Arithmetic

Question 1 **(25 marks)**

A shopkeeper bought 25 school blazers at €30 each and 25 trousers at €20 each.

(a) Find the total cost to the shopkeeper.

(b) The shopkeeper sells a blazer and a trousers as a set for €89·95. Find her profit on this transaction.

(c) The shopkeeper sells 22 blazer and trouser sets at €89·95 each. She sells the remaining 3 sets at a discount of 20% on the selling price. Find her mark up (profit as a percentage of cost price) on the total transaction.

Complex Numbers

Question 2 **(25 marks)**

Let $z_1 = 5 - i$ and $z_2 = 4 + 3i$, where $i^2 = -1$.

(a) **(i)** Find $z_1 - z_2$.

(ii) Verify that $|z_1 - z_2| = |z_2 - z_1|$.

(iii) Give a reason why $|z - w| = |w - z|$ will always be true, for any complex numbers z and w.

(b) Find a complex number z_3 such that $z_1 = \frac{z_2}{z_3}$.

Give your answer in the form $a + bi$, where $a,\ b \in \mathbb{R}$.

Algebra

Question 3 **(25 marks)**

(a) **(i)** Solve for x:

$$2(4-3x)+12=7x-5(2x-7).$$

(ii) Verify your answer to **(i)** above.

(b) Solve the simultaneous equations:

$$x+y=7$$
$$x^2+y^2=25.$$

Arithmetic

Question 7 **(35 marks)**

(a) Mary bought a new car for €20 000 on the 1st July 2010.
The value of the car depreciated at a compound rate of 15% each year.
Find the value of the car, correct to the nearest euro, on the 1st July 2014.

(b) Mary wishes to buy a new car, which costs €24 000, on the 1st July 2014.

(i) *Buy Right Car Sales* offers Mary €10 500 for her old car. She can borrow the balance for one year at a rate of 11·5%. How much would she repay on 1st July 2015?

(ii) *Bargain Deals Car Sales* offers Mary €10 000 for her old car and an interest free loan of the balance for six months. At the end of the six months Mary would make a payment of €4000 and would be charged interest at a compound rate of 1·5% per month for the next six months. How much would Mary repay on 1st July 2015?

(iii) Which of the above options should Mary choose if she wishes to pay the least amount? Justify your answer by calculation.

Probability

Question 1 **(25 marks)**

A garage has 5 black cars, 9 red cars and 10 silver cars for sale.

(a) A car is selected at random. What is the probability that:

(i) The car is black?

(ii) The car is black or red?

(b) A car is selected at random. Then a second car is selected at random from those remaining. What is the probability that:

(i) The first car is silver and the second car is black?

(ii) One of the selected cars is red and the other is black?

(c) Three of the black cars, two of the red cars and four of the silver cars have diesel engines. One car from the garage is again selected at random. What is the probability that it is a red car or a diesel car?

Probability

Question 2 **(25 marks)**

When taking a penalty kick, the probability that Kevin scores is always $\frac{3}{4}$.

(a) Kevin takes a penalty. What is the probability that he does **not** score?

(b) Kevin takes two penalties. What is the probability that he scores both?

(c) Kevin takes three penalties. What is the probability that he scores exactly twice?

(d) Kevin takes five penalties. What is the probability that he scores for the first time on his fifth penalty?

The Circle

Question 3 **(25 marks)**

(a) **(i)** The circle c has equation $(x+2)^2+(y-3)^2=100$.

Write down the co-ordinates of A, the centre of c. $A(\quad,\quad)$

Write down r, the length of the radius of c. $r=$_____

(ii) Show that the point $P(-8,\ 11)$ is on the circle c.

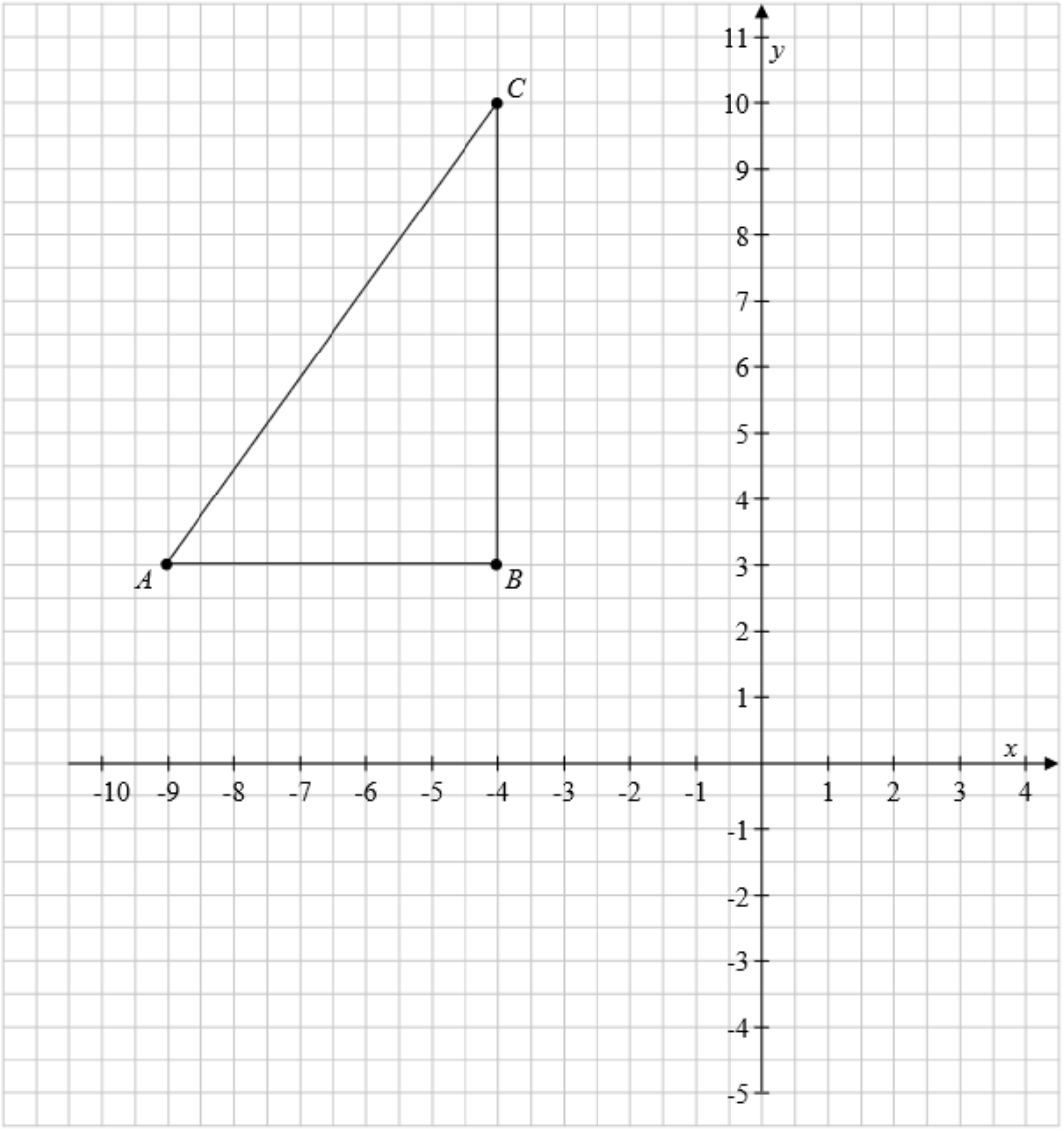
(b) **(i)** Find the slope of the radius $[AP]$.

(ii) Hence, find the equation of t, the tangent to c at P.

(c) A second line k is a tangent to c at the point Q and $k \parallel t$. Find the co-ordinates of Q.

Question 4 **(25 marks)**

The points $A(-9,\ 3)$, $B(-4,\ 3)$ and $C(-4,\ 10)$ are the vertices of the triangle ABC, as shown.



(a) **(i)** Find the length of $[AB]$.

(ii) Find the area of the triangle ABC.

(b) $X(2, -4)$ and $Y(2, 1)$ are two points.

(i) Draw, on the diagram above, a triangle, XYZ, which is congruent to the triangle ABC.

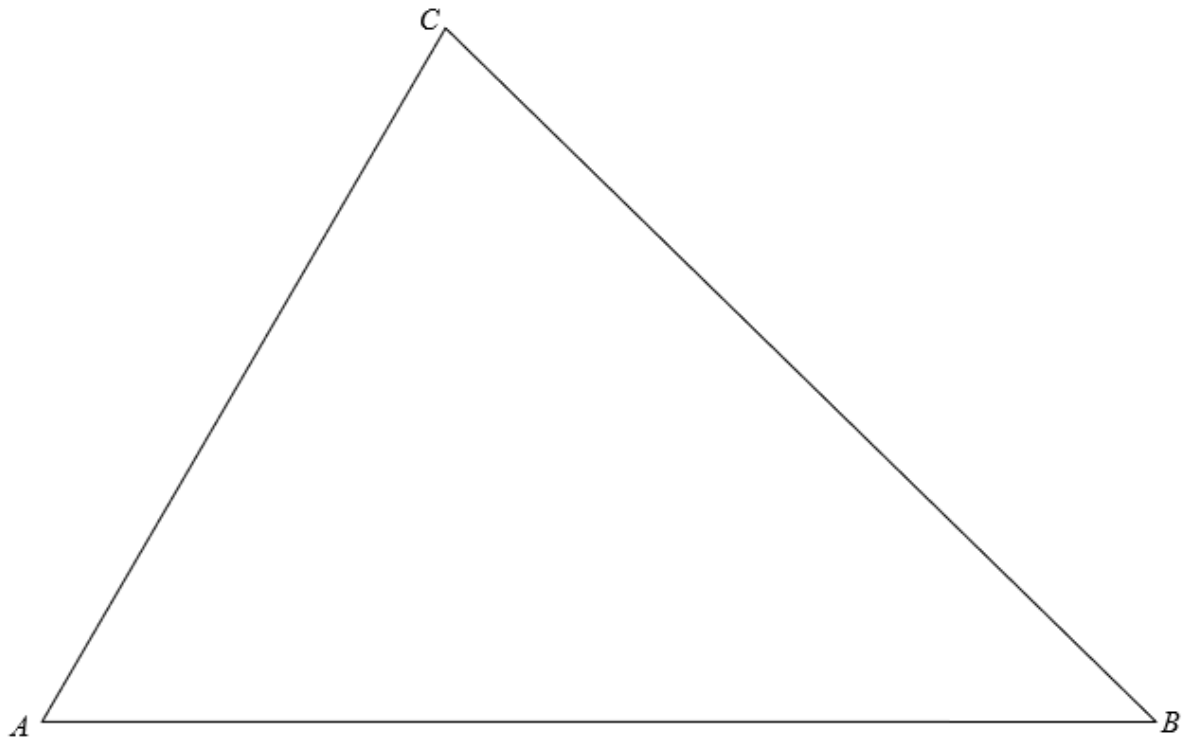
(ii) Write down the co-ordinates of Z and explain why the triangle XYZ is congruent to the triangle ABC.

$Z = (\quad , \quad)$

Reason:

Geometry

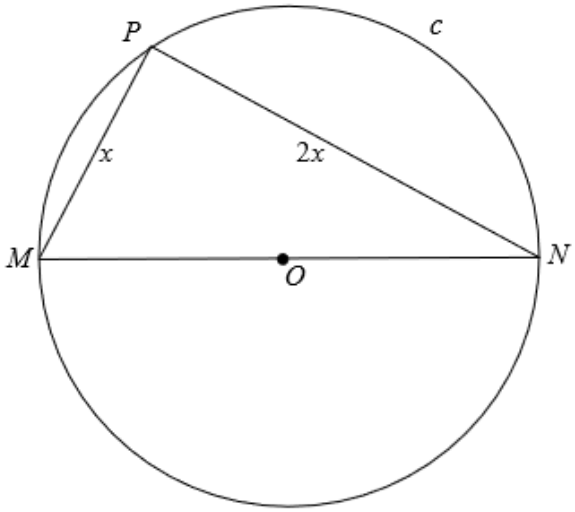
(a) **(i)** Construct the incircle of the triangle ABC below. Show all your construction lines clearly.



(ii) Measure the length of the radius of the circle constructed in part **(i)**.

Length of radius: _____

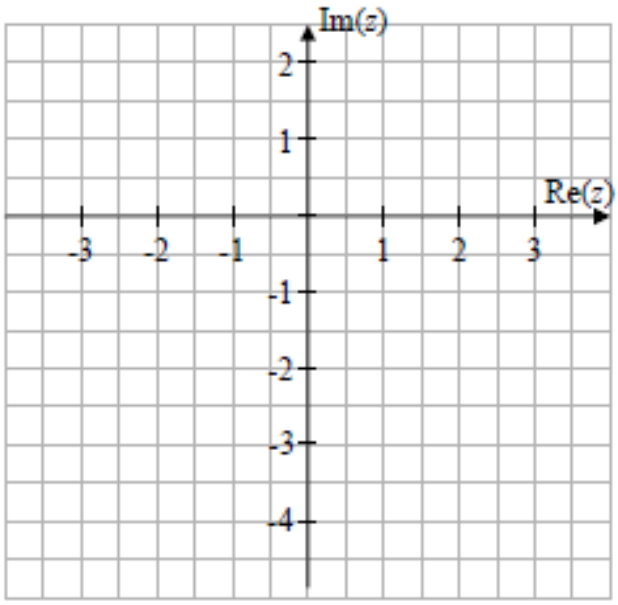
(b) The point P is on the circle c with centre O and diameter $[MN]$, as shown.
The length of the radius of c is $2\sqrt{5}$ cm.
$|MP| = x$ cm and $|PN| = 2x$ cm.
Find the value of x.



Complex Numbers 2013

Let $z_1 = 3 - 4i$ and $z_2 = 1 + 2i$, where $i^2 = -1$.

(a) Plot z_1 and z_2 on the Argand diagram over.



(b) From your diagram, is it possible to say that $|z_1| > |z_2|$?
Give the reason for your answer.

Answer:

Reason:

(c) Verify algebraically that $|z_1| > |z_2|$.

(d) Find $\frac{z_1}{z_2}$ in the form $x + yi$, where $x, y \in \mathbb{R}$.

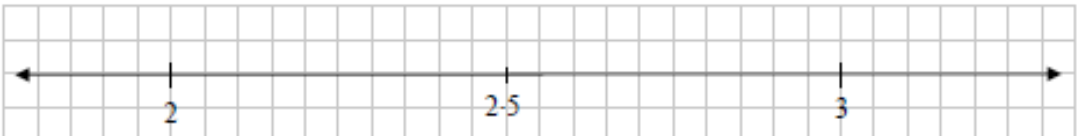
Arithmetic & Algebra 2013 Q3

(a) The mean distance from the earth to the sun is 149 597 871 km. Write this number in the form $a \times 10^n$, where $1 \leq a < 10$ and $n \in \mathbb{Z}$, correct to two significant figures.

(b) **(i)** Write each of the numbers below as a decimal correct to two decimal places.

	A	B	C	D	E	F	G
Number	2·1	$\sqrt{5}$	$\frac{243}{85}$	$\tan 70°$	$\frac{3\pi}{4}$	250%	$\left(1+\frac{1}{10}\right)^{10}$
Decimal Number	2·10						

(ii) Mark 5 of the numbers in the table on the number line below and label each number clearly.



(c) Solve the equation $27^{2x} = 3^{x+10}$.

Q4 Arithmetic 2013

(a) Given that $R = (1 + 0{\cdot}015)^{12}$, find the value of R, correct to 2 decimal places.

(b) Michael has a credit card with a credit limit of €1000. Interest is charged monthly at 1·5% of the amount owed. Michael gets a bill at the end of each month. At the start of January, Michael owes €800 on his credit card. If Michael makes no repayments and no more purchases, show that he will exceed his credit limit after 15 months.

(c) Michael buys an item costing £95 on the internet and pays with his credit card. If the exchange rate is €1 = £0·8473, calculate, correct to the nearest cent, the amount that will be included on Michael's credit card bill.

2013 the Line

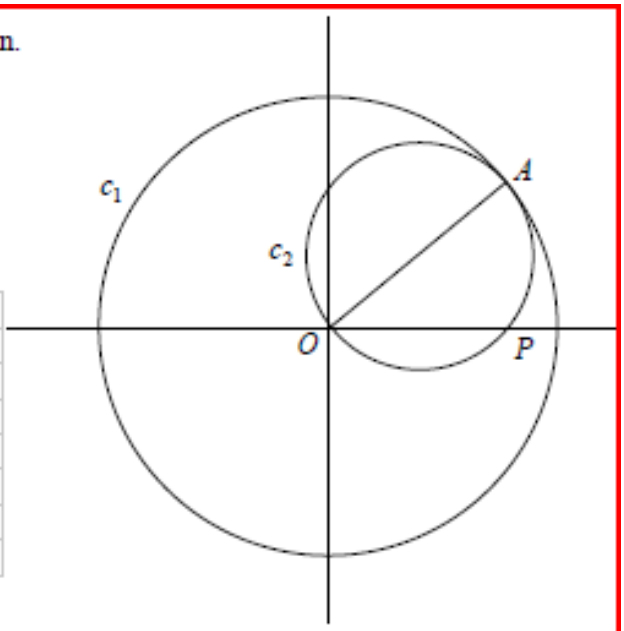
(a) l is the line $3x + 2y + 18 = 0$. Find the slope of l.

(b) The line k is perpendicular to l and cuts the x-axis at the point $(7, 0)$.
Find the equation of k.

(c) Find the co-ordinates of the point of intersection of the lines l and k.

2013 The Circle

The point A has co-ordinates $(8, 6)$ and O is the origin.
The diagram shows two circles c_1 and c_2.
c_1 has centre $(0, 0)$ and radius $|OA|$.
c_2 has a diameter of $[OA]$.



(a) Find the equation of c_1.

(b) Find the equation of c_2.

(c) The circle c_2 cuts the x-axis at the point P. Find the co-ordinates of P.

2013 Geometry Question

(a) Construct the triangle ABC such that $|AB| = 8$ cm, $|BC| = |AC| = 5$ cm. The point A is given to you.

(b) On the same diagram, construct the image of the triangle ABC under the axial symmetry in AB.

(c) Justify the statement "$AC'BC$ is a parallelogram" where C' is the image of C under the axial symmetry in AB.