## Photomath18



1 - A DROPLET. The most outstanding mathematical aspect of this photo is that the circle on the leaf is extremely detailed which gives you the magnifying experience of this picture. You can see that the lines of the leaf are also very clear. The lines are mathematically layed out because between the natural lines of a leaf there are all types of angles, big and small. The droplet which is the focus point of the picture, grasps everything together like a magnifying glass, which makes you think about the smaller picture in life as well as the big picture. The bright green color of the leaf also gives this image a fresh look and highlights the elegant lines which make you think about a roadmap.



2 - A PIECE OF HISTORY. Ever wondered where math came from? Well it's been with us from the very beginning of the universe: from the spiraled Milky Way to the very plants on the earth. This photo is a fossil that represents the most know mathematical aspect of nature: The Golden spiral with the Fibonacci numbers. In geometry, a golden spiral is a logarithmic spiral whose growth factor is  $\varphi$  (phi), the golden ratio. A golden spiral gets wider (or further from its origin) by a factor of  $\varphi$  for every quarter turn it makes. The nature created this spiral to optimize the space but also to be efficient and she used it the most in the creation of plants. So, everywhere we look, we will see a little bit of math even if we don't want to.



3 - Cuando fotografié este atardecer en la Albufera de Valencia me vino a la mente la imagen de un ábaco formado por las pequeñas boyas de las redes. El ábaco es un instrumento que sirve para efectuar operaciones matemáticas aritméticas sencillas.



4 - ALLURE. What makes something 'beautiful'? Aestheticians have pondered over the boundless paths that this question leads us to for hundreds of years. I took this photo one morning after a sudden realisation of the 'beauty' of this array of Renaissance-style houses. It then struck me that I did not know what drew me to feel a sense of charm and attraction towards the houses. It could be the different shade of colour each house is, the stair shaped rooftops or the fact that all the houses have several long windows. It could even be the that the second house from the left has broken windows and a hole in the roof. I think that this theme relates to mathematics because many architects, artists and possibly even writers would consider whenever they make their art. The details like length and precision mean nothing if you fo not know what you find beautiful.



 ${\it 5-Explanation\ of\ the\ mathematical\ content:\ In\ the\ photo,\ we\ can\ see\ that\ Emma's\ leg\ is\ positioned\ at\ different\ angles.}$ 



6 - BEING BACK HOME FOR CHRISTMASOne of the mathematical aspects of this photo is a shape. Different types of shapes convey different messages. Regular shapes (such as circles), convey a sense of order and stability. The photo of this candle gives me the feeling of home, stability and peace. The repeated pattern of a shadow around the candle (another mathematical aspect of this photo) plunges me into the meditating state, that brings even more peace and tranquility.



7 - The main lines converge towards the image's centre. Its focusing point is not found in the foreground; it is more towards the centre – again, enhancing the 'drawn towards the centre' effect. The benches under the trees break up the lines, creating a more interesting look. In the natural world, trees never grow in such a way – in such a straight line – it must have been measured out – this fact again enhancing the mathematical aspect of this image



8 - Most houses built in Amsterdam in the 16-17th centuries aren't straight. The reason for that is that there's a hook at the top of the house, which could help pull up packages and furniture to the higher floors of the house. An interesting question would be: What was the maximum size of a package going up to the top floor (the attic).



9 - Todo es un desorden, una confusión. Esta foto es una representación del estado de la materia anterior a la ordenación del universo. La esfera de luz representa el sol, la perfección y el orden y todo lo que hay a su alrededor representa el absoluto caos



10 - Here we see some hazel catkins hanging by their top, perfectly perpendicular to the ground. Even though they are at different heights and depths and every one is a slightly different shape they all share this common



11 - Es un hotel en el que consta de 60 plantas, 150 metros de altura, con una caída al vacío con figuras geométricas y simétricas como el cilindro.



12 - En esta fotografía se pueden observar y apreciar los siguientes conceptos matemáticos: Asimetría, unión de conjuntos y círculos descentrados.



13 - Razonamiento matemático: Son solo circunferencias unas encimas de otras, completamente simétrico y que al final forman el dibujo.



14 - This photograph shows a glass pentagon. Underneath this shape we can observe iscoceles triangles positioned in different directions.



15 - Razonamiento matemático: La foto está hecho en el Alcázar de Sevilla, por eso la he llamado así y como se puede observar, las palmeras a lo alto hacen la forma geométrica del rombo.



16 - CUBE SCULPTURE. The image that I have entered to the contest was taken on my way home from a friend's house, as I thought that the sculpture embodies the idea of combining mathematics with art. The sculpture's mathematical aspect is the geometry involved, it contains several cuboids and a cylinder at its centre. The sculpture is artistic in that although it's got a lot of geometric shapes that are often thought of as rigid, here they create a sense of fluidity.



17 - En esta imagen, las ramas sin hojas de una morera de la calle del Olimpo crean bifurcaciones con distintos ángulos.



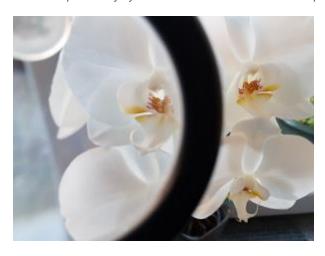
18 - This image draws one's eye to a particular spot in the centre of the image – with the aid of the main lines focusing towards the middle of the picture – and concentrating the viewer's attention on the main point of the image: the dog, standing perfectly balanced, on a crossroads, in the centre of the image.



19 - Photo taken at the Château de Langeais on the Val de Loire, France • The photograph shows an octagonal lamp with an embroidered top; its outside part, as seen on the right, is made up of two layers which appear as red trapeziums having a common base. • The octagonal lamp is partially reflected on the wall as an enlarged shadow composed of two isosceles triangles with a dark median line which separates the upper part – a trapezium - and the lower part – a triangle. There also appears to be somewhat of a symmetry between the two triangles on the wall. • The ground is made up of parallel wooden rectangles of equal width



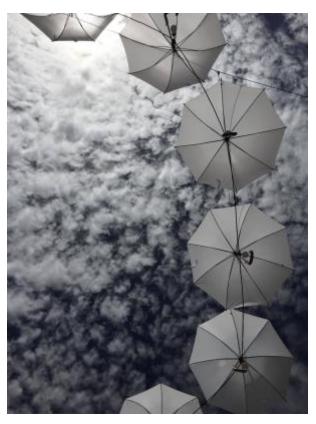
20 - The second photo is of a fern and it is similar to the Fibonacci spiral.



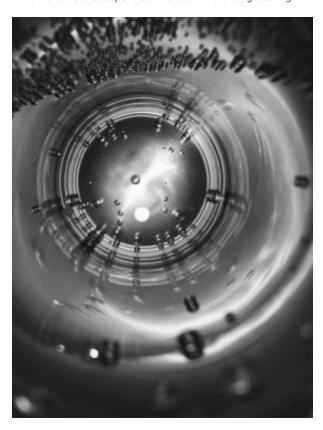
21 - Dans la première photo il y a le rapport d'analogie et d'agrandissement. Les deux fleures sont similaires mais l'une est un peu plus agrandie. Encore des pétales extérieures jusqu' aux étamines il y a une autoresemblence de motif à une échelle plus petite, une régularité.



22 - "Dans une flûte à champagne, on peut distinguer les différentes coniques :Une parabole se dessine sur les parois, à l'intérieur du contenant ;Grâce à l'angle de prise de vue, le bord du haut du verre forme une ellipse ;Le contour du pied du verre forme un cercle ;Deux branches d'hyperbole se dessinent sur le profil du verre, du pied jusqu'à la tige."



23 - The octagon shaped umbrellas are displayed in such a way that they appear to form one of the various phases of the moon. Eight triangles, each made up of 3 angles (180°), come together to create an octagon (1080°). These octagons or umbrellas are suspended in the air with a single string.



24 - In this picture there are circles within circles or, an infinite number of circles. The bubbles rising to the top of the water create a beautiful pattern along with the bubbles at the bottom of the water. The bubbles are also perfectly symmetrical and are reflected on the side of the can. The can is very small but, in the picture, it seems to be quite large, it's almost like an optical illusion.



25 - Creating a card castle is very easy, but the mathematical aspect from behind is very complex. First of all, we can observe that the cards took the form of an isosceles triangle. However, this makes me think about something else, another shape but in 3D: a pyramid. Furthermore, we can observe another mathematical aspect; if we look at the tooth sticks we can observe the even numbers appears up until 6 which is the number of triangles of the base. In a castle like this we can observe the Fibonacci number starting with 1 then 1+2, then 2+3 and so on, so by adding the number of the triangles formed by the cards we obtain this magic integer sequence which usually approach the golden ratio. The last mathematical point of this set of cards put together is the fact that we can obtain the prime numbers up until the number of triangles at the base 6 multiplied by 2, the last prime number obtain being 11. Sometimes when I get bored I tried to construct a card castle. It is very complicated but also very funny.



26 - There is symmetry, shape and enlargement in the photo.



27 - As we can see in this picture, there are multiple geometrical shapes, such as: 1. The handrails have a perfectly symmetrical shape that each level shrinks. The shape over all would be a spiral. In fact the decoration on the handrails (the one in the middle) is a repairing symmetrical pattern. 2. We can also take a look at the steps, that are symmetrical and that we could easily calculate the radius of each step.



28 - Small amounts of regular ice appear to be white because of air bubbles inside them, and also because small quantities of water appear to be colourless. In glaciers, the pressure causes air bubbles to be squeezed out, increasing the density and the size of the crystals in the created ice. Large quantities of water appear to be blue, as it absorbs other colours more efficiently than blue. Therefore, a large piece of compressed ice would also appear to be blue.



29 - En esta imagen podemos observar como muchos pequeños pequeños tubos tienen deformidades que unidas dan lugar a un grabado, un dibujo con sentido.

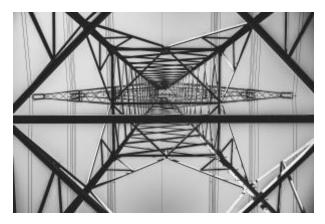


30 - So much symmetry! It's almost unbelievable: a square painting containing many squares — all in a squarelycropped image. The flowing curtains break up the otherwise very square image nicely





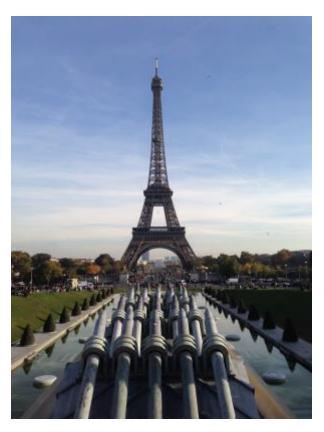
31 - A near-true infinity, with every line in this image converging on its centre; a corridor in Brussels Airport. Obeying the rule of thirds, and yet so perfectly symmetrical in so many ways – if this image is not mathematical, I do not know what is



32 - Under this construction we see the same shape getting smaller and smaller. They aren't the same but they all provide congruence, which is the mathematical term for a shape being compatible with another shape. This is seen in the turned squares and in the parallelograms.



33 - En esta bodega reina la simetría, los barriles simétricos los unos con los otros, las columnas, los techos, incluso las lámparas alineadas en una línea perfectamente recta.



34 - Vue du Trocadéro, la Tour Eiffel et son paysage nous dévoilent de nombreuses notions géométriques.



35 - Figura geométrica formada por varios pisos de lápices colocados en paralelo y diagonal respectivamente. Estos lápices se colocan entre sombras, haciendo simetrías e incluso formando figuras geométricas, como los rombos.



36 - In this picture, it is the present symmetry that strikes us. The form of the leaf is perfectly symmetrical by axis. The green veins grow always in the same mathematical way. If leaves are everywhere, maths are as well.



37 - "L'idée derrière cette image est, d'égaliser les forces agissant sur la structure pour arriver à un état stable. L'égalité (=) est le concept principal de l'image, idée sur laquelle repose toutes les équations mathématiques. Dans le même temps, l'image a une idée artistique, c'est pourquoi les gens s'arrêtent et regardent cette représentation et parfois paient pour ce concept et cette créativité. En arrière-plan, on retrouve le symbole de l'égalité ainsi qu'un clin d'œil à Jean Dieudonné : les mathématiques sont l'honneur de l'ESPRIT humain."



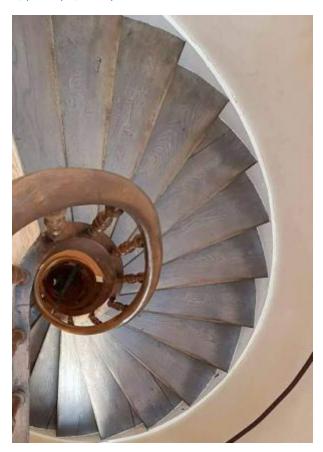
38 - Distribución bastante simétrica de un cristal al haber sido golpeado. Las grietas surgen de un mismo punto donde el cristal está más roto y compacto. Estas grietas crean un momento del que de un punto salen vectores orientados hacia un mismo plano.



39 - This picture has been taken near the "Monumento al Marinaio", which is a very important monument for the city and represents a ship rudder. Looking at the picture we can notice that there are barrel vaults seen from a frontal perspective. in a geometrical view the barrel vault is a conical surface at which is applied a contraction.



40 - El motor Stirling es el único capaz de aproximarse (teóricamente lo alcanza) al rendimiento máximo teórico conocido como rendimiento de Carnot, por lo que, en lo que a rendimiento de motores térmicos se refiere, es la mejor opción.



41 - MUSICAL SPIRAL. The picture has been made in a Musical school in Brussels and shows stairs in form of spiral. The spiral is a curve which emanates from a point, moving farther away as it revolves around the point.





42 - This photo, taken at the Lake Maggiore near Varese, Italy, depicts water waves in the form of parabolas, formed from a coot swimming in this lake. The parabolas' turning points are centered on the path where the coot swims.



43 - This picture shows a clock in whose centre it's possible to distinguish the reflection of a castle. looking at the picture from a mathematical point of view, the clock's shape can be associated with a circumference crossed by two parallel chords.

each number is placed at 30° distance and the two clock hands for an angle of 120°.



44 - On the photo, the girl is perpendicular to the two parallel lines, the vertical wooden columns. Her legs are parallel to each other as well as her arms.





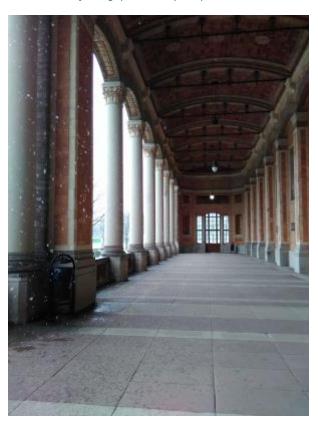
45 - As the name of the image implies, the wow-factor of this image is the (nearly) perfectly spherical nature of the waterdrop on the leaf of a plant. The surface tension (i.e. the forces acting on it) of the water droplet were all acting in in equal amounts; therefore, the droplet is in equilibrium. Spheres are uncommon in the natural world, as it is extremely difficult to achieve the balance needed for matter to be in such a shape.



46 - I took this picture on the spot on my way out of Paris underground. It felt like Alice in Wonderland going out of the white rabbit hole! The blue sky attracted me above the escalator like a magnet. I had only one choice: to follow the lines and enter the perspective offered to my eye.



47 - The picture shows the ocean seen through a door in a traditional market in Punta Cana, Dominican Republic. The space within the room is dark which lets us concentrate on the bright world out of it. The overflowing nuances of blue are the first thing that attracts the look. In the lower part of the image there is a wave which can be represented by a complex mathematical function. The perspective and the simple shape of the door are other mathematical aspects intensifying the feelings provoked by the picture.



48 - This picture was taken in Moscow, Russia, and show a bridge crossing the Moskva River. The mathematical aspect of the picture is the cylinder created by the flowers that forms a sort of tunnel, the end of which seems to connect with the lanterns of the bridge. All objects are directed towards the focal of the picture which is situated at the end of the bridge. The picture is also symmetrical.



49 - I was walking on one of the beaches of Normandy, completely deserted, when I noticed that the beach looked like a mirror. The water on the sand perfectly reflected the clouds in the sky, creating a magical atmosphere. The blue color of the sky was also reflected. The picture present a symmetry between the sky and the beach.



50 - The following photo was taken by me in the Sheikh Zayed Grand Mosque in Abu Dhabi, UAE. The image focuses on the typical for Muslim structures arches which surround the main courtyard and many rooms of the mosque. The design of arches roots from parabolas, which are one of the fundamental types of functions in mathematics and give the arches their distinctive shape. Designing arches is not simple as they must carry great amounts of weight and calculating important features such as the area under the graph is crucial. This can be done using calculus by finding the derivative of the curve of the arch 2000 and the second derivative 2000 2000. Using Integration for which is the opposite of differentiation, it is possible to find how much area is covered under a certain curve. Trigonometry is also very important in the building process as it is used to calculate how much force is needed on each side of a brick to balance out 2000. To do so we can use the simple trigonometric functions sin0,cos0,tan0.



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52 - The bracts of which consist the pine cone are arranged in a sort of spiral and indeed two spirals which are evolving in opposite directions. If we count the number of spirals in each direction, we will realise that it is in fact a fibonacci number.



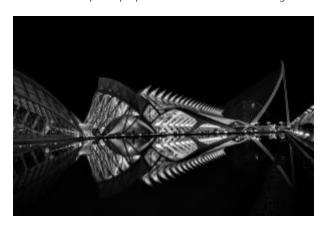
53 - A very shallow-focused image depicting a bee about to pollinate a flower. The mathematical aspect of this image is the capture of the bee's wings en plein movement – a bee is a rather large insect, and one would expect its wings to beat slowly and in a near circle – but no – a bee's wings beat around 230 times a second and over a short arc of about 90 degrees.



54 - The first picture is of an electrical post taken from the bottom to get a very symmetrical photo.



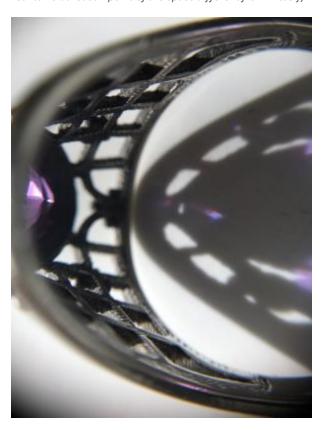
55 - The neon lights are parallel and are suspended along a "sinus wave"; in the distance, it seems as though the lengths between them are decreasing; however, they actually stay the same. In the distance, you can also notice the merging of the neon lights. The black boats symbolise the crossing of the sea, a journey which could be represented through vectors. On the left side of the room, we see arches. The roof is made up of parallel semi-decagons which are supported by parallel lines included in a plane perpendicular to the one including the neon lights.



56 - Las Matemáticas son una parte fundamental de la Arquitectura y queda demostrado en esta obra de la Ciudad de Las Artes y las Ciencias. Por una parte, sirven como herramienta de cálculo para determinar la estructura, estabilidad, resistencia de los materiales, etc y por otra, sirven como fuente de inspiración aportando a la arquitectura moderna la geometría de curvas y superficies.



57 - In this picture there are some bikes, that represent the effort of Brindisi to be more environmental friendly. The bikes' wheels are arranged to form a limit point (a point x in X is a limit point of the topological space if every neighborhood of x contains at least 1 point of the space different from x itself).



58 - In the first picture you can see the light creating a ?parabola out of the shadow of a ring, and also the light starting to break into different colors as it passed through the purple stone on the ring.



59 - SCHOOL CANTEEN. I felt the shadows and the poles were very aesthetic. I liked the way that we could notice picture persepctive. We shouldn't underestemate the size of things, or anything in life for that matter. The poles are all the same but all look a different size. And they are alligned perfectly and parallel but our eyes and perspective is tricking us.



60 - From drilling deep boreholes weaving made possible by the development of directional drilling techniques based on mathematics to the forms of spirals in galaxy, in architecture, in Escher's graphic art Mathematics is not just about formulas and logic, but also about patterns, symmetry, structure, shape and beauty. The Quinta da Regaleira is a wonderful example of how mathematics, art, architecture, and history overlap.



61 - The third photo is of a skyscraper in Manchester and you can see parallel lines in it and reflection



62 - This snail shell depicts a logarithmic or equiangular spiral, since the shell needs to grow in the same proportion as the snail. Logarithmic spirals often appear in nature (e.g. cyclones, Romanesco Broccoli, galaxies...) and shells are the most well known.



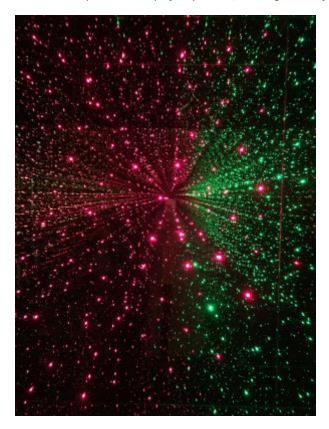
63 - "Sur la photo on peut distinguer que deux triangles équilatéraux forment un losange, six triangles équilatéraux forment un hexagone et l'ensemble de ces triangles forme une sphère. Source : Swarovski Kristallwelten in Wattens"



64 - A spider is an arachnid, of which all are characterised by having eight legs. The plant on which the spider is standing also has eight stems: a nice mathematical coincidence.



65 - In the last picture we can see water droplets that are perfectly? round, creating a beautiful pattern on a spiderweb.



66 - Esta ilsuion óptica se puede crear usando una serie de espejos normales y espejos de una sola dirección. La fotografía se puede interpretar como una Supernova después de su explosión. Las supernovas se suelen observar en otras galaxias ya que son complicadas de observar en la Vía Láctea.



67 - Symmetry is when one shape becomes exactly like another if you flip, slide or turn it. This type of symmetry which is shown in the picture is "Reflection" or "Mirror".



68 - This photo is representative of two mathematical phenomena that occur everywhere in nature: Symmetry, and the famous Fibonacci sequence, which can be found in most places in nature, like sunflower patterns, nautilus shells, etc... On this picture the tree in the background is an elm, and it has a Fibonacci leaf arrangement of ½. This means the spiral takes 2 branches to spiral twice around the trunk for one pattern. The leaves of course cannot be seen here as it is winter, but we

can still see the way the branches are arranged, representative of the Fibonacci tree. In the foreground of the photo, we can see a potted plant, with big thick leaves, each one of them representative of Dorsiventral symmetry. It is common amongst leaves/plants and animals to have their shape be driven by symmetry, with the two most notable being radial and bilateral (dorsiventral is a type of bilateral).



69 - A long-exposure shot of a sunset and cars on the Tervurenlaan in Tervuren, Belgium. A technically challenging image to take, and yet another one where the lines converge towards its centre. The even spacing of the streetlights add to its mathematical aspect.



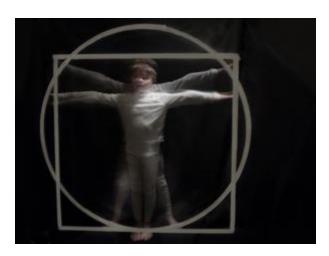
70 - The picture on top is the camera sensor. It is taken in 24:18. (on iphone 4:3). Here this is all you can see with the camera. You can't see the window frame or the wall, and it is smaller than with eyes. With the camera it would have to be about 1,50m back to see what you see with the eye. Here 1° of vision is 1,2cm². Here is the calculation:24X18=432; 432/360=1.2cm²; 1.2cm²=1° of vision a camera. The picture on top is human vision and is in 120:80 because that is how humans see. However the human or in this case me, from the same place that the phone took the picture, I can see the window frame and the wall inside and i measured my vision and it is 120:80. Here I will figure out the area then the area of 1°. How can it be if we only have 180°, well because our vision is actually 360. Our eyes have 180° from top to bottom and 180° from left to right, doing 360°.. Here is the math: 120X80=9600; 9600/360=26.6; 26.6\*cm²=1° of human vision; (\* Is recurring). Difference with the human eye: 1°=1,2 cm² on camera; 1°=26.6\*cm² with eye. There is a 25.4cm² difference: 26.6\*-1.2=25.4cm².



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72 - THE VENETIAN. This is a picture taken in the depths of Taipa, Macau. Known for its remake of European cities as well as its Las Vegas inspired casino's, it is a must see destination for many tourists. This image gives us a glimpse of the buildings surrounding one of the many casino's. The art of maths is present everywhere throughout this image. The buildings are made entirely out of geometric shapes. We are able to observe the round top semi-circles used as windows and entrance halls. The windows are perfectly rectangular and the shape of the buildings is well structured and orderly which causes the buildings to fit in together harmoniously. Without the creativity of art and the precision of mathematics, none of these buildings would be present to this day.



73 - Da Vinci's Vitruvian Man is a combination of mathematical studies of the human body and art. The original picture is accompanied by notes on measurements and proportions of the human body, one of them is: "if you open your legs enough that your head is lowered by one-fourteenth of your height and raise your hands enough that your extended fingers touch the line of the top of your head, know that the centre of the extended limbs will be the navel, and the space between the legs will be an equilateral triangle." This is seen in the picture I took. The square also shows that the height of a man is equal to the spread of his arms. Da Vinci compared the sizes of different limbs to each other: four cubits make a man and a man is 24 palms; and to the total height of a man: the foot is one seventh of the height of a man and the distance from elbow to armpit is one eighth of the height of a man.



74 - The number three is represented by the triangles, types of triangles and the orientation.



75 - Razonamiento matemático: Se puede observar que en el barco hay tres velas. Las velas son triángulos distintos, dos tienen la misma forma pero tienen tamaños distintos y uno de sus lados son de madera, como unas rectas inclinadas que cortan el mástil (eje X). Además se puede observar que los tres tienen un ángulo de 90 grados en la base.



76 - In this picture we can see a building facade with some balconies placed in order to form a translated function with the formula f(x) = [x] + h (translation applied to the integer part of the ceiling function).



77 - The photograph shows us the perfection of lines and reflections. Even though the straights will never meet in reality, the perspective makes it possible. The proportional decrease of the distances have a huge incidence in the nature, a phenomena which is linked strongly to mathematic rules. The architecture in this picture takes a benefit of this mathematic perfection, it makes the corridor to appear longer and wider.



78 - An interesting image mathematically, as the background is pure white (it was very cloudy on the day), depicting a weather vane of a horse. Half of this image is pure white and the other is black: emphasising on the fact that this image is absolutely devoid of colour – and it didn't even need to be black and white processed!



79 - The mathematical nature of this particular image is rather interesting; the image can be divided into three parts both horizontally and vertically by following the main lines of the rock and sign.



80 - Dans la deuxième photo on trouve la symétrie. Il y a aussi la perspective qui crée une échelle. Lorsque on va plus au fond les moulins se réduisent, mais il y a une analogie entre eux.



81 - In this second picture the window creates a perfect reflection of the pink sky above.



82 - The lines and curves of the plane go off into the distance.



83 - Numbers and mathematical symbols cover this image all over. The low focus depth draws the viewer's attention to the title of the segment: World Markets. Underneath this, one sees – in a diagonal line – the differences between the value of currencies over two different days.



84 - A wow-perspective! Personally, one of my favourite images – because it is perfect and imperfect at the same time. There are four main parts (trees) of the image 'pointing' in all the compass directions, yet they are not really – as the camera is just pointing upwards. The photo also idyllically obeys the rule of thirds.