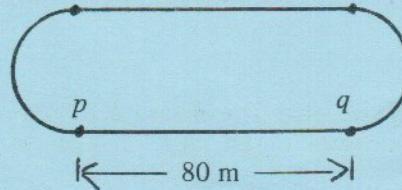


THURSDAY, 9 JUNE – MORNING, 9.30 – 12.00

Attempt **Question 1** (100 marks) and **four** other questions (50 marks each)

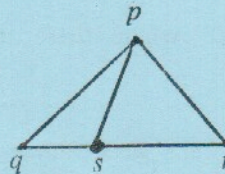
Marks may be lost if all your work is not clearly shown
or if you do not indicate where a calculator has been used.

1. (i) Calculate the length of the perimeter of the track if $|pq| = 80$ m and the radius of each semicircular end is 40 m. [Take $\pi = 3$].

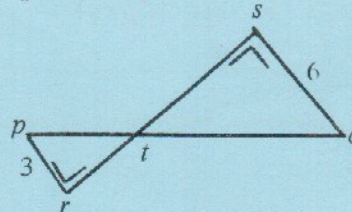


- (ii) If $x = \frac{y(t-z)}{z}$, express t in terms of x , y and z .

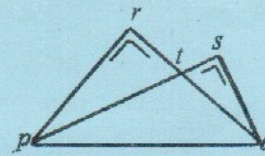
- (iii) The area of the triangle pqr is 40 and $|qs| : |sr| = 2 : 3$. Calculate the area of the triangle pqs .



- (iv) pq and rs intersect in t and $|\angle prt| = |\angle tsq| = 90^\circ$.
If $|pr| = 3$, $|sq| = 6$ and $|pq| = 15$ calculate $|rs|$.



- (v) pqr and pqs are two right-angled triangles.
If qr intersects ps at t , give a reason for saying
 $|qt| \cdot |tr| = |pt| \cdot |ts|$.

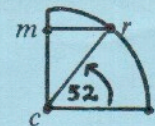


- (vi) t is the mid-point of $[xy]$.
The co-ordinates of x and t are $(-4, 2)$ and $(1, -3)$ respectively.
How far is y from the origin?

- (vii) The X -axis is a tangent to the circle, centre $(-2, 5)$. Write down the equation of the circle.

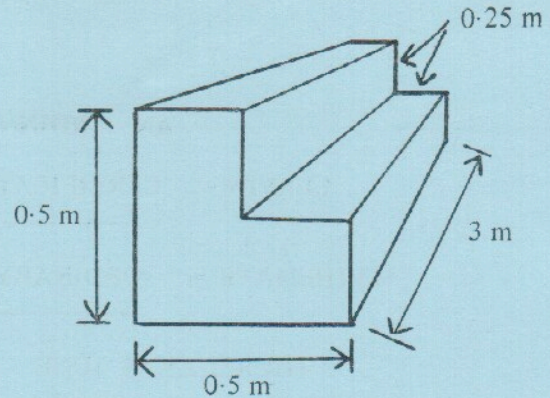
- (viii) Write down the co-ordinates of the image of $(0, 4)$ under the projection, parallel to the X -axis, on the line $x = 2$.

- (ix) The length of the radius of the quadrant of the circle, centre c , is 100 m. If $|\angle tcr| = 52^\circ$ and $mr \parallel ct$, calculate $|mr|$, correct to one place of decimals.



- (x) In the parallelogram $pqrs$,
 $\vec{p} = -3\vec{i} + \vec{j}$
 $\vec{q} = 5\vec{i} - 2\vec{j}$
 $\vec{r} = 4\vec{i} + 2\vec{j}$
 find \vec{s} in terms of \vec{i} and \vec{j} .

2. (a) The diagram shows two solid concrete steps, 0.25 m high and 0.25 m deep. Other dimensions are shown. If all the angles are right angles, calculate the volume of concrete needed. If concrete costs IR£40.00 per 1 m^3 , find the cost of the concrete in the steps.

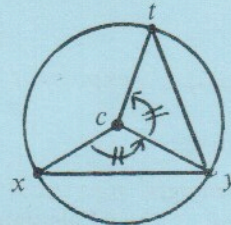


- (b) Water flows through a cylindrical pipe of internal radius 1.25 cm at a speed of 50 cm per second. For how many seconds does water flow so as to deliver 31.4 litres. [Take $\pi = 3.14$].
- If turning a tap has the effect of halving the internal radius, how long must water flow to deliver 31.4 litres, assuming the same value of π and the same speed of flow ?

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

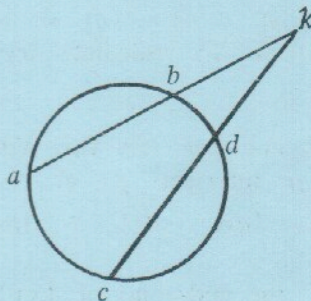
- (ii) In the circle, centre c ,
 $|\angle ycx| = |\angle tcy|$.

Prove $|xy| = |yt|$, where these are chords of the circle.

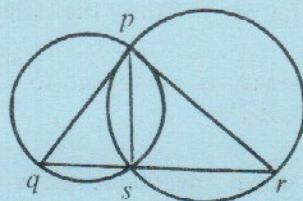


- (iii) If points p and q are 5 cm apart, construct the locus (set of positions) of a point k so that $|\angle pkq| = 60^\circ$.

4. (a) (i) $[ab]$ and $[cd]$ are two chords of a circle. If ab , cd intersect at k , prove
 $|ak| \cdot |kb| = |ck| \cdot |kd|$.



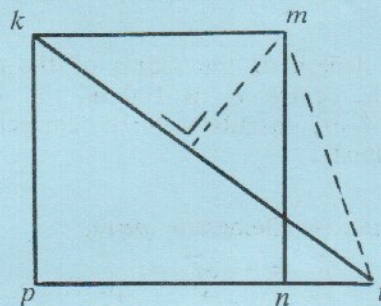
- (ii) In the triangle pqr , $\angle rpq = 90^\circ$ and $ps \perp qr$. Prove
 $|pq|^2 + |pr|^2 = |qr|^2$.



- (b) $kmnp$ is a square of side 6 units.
 $|nt| = 2$.

Calculate

- (i) $|kt|$
- (ii) the area of Δktm
- (iii) the distance of m from kt .



5. K is the line $3x - 2y + 6 = 0$.

- (i) Verify that $(0, 3) \in K$.
- (ii) Find the equation of the line L through $q(3, 1)$ parallel to K .
- (iii) Write down the co-ordinates of the vertices of the parallelogram formed by the four lines: K , L , the Y -axis and the line through q parallel to the Y -axis.
- (iv) Calculate the area of this parallelogram.

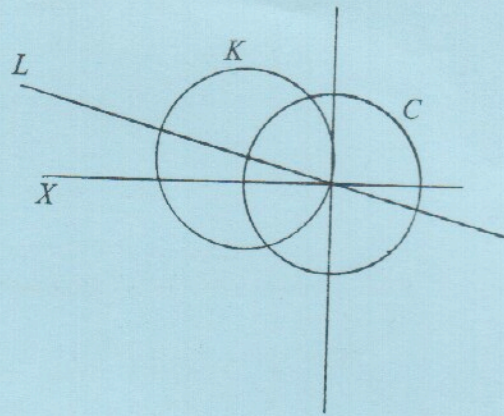
6. (i) Calculate the co-ordinates of the point(s) of intersection of the circle $C : x^2 + y^2 = 50$ and the line $y = 7x + 50$.

(ii) If K is the images of C under the translation $(1, 1) \rightarrow (-6, 2)$ find the equation of K .

If L is the axis of symmetry through the origin of $C \cup K$, write down the equation of the image of K under

$$S_X \circ S_L,$$

where S_X is the axial symmetry in X -axis.

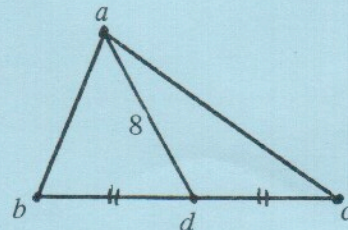


7. (a) If $|bd| = |dc|$ and $|ad| = 8$ (see diagram) also $|\angle abd| = 60^\circ$, $|\angle bda| = 70^\circ$ calculate, correct to the nearest integer

(i) $|bd|$.

Use this answer to find

(ii) $|ac|$.



(b) Fill in the blanks in the table

x	$-\frac{\pi}{2}$	$-\frac{\pi}{4}$	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$
$2x$					
$\sin 2x$					

Draw the graph of $f : x \rightarrow \sin 2x$ in the domain $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$, $x \in \mathbf{R}$.

Show on the graph how to estimate the values of x for which

$$0.3 - \sin 2x = 0$$

in the domain.

8. (a) If $\vec{u} = 6\vec{i} - 8\vec{j}$ and $\vec{v} = \vec{i} + 4\vec{j}$ calculate $|\vec{u}\vec{v}|$.

If $5\vec{i} - 12\vec{j} = m\vec{u} + n\vec{v}$, find the value of m and the value of n , when m and n are scalars.

(b) $opqr$ is a parallelogram, o is the origin. Copy the diagram and show k_1 , where

$$\vec{k}_1 = \frac{1}{3}\vec{r} + \frac{1}{2}\vec{p}.$$

If x divides $[pq]$ in the ratio 2 : 1 (see diagram) and y is the mid-point of $[qr]$, express in terms of \vec{p} and \vec{r}

$$\vec{x}, \vec{y} \text{ and } \vec{xy}.$$

On the diagram, show k_2 , where

$$\vec{k}_2 = \vec{xy}.$$

Express $\vec{k}_1 - \vec{k}_2$ in terms of \vec{p} .

