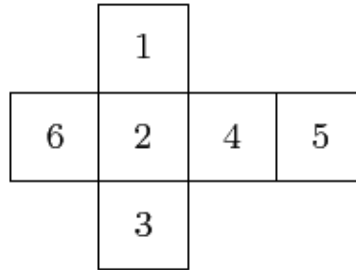


Question 1

10 marks

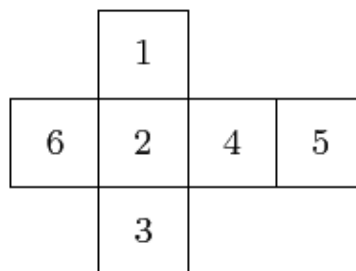
The following figure may be folded along the lines shown to form a number cube. What is the largest sum of three numbers whose faces come together at a corner?



Question 1

10 marks

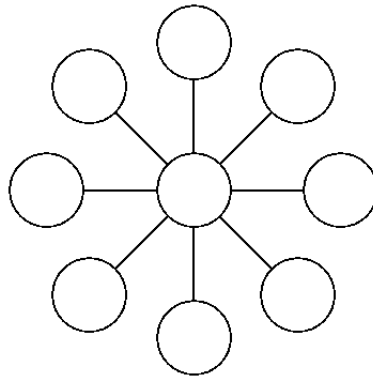
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Question 2

10 marks

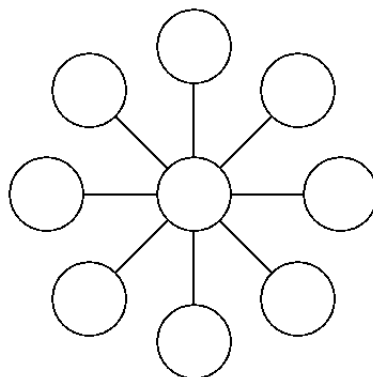
One rainy afternoon, Adib arranged the numbers 1, 4, 5, 7, 8, 9, 10, 11, 14 into the circles shown, so that every line added up to the same value. What number was in the middle?



Question 2

10 marks

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Question 3**10 marks**

Walking through the University of Melbourne during Open Day, the seven dwarves stumble upon a \$10 note. They decide to put the money to good use and buy themselves seven decaf soy lattes. There is a short wait while the barista works her magic. When the coffees arrive the dwarves pay using the note and receive one coin in change. Since the coffees are so excellently brewed, they leave their one coin as a tip. What is the price of a decaf soy latte?

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Question 4**10 marks**

If it takes Tim two minutes to transcribe three trick questions, and it takes Tom three minutes to transcribe two trick questions, then if the two (that's Tim and Tom) tried transcribing thirteen trick questions, how long would it take them?

Question 4**10 marks**

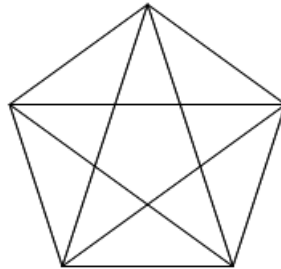
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Question 5

CHANGE RUNNER NOW

10 marks

How many triangles are there in the following diagram:

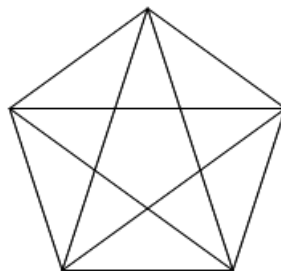


Question 5

CHANGE RUNNER NOW

10 marks

How many triangles are there in the following diagram:



Question 6**10 marks**

If n points are placed at random inside a unit cube, what is the lowest n guaranteeing that two of these points are no more than $\frac{\sqrt{3}}{2}$ apart?

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Question 7

10 marks

Evaluate $2009 - 2008 + 2007 - 2006 + \dots + 3 - 2 + 1$.

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Question 8

10 marks

In how many ways can you arrange the letters of the word MATHS so that the letter M is always before (but not necessarily adjacent to) the letter S?

Question 8

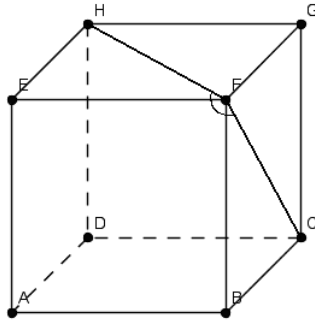
10 marks

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Question 9

10 marks

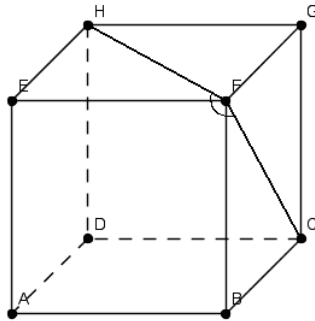
If ABCDEFGH is a cube, find the angle $\angle CFH$.



Question 9

10 marks

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Question 10

CHANGE RUNNER NOW

10 marks

What is the largest number such that if you add 36 to the number written backwards, you get the original number back?

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CHANGE RUNNER NOW

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Question 11

20 marks

For not doing enough math problems, Han's teacher punishes him by making him write the Roman numerals up to 100: I II III IV V VI VII VIII IX X ... XCVII XCVIII XCIX C

How many times does he write the letter X?

Question 11

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Question 12

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There exists two 2-digit numbers such that the difference between their sum and their product is 2009. What is the larger 2-digit number?

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Question 13**20 marks**

People from a small island with 3000 inhabitants all get married exactly once in their life, and all to another inhabitant of the island. If each wedding has exactly 68 guests at it, in how many weddings will the average inhabitant participate in their lifetime?

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Question 14**20 marks**

Han stands at $(-2, 0)$ on a plane. Han's cake sits at $(2, 0)$ on the plane. Centred at $(0, 0)$ there is an impenetrable circle of radius 1. If Han is starving and infinitesimally thin, how far must he walk to reach his cake?

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Question 15

CHANGE RUNNER NOW

20 marks

A restaurant offers 10% off the price of a bill that costs at least 10 dollars, 20% off the price of a bill that costs at least 20 dollars, and so on. Everything on the menu costs an integer number of dollars. What is the most you will pay?

Question 15

CHANGE RUNNER NOW

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Question 16

20 marks

Imagine the digit 7 has been banned from use. So the “seventh number” is written using the symbol 8. How would the “two-thousand-and-ninth number” be written?

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Question 17**20 marks**

$x = \pm 1 \pm 2 \pm 3 \pm 4 \pm 5 \pm 6 \pm 7 \pm 8 \pm 9 \pm 10$. How many possible values can x take?

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Question 18

20 marks

A box contains 3 black balls, 3 red balls, and 3 yellow balls. Three of these are selected at random. What is the probability that they are all different colours?

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Question 19

20 marks

An equilateral triangle has vertices at $(0, 0)$, $(a, 5)$ and $(b, 13)$. Find the area of the triangle.

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Question 20

CHANGE RUNNER NOW

20 marks

How many integers between 1 and 2009 inclusive can be written as the difference of two positive squares?

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Question 21**30 marks**

Julia asks Lu to think of a 3-digit number (abc) where a , b , and c represent digits in base 10 in the order indicated. Julia then asks Lu to form the numbers (acb) , (bca) , (bac) , (cab) , and (cba) , to add these five numbers, and to reveal their sum, N . Lu tells Julia that $N = 2609$. Play the role of Julia and determine the original 3-digit number (abc) .

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Question 22**30 marks**

A security door keycode consists of 3 digits (0 to 9). The keys have no memory, so that pressing 4705 will unlock a door with code 705. However, you do know for certain that the three-digit code does not begin with a 5. What is the minimum number of keys you have to press in order to be assured of cracking the code?

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Question 23**30 marks**

Yi, Han and Sam have a snowball fight, whereby anyone hit in the face is knocked out, and the last man standing wins. Yi targets Han if he's still standing, and otherwise targets Sam. Han targets Sam if he's still standing, and otherwise targets Yi. Sam targets Yi if he's still standing, and otherwise targets Han. They take turns launching snowballs in the order Yi, Han, Sam (skipping anyone knocked out). If each has 50% chance of a critical hit with any snowball, what's the probability that Yi wins?

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Question 24**30 marks**

Chris has a triangle with side lengths 26, 28, 30. He draws lines connecting the midpoints of each side. If he then folds these lines and connects the vertices to form a tetrahedron, what is the volume of this tetrahedron?

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Question 25

30 marks

Find a 9-digit number, made up of only the digits 2 and 9, that leaves a remainder of 29 when divided by 2^9 .

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