Some ideas for works and supporting details (pdf)

In all work submitted to the competition *find a sundial and, ... show it to us!* the points listed below must be studied:

a) Take and send us at least six pictures of the sundial and the environment in which it is located (10 photos maximum in total).

b) Make a study of the most important astronomical elements contained in the sundial that you have found.

c) Make an art-historical study of the sundial and its environment.

d) Included in the work freely, other aspects of study that you consider interesting.

But principally, in this section we would like to offer an outline of what we consider interesting to note in the work that we expect to receive and that also is training for students who participate.

The first, as you know, is that you find a sundial anywhere either city, town, church, road, etc.

When you have found a sundial what you ought to do is the following:

1) Take several photographs of the sundial from different angles. Take some pictures also of the general framework in which the sundial is. For example, if is located in the tower of a church, take some pictures of the tower and the whole church so you can see the whole building as a whole. For example in the picture 1 we can see the rear wing Milanów Palace in Warsaw, where a sundial is.

*Pic. 1: Rear wing Milanów palace where the sundial is placed.*
2) Determine what type of sundial you are looking at. There are many types of them. Here we will put a special interest in the most common: equatorial, vertical and horizontal types.

If you want to know the different types of sundials that there are, you just have to type in the web 'Types of sundials' and immediately several pages will prompt up where you can obtain all information you want about them.

3) **If the sundial** that you have discovered **is of equatorial type**, remember that the **gnomon is the axis of the world and form an angle \( \phi \) with the horizon equal to the latitude of the place**, also that the plane on which are projected hours is parallel to Ecuador. Your work would be more complete if you also determine the coordinates of the place where the sundial is, that is, latitude and longitude.

The equatorial sundial hour lines are symmetrical about the line of the noon (12 morning). Picture 3 a).

**If the sundial is horizontal**, the gnomon is also the axis of the world and the angle with the horizon is also the latitude.

In the picture 3 b) you can observe as time lines are drawn in a horizontal sundial based on the hour lines of an equatorial sundial.

**If the sundial is vertical and oriented**, that means the wall on which it is placed is oriented south, the direction of the gnomon is, as always, the world's axis direction.
and the angle determined by the vertical wall and the gnomon is the complementary angle of latitude called colatitude \((90-\phi)\) as shown in picture 4.

![Diagram of sundial angle](image)

**Pic. 4: Time drawing lines in a vertical sundial based on the hour lines of an equatorial sundial**

As you can see by the small explanations and the drawings attached, in the three cases of sundials described above is possible to determine the latitude and longitude of where it is provided that the sundial is properly constructed.

4) We want you describe also in your work the astronomical aspects that can be seen on the sundial. Some sundials in addition to the hour lines are drawn solstice and equinoctial line, the analemma, the sun, moon, ... Explain all this to us!

![Sundial in Carcassonne](image)

**Pic. 5: Sundial in Carcassonne (France).**

5) We have already seen that sundials have a long history from the earliest civilizations to today. As European citizens we are interested in history and culture of all peoples of Europe. In many cases the sundials are located in historic buildings and in others, the sundials themselves have their story. We would like that you investigate and study a little, the sundial that you have found.
Pic. 6: The famous sundial at the Milanów Palace in Warsaw.

The picture 6 shows the famous sundial at Milanów Palace in Warsaw and picture 1 a broader vision in which we can see the place of the sundial in the palace. Milanów Palace was built in a given time and its architecture is of a particular style. The palace also has a history.

So, we want you to describe briefly, your area, the place where you have discovered the sundial. If this has any history, the surrounding countryside and everything that you think may be interesting to know about this place (for instance, picture 7).

Pic. 7: Sundial in the gardens of the Cathedral of Narbonne.

Since this call is for a competition at European level, it is desirable that all work be submitted in English. If any are present in the mother tongue should also attach a summary, as complete as possible, in English.

Some details of the vertical declining sundials

As the vertical declining sundial is designed for a wall that does not face directly north, south, east or west, the first task is to determine the wall's declination (d). Declination of a wall, sometimes called the declining angle or the derivation, is the angle
of the wall with the east–west line (or the angle measured in a horizontal plane, that a wall’s perpendicular makes with due south). A wall facing south has \( d = 0^\circ \). Walls declining westward have positive declinations, those eastward, negative. Here, we don’t ask that you determine the declination of the wall but it’s not complicated. We just want that you recognize the orientation of the wall watching the sundial.

If your sundial is vertical, you will have to look at the wall orientation in which the sundial is placed. The most common is that the orientation was south or small deviations from it. The time lines are very different in a sundial if it is perfectly facing south or if for example, the wall undergoes a deviation of 20 degrees from it.

Then we only show you by drawings, as the hour lines are for some cases that we consider more common. We are talking about the sundials southwest and southeast decliners.

First, we present, as a vertical sundial is on a perfectly south–facing wall.

![Pic. 8: a) Time lines in a vertical sundial facing south. b) Oriented vertical sundial at Mirambel, Teruel (Spain)](image)

The picture 9 illustrates the layout for a southeast–declining dial. It is located at latitude of 43.15º and longitude 0.878º W. The declination of the wall is 20º E in the left image and 40º E in the right one.

![Pic. 9: a) Sundial southeast–declining; declination of the wall 20º. b) Sundial southeast declining; declination of the wall 40º.](image)
The picture 10 shows the layout for a southwest–declining dial. We assume that the designs are for the same location as latitude and longitude are the same as in the previous case. The picture on the left is for a wall with a declination of 20° W and the right to a declination of 40° W.

Pic. 10: a) Sundial southwest–declining; declination of the wall 20°. b) Sundial southwest declining; declination of the wall 40°.

Note: By a computer program, Antonio Salazar staff of the Real Observatorio de la Armada de San Fernando (Cádiz, Spain) has made the pictures of sundials presented above.

In picture 11 we can see two vertical declining sundials. Belong to two private homes. The left hand is in Murcia and the wall is declined to the east. The second, with the decline of the west wall is in the coastal town of Masnou (Barcelona)

Pic. 11: a) Southeast declining sundial at Sebastian house in Murcia. b) Southwest declining sundial at Can Bonet in Masnou (Barcelona).