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JUNIOR CERTIFICATE EXAMINATION, 2002

MATHEMATICS - HIGHER LEVEL

MONDAY, 10 JUNE - MORNING, 9.30 to 12.00

PAPER 2 (300 marks)

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

WARNING: Marks will be lost if necessary work is not clearly shown.
Mathematics Tables may be obtained from the Superintendent.

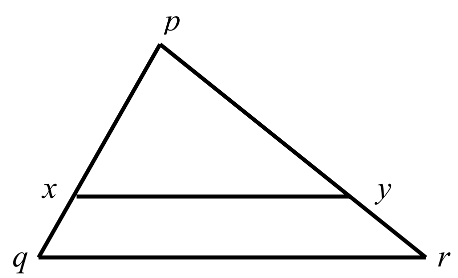
1. **(i)** Calculate $\frac{3}{7}$ of 98 and express your answer as a fraction of 56.
Give your answer in its simplest form.

(ii) €225 is shared among three people in the ratio $1 : \frac{3}{2} : 2$. Calculate the largest share.

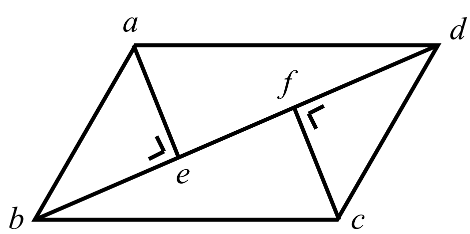
(iii) The height of a cone is twice the radius. The volume of the cone is $\frac{16}{3}\pi$ cm^3.

Calculate the radius.

(iv) In the triangle *pqr*, *xy* is parallel to *qr*.
$|pq| = 14$ cm, $|qr| = 21$ cm and $|xq| = 4$ cm.
Find $|xy|$.



(v) *abcd* is a parallelogram.
ae and *cf* are perpendicular to *bd* as shown.
Prove the triangles *abe* and *dcf* are congruent.

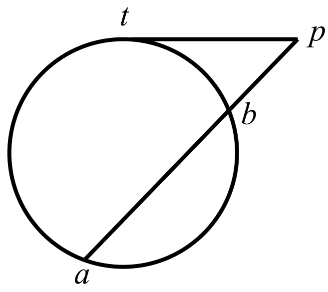


(vi) pt is a tangent to the circle at t.

$|pt| = 8$ cm and $|ab| = 12$ cm.

Find $|pb|$.

[Hint: Let $|pb| = x$.]



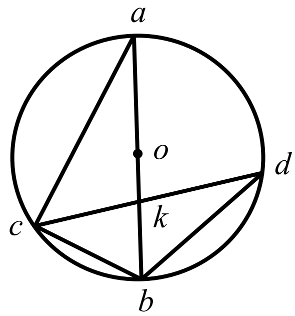
(vii) $[ab]$ is a diameter of the circle of centre o.

c and d are points on the circle.

$[ab]$ and $[cd]$ intersect at k.

$|\angle cdb| = 38°$ and $|\angle ckb| = 80°$.

Write down $|\angle cab|$ and then find $|\angle dcb|$.



(viii) The line $2x - 3y + 12 = 0$ cuts the x-axis at p and the y-axis at q.

Find the coordinates of the midpoint of $[pq]$.

(ix) Verify that the point $(1, -1)$ is on the line $3x + 2y - 1 = 0$.

Find the equation of the image of this line under the translation $(1, -1) \rightarrow (-2, 3)$.

(x) $\sqrt{3}\tan 2A = 1$ where $0° \leq A \leq 90°$. Find A.

2. **(a)** €750 was invested for three years at compound interest.

The rate of interest for each of the first two years was 4% per annum.

(i) Calculate the amount of the investment at the end of the second year.

(ii) At the end of the third year the amount of the investment was €851.76.

Calculate the rate of interest for the third year.

(b) Given that $4xp - 3t = 5p$

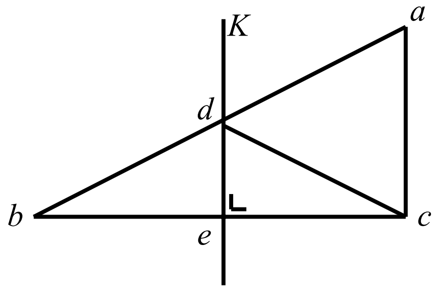
(i) express x in terms of p and t

(ii) find the value of x when $t = \dfrac{2p}{3}$.

3. **(a)** Prove that any point on the perpendicular bisector of a given line segment is equidistant from the end points of the line segment.

(b) In the triangle abc, $ac \perp bc$ and $|\angle abc| = 30°$.

K is the perpendicular bisector of $[bc]$ and K intersects $[ab]$ at d.



(i) Find $|\angle dcb|$.

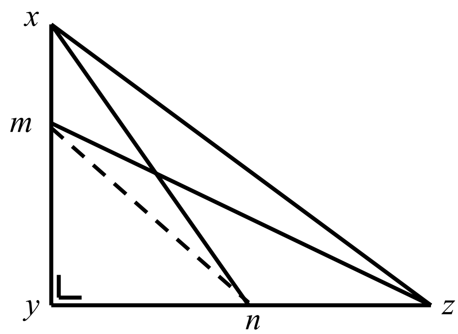
(ii) Prove $|dc| = |da| = |ac|$.

(iii) Find the ratio $\dfrac{\text{area } \Delta\, dbe}{\text{area } \Delta\, abc}$.

4. **(a)** 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.

(b) In the triangle xyz, $|\angle xyz| = 90°$.

m is a point on $[xy]$ and n is a point on $[yz]$.



(i) Prove that

$$|xz|^2 - |mz|^2 = |xy|^2 - |my|^2 .$$

(ii) Deduce that

$$|xz|^2 - |mz|^2 = |xn|^2 - |mn|^2 .$$

5. $a(-1, 4)$, $b(3, 1)$ and $c(2, 0)$ are three points.

(i) Find $|ab|$.

(ii) Find the slope of ab.

(iii) The line L passes through the point c and is perpendicular to ab.

Find the equation of L.

(iv) Calculate the area of the triangle abc.

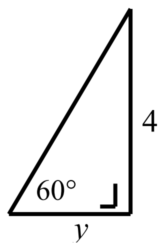
(v) The line L intersects ab in d. Use the area of the triangle abc to find $|cd|$.

6. **(a)** In the triangle shown,

(i) calculate y

(ii) calculate the area of the triangle.

Give both answers in surd form.



(b) In the triangle abc,

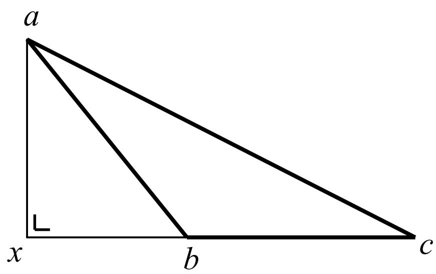
$|\angle acb| = 28°41'$, $|\angle bac| = 23°35'$

and $|bc| = 15$ cm.

(i) Calculate $|ab|$.

(ii) x is on cb such that $ax \perp xb$ as shown.

Calculate $|ax|$, correct to the nearest cm.



(c) x, y, z are points on the circle of centre o.

The radius of the circle is 10 cm.

The triangle xoz is an equilateral triangle.

Find

(i) area of triangle xoz

(ii) area of triangle xyz.