

PRIMARY QUESTIONS

QUESTION 1

In the following addition, A and B are digits.

$$\begin{array}{r} A \ A \ B \\ + \ B \ A \ 5 \\ \hline 9 \ 5 \ A \end{array}$$

What digits are represented by A and B?

QUESTION 2

Any number can be written as the sum of powers of two.

For example, $18 = 2^4 + 2^1$.

Write 74 as the sum of powers of two.

QUESTION 3

Find, with reasoning, the next number in the patterns below

(a) 2, 5, 7, 12, 19....

(b) 1, 4, 18, 87, 431...

MASA QUESTIONS

QUESTION 4

A mystery number is between 10 and 100.

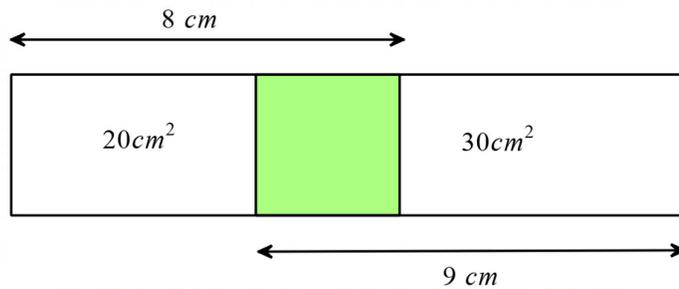
It is equal to four times the sum of its digits.

It is three times the product of its digits.

Find the mystery number.

QUESTION 5

Find the area of the green shape, given the sides are whole numbers.



MASA QUESTIONS

JUNIOR QUESTIONS

QUESTION 1

A **reverse prime** is defined to be a positive integer N such that when the digits of N are read in reverse order, the resulting number is prime.

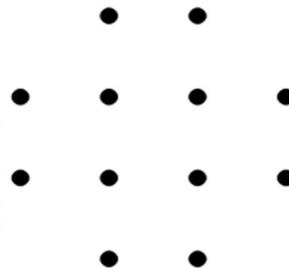
For example, the number 5, 16, 110 are all reverse primes.

Find the largest two-digit integer N for which $4 \times N$ and $5 \times N$ are also reverse primes.

QUESTION 2

12 dots are marked in the grid below.

How many squares can be formed by joining 4 of these points?



QUESTION 3

Fibonacci was preparing for a marathon by running up a set of 15 stairs. He decided to run up a set of stairs in every possible way by going up 1 step at a time, going up 2 steps at a time and using every possible combination of 1 and 2 steps. Fibonacci was born in 1170.

Did the number of ways of climbing 15 stairs match the year of his birth?

(*Hint:* Start with how many ways to climb 1 stair, then 2 stairs etc & look for a pattern)



MASA QUESTIONS

QUESTION 4

A rabbit is 40 leaps ahead of a hound.

The rabbit makes three leaps for every two leaps that the hound makes.

One of the hound's leaps covers as much ground as two of the rabbit's leaps.

How many leaps will the hound take to catch the rabbit?



QUESTION 5

How many 7-digit numbers of the form **A34567B** are divisible by 11 where **A** and **B** represent digits?

(*Hint:* Look up divisibility by 11 pattern)

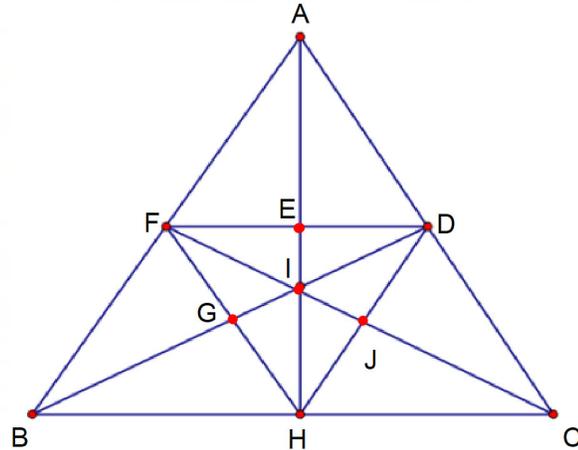
MASA QUESTIONS

INTERMEDIATE QUESTIONS

QUESTION 1

How many triangles are there in the figure below?

(Hint: Name the triangles using the letters on the diagram)



QUESTION 2

Scrooge has collected a very large number of precious gold coins all one centimetre in diameter. He wishes to display as many as he can in a square display case with an area of one square metre.

Calculate the maximum number of coins Scrooge can fit in his display case assuming space between the coins is as small as possible.

QUESTION 3

An 8-digit number is of the form **X384276Y**, where X and Y are digits such that the whole number is divisible by 4, and is divisible by 9.

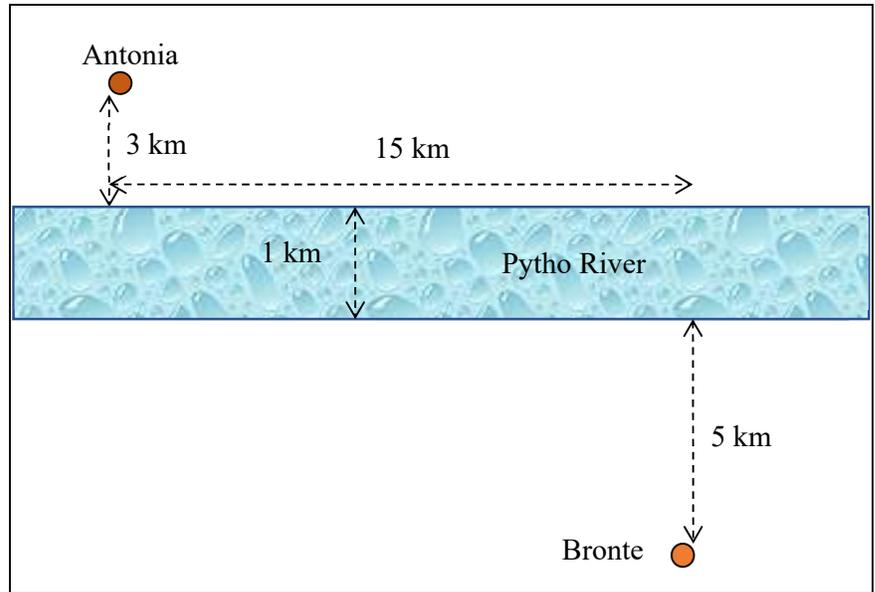
Find all possible values of X and Y.

(Hint: Look up the division by 4 and 9 patterns)

MASA QUESTIONS

QUESTION 4

The river Pytho is exactly one kilometre wide and runs in a true east-west direction. Antonia lives in a house exactly three kilometres to the north of the river Pytho, while Bronte lives in a house exactly five kilometres south of the river, but fifteen kilometres along the river from Antonia, as shown in the diagram below.



Antonia leaves her house and walks to Bronte's house along the shortest possible route which involves crossing the river at right angles to its banks. She can walk wherever she wishes to as the land is perfectly flat for kilometres around the two homes.

How long is Antonia's shortest route?

QUESTION 5

The town of Alpha is 3 kilometres directly north of town Beta and Town Gamma is 4 kilometres directly east of Beta. There are 3 excellent straight roads between all three towns.

The people of town Beta want a new road built which is the shortest possible in length to reach the road between town A and town C.

As the resident mathematician in town B the mayor asks you to calculate the length of road that needs to be built. The mayor wants you to provide *at least* two different sets of calculations to convince him that your calculations are correct.

Show the detailed calculations you would present to the mayor.

(Hint: One possibility is to consider the area of the triangle connecting Alpha, Beta and Gamma)

MASA QUESTIONS

SENIOR QUESTIONS

QUESTION 1

In the multiplication L, M and N represent different digits.

$$\begin{array}{r} \\ \\ \times \\ \hline N \\ \hline \end{array}$$

What are the values of L, M and N?

QUESTION 2 (Challenge)

The town of Alpha is 3 kilometres directly north of town Beta and Town Gamma is 4 kilometres directly east of Beta. There are 3 excellent straight roads between all three towns.

The people of town Beta want a new road built which is the shortest possible in length to reach the road between town A and town C.

As the resident mathematician in town B the mayor asks you to calculate the length of road that needs to be built. The mayor wants you to provide *at least* two different sets of calculations to convince him that your calculations are correct.

Show the detailed calculations you would present to the mayor.

(Hint: One possibility is to consider the area of the triangle connecting Alpha, Beta and Gamma)

QUESTION 3

Gabrielle has \$300 in her purse made up of 5, 10, 20 and 50 dollar notes.

Angela decides to surprise Gabrielle by changing each note to the next higher note.

So \$5 notes are replaced by \$10 notes, \$10 notes are replaced by \$20 notes, \$20 notes are replaced by \$50 notes and \$50 notes are replaced by \$100 notes.

Gabrielle finds she now has \$650 in her purse. Of this \$650, what is the value of the \$20 notes in Gabrielle's purse?

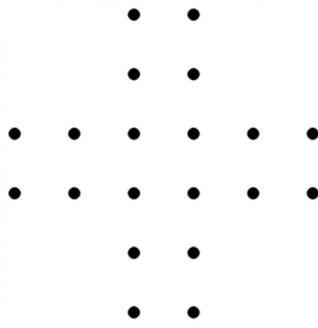
(Hint: Let a = number of \$5 notes etc and use these to set up a pair of equations from the information above)

MASA QUESTIONS

QUESTION 4

Four pegs have been removed from each corner of a 5 by 5 geoboard (6 pegs on each side), leaving a board with 20 pegs.

How many squares can be formed on this new geoboard?



QUESTION 5

In the figure at right, two lines l_1 and line l_2 intersect at the point $(2, 6)$.

Line l_1 has slope of $\frac{9}{4}$ and line l_2

has slope $-\frac{1}{3}$.

Calculate the distance between the x intercepts of lines l_1 and l_2 showing all working.

