SSLC Model Examination February 2024.

Mathematics – English Version.

Detailed Solutions with Questions.

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Question. 1

Consider the arithmetic sequence 1, 11, 21 .....

(a) What is its common difference ?

(b) Find the 10^{th} term of this sequence.

Solution.

Sequence = 1,11,21,. …...

a) Common difference = $x_2 - x_1$

= 11 – 1 = 10.

b) 10^{th} term = f + 9 d

= 7 + 9 x 10 = 97.

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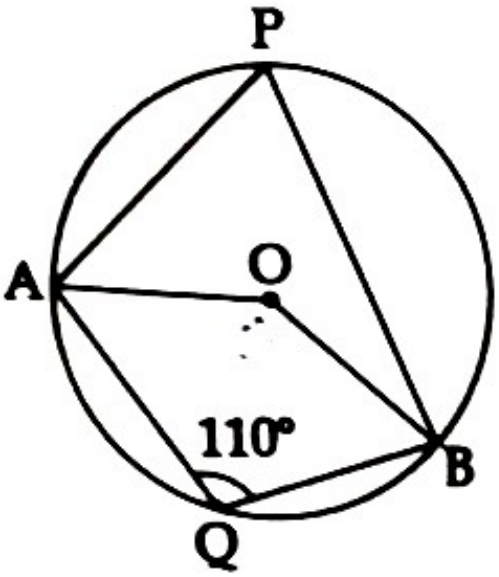
Question. 2.



In the figure O is the centre of the circle and $\angle AQB = 110°$.

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

(b) What is the measure of $\angle AOB$?

Solution.

Given $\angle AQB = 110^0$.

a) $\angle APB = 180 - 110 = 70^0$.

[Using Cyclic quadrilateral]

b) $\angle AOB = 2 \times 70 = 140^0$.

[Using arc theory]

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Question. 3.

The marks of 8 students in a Maths test are given in ascending order as below.
20, 20, 24, 32, x, 40, 45, 48
If the median mark is 34, then find the value of x.

Solution.

Arrange the weight in ascending order20,20,24, 32,x,40,45,48.

Given median mark = 34

$$\therefore \text{Median} = \frac{32+x}{2} = 34$$

$$= 32 + x = 34 \times 2$$

$$x = 68 - 32 = 36..$$

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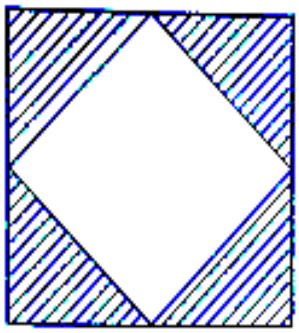
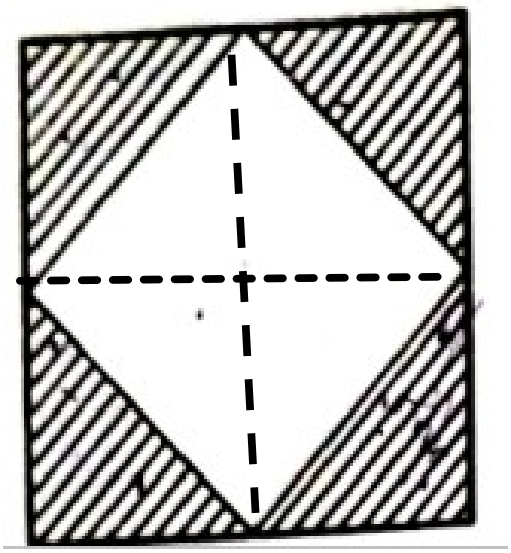
Question. 4.

The midpoints of the sides of a square are joined to form another square. If a dot is put inside the large square find the probability that it is within the shaded portion.



Solution.

Required Probability



$$= \frac{\text{Area of shaded part}}{\text{Area of total region}}$$

= 4 × area of rt.Δ÷

8 × area of rt.Δ

$$= 4 \times \frac{1}{2}\,bh \div 8 \times \frac{1}{2}\,bh$$

$$= \frac{4}{8} = \frac{1}{2}.$$

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Question. 5.

The algebraic expression of an Arithmetic sequence is $3n-2$.

(a) Find the first term of the sequence.

(b) Find the sum of the first 50 terms.

Solution.

Given algebraic expression

$= 3n - 2$.

a) First term $= 3 \times 1 - 2$

$= 3 - 2 = 1$.

b) $d = 3$. [coefficient of n]

$$S_{50} = \frac{n}{2} [x_1 + x_n]$$

OR $$\frac{n}{2} [2x_1 + (n - 1) d]$$

$$S_{50} = \frac{50}{2} [2 \times 1 + (50 - 1) 3]$$

= 25 [2 +49 X 3]

= 25[2 + 147] = 25 X 149

= 3725.

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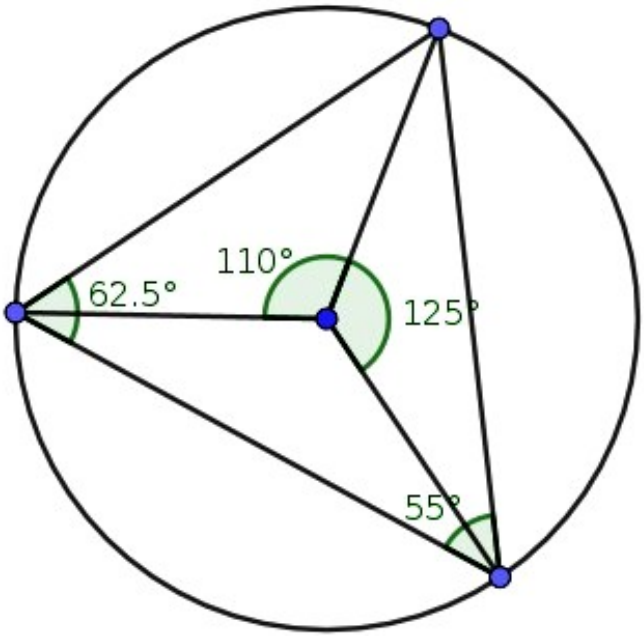
Question. 6.

Draw a triangle of circumradius 3 centimetres and two of its angles 55° and $62\frac{1}{2}°$.

Solution.



Construction

Draw a circle with radius 3cm.

Draw any radius and make an angle 110^0(2 x 55= 110^0) and then make an angle 125^0 .(2 x 62.5=125^0).and join all vertices.

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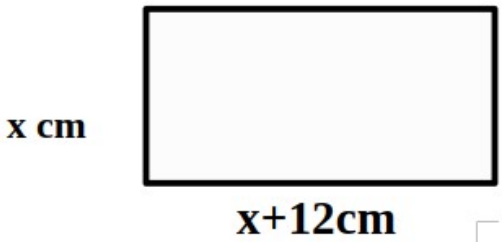
Question. 7.

One side of a rectangle is 12 centimetres longer than the other side and its area is 864 square centimetres.

(a) Form a second degree equation by taking the smaller side as 'x'.

(b) Calculate the lengths of the sides of the rectangle.

Solution.



Given area $=864cm^2$.

ie., l X b = 864.

a) Let x be the smaller side

Larger side x + 12 cm.

By question $x(x + 12) = 864$.

$x^2 + 12x = 864$.

b) $x^2 + 12x = 864$.

[Using square completion method]

$x^2 + 12x + 36 = 864 + 36$

$(x + 6)^2 = 900.$

$x + 6 = \sqrt{900} = \pm 30$

$x = 30 - 6 = 24$

Hence the smaller side = 27cm

$\because$ Length = 27 + 12 = 39cm.

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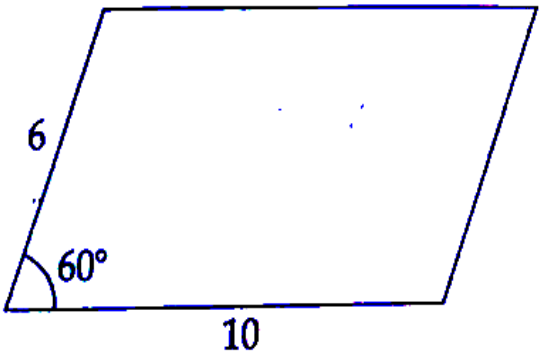
Question. 8.

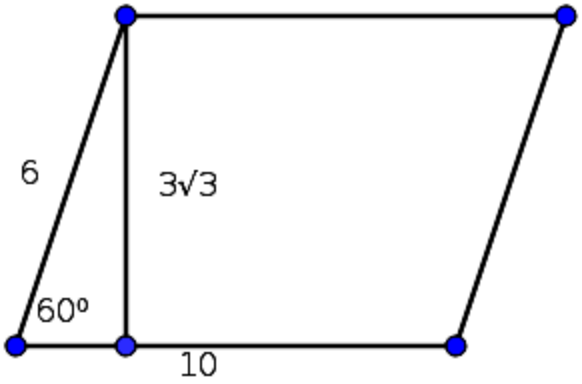
A parallelogram is drawn with lengths of adjacent sides 10 centimetres, 6 centimetres and angle between them is 60°.



(a) Find the distance between the top and bottom side of the parallelogram.

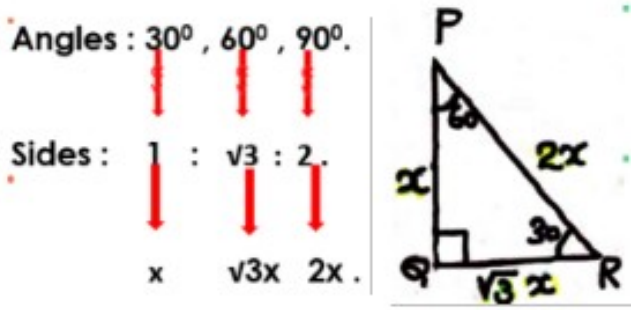
(b) Calculate the area of the parallelogram.

Solution.



a) Consider the angles be 30^0 , 60^0 , 90^0 .

ie., 1: √3:2.



Distance = 3√3cm

(see the fig.)

b) Area of the parallelogram = bh

= 10 X 3√3 = 30√3 cm^2 .

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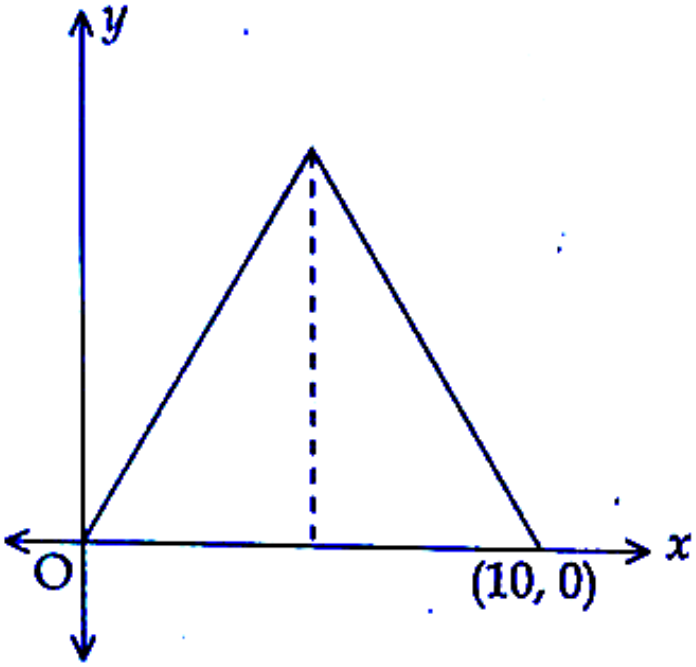
Question. 9.

Two vertices of an equilateral triangle are (0, 0) and (10, 0).



(a) Find the length of one side of this triangle

(b) Find the height of the triangle

(c) Find the coordinates of the third vertex

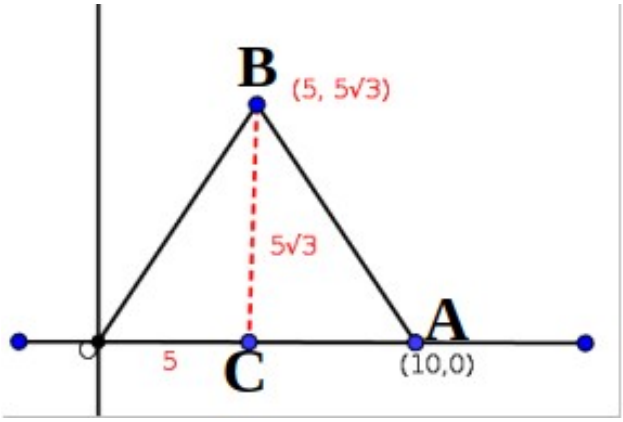
Solution.

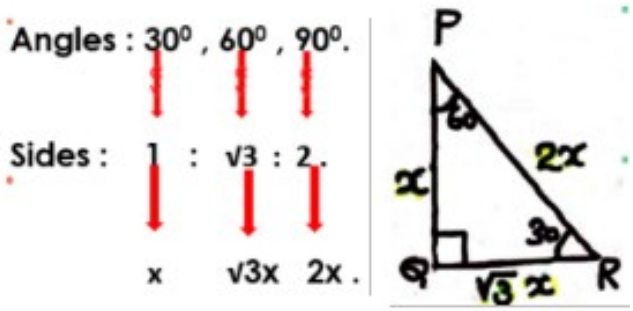
Given vertices are (0,0) and (10,0)

a) 10 [on inspection we get from the figure]

b) In ΔOCB , angles be 30^0 , 60^0 , 90^0 .

ie., 1: √3:2.





Height of the triangle = 5√3cm

(see the fig.)

c) Coordinate of third vertex B

= (OC, CB) = (5,5√3).

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Question. 10.

A circle with centre at the origin passes through the point (4, 3).

(a) What is the radius of the circle ?

(b) Write the coordinates of the points where this circle cut the y axis.

Solution.

Given origin (0,0) and passes through the point (4,3)

a) Radius of the circle = Us distance formula

$= \sqrt{x^2+y^2} = \sqrt{4^2+3^2}$

$= \sqrt{16+9} = \sqrt{25} = 5.$

b) Coordinates of the point where the circle cut the y-axis

= (0,5), (0,- 5) .

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Question. 11.

The 3rd term of an arithmetic sequence is 16 and its 21st term is 124.

(a) Find the common difference of the sequence.

(b) Find the first term of the sequence.

(c) What is the position of 280 in this sequence ?

Solution.

Given 3^{rd} term = 16

21^{st} term = 124.

a) $x_3 + 18d = x_{21}$

$16 + 18d = 124$

$18d = 124 - 16 = 108$

$$d = \frac{108}{18} = 6.$$

OR.

We know that in an arithmetic sequence , term difference is proportional to the possession difference, and the constant proportionality is the common difference

ie.,

$$\frac{X_m - X_n}{m-n} = d$$

$$\frac{124-16}{21-3} = \frac{108}{18} = 6.$$

b) $x_1 = x_3 - 2d$

$= 16 - 2 \times 6 = 4$

OR

Given 3rd term = 16

ie., $f + 2d = 16$

$f = 16 - 2 \times 6$

$= 16 - 12 = 4.$

c) $n = \frac{x_n - x_1}{d} + 1$

$= \frac{280-4}{6} + 1 = \frac{276}{6} + 1$

$= 46 + 1 = 47.$

∴ The position of 280 = 47.

OR

$x_n = dn + (f - d)$

ie., $280 = 6n + (4 - 6)$

$280 = 6n - 2$

$280 + 2 = 6n$

$6n = 282$

$$n = \frac{282}{6} = 47.$$

∴ The position of 280 = 47.

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Question. 12.

One box contains 10 paper slips numbered 1 to 10 and another box contains 20 paper slips numbered 1 to 20. One slip is taken from each box.

(a) In how many different ways can we choose a pair of slips ?

(b) What is the probability of both numbers being the same ?

(c) What is the probability of getting one even number and one odd number ?

Solution.

Box – 1. → 1, 2, 3, 4,5,6,7,8, 9,10.

Box – 2.→1,2,3,4,5,6,7,8,9,10, 11,12,13,14,15,16, 17, 18,19,20.

a) Total ways = m x n

= 10 x 20 = 200.

b) Both numbers being same

ie., (1,1),(2,2),……..(9,9),(10,10)

= 10

$= n(F) / n(N) = \frac{10}{200} = \frac{1}{20}$.

c) Probability of one even number and one odd number

$$= \frac{Even \times + odd \times even}{Total}$$

$$= \frac{5\times10+5\times10}{200} = \frac{50+50}{200} = \frac{100}{200}$$

$$= \frac{1}{2} .$$

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Question. 13.

10 added to the product of a natural number and the number 7 more than that is 304.

(a) If the first number is x, what will be the next number ?

(b) Form a second degree equation and find the two numbers.

Solution.

a) Let the first number be x

(Given)

The second number be x + 7 .

b) By question,

$x(x + 7) + 10 = 304$

$x^2 + 7x = 304 - 10 = 294$

$x^2 + 7x - 294 = 0$

[Using factorizing method]

$(x + 21)(x - 14) = 0$

$x + 2 = 0$ or $x - 14 = 0$

$x = -2$ or $x = 14$.

- 2 rejected , so x = 14.

Hence the fist number = 14

Second number = 14 + 7 = 21.

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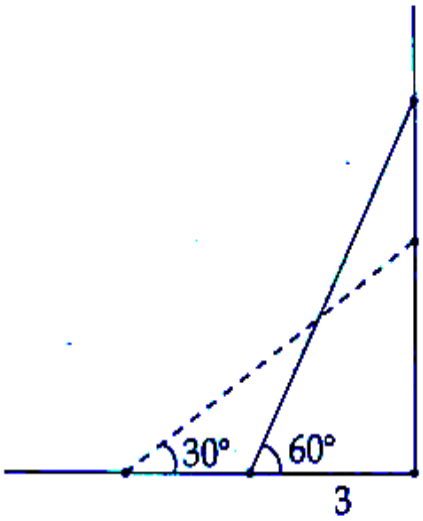
Question. 14.

A ladder leans against a wall with its foot 3 metres away from the wall and makes an angle 60° with the floor.



(a) Find the length of the ladder.

(b) The foot of the ladder is pulled to make an angle 30° with the floor. How high will be its top from the ground ?

Solution.

In ΔAOB,

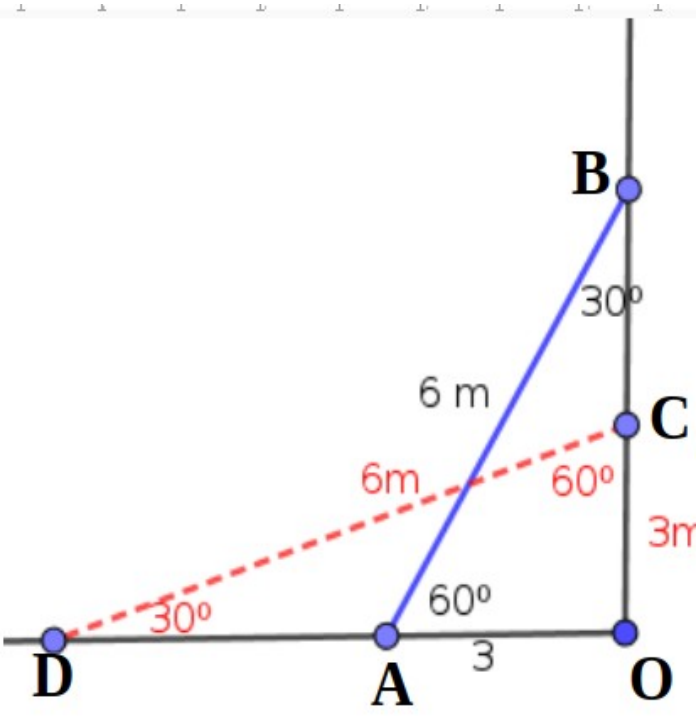
angles be

30^0 , 60^0 , 90^0

ie., 1 : √3 : 2.

ie., OA = 3m.

∴ OB $3\sqrt{3}$.



AB 2 X 3 = 6m

Hence the length of the ladder

= 6m.

b) Consider the ΔOCD,

angles be 30^0 , 60^0 , 90^0

ie., 1: √3:2.

Here CD = AB = 6m

So , Oc = $\frac{6}{2}$ = 3 .

∵ the lheight of the ladder

= 3m.

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Question. 15.

(a) Find the distance between the points (−1, 2) and (5, 10).

(b) Prove that the line joining these points passes through the point (11, 18).

Solution.

Given points (- 1, 2) and (5,10)

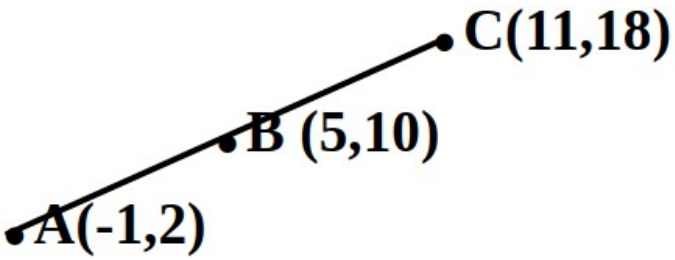
a) Distance = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

= $\sqrt{(5+1)^2+(10-2)^2}$

= $\sqrt{6^2+8^2}$ = $\sqrt{36+64}$

= $\sqrt{100}$ = 10.

b) Given (11,18)



Slope AB

= $\frac{y_2-y_1}{x_2-x_1}$

= $\frac{10-2}{5+1}$ = $\frac{8}{6}$ = $\frac{4}{3}$

$$\text{Slope } AC = \frac{18-2}{11+1} = \frac{16}{12} = \frac{4}{3}$$

Here the slope AB = AC .

Hence proved.

OR

Distance of AB = 10

Distance of BC = $\sqrt{6^2+8^2}$ = 10.

Distance of AC = $\sqrt{10^2+16^2}$ = 20.

Here AB + BC = AC

Hence proved.

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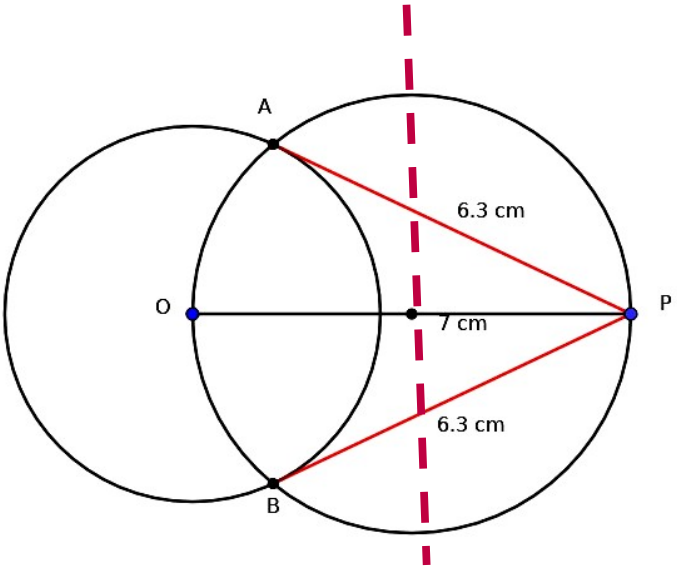
Question. 16.

Draw a circle of radius 3 centimetres. Mark a point 7.5 centimetres away from the centre and draw the pair of tangents to the circle from this point.

Solution.

Construction



Draw a circle with a radius 3cm O as its center. Draw OP= 7.5cm line and draw perpendicular to OP .Draw a circle OQ as radius and cut it A and B . Join AP and BP becomes the tangents.

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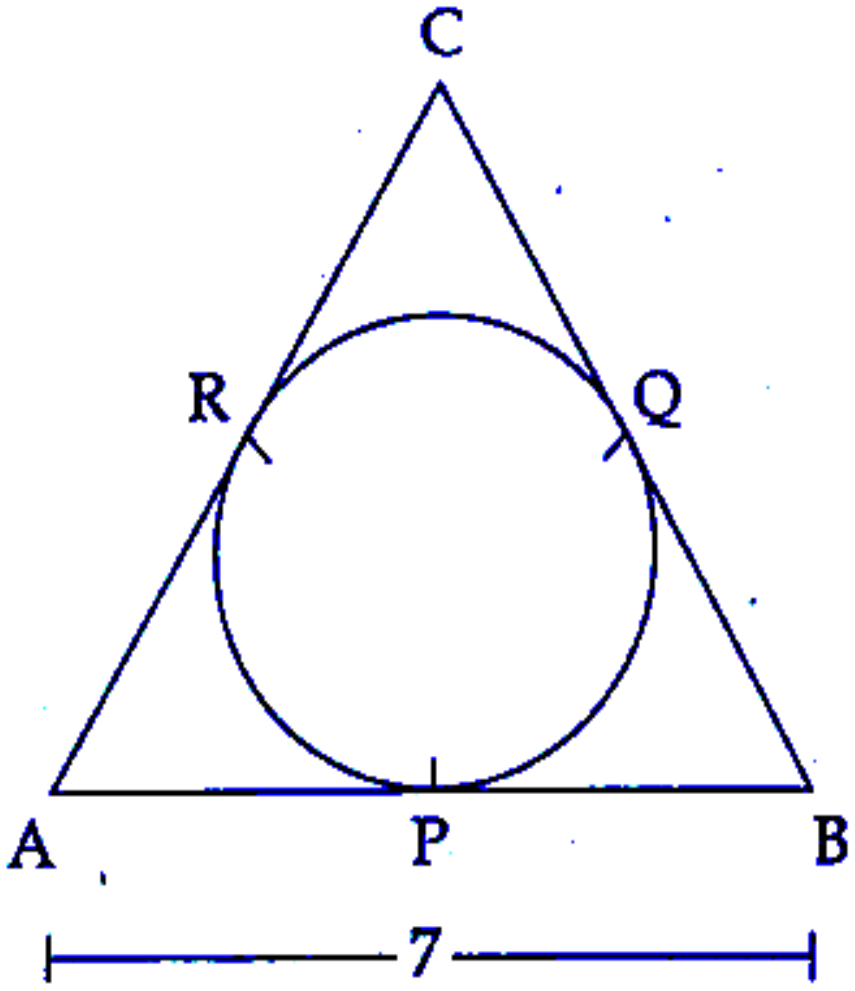
Question. 17.

The incircle of a triangle touches the sides at P, Q and R. The perimeter of the triangle is 24 centimetres and the length of AB is 7 centimetres.



(a) Prove that AP + BQ + CR = 12 centimetres.

(b) Find the length of QC.

Solution.

a) AP = AR , BP = BQ, CR = CQ

AB + BC + AC = 24

ie AP + BP + BQ + QC + AR + CR = 24

AP + BQ + BQ + CR + AP R = 24

2(AP + BQ + CR) = 24

$$\text{ie } AP + BQ + CR = \frac{24}{2} = 12 \text{ cm.}$$

b) AP + BQ = 7

CR = 12 – 7 = 5

ie QC = Cr = 5 cm.

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Question. 18.

A cone of radius 12 centimetres is to be made by folding a sector cut from a circle of radius 20 centimetres.

(a) What should be the central angle of the sector ?

(b) Calculate the curved surface area of the cone.

Solution.

Given radius of the cone = 12cm

Radius of the sector = 20cm.

a) Hear we know that the slant height of the cone = the radius of the sector or circle.

ie., R = l = 20cm.

$$\frac{r}{l} = \frac{x}{360} \quad .\;; \quad \frac{12}{20} = \frac{x}{360}$$

$$x = \frac{12 \times 360}{20} = \frac{4320}{20} = 216^0 \ .$$

b) CSA of the cone = πrl

$= \pi \times 12 \times 20 = 240\pi \text{ cm}^2$.

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Question. 19.

A line is drawn by joining the points (2, 3) and (5, 9)

(a) Find the slope of the line.

(b) Find the equation of the line.

(c) Check whether (1, 5) is a point on this line.

Solution.

Given points are (2,3) and (5,9).

a) Slope $= \frac{y_2 - y_1}{x_2 - x_1} = \frac{9-3}{5-2} = \frac{6}{3} = 2.$

b) Equation of the line

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

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

$= y - 3 = 2x - 4$.

$2x - 4 - y + 3 = 0$

$2x - y - 1 = 0$.

c) Given point be (1,5)

Put x = 1 and y = 5 in the equation 2x – y – 1 = 0

ie., 2 X 1 – 5 – 1

2 – 5 – 1

2 – 6 = – 4 ≠ 0.

∴ The point (1,5) is not on the line.

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Question. 20.

Consider the polynomial $P(x)=2x^2-7x+9$

(a) Find the value P(2)

(b) Find the solutions of the equation $P(x)-P(2)=0$

Solution.

Given $P(x) = 2x^2 - 7x + 9$.

a) $P(2) = 2 \times 2^2 - 7 \times 2 + 9$

$= 8 - 14 + 9 = 17 - 14 = 3$.

b) $P(x) - P(2) = 0$.

$2x^2 - 7x + 9 - 3 = 0$

$2x^2 - 7x + 6 = 0$

$\Rightarrow 2x^2 - 4x - 3x + 6 = 0$

$\Rightarrow (2x^2 - 4x) - (3x - 6) = 0$

$\Rightarrow 2x(x - 2) - 3(x - 2) = 0$

$\Rightarrow (2x - 3)(x - 2) = 0$

ie. $2x - 3 = 0$, or $x - 2 = 0$

$2x = 3$ or $x = 2$

$x = \frac{3}{2}$ or $x = 2$.

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Question. 21.

A solid metal hemisphere of radius 10 centimetres is melted and recast into small solid spheres of radius 1 centimetre each. How many such spheres can be made ?

Solution.

Radius of hemisphere = 10cm.

Radius of sphere = 1cm.

Number of sphere = Volume of hemisphere ÷ Volume of sphere

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

$= \frac{2}{3}\pi \times 10^3$.

Volume of sphere $= \frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi \times 1^3$.

∵ Number of sphere

$= \frac{2}{3}\pi \times 10^3 \div \frac{4}{3}\pi \times 1^3 = 500.$

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Question. 22.

The first term of an arithmetic sequence is 5 and the common difference is 4.

(a) What is the algebraic expression for this sequence ?

(b) What is the algebraic expression for the sum of first n terms of this sequence ?

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

Solution.

Given $x_1 = 5$; $d = 4$.

a) Algebraic expression

$= dn + (f - d)$

$= 4n + (5 - 4)$

$= 4n + 1$.

b) $S_n = \frac{d}{2} n^2 + (f - \frac{d}{2}) n$

$= \frac{4}{2} n^2 + (5 - \frac{4}{2}) n$

$= 2n^2 + (5 - 2) n$

$= 2n^2 + 3n$.

c) $S_{20} = 2 \times (20)^2 + 3 \times 20$

$= 800 + 60 = 860.$

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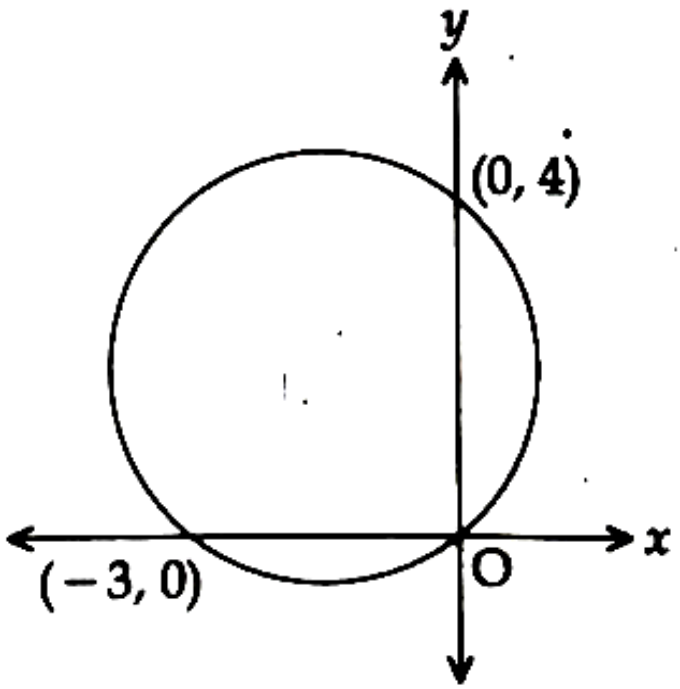
Question. 23.

A circle passes through the origin, $(-3, 0)$ and $(0, 4)$.



(a) Find the length of the diameter of circle.

(b) What are the coordinates of the centre ?

(c) Write the equation of the circle.

Solution.

Given, points (- 3 , 0) and (0, 4)

Origin (0,0)

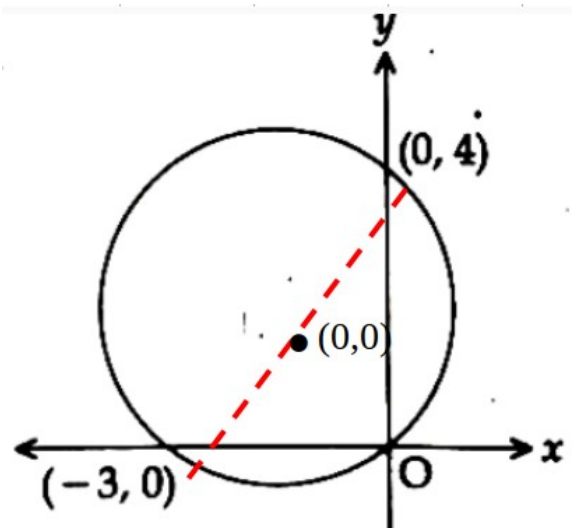
a) Diameter of the circle

$= \sqrt{x^2+y^2}$

$= \sqrt{3+4}$

$= \sqrt{9+16} = \sqrt{25}$

$= 5.$



b) Center

$= \left(\frac{x+x_2}{2} , \frac{y_1+y_2}{2} \right)$

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

$= \left(\frac{-3}{2} , 2 \right)$

c) Equation of the circle

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

$\left(x + \frac{3}{2} \right)^2 + (y - 2)^2 = \left(\frac{5}{2} \right)^2$.

$$\Rightarrow x^2 + 3x + \frac{9}{4} + y^2 - 4y + 4 = \frac{25}{4}$$

$$\Rightarrow x^2 + y^2 + 3x - 4y + \frac{9}{4} + 4 = \frac{25}{4}$$

$$\Rightarrow x^2 + y^2 + 3x - 4y + 4 = \frac{25}{4} - \frac{9}{4}$$

$$\Rightarrow x^2 + y^2 + 3x - 4y + 4 = \frac{16}{4}$$

$$\Rightarrow x^2 + y^2 + 3x - 4y = 4 - 4$$

$$\Rightarrow x^2 + y^2 + 3x - 4y = 0.$$

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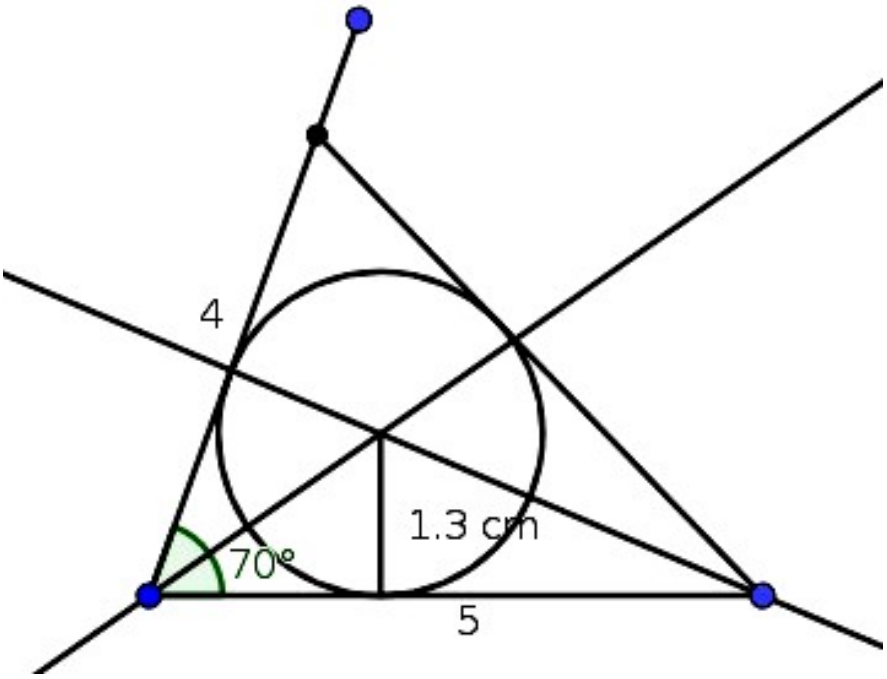
Question. 24.

Draw a triangle of sides 4 centimetres, 5 centimetres and angle between them 70°. Draw the incircle of the triangle and measure its inradius.

Solution.

Construction

Draw the triangle in the given



measurement . Draw any two angle bisector and meet its at o And then draw a circle.

Radius = 1.3cm

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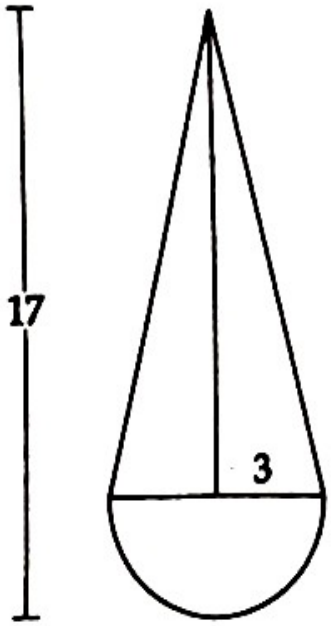
Question. 25.

A toy is in the shape of a cone attached to a hemisphere. Its common radius is 3 centimetres and the total height is 17 centimetres.



(a) What is the height of the cone ?

(b) Find the volume of the toy.

Solution.

Given common radius = 3cm

Height = 17cm.

a) Height of the cone

= 17 – 3 = 14cm.

b) Volume of the toy = Volume of cone + volume of hemisphere.

Volume of the cone = $\frac{1}{3}\ \pi\ r^2\ h$.

$= \frac{1}{3} \times \pi \times 3 \times 3 \times 14 = 42\pi\ cm^3$

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

$= \frac{2}{3}\ \pi \times 3 \times 3 \times 3 = 18\pi\ cm^3$.

∴ The volume of the toy

$= 42\pi + 18\pi = 60\pi\ cm^3$.

.....drvsr.

Question. 26.

The table shows the number of workers in a company sorted according to their daily wages.

Daily wages (Rs.)	Number of Workers
800 - 900	5
900 - 1000	7
1000 - 1100	6
1100 - 1200	10
1200 - 1300	15
1300 - 1400	2

(a) If the daily wages are arranged in ascending order, what will be the assumed wage of the 19th worker ?

(b) Find the median wage.

Solution.

Class	Frequency	Wages	cf
800-900	5	<900	5
900-1000	7	<1000	12
1000-1100	6	<<1100	18
1100-1200	10	<1200	28
1200-1300	15	<1300	43
1300-1400	2	<1400	45
	45		

Now $d = \frac{1200-1100}{10} = \frac{100}{10} = 10.$

$$\frac{d}{2} = \frac{10}{2} = 5$$

$$x_{19} = 1100 + \frac{d}{2} = 1100 + 5$$

$$= 1105.$$

b) Median position $= \frac{45+1}{2} = \frac{46}{2}$

$$= 23.$$

Hence the median $= x_{23}$.

$$= x_{19} + 4d$$

$$= 1105 + 4 \times 10$$

$$= 1105 + 40 = 1145.$$

.....drvsr

Question. 27.

A boy 1.5 metre tall, standing at the top of a building 8.5 metre high, sees the top of a tower at an elevation of 40° and the bottom of the tower at a depression of 50°.

(a) Draw a rough figure using the given details.

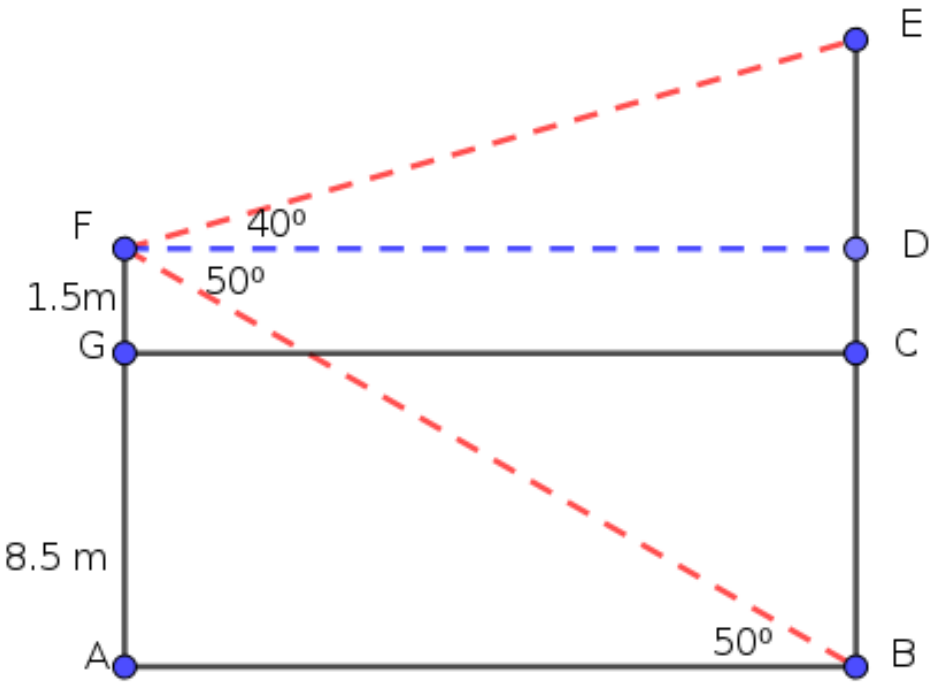
(b) How far is the building from the tower ?

(c) Find the height of the tower.

(tan 40° = 0.84, tan 50° = 1.2)

Solution.

a)



b) In ΔABF, $\frac{AB}{AF}$ = tan 40.

$\frac{AB}{10}$ = tan 40

AB = 10 x0.84 = 8.4m

c) In ΔEDF, $\frac{ED}{FD}$ = tan 40.

$\frac{ED}{804}$ = 0.84

ED = 8.4 x 0.84 = 7.056

Hence the height of the tower = 10 + 7.056 = 17.056m.

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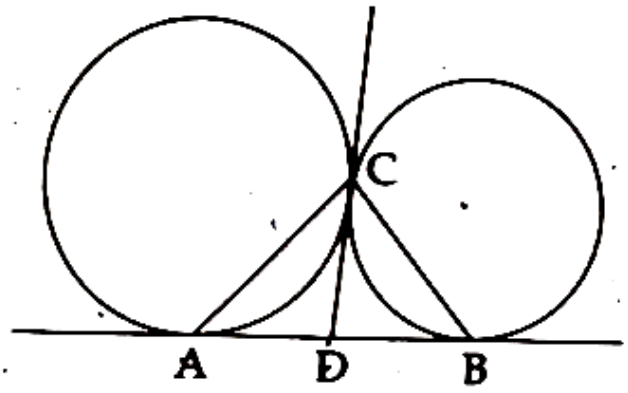
Question. 28.

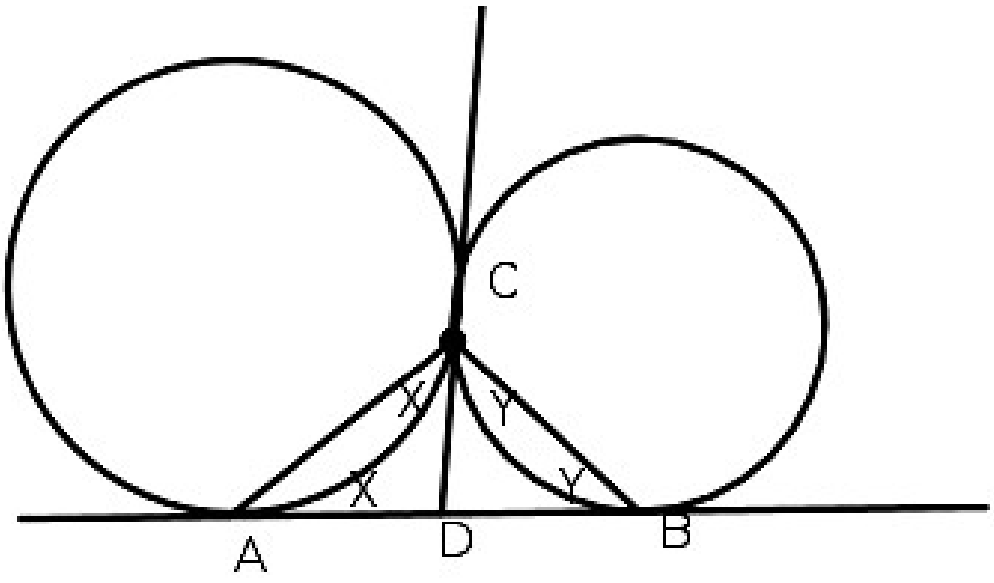
Two circles meet at point C. AB and CD are common tangents to the circles.



(a) Prove that D is the midpoint of AB.

(b) Find the measure of ∠ACB

Solution.



a) Here CD and are tangents

So, AD = CD and BD = CD

ie AD = BD

ie D be the mid point of AB.

Hence proved.

b) AD = CD and BD = CD

ie $\angle DAC = \angle DCA = x$ and $\angle DBC = DCB = y$

In ΔABC, $x + x + y + y = 180$

$2x + 2y = 180$

$2(x+y) = 180$

$x + y = \frac{180}{2} = 90$

ie $\angle ACB = 90^0$.

.....drvsr

Question. 29.

See the pattern given below.

$1+2+1=4$

$1+2+3+2+1=9$

$1+2+3+4+3+2+1=16$

$1+2+3+4+5+4+3+2+1=25$

.....

.....

(a) Write the 5^{th} line of the pattern.

(b) Find the sum of the line

$1+2+3+\ldots\ldots+13+14+15+14+13+\ldots\ldots+2+1$

(c) Find the middle number of the line that gives the sum 400.

(d) Find the value of n if

$1+2+3+\ldots\ldots+(3n-2)+(3n-1)+(3n-2)+\ldots+2+1=2500$

Solution.

a) $1 + 2 + 3 + 4 + 5 + 6 + 5 + 4 + 3 + 2 + 1 = 36.$

b) $1+2+\ldots\ldots+14+15+14+14+\ldots\ldots+1 = 15^2 = 225.$

c) Middle number $= 20.$

d) $(3n - 1)^2 = 2500.$

$$3n - 1 = \sqrt{2500} = 50$$
$$3n = 50 + 1 = 51$$
$$n = \frac{51}{3} = 27.$$

.....drvsr

SSLC Model Examination February 2024.

Mathematics – English Version.

Detailed Solutions with Questions.

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