Question 1 **10 marks**

The first two numbers in a sequence are 3 and 5. Each following number is equal to the product of the previous two numbers. What is the last digit of the 2013th number in the sequence?

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Question 2 **10 marks**

Assuming that you want the cheapest price, would you rather:

(a) 20% off $1200,

(b) 10% off $1050, or

(c) 75% off $1300?

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Question 3 **10 marks**

How many ways are there to place three (indistinguishable) pawns on a mini 4×4 chess board so that they are all on the same row or all on the same column?

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Question 4 **10 marks**

Blub is a fish in a lake. He swims 30m on the first day. On each day he swims twice as far as he did on the previous day. How far does he swim in a week?

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Question 5 **CHANGE RUNNER NOW** **10 marks**

A circle has the same area in cm^2 as it has circumference in cm. What is the circle's radius?

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Question 6 **10 marks**

Matt is somewhat rich as he has \$100 worth of \$1 coins. He places them all on a table with tails facing up. Each "move" he has to to flip exactly three over. What is the least moves it will take him before all the coins are heads up?

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Question 7 **10 marks**

Put the numbers 1, 3, 5 and 8 into the boxes in some order so that the equation below holds:

$$(\square - \square) \times \square + \square = 35$$

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The product of Josh and Han's age is 475. If they are both less than 30 years of age, how old are they?

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What is the smallest positive integer divisible by all the integers from 1 to 10 inclusive?

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Question 10 **CHANGE RUNNER NOW** **10 marks**

There are five colours in the game Magic the Gathering. The colour type of a creature can be

- one colour; or
- a mixture of multiple colours (mixing up to 5); or
- no colour.

How many possible colour types are there?

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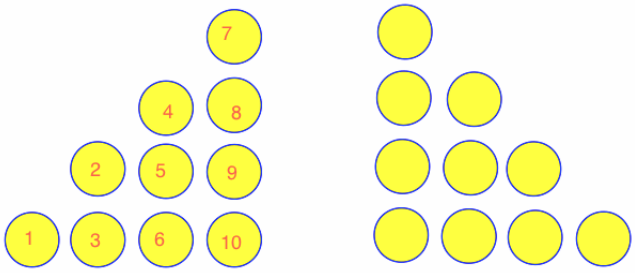
How many possible colour types are there?

Question 11 **20 marks**

To change the diagram on the left hand side to the diagram on the right hand side, one only has to move three counters. What is the sum of their numbers?



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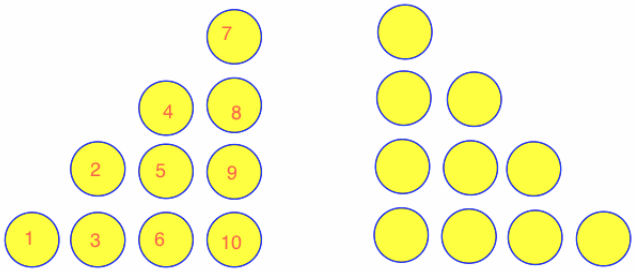

Question 12 **20 marks**

Friar Tuck likes making stained glass windows. He's not very talented so he only uses square pieces of glass of dimension 10cm×10cm. His windows are not necessarily rectangular. He uses A-lead for joining two pieces of glass by their side, and uses B-lead to put around the outside edge of the window. In his "masterpiece" design Friar Tuck uses 16m of A-lead and 12m of B-lead. What is the area of glass used in his masterpiece?

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Question 13 **20 marks**

Thomas and Percy are trains which are travelling along parallel tracks in the same direction, with Percy's front end starting behind Thomas' back end. Thomas is 100m long and travelling at 20 m/s while Percy is only 50m long and travelling at 25 m/s. For how many seconds is some part of Percy alongside some part of Thomas?

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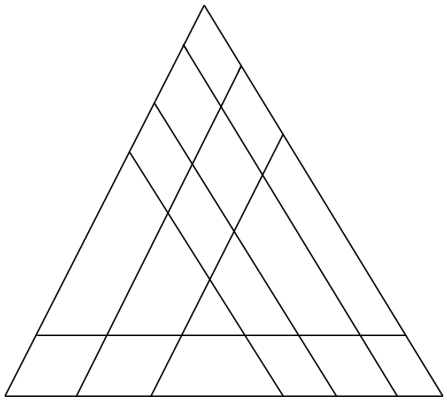
Question 14 **20 marks**

How many parallelograms are in the following diagram?



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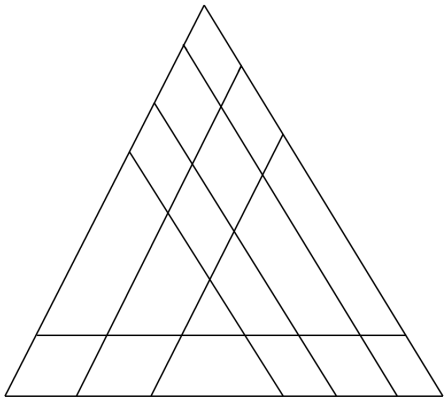
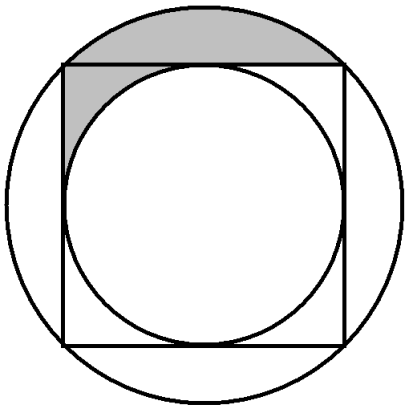


Question 15 **CHANGE RUNNER NOW** **20 marks**

A circle of radius 1 is inside a square which is inside another circle, as shown. What is the area of the shaded region?



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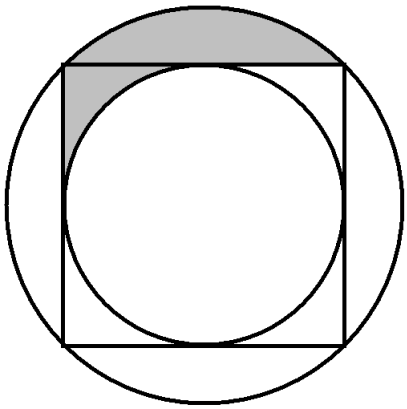

Question 16 **20 marks**

Tiane has spilled a packet of jelly beans in the bottom of her pocket. She knows that there are 4 different flavours and there are four of each. She pulls three out of her pocket to eat. What's the probability she will get at least two of the same flavour?

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Question 17 **20 marks**

In the (incomplete) table below, the numbers in all rows and all columns multiply to give the same number. What is that number?

		15
21	5	
10	33	

Note: All numbers in the table must be positive integers.

Question 17 **20 marks**

In the (incomplete) table below, the numbers in all rows and all columns multiply to give the same number. What is that number?

		15
21	5	
10	33	

Note: All numbers in the table must be positive integers.

Question 18 **20 marks**

Jenny is thinking of a number. All of the digits of Jenny's number are different primes and their product divides the number itself. What is the largest possible value of Jenny's number?

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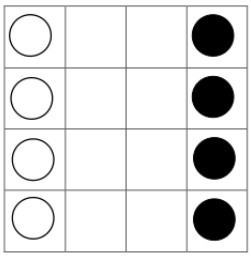
Question 19 **20 marks**

Here are some bishops on a baby chess board. They can move diagonally without jumping over each other or landing on other pieces. What is the minimum number of moves it takes to swap the positions of the black and white pieces?



Note: one move can be of any length so long as the piece does not change direction or violate the other rules.

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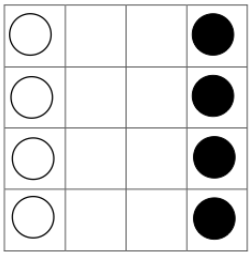

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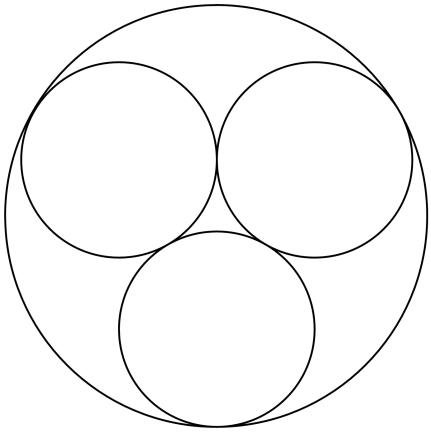
Question 20 **CHANGE RUNNER NOW** **20 marks**

In the diagram below, the three smaller circles each have radius 1. What is the radius of the larger circle?



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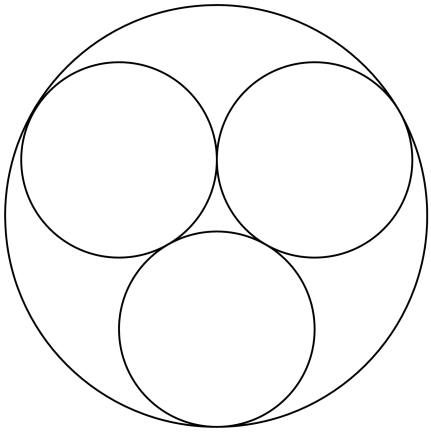

Question 21 **30 marks**

An inebriated Jeff is standing on the end of a pier. He needs to take ten steps to get back to land. Unfortunately, for every step he travels forward, he stumbles one step randomly either left or right. If he is displaced two steps in either direction, he falls into the water. What is the probability he will return to land safely?

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Question 22 **30 marks**

Andrew has a $10 \times 10 \times 10$ cube made up of little $1 \times 1 \times 1$ cubes. He removes a $2 \times 2 \times 2$ cube from each of the corners then paints the outside of the solid he has left. How many of the $1 \times 1 \times 1$ cubes have had at least one face painted?

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In how many ways can the squares of a 4×4 board be coloured black and white such that each of the 2×2 squares on the board contains an odd number of black squares?

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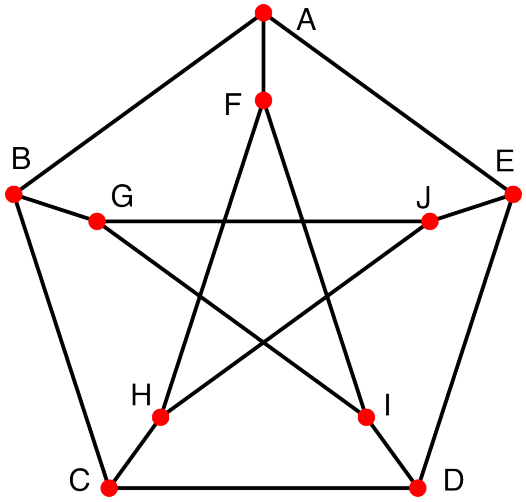
Question 24 **30 marks**

Dougal wants to relabel the dots A, B, C, D, E, F, G, H, I and J in the diagram below so that any two labels which are joined by a straight line before relabelling are joined after relabelling as well. In how many ways can this be done, including keeping the original labelling?



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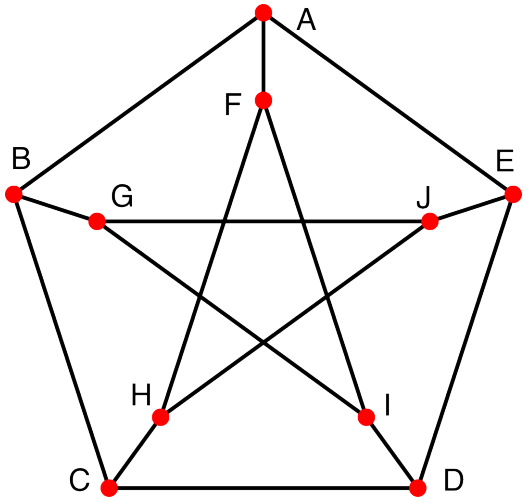

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How many numbers between 1 and 1000 can be written as the sum of three square numbers? (The square numbers are $0, 1, 4, 9, \ldots$)

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