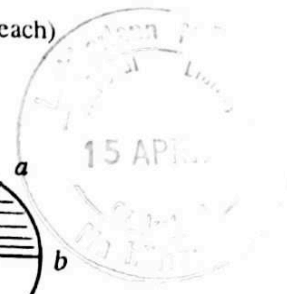


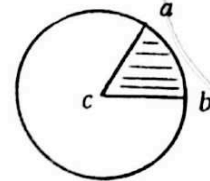
Attempt **QUESTION 1** (100 marks) and **FOUR** other questions (50 marks each)  
**Marks may be lost if necessary work is not clearly shown**  
**or if you do not indicate where a calculator has been used.**



1.

- (i) Calculate, to the nearest  $\text{cm}^2$ , the shaded area of the disc, centre  $c$ , radius length 7 cm,

if  $|\angle acb| = 60^\circ$ . Take  $\pi = \frac{22}{7}$ .



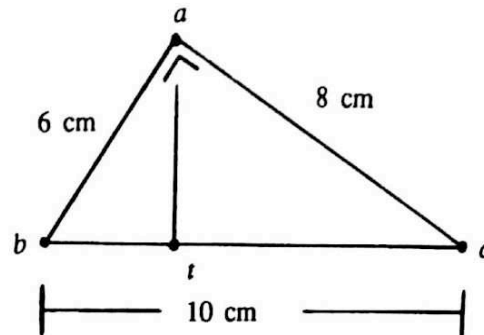
- (ii) Express  $t$  in terms of  $x$  and  $y$ , if

$$\frac{x}{y} = \frac{2t + 1}{t}$$

- (iii) Construct, or explain how to construct, the circumcircle of a triangle.

- (iv) In the triangle  $abc$   
 $ab \perp ac$ ,  $at \perp bc$ .  
 $|ab| = 6 \text{ cm}$ ,  $|ac| = 8 \text{ cm}$ ,  
 $|bc| = 10 \text{ cm}$ .

Calculate  $|at|$ .



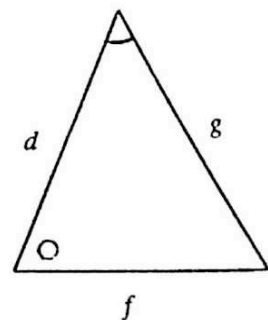
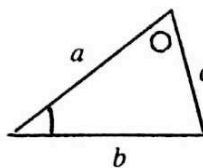
- (v) The lines  $2x + 3y - 12 = 0$  and  $x - y = 0$  intersect at  $(a, b)$ .  
 Find the value of  $a$  and the value of  $b$ .

- (vi) Find the equation of the image of the line  $y = x + 2$  under the central symmetry in the origin.

- (vii) Two equiangular triangles are shown, with equal angles indicated.  $a, b, c, d, f, g$  represent the lengths of sides.

Copy and complete the ratios

$a : b = ? : ?$   
 and  $c : ? = ? : g$ .

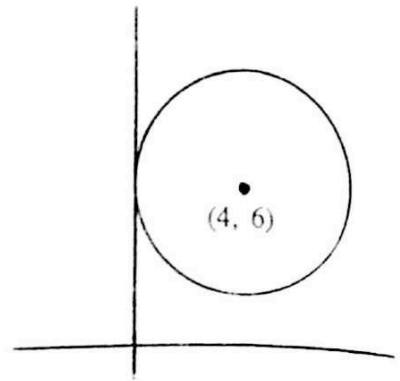


1 (contd.)

(viii) The Y axis is a tangent to the circle centre (4, 6). Write the equation of the circle.

(ix) Find, without the use of Tables or calculator, the value of  $\tan \theta$ ,  $0^\circ < \theta < 90^\circ$ , when  $\sin \theta = \frac{12}{13}$ .

(x) If  $a \vec{i} + 7 \vec{j} = (4 \vec{i} + 3 \vec{j}) - (5 \vec{i} - b \vec{j})$  find the value of  $a$  and the value of  $b$ .

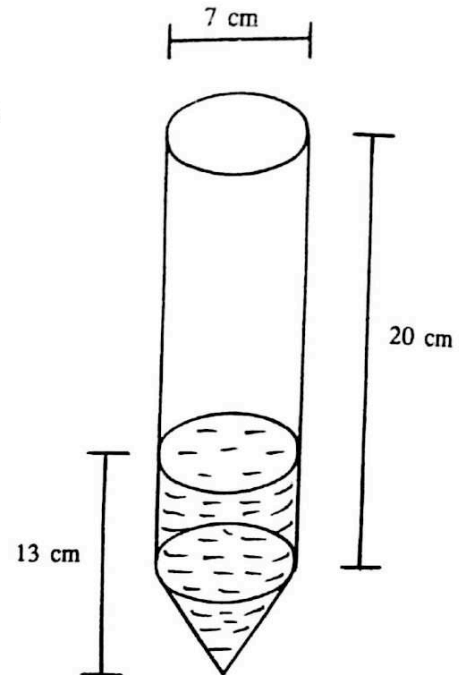


2.

A closed upright container consists of an open hollow cone joined to the open end of a hollow cylinder. The height and internal diameter of the cylinder measure 20 cm and 7 cm, respectively. The diameter of the base of the cone is 7 cm.

Calculate, without giving a value to  $\pi$ ,

- (i) the internal capacity of the cylindrical part.
- (ii) the vertical height of the cone, if its capacity is known to be one tenth of the capacity of the cylinder.
- (iii) the volume of water in the container when the level is 13 cm above the vertex of the cone.



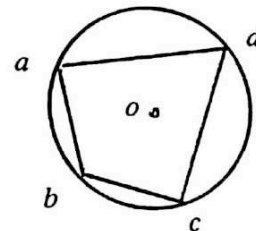
What would be the height of water in the cylinder should the container be inverted so as to stand on its circular base?

3.

(i) Prove that the measure of the angle at the centre of a circle is twice the measure of the angle at the circle standing on the same arc.

(ii)  $a, b, c, d$  are points of a circle, centre  $o$ , as shown.

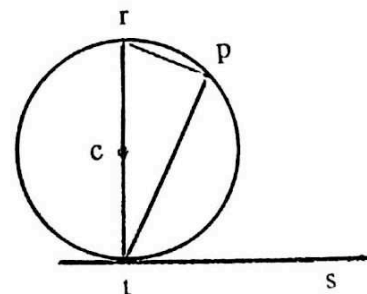
Prove that  $|\angle dab| + |\angle bcd| = 180^\circ$



(iii)  $ts$  is a tangent to the circle, centre  $c$ , (see diagram).  $ts$  is perpendicular to a diameter  $tr$ .

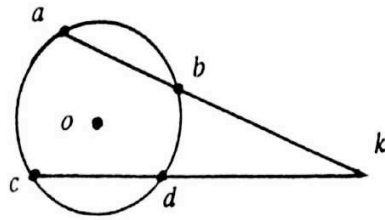
Prove

$|\angle pts| = |\angle prt|$ .

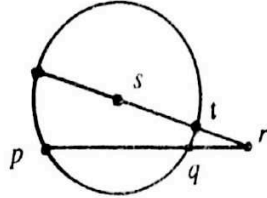


4.

- (i)  $[ab]$  and  $[cd]$  are two chords of a circle, centre  $o$ , which intersect at  $k$ . Prove  $|ak| \cdot |kb| = |ck| \cdot |kd|$ .

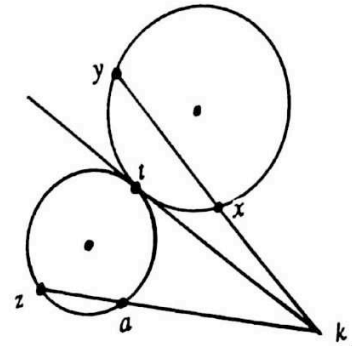


(ii)



In the circle, centre  $s$ ,  
 $|pq| = 10$  cm,  $|qr| = 4$  cm  
 and  $|st| = 13$  cm. Calculate  $|tr|$ .

- (iii)  $kt$  is a tangent to both circles, as shown.  
 $|ka| = 4$ ,  $|az| = 0.5$   
 and  $|kx| = |xy|$ .  
 Calculate  $|kx|$ .



5. The line  $M : y = x - 3$  intersects the X axis at  $p$  and Y axis at  $q$ .

- (i) Find the coordinates of each of  $p$  and  $q$ .
- (ii) Find the equation of  $N$ , the image of  $M$  under the translation.  
 $(0, 0) \rightarrow (-3, 3)$ .
- (iii) Verify  $pq \perp pp'$ , if  $p'$  is the image of  $p$  under the translation.
- (iv) Calculate  $|ot|$  if  $t$  is the mid-point of  $[pq]$  and  $o$  is the origin.
- (v) Calculate the area of the triangle  $ppp'$

6.  $(-5, 12)$  and  $(5, -12)$  are end-points of a diameter of a circle  $S$ .

Calculate

- (i) the coordinates of the centre
- (ii) the length of the radius
- (iii) the equation of the circle  $S$ .

$S_1$  is the image of  $S$  under a central symmetry in the point  $(-5, 12)$ .  
 Write the equation of  $S_1$ .

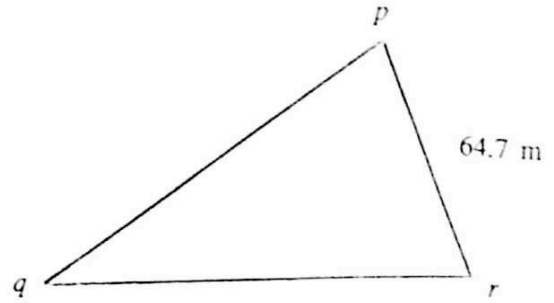
The circle  $S_2 : (x - 5)^2 + (y - 10)^2 = 169$  is the image of  $S_1$  under the translation  $(0, 0) \rightarrow (a, b)$ .

Find the value of  $a$  and the value of  $b$ .

OVER  $\rightarrow$

7.

- (a) The diagram shows a triangular field  $pqr$  in which  $|pr| = 64.7\text{m}$   
 $|\angle rpq| = 83^\circ 28'$  (or  $83.47^\circ$ )  
 If the area of the field is  $2700\text{ m}^2$ ,  
 calculate to the nearest metre



- (i)  $|pq|$   
 (ii)  $|qr|$

- (b) Sketch the graph of the function  $f$

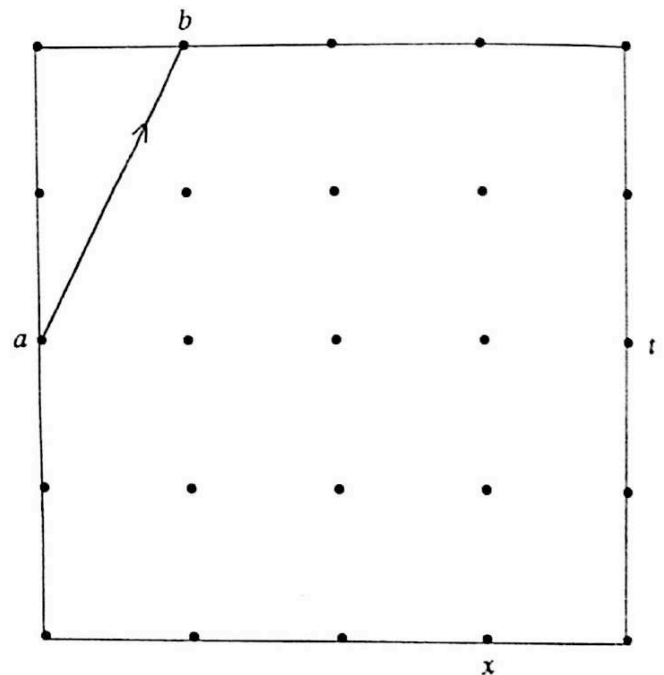
$$f : x \rightarrow \cos 2x$$

in the domain  $0 \leq x \leq 2\pi$

Write down the values of  $x$  for which  $f(x) = 0$  and state the period of  $f(x)$ .  
 Deduce, or find otherwise, the value of  $\cos(100\pi)$ .

8.

The diagram shows the points  $a, b, t, x$  on a grid where  $\vec{ab}$  can represent, say,  $\vec{ax} + \vec{xt}$ . Using such a grid each time illustrate by linking a single pair of points



- (i)  $\vec{ax} + \vec{xt}$   
 (ii)  $\vec{at} - \vec{ab}$   
 (iii)  $\frac{1}{2} (\vec{ab} + \vec{ax})$   
 (iv)  $\vec{ab} + \vec{ab}$ .

The point  $b$  is  $-2\vec{i} + 4\vec{j}$  with  $x$  as the origin. Express, with  $x$  as origin,

$$(\vec{xt} + \vec{tb} + \vec{ba})$$

in terms of  $\vec{i}$  and  $\vec{j}$ .