SAMPLE QUESTIONS

Junior Division Years 7 & 8

Question 1 J
Each of my three uncles owns some goats. They have different numbers of goats, each 3 or more, and multiplying the three numbers together gives the product 108.
What is the total number of goats?

Question 2 J
My watch loses time steadily at the rate of 96 minutes every day. If it shows the correct time at 2am, what is the correct time when the watch shows 4pm on the same day?

Question 3 J
Joe had a number of jellybeans. Half of them were red, one third of them were blue and the rest were green. Amanda took one third of the red ones and half of the green ones, then Cassandra took half of the remaining red ones and a quarter of the blue ones. Exactly 54 jellybeans remained in total. How many were there originally?

Question 4 J
Mr Smith asked Mr Brown how many children he had. "Two" was the reply. When asked if at least one of them was a girl, the answer was "Yes". What are the chances (i.e. what is the probability) that they are both girls?

Question 5 J
How many different numbers can you write using four 2's in a tower $2^{2^{2^{2}}}$ by using parentheses, such as $\left(2^{2}\right)^{\left(2^{2}\right)}$ and $2^{\left(\left(2^{2}\right)^{2}\right)}$?

SAMPLE QUESTIONS

Intermediate Division Years 9 & 10

Question 1 I

The operation " Δ *" is defined by* $a \,\Delta\, b = 1 - \frac{a}{b}, b \neq 0.$

What is the value of $(1 \,\Delta\, 2)\,\Delta\,(3 \,\Delta\, 4)$?

Question 2 I

Consider the sequence -7, 14, -21, 28, -35, 42, -49, 56, …. If the sum of the first n terms of this sequence is 140, determine n.

Question 3 I

How many positive five-digit integers have the property that the product of their digits is 2000?

Question 4 I

Intermediate Years 9 & 10

Solve the equation

$$4\left(16^{\sin^2(x)}\right) = 2^{6\sin(x)}, \quad \text{for } 0 \leq x \leq 2\pi.$$

Question 5 I

In triangle ABC, the points D, E and F are on sides BC, CA and AB respectively, such that $\angle AFE = \angle BFD$, $\angle BDF = \angle CDE$, and $\angle CED = \angle AEF$. Show that:

(a) $\angle BDF = \angle BAC$.

(b) If AB = 5, BC =8 and CA = 7, determine the length of BD.

SAMPLE QUESTIONS

Senior Division Years 11 & 12

Question 1 S
The symbol $n!$ means the product $n\times(n-1)\times(n-2)\times\ldots\times 2\times 1$.

For example, $5!=5\times 4\times 3\times 2\times 1=120$. Find n such that $n!=2^{15}\times 3^{6}\times 5^{3}\times 7^{2}\times 11\times 13$.

Question 2 S
The symbol $\lfloor x\rfloor$ means the greatest integer less than or equal to x. Thus $\lfloor 5.7\rfloor=\lfloor 5.3\rfloor=\lfloor 5\rfloor=5$. Calculate the sum

$$\lfloor\sqrt{1}\rfloor+\lfloor\sqrt{2}\rfloor+\lfloor\sqrt{5}\rfloor+\ldots+\lfloor\sqrt{48}\rfloor+\lfloor\sqrt{49}\rfloor+\lfloor\sqrt{50}\rfloor.$$

Question 3 S
The sequence of numbers $\ldots, a_{-3}, a_{-2}, a_{-1}, a_0, a_1, a_2, a_3, \ldots$ is defined by $a_n-(n+1)a_{2-n}=(n+3)^2$, for all integers n. Calculate a_0.

Question 4 S
The triangle ΔABC is equilateral and the radius of its inscribed circle is 1. The line DE is drawn through C, parallel to AB, such that $AEDB$ is a rectangle. A circle is drawn through the four vertices of the rectangle. What is its radius?

Question 5 S
The octagon $P_1\,P_2\,P_3\,P_4\,P_5\,P_6\,P_7\,P_8$ is inscribed in a circle, with the vertices around the circumference in the given order. Given that the polygon $P_1\,P_3\,P_5\,P_7$ is a square of area 5 and the polygon $P_2\,P_4\,P_6\,P_8$ is a rectangle of area 4, find the maximum possible area of the octagon.