##  <br> Level in igeebia

At the Olympic Games 40 years ago, the average number of competitors per sport was 5 times the number of sports played.
In 2004 there were 10 more sports than there were 40 years ago.
1.

In 2004 the average number of competitors per sport was 3.5 times greater than 40 years ago.
At the 2004 Olympic Games there were 10500 competitors.
Write at least ONE equation to model this situation.
Use the model to find the number of sports played at the Olympic Games 40 years ago.
Show all your working.

One integer is 5 more than twice another integer.
The squares of these two integers have a difference of 312 .
Write at least ONE equation to describe this situation, and use it to find the TWO integers.
Show all your working.


James is five years old now and Emma is four years older.
Form a relevant equation and use it to find out how many years it will take until James's and Emma's ages in years, multiplied together, make 725 years.
Show all your working.

Alison is using hexagonal tiles to make patterns.

## Pattern 1



Pattern 2


Alison has 461 hexagonal tiles.

Pattern 3


She wants to use all of the tiles to make a pattern like those in the diagrams above.
Write an equation to show the relationship between the pattern number, $n$, and the number of tiles used, $T$.
Solve this equation to find the pattern number that would have 461 tiles.
You must: write an equation,
solve the equation, write down the pattern number with 461 tiles.

Sheffield school uses two vans to take a group of students on a field trip.

- If two students moved from van $A$ to van $B$, then the two vans would have the same number of students in each.
- If, instead, two students moved from van $B$ to van $A$, then van $B$ would have half the number of students that were then in van $A$.
Use this information to find the total number of students on the field trip.
You must give at least one equation that you use in solving the problem.


The diagram shows a square of side length $c$ inside another square of side length $a+$ b.

The area of the large square can be written as $(a+b) 2$ or $c 2+2 a b$ (the area of the small square plus the four triangles).
Use this information to prove Pythagoras' theorem for a right-angled triangle.
(2009)

Peg makes a patchwork rug by sewing small equilateral triangles together to form a pattern. Her pattern uses rows of equilateral triangles, as shown in the diagram.


There are $n$ rows of equilateral triangle patches to make up the pattern.
Write an expression to find $P$, the total number of equilateral triangles used to make the pattern in terms of $n$, the number of rows and then calculate the number of rows in Peg's pattern when she has used a total of 323 equilateral triangles.

George cuts $x$ metres off the 8 m rope and then makes the circumferences of TWO circles, one from each piece of rope.
Write an expression for the sum of the areas of the two circles in its simplest form.

Mathsville School has two square playing fields.
One playing field is 12 metres wider than the other.
The total area of the two playing fields is 584 square metres.
Form and solve at least one equation to find the width of both the playing fields.
(2010)

## 風以 Ma

$10500=(x+10) \times 3.5 \times 5 x$
$0=x^{2}+10 x-600$
$(x+30)(x-20)=0$
$x=20,-30$
Number of sports $=20$

$$
\begin{align*}
& (2 x+5)^{2}-x^{2}=312 \\
& 4 x^{2}+20 x+25-x^{2}=312 \\
& 3 x^{2}+20 x-287=0 \\
& (3 x+41)(x-7)=0 \\
& x=-\frac{41}{3} \text { or } x=7 \tag{2.}
\end{align*}
$$

Since $x$ is an integer, the numbers involved are:
7 and 19

$(x+5)(x+9)=725$
$x^{2}+14 x+45=725$
$x^{2}+14 x-680=0$
$(x+34)(x-20)=0$
$x=-34,20$
Since $x$ has to be positive, the number of years is 20

## OR

If $J$ is James age
$J(J+4)=725$
$J^{2}+4 J=725$
$J^{2}+4 J-725=0$
$(J+29)(J-25)=0$ $J=-29,25$
Since $J$ has to be positive, James will be 25 hence the number of years is 20

## OR

If $J$ is James \& E is
Emma's age, solve sim eq $\mathrm{J} \times \mathrm{E}=725$ and $\mathrm{E}=\mathrm{J}+4$

Let $x$ be number of students in first van.
Let $y$ be number of students in second van.

$$
x-2=y+2
$$

$y-2=\frac{1}{2}(x+2)$
$x=14, y=10$
Total number of students is 24.

Using the area of the large square

$$
\begin{aligned}
& (a+b)^{2}=c^{2}+2 a b \\
& a^{2}+2 a b+b^{2}=c^{2}+2 a b \\
& a^{2}+b^{2}=c^{2}
\end{aligned}
$$

6. 

$$
n^{2}+2 n=323 \text { or }
$$

$$
n(n+2)=323
$$

$n=17$ rows of patchwork.

$$
n=17 \text { rows of patchwork. }
$$

Circumference $1=x$
Circumference $2=8-x$
Total area $=$

$$
\begin{gathered}
\frac{x^{2}+(8-x)^{2}}{4 \pi} \text { or } \frac{2 x^{2}-16 x+64}{4 \pi} \\
\text { or } \frac{x^{2}-8 x+32}{2 \pi}
\end{gathered}
$$

$$
\text { and area }=\frac{(8-x)^{2}}{4 \pi}
$$

$$
\text { and area }=\frac{x^{2}}{4 \pi}
$$

OR circumference 2-8-x

$$
\begin{aligned}
& x^{2}+(x-12)^{2}=584 \\
& x^{2}-12 x-220=0 \\
& (x+10)(x-22)=0 \\
& x=-10 \text { or } 22 \\
& \text { OR } \\
& x^{2}+(x+12)^{2}=584 \\
& x^{2}+12 x-220=0 \\
& (x-10)(x+22)=0 \\
& x=10 \text { or }-22
\end{aligned}
$$

Must show the elimination of the negative solution, so width of one is 22 m and the other 10 m .
OR
The width of one is 10 m and the other 22 m .
(2)
$\square$

