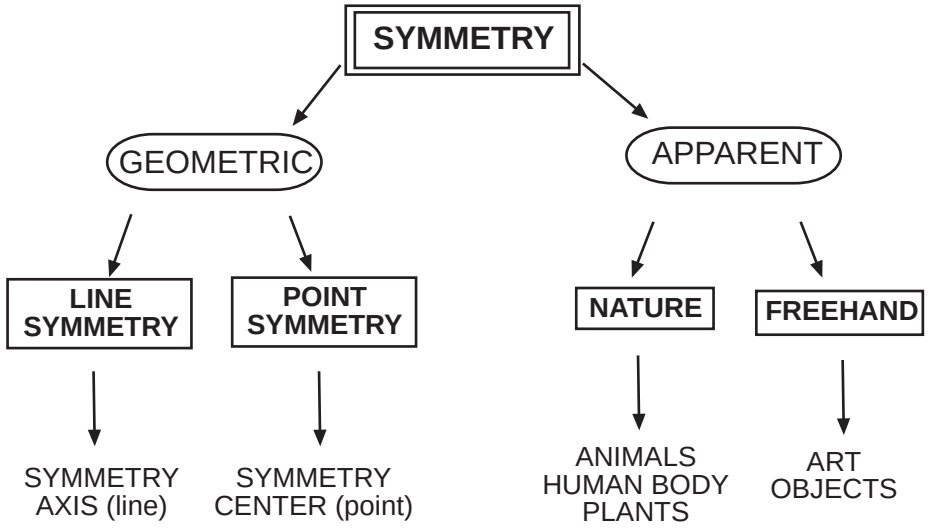


Learn many aspects about symmetry and read some definitions in this **Math is fun symmetry section**

http://www.mathsisfun.com/geometry/symmetry.html

Watch this short **Youtube video** that introduces you to symmetry in life and nature

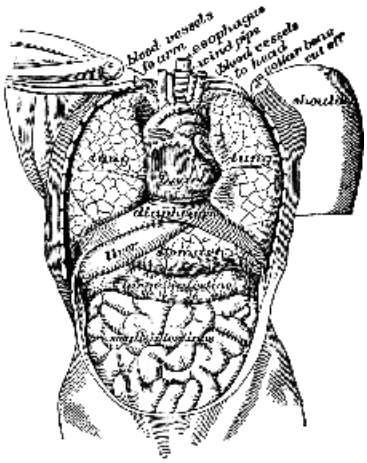
http://youtu.be/TldmWSbOvM0

IMPORTANT DEFINITIONS RELATED TO SYMMETRY

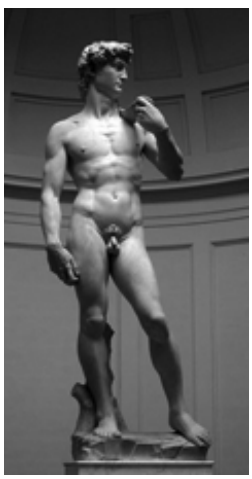
Symmetry: It is a quality of some shapes which some of their parts are reflections of others.
Reflection symmetry (line symmetry): It is a shape's quality which is formed by two halves facing each other with an axis or fold line in between as if both sides were mirror images of each other.
Symmetry axis (also symmetry line): It is a line which divides a shape into two symmetric halves. Every element of the shape is reflected on the other side and at the same distance from the axis (fold line). Symmetric points are on a perpendicular line to it.
Central symmetry (also point symmetry): It is the reflection of an object through a point called the symmetry center (or symmetry point). Every symmetric point is on the other side and at the same distance from the center of symmetry. Symmetric pair of points are collinear with the center.
Geometric symmetry: It is a kind of symmetry which follows accurately the geometric symmetry rules.
Apparent symmetry: It is the quality of shapes or objects which show an obvious symmetry, but not every point or element follows accurately the geometric symmetry rules. It happens very frequently in nature.
Symmetrical balance: It is a way to organize parts of an image, picture or drawing so one side duplicates or mirrors the other. The opposite way is called Asymmetrycal balance.

SYMMETRY AXIS (SYMMETRY LINE)

There is an international standarization to represent the symmetry axis in technical drawings and plans, so they are drawn with short traces alternating with dots. This way whoever that sees a plan or a drawing can be aware of that line representing the symmetry of the drawing.



Organs of the human cavity.
Source:http://etc.usf.edu/clipart/22100/22141/bdycavorgans_22141.htm



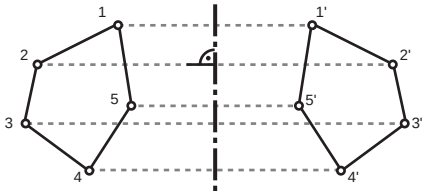
David.Michellangello Buonaroti
Source:http://www.leslieparke.com/2011/01/michelangelo-revealed/

Tree Silhouette.Keith Evans
Source:http://www.geograph.org.uk/photo/2274631

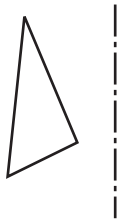
SYMMETRY AND ASYMMETRY IN NATURE

Somehow symmetry is the beauty expression for nature. Animals, humans and plants are symetrical in the outside but mostly asymmetrical in their inside.

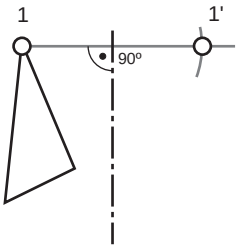
REFLECTION SYMMETRY (Axial Symmetry or line symmetry): Pairs of symmetrical points are located on a perpendicular line to the symmetry axis or fold line, at the same distance from it but on opposite side. Some objects or shapes are just symmetrical on their own. That is to say, half of the figure is a mirror image of the other half.



How to draw a symmetrical triangle over an axis or line of symmetry .



1



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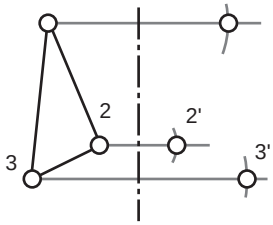

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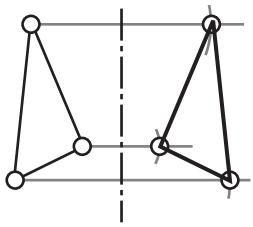


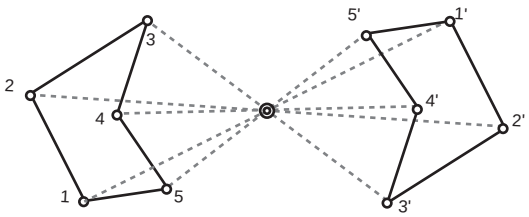
1st- Make a perpendicular line to the axis from one vertex to the other side of it. With the compass, take the dimension from the vertex to the intersection of the line with the axis and copy it on the perpendicular line but on the other side.
2nd-Repeat the procedure with the other two vertices of the triangle.
3nd-Connect the three symmetrical vertices with three segments.

Learn about lines of symmetry and drawing a symmetric figure in this **Youtube video**

http://youtu.be/wLIY8HwmjxE

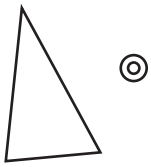
CENTRAL SYMMETRY or POINT SYMMETRY: Symmetric points are colinear (on the same line) with the symmetry center, at the same distance and on opposite side from it.

Here you'll learn how to Draw a symmetrical figure using compass and ruler or straight edge.

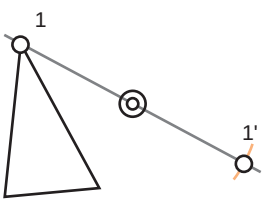


A central symmetrical shape is the same than rotating the original shape 180º.

How to trace a symmetrical triangle over a symmetry center:



1



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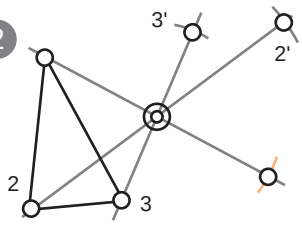

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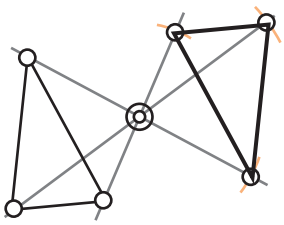
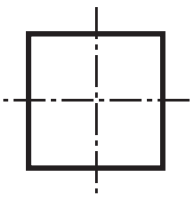


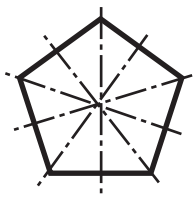
1st- Make a line from one vertex through the symmetry center. With the compass, take the dimenssion from the center to the vertex and copy that distance on the other side of the center on the perpendicular line. Therefore we have one symmetrical vertex of one pair of symmetrical points.
2nd-Repeat the procedure with the other two vertices of the triangle.
3nd-Connect the three symmetrical vertices with three segments.

Symmetry order of a shape:

When a figure matches with more than one symmetry line; that is the same than saying: when we can draw more than one fold line for the same shape. Then we say it has a symmetry order of the number of symmetry lines that can be drawn. Also, those figures, can be rotated a number of times showing the same shape than the original as many times as fold lines can hold.
So a square has a symmetry order of four, or four fold symmetries, A regular pentagon has a five fold symmetry, etc.



2 fold symmetry



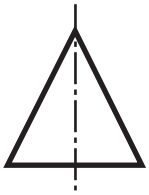
5 fold symmetry

here you can watch a **Youtube video** explaining the concept of "order of symmetry

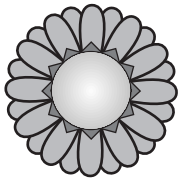
http://youtu.be/h-EBCSf8o4c

Play this **interactive online game** in which they'll ask you about symmetry lines of geometic shapes

http://www.innovationslearning.co.uk/subjects/maths/activities/year3/symmetry/shape_game.asp



1 fold symmetry



12 fold symmetry

So, as you can see, architecture uses both types of symmetry (line and point symmetry).Following you can see three pictures. These are all Gothic architecture elements such as a Rose window or two Porticos.

Look at them carefully, identify which type of both symmetries each picture has. And find the hidden asymmetry.

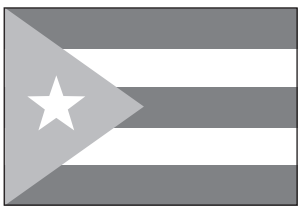
Sto. Domingo de Soria. Rose window
Source: http://commons.wikimedia.org/

Apostoles Portico. Valencia's Cathedral
Source:http://www.jdiezarnal.com/

Sta Maria de Requena. Portico
Source: laslaminas.es

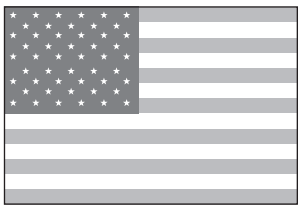
Now you are going to check some flags of the world symmetries. They may have one axis symmetry, two axis symmetries or none (asymmetrical). If they have any symmetries draw the axis on it:

SYMMETRIC ☐ ASYMMETRIC ☐



CUBA

SYMMETRIC ☐ ASYMMETRIC ☐



USA

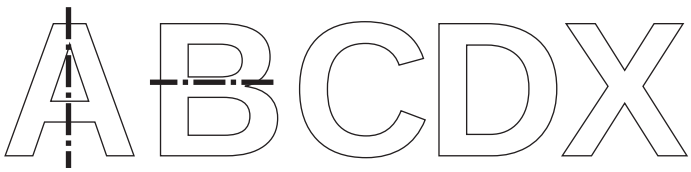
SYMMETRIC ☐ ASYMMETRIC ☐

CANADA

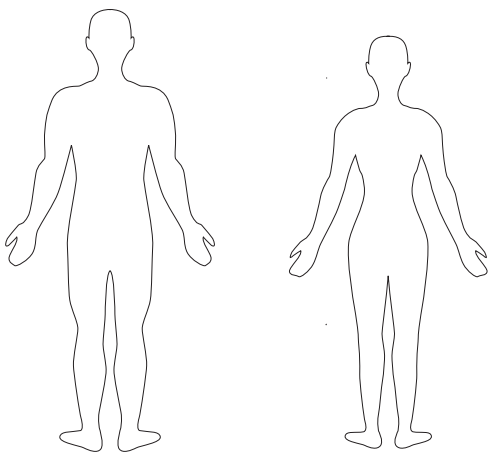
SYMMETRIC ☐ ASYMMETRIC ☐

GREAT BRITAIN

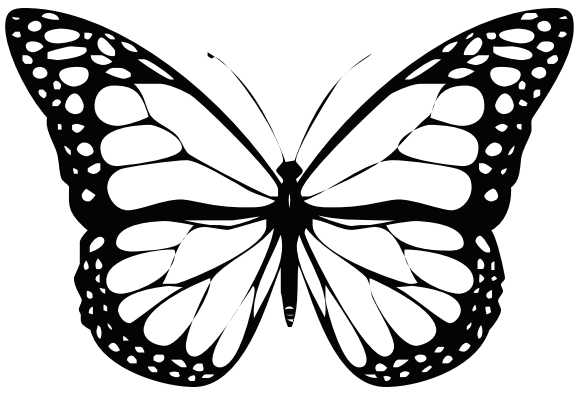
Many capital letters also show symmetries. Knowing this helps tracing them quite a bit. Some letters may contain even two lines of symmetry.
Draw the line of symmetry to the last three letters



So Nature creates its shapes with symmetry. However it is very common that natural symmetry hides slight differences between two symmetric halves. Those small differences show up due to growth issues or other circumstances. When some object is not geometrically and accurately symmetric but still shows a main symmetry we regard to it as an **apparent symmetry**.



Despite human body apears to be completely symmetric. Everyone's body has little imperfections that break the perfect accurate symmetry such as one leg or an arm longer than the other.



Also many animals show a reflexion in their bodies, which is not accurately following the geometric symmetry rules.

In this page you can see a couple examples on how Symmetry inspires artists to make a song or a short movie, bees to find their flowers or even a psychiatrist to prepare his character and psichological tests.

Listen carefully to the song and fill in the gaps:

LITTLE BOOTS - SYMMETRY

You're the night to my _____
And the left to my right
The blood to my veins
And the dark to my light
The stop to my start
And the constant beat of my _____

The sun to my moon
And the stars in my _____
The hot to my cold
And the black to my white
The rain to my thunderclouds
And the truth in my lies

So tell me what you want to see
Coz everything I want to be
Is there in your _____
Shining out right back at me

So love me in perfect symmetry
Be my _____
If you just love me in perfect symmetry
Only you can make me feel complete
In perfect symmetry
Be my everything
If you just love me in perfect symmetry
Only you can make me feel _____

So tell me your dreams and
I'll tell you all my fears
So ask me your _____
I'll tell you what you want to hear

You're the high to my low
And the give to my take
The shadow I cast

And the echo I make
The calm to my storm
And the lesson in my _____

So tell me what you want to see
You're everything I want to be

Just love me in perfect symmetry
Be my everything
If you just love me in perfect symmetry
Only you can make me feel complete
In perfect symmetry
Be my _____
If you just love me in perfect symmetry
Only you can make me feel _____

So tell me your dreams
And I'll tell you my fears
So ask me your questions
What you want to hear

Listen **Symmetry by Little Boots** and see how symmetry also can inspire lyrics for a song.
http://youtu.be/6S9bOriXMEA

HONEY BEES VISION

Did you know the bee's vision is specifically designed to reach out shapes with central or point symmetry?. That is meant for finding better the flowers, which own that quality, in order to get more pollen and produce more honey. And this way flowers which have a better symmetry survive better in time since bees help them reproduce.

THE 20 SYMMETRYCAL IMAGES OF RORSCHACH TEST

Rorschach blot 4.
Source: http://commons.wikimedia.org/

Hermann Rorschach was a Swiss psychiatrist (brain doctor) who developed a test consiting on twenty images that are ambigous abstract symmetric inkblots (ink stains).

His patients would observe the images and tell the doctor or psychologist what they saw, perceive or what it went through their minds.

That way the images meant actually nothing, but the positive or negative information told by the patients could help the therapist to diagnose any problem or issue they had.

SYMMETRY IN VISUAL CONCEPTS. SHORT MOVIE

As we saw symmetry helped a songwriter to compose the lyrics. we can see that it can also help to make up a short movie showing images about opposite concepts.

Watch **this short movie** abou symmetry on Vimeo. It doesn't have much to do with geometry but with the main concep of symmetry.
http://vimeo.com/22564317