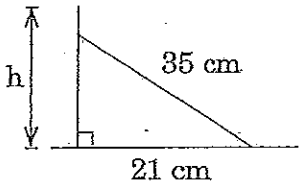
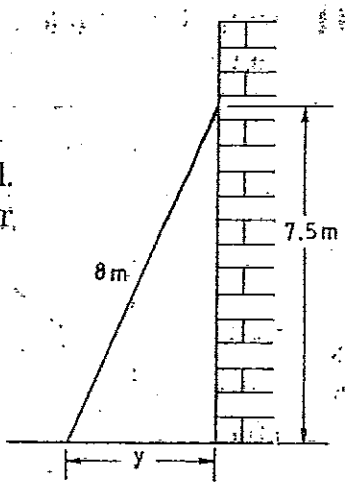
12. A rectangle is 16 cm long and 12 cm wide. Calculate the length of the diagonal of the rectangle.

13. Calculate the length of a diagonal of a square of side 3 cm correct to one decimal place.

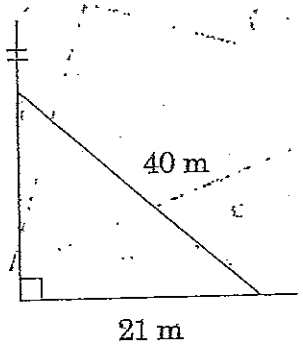
14. A metal brace 35 cm long is screwed into place so that one end is 21 cm from a wall. How far up the wall does the brace reach.



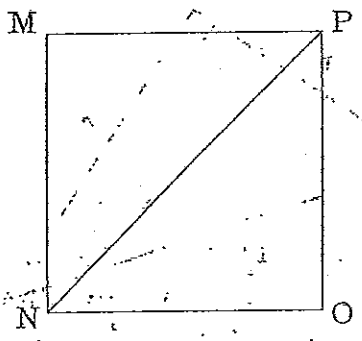
15. An 8 metre ladder reaches 7.5 metres up a brick wall. How far is the foot of the ladder from the wall? Answer correct to one decimal place.



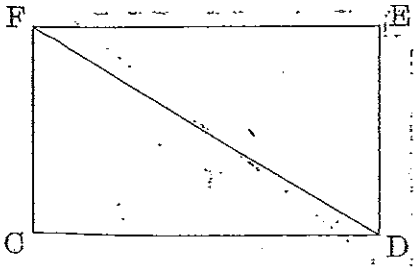
16. A pollution tower 45 metres high is supported by wires 40 metres long. Each wire is attached at ground level 21 metres from the base of the tower. How far from the top of the tower are the wires attached? Answer correct to 4 significant figures.



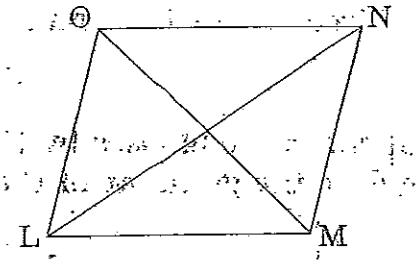
17. The square MNOP has diagonal of length 18 cm. Calculate the length of the side of the square correct to one decimal place.



18. A rectangle CDEF has length 20 cm and diagonal 25 cm long. Calculate the width of the rectangle.



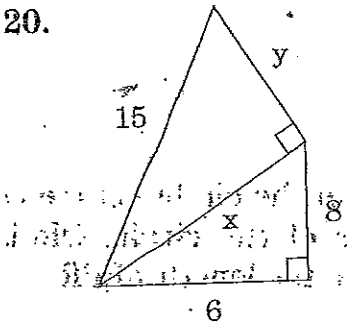
19. LMNO is a rhombus with diagonals 24 cm and 10 cm. Calculate the length of each side of the rhombus.



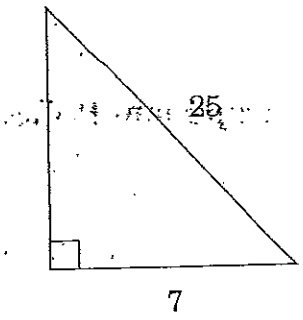
Note: The diagonals of a rhombus bisect each other at right angles.

All sides of a rhombus are of equal length.

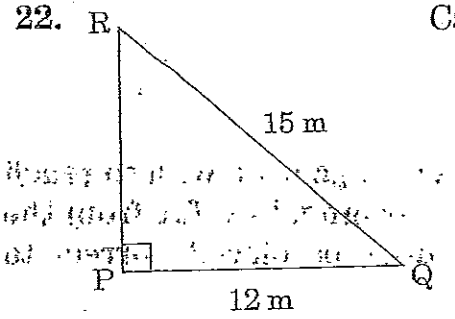
20. Calculate the value of x and hence calculate the length y correct to three significant figures.



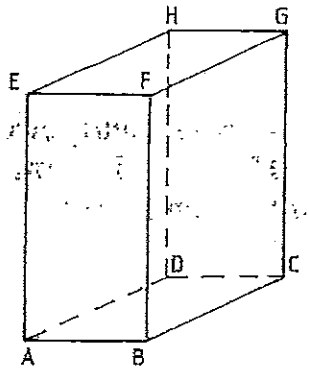
21. A sail is to be cut in the shape of a right angled triangle. If the longest side is 25 metres and the shortest 7 m, calculate the length of the third side.



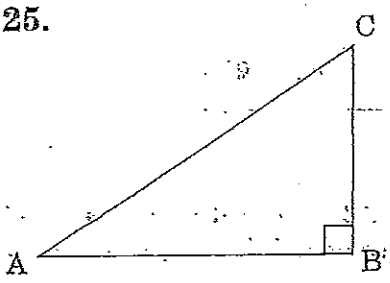
22. Calculate the perimeter of the triangle PQR.



23. ABCDEFGH is a rectangular prism with AB = 9 cm, BC = 12 cm and CG = 20 cm. By first calculating the length of the diagonal AC calculate the shortest distance that Florrie the Fly must travel between A and G.

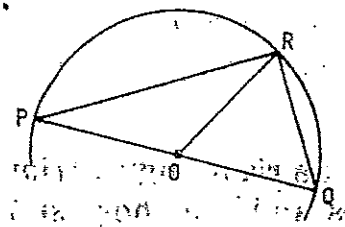


24. Consider the same diagram as for question 23. Harry the ant sets off from A to meet Florrie at G. If Harry travels by the most direct route how much further (if any) must Harry travel than Florrie?

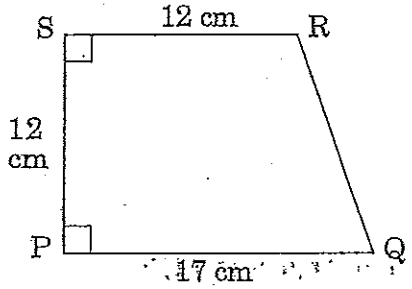
25. 

A section of railway line AC, 61 metres long rises by 11 metres between A and C. Calculate the gradient of the line as a simple fraction.

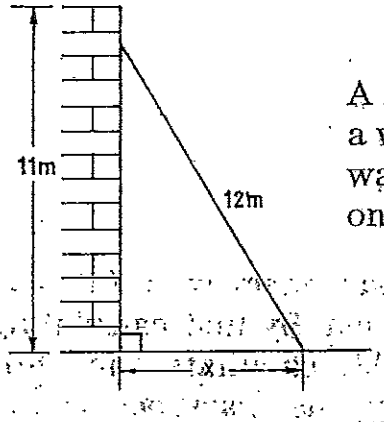
$$\text{Gradient} = \frac{\text{RISE}}{\text{RUN}} = \frac{BC}{AB}$$

26. 

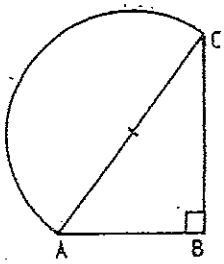
PQR is a triangle on the diameter of the circle centre O. The angle PRQ = 90°. The radius of the circle, OR is 7.5 cm long. If QR = 9 cm, calculate the length of PR.

27. 

Calculate the perimeter of the trapezium PQRS.

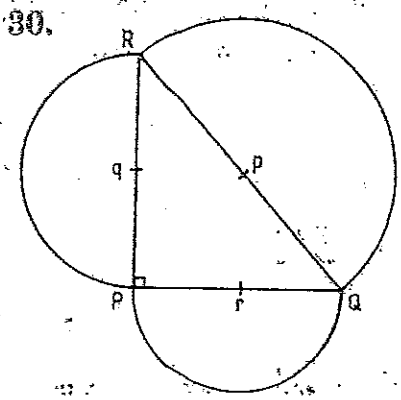
28. 

A 12 metre ladder is to be placed against a wall to reach a window 11 metres above the ground. How far from the wall must the foot of the ladder be placed correct to one decimal place?

29. 

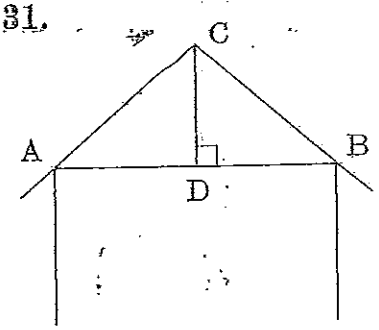
ABC is a triangle right angled at B. A semi-circle is drawn with AC as diameter. If AB = 12 cm and BC = 16 cm, calculate the area of the semi-circle.

30.



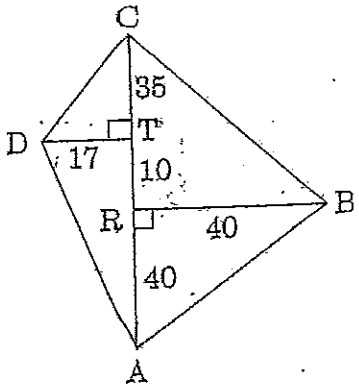
PQR is a triangle right angled at P. The lengths of the sides PQ, QR and PR are r cm, p cm and q cm respectively. Semi-circles are drawn on each side of the triangle. Show that the sum of the areas of the semi-circles, A, can be expressed as $A = \frac{1}{4}\pi p^2$.

31.



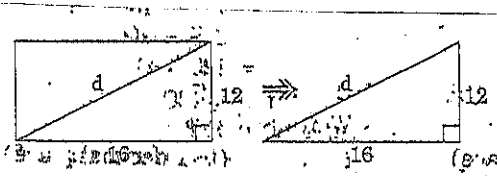
The roof of a house is in the shape of a triangle when viewed from the side. If the width of the house AB is 24 m and the height of the roof is 8 m, calculate the slant height BC of the roof. It can be assumed that the perpendicular height CD is in the centre of AB.

32.



A surveyor makes this sketch of a paddock in his note book. The measurements are AR = 40 m, RT = 10 m, TC = 35 m, DT = 17 m, RB = 40 m. Calculate the perimeter of the paddock correct to the nearest metre.

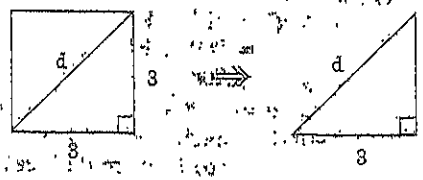
12.



$d^2 = 12^2 + 16^2$
$= 144 + 256$
$= 400$
$\therefore d = \sqrt{400}$
$= 20$

Length of diagonal is 20 cm

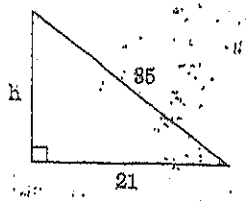
13.



$d^2 = 3^2 + 3^2$
$= 9 + 9$
$= 18$
$\therefore d = \sqrt{18}$
$= 4.2$ (to 1 decimal place)

Diagonal is 4.2 cm.

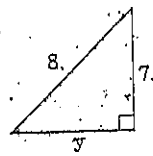
14.



$h^2 + 21^2 = 35^2$
$\therefore h^2 = 35^2 - 21^2$
$= 1225 - 441$
$= 784$
$\therefore h = \sqrt{784}$
$= 28$

Brace reaches 28 cm up wall

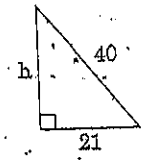
15. $y^2 + 7.5^2 = 8^2$



$\therefore y^2 = 8^2 - 7.5^2$
$= 64 - 56.25$
$= 7.75$
$\therefore y = \sqrt{7.75}$
$= 2.8$

Foot of ladder is 2.8 m from wall

16.

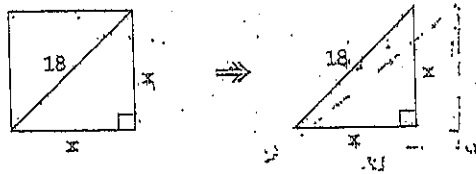


$h^2 + 21^2 = 40^2$
$h^2 = 40^2 - 21^2$
$= 1600 - 441$
$= 1159$
$\therefore h = \sqrt{1159}$
$= 34.044089$

Distance from top $= 45 - 34.044089$
$= 10.955911$
$\doteq 10.96$ (to 4 significant figures)

Wires are attached 10.96 m from the top.

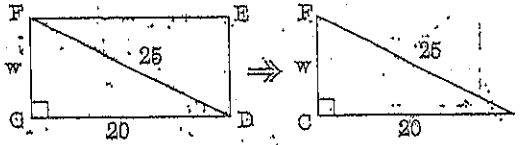
17.



Let length of square be x cm.
$\therefore x^2 + x^2 = 18^2$
$2x^2 = 324$
$\therefore x^2 = 162$
$x = \sqrt{162}$
$\doteq 12.7$ (to 1 decimal place)

Length of side is 12.7 cm

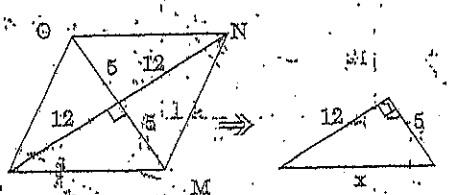
18.



$w^2 + 20^2 = 25^2$
$w^2 = 25^2 - 20^2$
$= 625 - 400$
$= 225$
$\therefore w = \sqrt{225}$
$= 15$

Width is 15 cm.

19.

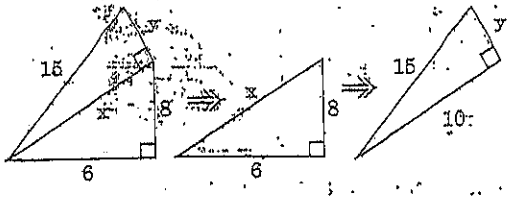


Let length of side be x cm.

$x^2 = 5^2 + 12^2$
$= 169$
$\therefore x = \sqrt{169}$
$= 13$

Length of each side is 13 cm

20.

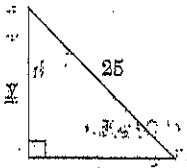


$x^2 = 6^2 + 8^2$
$= 36 + 64$
$= 100$
$\therefore x = \sqrt{100}$
$= 10$

$(x = 10)$

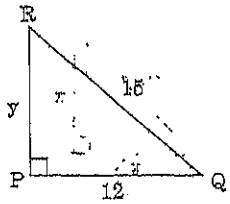
From second △,
$y^2 + 10^2 = 15^2$
$\therefore y^2 = 15^2 - 10^2$
$= 225 - 100$
$= 125$
$\therefore y = \sqrt{125}$
$= 11.2$ (to 3 significant figures)

21. Let third side be y m.

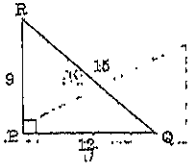


$y^2 + 7^2 = 25^2$
$\therefore y^2 = 25^2 - 7^2$
$= 625 - 49$
$= 576$
$\therefore y = \sqrt{576}$
$= 24$
Third side is 24 m

22. Let PR = y m

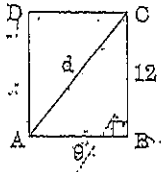


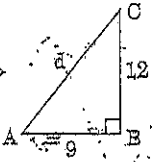
$\therefore y^2 + 12^2 = 15^2$
$\therefore y^2 = 15^2 - 12^2$
$= 225 - 144$
$= 81$
$\therefore y = \sqrt{81}$
$= 9$
$\therefore$ PR = 9 cm



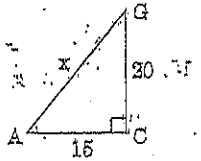
Perimeter = 9 + 12 + 15
= 36
Perimeter is 36 cm

23. Consider rectangle ABCD

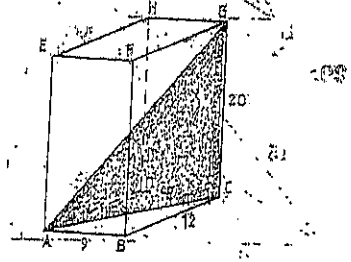




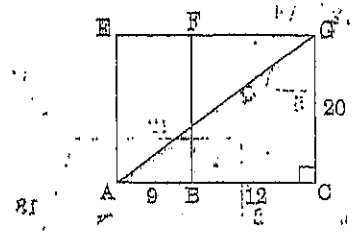
Let AC = d cm
$d^2 = 12^2 + 9^2$
$= 144 + 81$
$= 225$
$\therefore d = \sqrt{225}$
$= 15$
AC = 15 cm
Now consider △AGC
Let AG = x cm



$\therefore x^2 = 20^2 + 15^2$
$= 400 + 225$
$= 625$
$\therefore x = \sqrt{625}$
$= 25$
Shortest distance AG is 25 cm

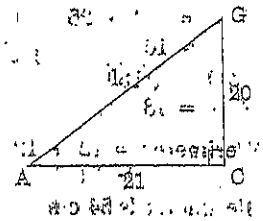


24. Harry the Ant must crawl across the walls. To find the shortest route, fold out the NET of the prism (part of it that we need):



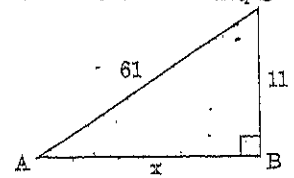
Shortest distance is the straight line between A and G.

Let AG = l cm
$\therefore l^2 = 21^2 + 20^2$
$= 441 + 400$
$= 841$
$\therefore l = \sqrt{841}$
$= 29$



Shortest distance for Harry is 29 cm. Harry's extra distance = 29 − 25 = 4. Harry travels an extra 4 cm.

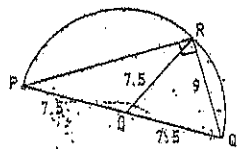
25. Let length AB be x m

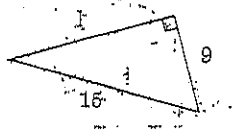


$\therefore x^2 + 11^2 = 61^2$
$x^2 = 61^2 - 11^2$
$= 3721 - 121$
$= 3600$
$\therefore x = \sqrt{3600}$
$= 60$
AB is 60 m

Gradient = $\frac{BC}{AB}$
$= \frac{11}{60}$
Gradient of railway line is $\frac{11}{60}$.

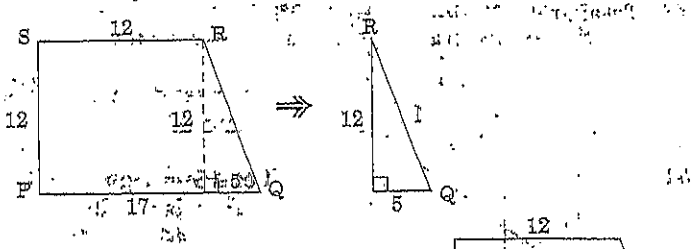
26.





PO = OQ = OR (equal radii)
$\therefore$ PO = OQ = 7.5 cm
Then PQ = 15 cm
Let PR = l cm
$\therefore l^2 + 9^2 = 15^2$
$l^2 = 15^2 - 9^2$
$= 225 - 81$
$= 144$
$\therefore l = \sqrt{144}$
$= 12$
$\therefore$ length of PR is 12 cm

27.



Let RQ = l cm

$\therefore l^2 = 12^2 + 5^2$

$= 144 + 25$

$= 169$

$\therefore l = \sqrt{169}$

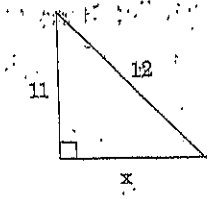
$= 13$

Perimeter $= 12 + 12 + 13 + 17$

$= 54$

Perimeter is 54 cm

28.



$x^2 + 11^2 = 12^2$

$x^2 = 12^2 - 11^2$

$= 144 - 121$

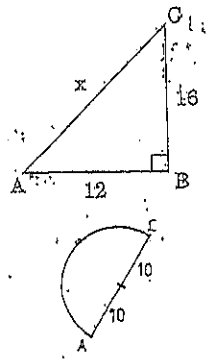
$= 23$

$\therefore x = \sqrt{23}$

$= 4.8$ (to 1 decimal place)

Foot of ladder should be placed 4.8 m from the wall.

29.



Call AC x cm

$x^2 = 12^2 + 16^2$

$= 144 + 256$

$= 400$

$\therefore x = \sqrt{400}$

$= 20$

Then diameter of circle, AC, is 20 cm

Area $= \frac{1}{2}\pi r^2$

$= \frac{1}{2} \times \pi \times 10^2$

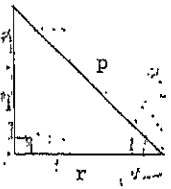
$= 157.07963$

≈ 157 (nearest whole number)

Area of semi-circle is 157 cm^2

30. Using Pythagoras' Theorem in $\triangle PQR$

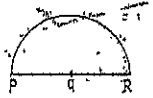
$p^2 = q^2 + r^2$



Now areas of semi circles:

$A_1 = \frac{1}{2}\pi(\frac{1}{2}q)^2$

$= \frac{1}{8}\pi q^2$



$r = \frac{1}{2}q$

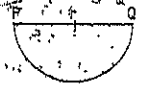
$A_2 = \frac{1}{2}\pi(\frac{1}{2}p)^2$

$= \frac{1}{8}\pi p^2$

$r = \frac{1}{2}p$

$A_3 = \frac{1}{2}\pi(\frac{1}{2}r)^2$

$= \frac{1}{8}\pi r^2$



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

Total area $= \frac{1}{8}\pi p^2 + \frac{1}{8}\pi q^2 + \frac{1}{8}\pi r^2$

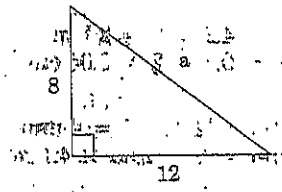
$= \frac{1}{8}\pi(p^2 + q^2 + r^2)$

$= \frac{1}{8}\pi(p^2 + p^2)$ $\quad p^2 = q^2 + r^2$

$= \frac{1}{8}\pi(2\,p^2)$

$= \frac{1}{4}\pi p^2$

31.



Let slant height = a m

$\therefore a^2 = 8^2 + 12^2$

$= 64 + 144$

$= 208$

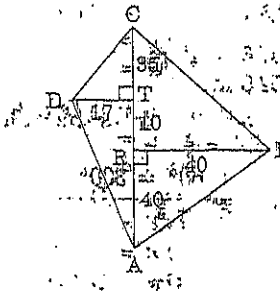
$\therefore a = \sqrt{208}$

$= 14.422205$

≈ 14.4 (to 1 decimal place)

Slant height of roof is 14.4 metres

32.



Consider $\triangle ABR$

$AB^2 = 40^2 + 40^2$

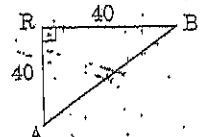
$= 1600 + 1600$

$= 3200$

$\therefore AB = \sqrt{3200}$

$= 56.6$

(to 1 decimal place)



$\triangle RBC$

$BC^2 = 45^2 + 40^2$

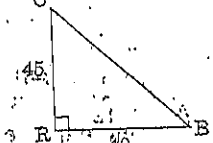
$= 2025 + 1600$

$= 3625$

$\therefore BC = \sqrt{3625}$

$= 60.2$

(to 1 decimal place)



$\triangle DTC$

$DC^2 = 17^2 + 35^2$

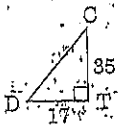
$= 289 + 1225$

$= 1514$

$\therefore DC = \sqrt{1514}$

$= 38.9$

(to 1 decimal place)



$\triangle ATD$

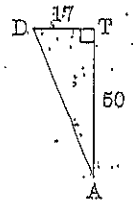
$AD^2 = 50^2 + 17^2$

$= 2500 + 289$

$= 2789$

$\therefore AD = \sqrt{2789}$

$= 52.8$



Perimeter $= AB + BC + DC + AD$

$= 56.6 + 60.2 + 38.9 + 52.8$

$= 208.5$

Perimeter is 208.5 metres