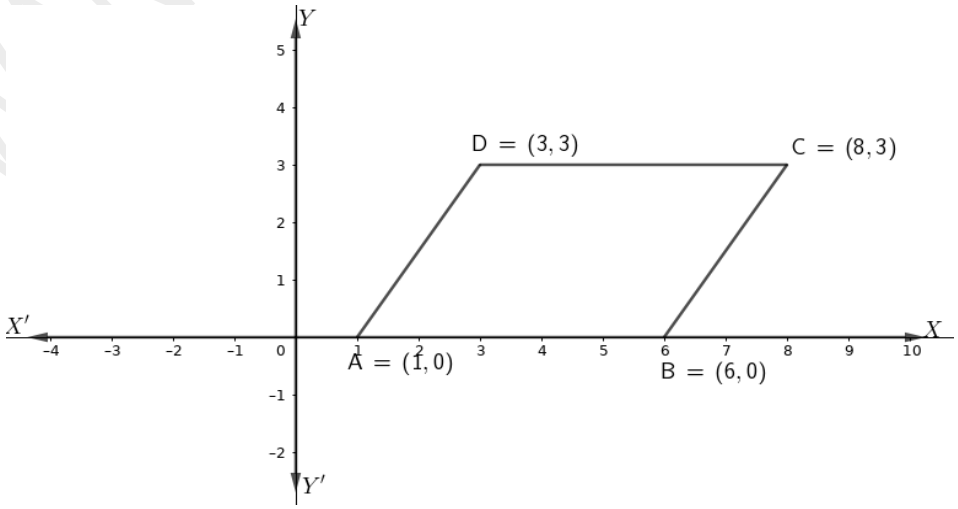
32 (a) Draw the x, y axes and mark the points A(1, 0), B(6, 0), C(8, 3), D(3, 3).

(b) Write the most suitable name for quadrilateral ABCD.

(c) Find its area.

Answer.

a)

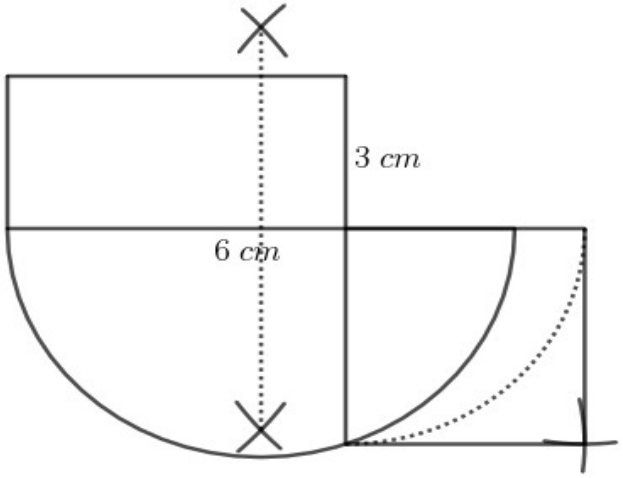


b) Parallelogram

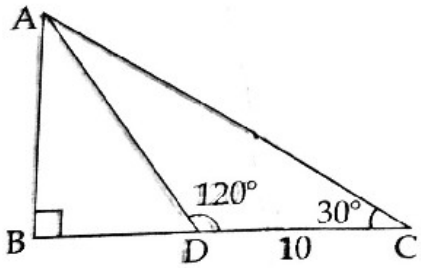
c) Area = $5 \times 3 = 15\ sq.units$

33 (a) Draw a rectangle of sides 6 centimetres and 3 centimetres.

(b) Draw a square of same area.



34 In triangle ABC, $\angle B = 90°$, $\angle C = 30°$, $\angle ADC = 120°$. Also DC = 10 centimetres.



(a) What is $\angle DAC$?

(b) What is the length of AD ?

(c) Find $\angle ADB$.

(d) Find the lengths of BD and AC.

Answer.

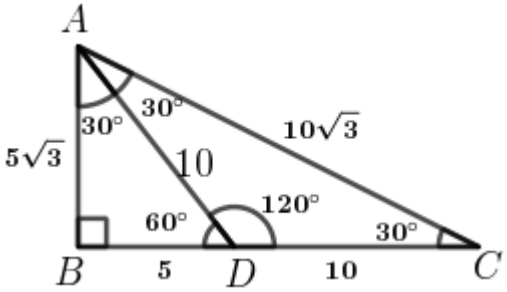
a) $\angle DAC = 30^0$

b) $AD = 10\ cm$

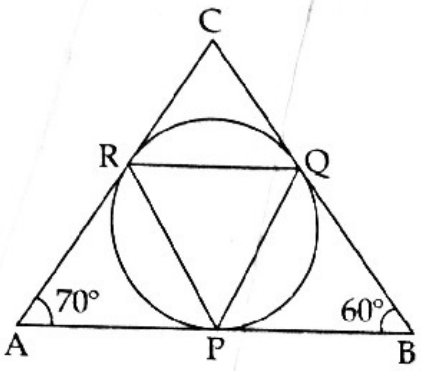
c) $\angle ADB = 60^0$

d) $BD = 5\ cm$

$AC = 10\sqrt{3}\ cm$



35 In the figure, the circle touches the sides of triangle ABC at P, Q and R. $\angle A = 70°$, $\angle B = 60°$.



(a) What is the measure of $\angle BPQ$?

(b) What is $\angle PRQ$?

(c) Find the measures of other two angles of triangle PQR.

Answer.

a) $BP = BQ$ **(The tangents to a circle from a point are of the same length)**

$\angle BPQ = 60^0$ $\left(\angle BPQ = \angle BQP = \frac{180-60}{2} = \frac{120}{2} = 60^0 \right)$

b) $\angle PRQ = 60^0$ **(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)**

c) $AP = AR$ ==> $\angle APR = \angle ARP = \frac{180-70}{2} = \frac{110}{2} = 55^0$

==> $\angle PQR = 55^0$

$\angle QPR = 65^0$ **(In triangle PQR** $\angle PRQ = 60^0$ **,** $\angle PQR = 55^0$ **)**

36 The sum of first 31 terms of an arithmetic sequence is 620.

(a) What is its 16^{th} term ?

(b) What is the sum of 15^{th} and 17^{th} terms ?

(c) Find the sum of first and 31^{st} terms.

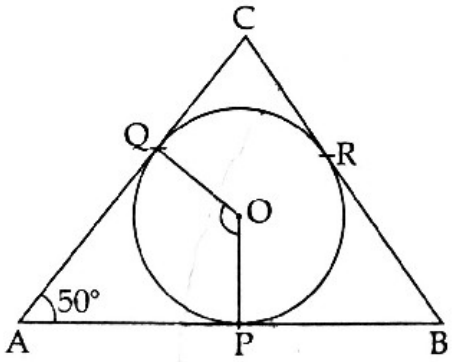
Answer.

a) $x_{16} = \frac{620}{31} = 20$ ($Sum\ of\ first\ 31 terms = 31 \times midterm = 31 \times x_{16}$)

b) $x_{15} + x_{17} = 2 \times x_{16} = 2 \times 20 = 40$

c) $x_1 + x_{31} = x_{15} + x_{17} = 40$

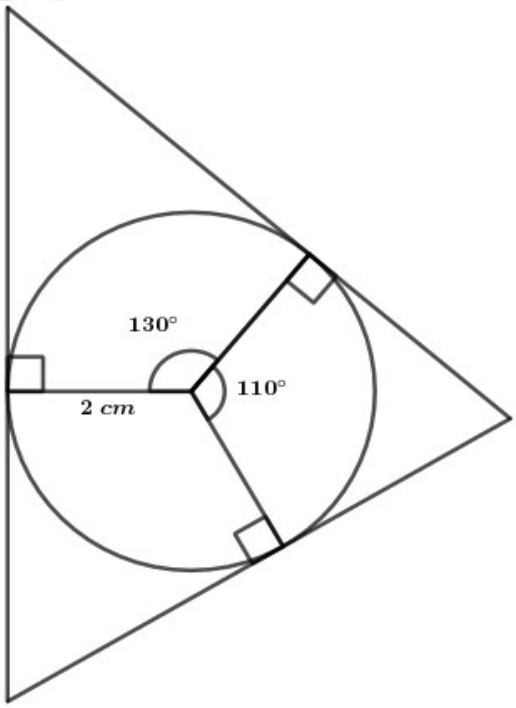
37 (a) The circle touches the sides of triangle ABC at P, Q and R, $\angle A = 50°$. What is $\angle POQ$?



(b) Draw a circle of radius 2 centimetres. Draw the triangle with two angles 50° and 70° and all its sides as tangents to this circle.

Answer.

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



38

The diameters of two spheres are in the ratio 2 : 3.

(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 16π square centimetres. Find the surface area of the second sphere.

Answer.

a) $r_1 : r_2 = 2:3$

b) $r_1 = 2r$, $r_2 = 3r$

b) Ratio of the surface areas = $4\times\pi\times(2r)^2 : 4\times\pi\times(3r)^2$ = $4:9$

c) Surface area of the second sphere = $\frac{9\times 16\,\pi}{4} = 36\,\pi\ sq.cm$

39

The following table shows the students in a class sorted according to their heights.

Height (centimetres)	Number of Students
130 - 140	9
140 - 150	10
150 - 160	10
160 - 170	9
170 - 180	7
Total	45

(a) If the students are arranged in the increasing order of their heights, student at what position will be in the middle ?

(b) What is assumed to be the height of the 20^{th} student ?

(c) Find the median height.

Height	**Number of students**
Below 140	**9**
Below 150	**19**
Below 160	**29**
Below 170	**38**
Below 180	**45**

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

Median = Height of the 23rd student = x_{23}

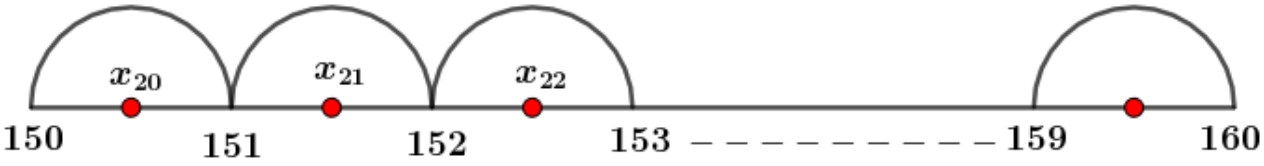
Median comes between 150 and 160 .

There are 10 students in the median class .

Divide the distance between 150 and 160 in to 10 equal parts .

$$A\ portion = \frac{160-150}{10} = \frac{10}{10} = 1 = d$$

Assume that the height of the students in the median class come at the mid point of these subdivisions .



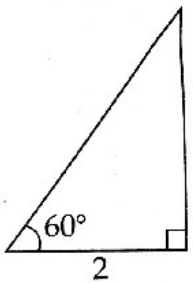
b) Height of the 20th student = $x_{20} = \frac{150+151}{2} = \frac{301}{2}$

(Heights of the students in the median class are in arithmetic sequence)

c) Median = $x_{23} = x_{20} + 3d = \frac{301}{2} + 3 \times 1 = \frac{301}{2} + 3 = 150.5 + 3 = 153.5\ cm$

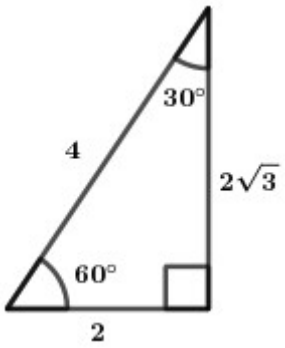
40

(a) The figure shows a ladder leaning against a wall. It makes an angle 60° with the floor. The foot of the ladder is 2 metres away from the wall. Find the length of the ladder.



(b) If the same ladder is kept such that the angle with the floor is 30°, how high will its top be from the floor ? How far is the foot of the ladder from the wall ?

Answer.



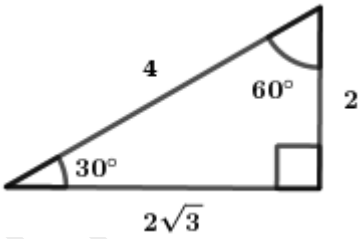
a) Length of the ladder = $4\ m$

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

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

b) Distance between the top of the ladder

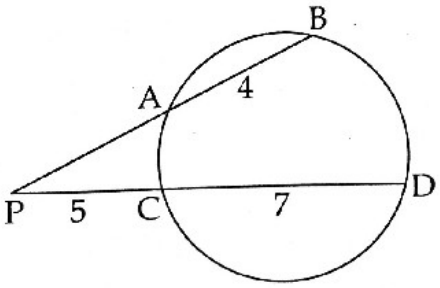
and the floor = $2\ m$



Distance between the foot of the ladder

and the floor = $2\sqrt{3}\ m$

41 In the figure, the chords AB and CD are extended to meet at P. AB = 4 centimetres, PC = 5 centimetres, CD = 7 centimetres.



(a) What is the length of PD ?
(b) If the length of PA is taken as x, then what is the length of PB ?
(c) Form a second degree equation in x and find the length of PA.

Answer.

a) $PD = 5+7 = 12\ cm$

b) $PB = x+4$

c) $PB \times PA = PD \times PC$ ==> $(x+4)x = 12 \times 5$ ==> $x^2+4x = 60$

$x^2+4x+2^2 = 60+2^2$ ==> $(x+2)^2 = 64$ ==> $x+2 = \sqrt{64}=8$

$x = 8-2=6$ == > $PA = 6\ cm$

42

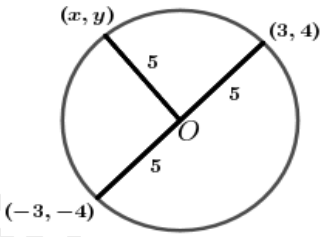
The coordinates of the end points of a diameter of a circle are $(3, 4)$ and $(-3, -4)$.

(a) Write the coordinates of the centre of the circle.

(b) What is the radius of the circle ?

(c) Write the equation of this circle.

Answer.



a) $\left(\frac{3+(-3)}{2}, \frac{4+(-4)}{2}\right) = \left(\frac{0}{2}, \frac{0}{2}\right) = (0,0)$

b) Radius $= \sqrt{(3-0)^2+(4-0)^2} = \sqrt{9+16} = \sqrt{25} = 5$

c) If (x, y) **is a point on this circle ,**

$(x-0)^2+(y-0)^2 = 5^2$ ==> $x^2+y^2 = 25$ ==> $x^2+y^2-25 = 0$

43

The base radius and height of a cylindrical block of wood are 8 centimetres and 15 centimetres. A cone of maximum size is carved out of this.

(a) What are the radius and height of the cone ?

(b) Find its slant height.

(c) Find the curved surface area of this cone.

Answer.

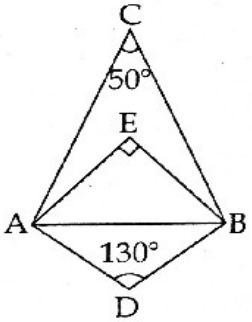
a) *Radius* $= 8$ *cm* , *Height* $= 15$ *cm*

b) *Slant height* $= \sqrt{8^2+15^2} = \sqrt{64+225} = \sqrt{289} = 17$ *cm*

c) *Curved surface area* $= \pi \times r \times l = \pi \times 8 \times 17 = 136\pi$ *sq.cm*

44

In the figure, $\angle AEB = 90°$, $\angle C = 50°$, $\angle D = 130°$.



Answer.

a) E is on the circle .

b) C is outside the circle and D is inside the circle .

(The angle formed by joining the end points of diameter of a circle to a point inside the circle is greater than 90 º , on the circle is 90 º and outside the circle is less than 90 º)

c) $\angle C + \angle D = 50 + 130 = 180^0$ **.**

Since the opposite angles are supplementary , ABCD is a cyclic quadrilateral .

That is , it is possible to draw a circle through the four points A , B , C and D .

45

Read the following mathematical concept and answer the questions that follow.

Let us examine the natural numbers, which are powers of 2.

Powers of 2	Digit in the ones place
$2^1 = 2$	2
$2^2 = 4$	4
$2^3 = 8$	8
$2^4 = 16$	6
$2^5 = 32$	2
$2^6 = 64$	4
$2^7 = 128$	8
$2^8 = 256$	6

(a) Which of the following cannot be the digit in the ones place of a power of 2 ?

[2, 3, 4, 6]

(b) Which of the following is the ones place digit in 2^9 ?

[2, 3, 4, 6]

(c) What is the ones place digit in 2^{100} ?

[2, 4, 6, 8]

(d) The ones place digit of 2^n is 6. Then the number n can be :

[12, 13, 14, 15]

	(e) $m+n=26$, then what is the ones place digit of $2^m \times 2^n$? [2, 8, 4, 6]
	Answer. **a)** 3 **b)** 2 **c)** 6 **d)** 12 **e)** 4