AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA

JUNIOR CERTIFICATE EXAMINATION, 1998

MATHEMATICS — HIGHER LEVEL — PAPER 2 (300 marks)

FRIDAY, 12 JUNE – MORNING, 9.30 to 12.00

Attempt **QUESTION 1** (100 marks) and **FOUR** other questions (50 marks each).

(i) Find the sum of 50% of 20 and 60% of 30.

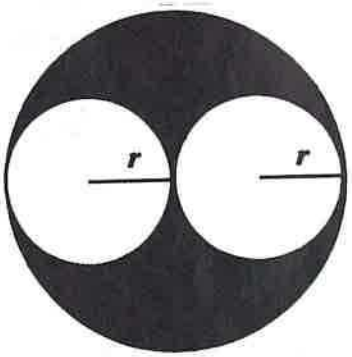
(ii) The measurements of the three angles of a triangle are in the ratio 4 : 5 : 6.
Find, in degrees, the measurement of each of the angles.

(iii) Find the value of $k \in \mathbf{N}$ such that

$$k^2 = (5 + \sqrt{7})^2 + (5 - \sqrt{7})^2.$$

(iv) Two circles, each with radius of length r, fit exactly inside a larger circle, as shown.

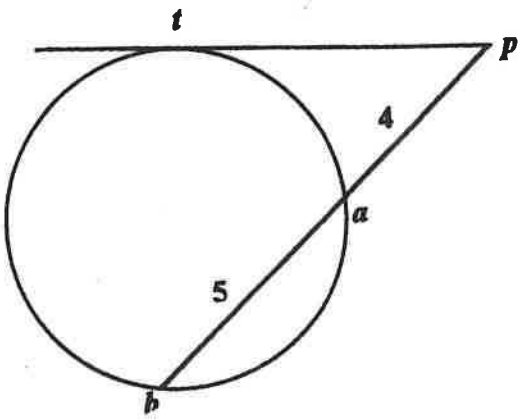
Express the area of the shaded region in terms of r and π.



(v) pt is a tangent to the circle.

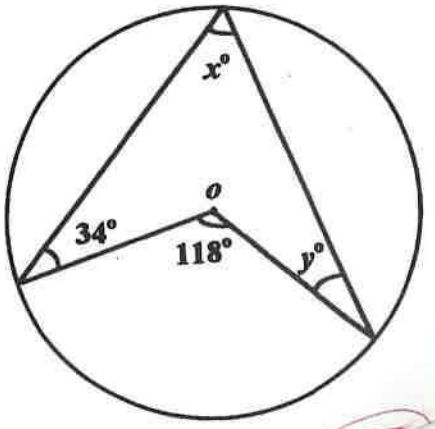
$|\,pa\,| = 4$ and $|\,ab\,| = 5$.

Find $|\,pt\,|$.



(vi) The circle in the diagram has centre o.

Find the value of x and the value of y.

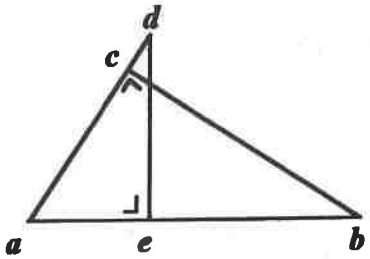


(vii) $de \perp ab$ and $bc \perp ad$.

$|\,de\,| = |\,ac\,| = 4$.

Name two triangles that have angles which are, respectively, equal in measure.

Hence, or otherwise, find the value of $|\,bc\,| \,.\, |\,ae\,|$.



(viii) The equation of a line is $4x + ty - 10 = 0$ where $t \in \mathbf{R}$.

The line contains the point $(-1, 2)$.

Find the value of t.

(ix) The image of the point $(1, 3)$ under the axial symmetry in the line L is the point $(3, 7)$.

Find the equation of L.

(x) Find the area of the triangle abc where $|\angle abc| = 23° 35'$, $|\,ab\,| = 5$ cm and $|\,bc\,| = 8$ cm.

2. (a) At the beginning of each year for three consecutive years a person invested IR£560 at 5% compound interest per annum.

Calculate the total value of the three investments at the end of the third year.

(b) If $\frac{1}{3}(a - 2b) = \frac{1}{4}$, express a in terms of b.

Hence, show that

$$2z + w = -3 \quad \text{if it is given}$$

that

$$z + 3a = 2b \text{ and } w - 2a = 4b.$$

3. Prove that the angles at the base of an isosceles triangle are equal in measure.

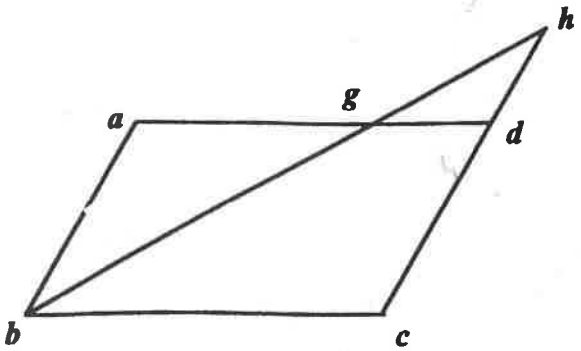
$abcd$ is a parallelogram.
The line bg bisects $\angle abc$.
h is an element of the line cd and of the line bg.

Prove that

(i) $|\,ab\,| = |\,ag\,|$

(ii) $|\,dg\,| = |\,dh\,|$

(iii) $|\,ad\,| = |\,ch\,|$.

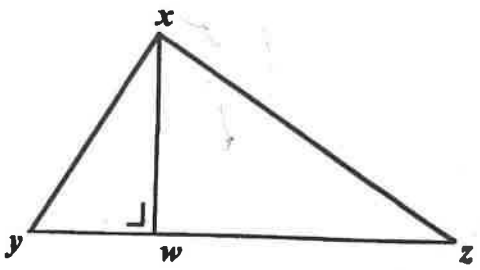


4. Prove that in a right-angled triangle the area of the square on the hypotenuse is the sum of the areas of the squares on the other two sides.

In the triangle xyz, $xw \perp yz$.

Prove that

$|\,xy\,|^2 + |\,wz\,|^2 = |\,yw\,|^2 + |\,xz\,|^2$.



5. L is the line $3x + 2y - 4 = 0$ and K is the line $2x - 3y - 7 = 0$.

(i) Find the coordinates of the point where L crosses the y-axis.

(ii) Find the slope of L.

(iii) Prove that L is perpendicular to K.

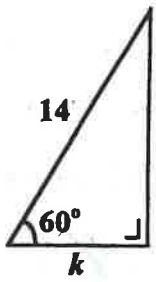
(iv) Find the coordinates of q, the point of intersection of L and K.

(v) Write down the equation of the line through q which is parallel to the x-axis.

(vi) Calculate the area of the triangular region enclosed by L, K and the y-axis.

6. **(a)** Write down the value of cos 60°.

Hence, or otherwise, calculate the value of k in the right-angled triangle shown in the diagram.



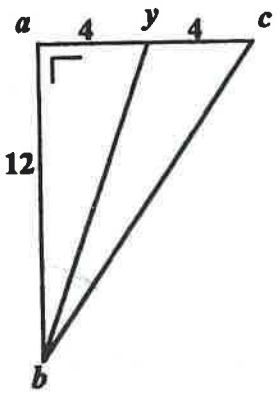
(b) In the right-angled triangle abc,

$|ay| = |yc| = 4$ and $|ab| = 12$.

Calculate, as accurately as the Tables allow,

(i) $|\angle aby|$

(ii) $|\angle ybc|$.



(c) Two lighthouses, p and q, are 73 km apart.

q is directly East of p.

Another lighthouse, r, is situated 52 km from q.

The bearing of r from p is E 31° 20′ N.

Calculate $|pr|$, correct to the nearest kilometre.