









# 13 Buildings

## Children Should Know

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PRESTEL

Munich · Berlin · London · New York

# Contents



4 • The Great Pyramid of Giza



8 • The Parthenon



12 • Notre Dame de Paris



14 • The Leaning Tower of Pisa



18 • The Tower of London



20 • Saint Peter's Basilica



24 • The Taj Mahal



26 • Neuschwanstein Castle

**W**asps build their homes out of paper; birds make complicated nests; and moles dig systems of burrows that have lots of rooms.

And what about humans? We, too, are born with a need to build things, as you can see if you watch children playing in a sandpit! Unlike most animals, however, humans have come up with a variety of architectural styles over time. Luckily, a lot of great buildings, some of them very old, have been preserved. 13 very special ones are presented and explained to you in this book. It wasn't easy to choose just 13—there are of course many, many more!

44 • Glossary

Explanation  
of  
special words

42 • The Beijing National Stadium



38 • The Sydney Opera House



36 • The Guggenheim Museum, New York



32 • The Chrysler building



30 • The Eiffel Tower





The wheel is invented

Baked and glazed tiles first made  
in Mesopotamia

4000 BCE 3900 BCE 3800 BCE 3700 BCE 3600 BCE 3500 BCE 3400 BCE 3300 BCE 3200 BCE 3100 BCE 3000 BCE 2900 BCE



## The Pyramids

were already being studied a long time ago: even Napoleon sent a team of scientists to Egypt.

2800 BCE 2700 BCE 2600 BCE 2500 BCE 2400 BCE 2300 BCE 2200 BCE 2100 BCE 2000 BCE 1900 BCE 1800 BCE 1700 BCE

# The Great Pyramid of Giza



The only one of the Seven Wonders of the Ancient World to have survived to this day; it is the biggest single building ever to have been constructed—and it was the highest in the world for the longest time. The Great Pyramid of Giza has broken lots of records!

To this very day, we don't quite know how the Egyptians managed to construct this enormous, perfect geometric miracle in stone over 4,000 years ago. You can still visit it on the outskirts of Cairo, the Egyptian capital. What were the pyramids built for? How did the architects and laborers manage to pile the incredibly heavy stones on top of each other without the help of modern machines or electric power? No wonder that some people's imaginations run wild when it comes to this wonder of the ancient world: some talk about a huge observatory, of places of worship and of aliens who could move objects using nothing but the strength of their willpower.

**Started:**

c. 2554 BCE

**Location:**

Giza, near Cairo, Egypt

**Commissioned by:**

Pharaoh Khufu

**Height:** 146.6 m

(481 feet); today, it is only 138.7 m/455 feet high because the tip is missing

**Length of each side:**

230.3 m (755 feet)

**Material:** Limestone

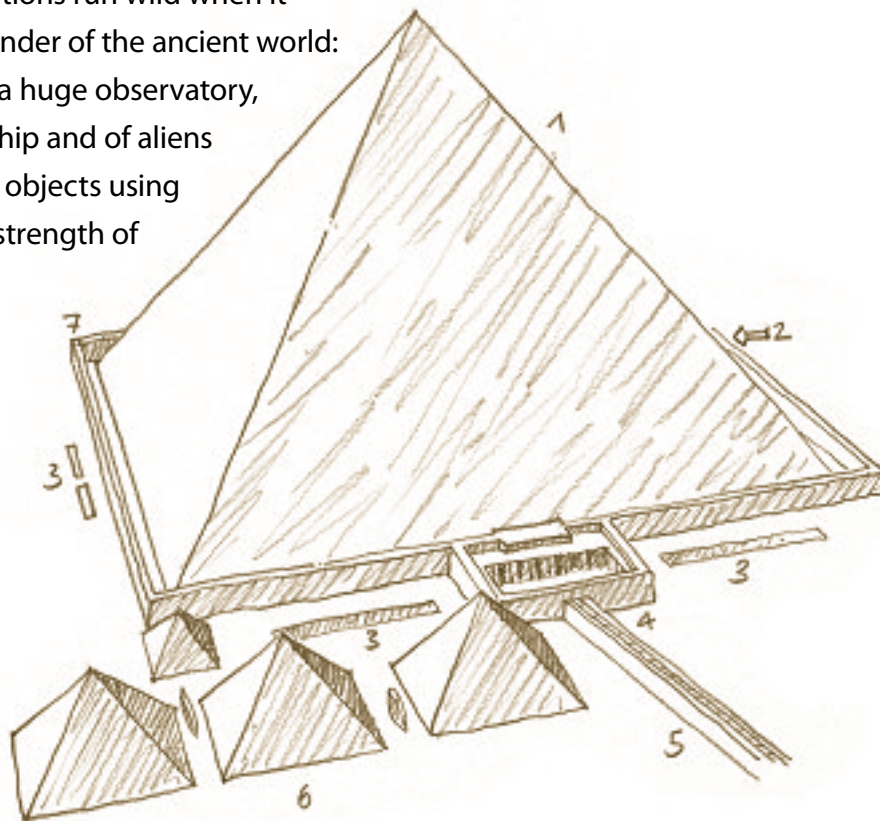
**Special features:**

Together with its two sister pyramids, this is the only one of the Seven Wonders of the Ancient World left today

**The Great Pyramid of Giza**

was the main structure on a big burial site that had walls, temples and smaller pyramids for the queens. The Ancient Egyptians even dug pits for the big boats that would carry the dead pharaoh's soul into the afterlife.

- 1 Great Pyramid of Giza
- 2 Entrance
- 3 Boat pits
- 4 Temple
- 5 Covered walkway
- 6 Queens' pyramids
- 7 Surrounding wall



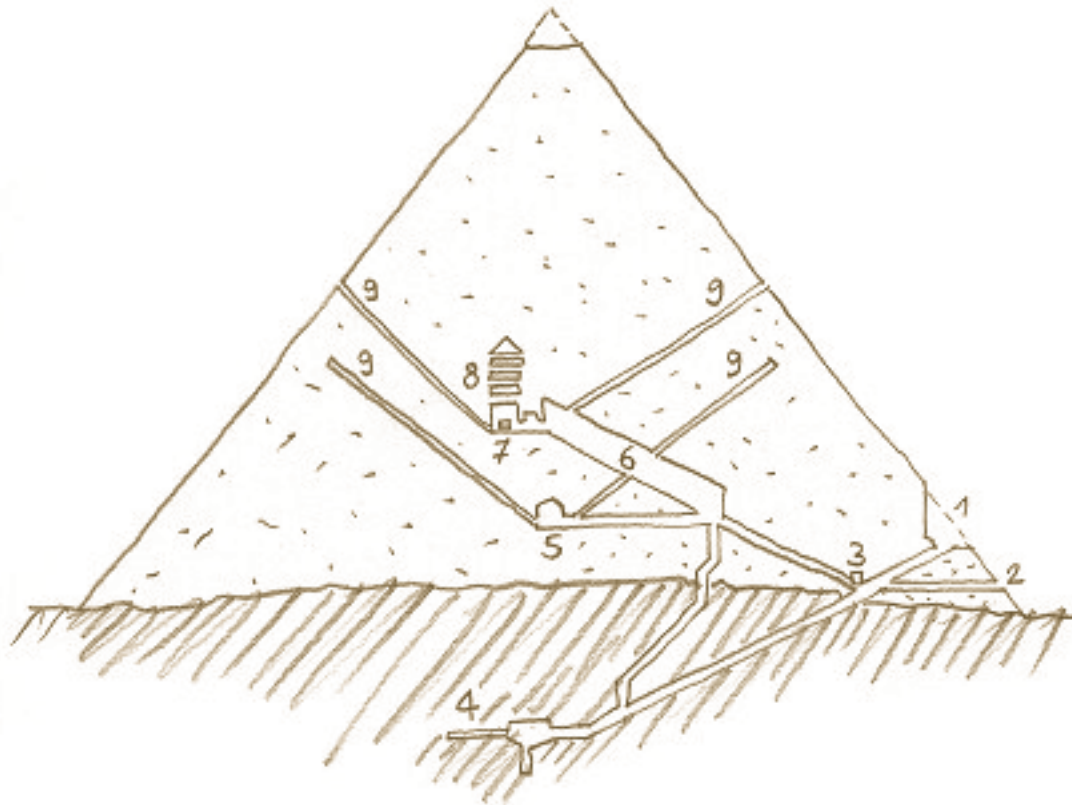


The archeologists\* were right after all. They always thought that the Great Pyramid of Giza was built as a monumental tomb for the pharaoh Khufu, who was called Cheops in Greek. A stone coffin, known as a sarcophagus, was eventually found in the inner chamber. And there can be little doubt that the pyramid was built using the muscle-power of thousands and thousands of laborers and oxen.

### Cross-section\*

Here, you can see what sorts of rooms or chambers there are inside the Great Pyramid. They are very small even though the structure is so huge!

- 1 Original entrance
- 2 Entrance used today
- 3 Stones blocking the passage
- 4 Subterranean chamber
- 5 Queen's chamber
- 6 Grand gallery
- 7 King's chamber
- 8 Weight-relieving chambers
- 9 Shafts



### A Big Building for a Small Mummy

For the Ancient Egyptians, life was the journey you had to take to reach your goal: the afterlife. The long path from the valley temple to the pyramid temple and the buried boats are symbols for this journey.

The body of the dead pharaoh was mummified using complicated methods. Specialists dried the body out, removed the inner organs and the brain, and then wrapped the body in a sort of fabric bandage. This way, the dead body would remain intact in the sarcophagus for eternity. Tests have shown that the pyramids' geometric shape helps speed up mummification.



The mummy of the pharaoh Khufu has disappeared and nothing but this small statue shows us what he looked like when he was alive.



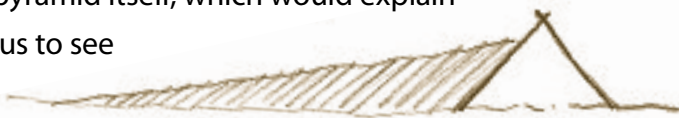
## An Army of Laborers or Aliens?

Most experts on pyramids think that approximately 20,000 laborers took 20 years to pull the heavy stones into place using sleds on flat ramps\*. On average, these granite slabs weigh 2.5 tonnes, while some of the stone ceiling beams are estimated to weigh 80 tonnes! As a comparison: a family car weighs about 1.5 tonnes.



It is possible that ramps wound their way up inside the pyramid, a bit like a snail's shell. This would have protected the workers from the sun's glaring heat.

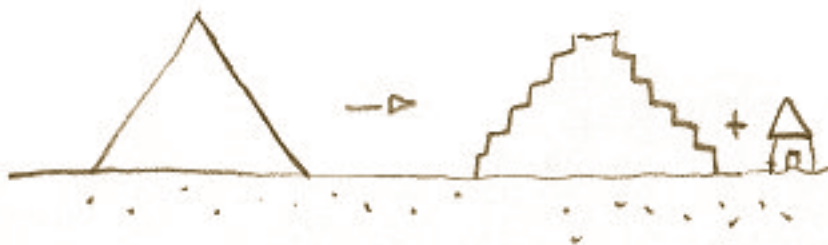
According to another theory, there was a long, straight ramp leading up the pyramid. The stones of which it was built could then have been incorporated into the pyramid itself, which would explain why there aren't any left for us to see today.



And then there are others who think that the pyramid must have been built by aliens from outer space.

What do you think?

Over the centuries, tomb robbers have stolen everything and anything that could be carried away, including the polished white limestone which formed a casing around the pyramid. They used this stone to build their own houses. That is why the Great Pyramid of Giza now has a stepped outer surface.



### Quiz

A pyramid is a geometric form that has a rectangular base and four identical triangular sides. Where—apart from your math book—can you find other pyramids?

(Answer on p. 46)

### Tip

If you log onto [www.pbs.org/wgbh/nova/pyramid/explore/khufutombkinglo.html](http://www.pbs.org/wgbh/nova/pyramid/explore/khufutombkinglo.html), you can go on a virtual exploration of the Great Pyramid of Giza.

2300 BCE–1000 BCE  
Bronze Age in Europe

1000 BCE–500 CE Antiquity\*

500–432 Phidias

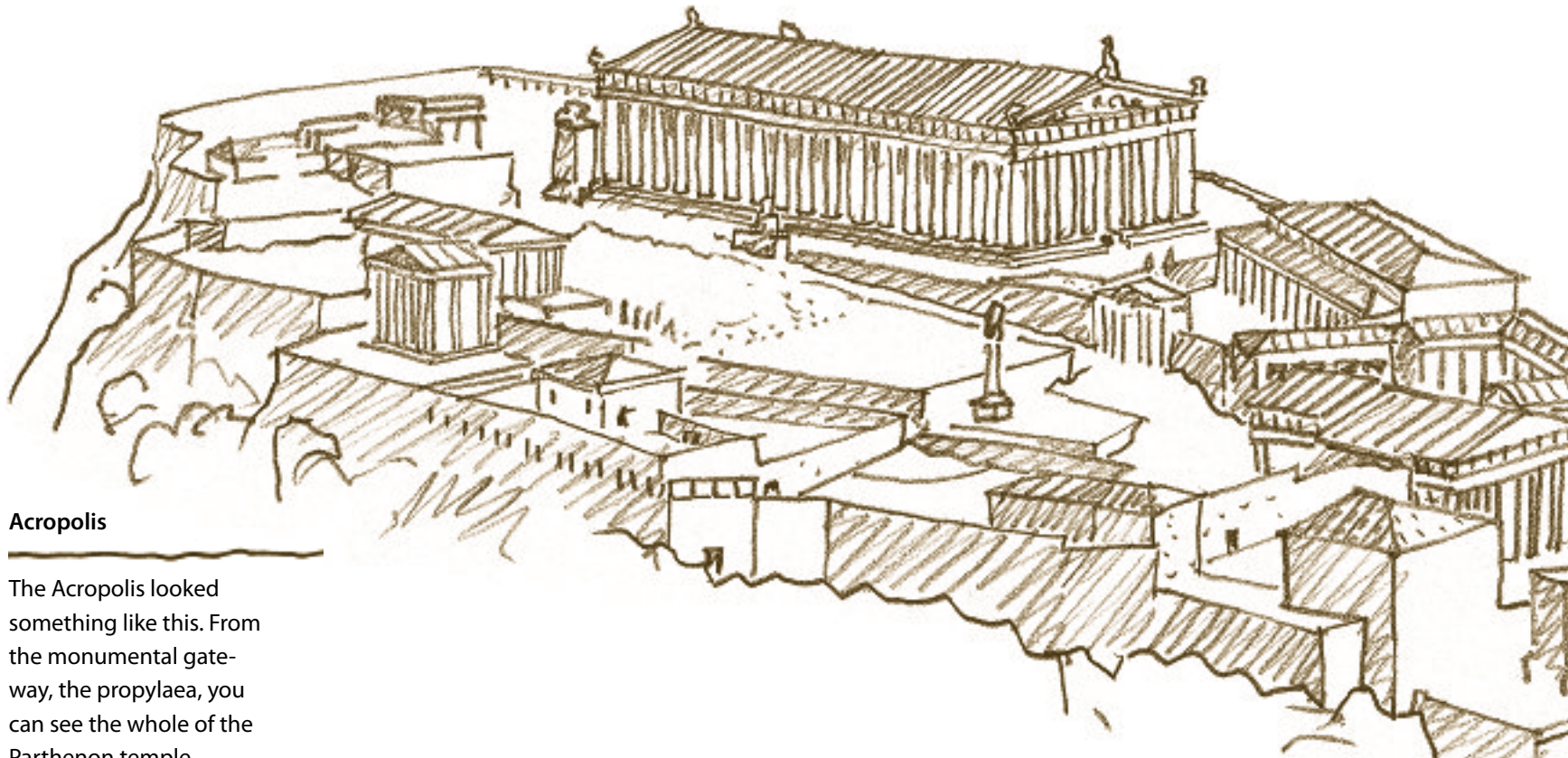
490–429 Pericles

120 BCE  
The Romans  
first use  
cement for  
building

970 BCE First evidence of a  
pulley system being used

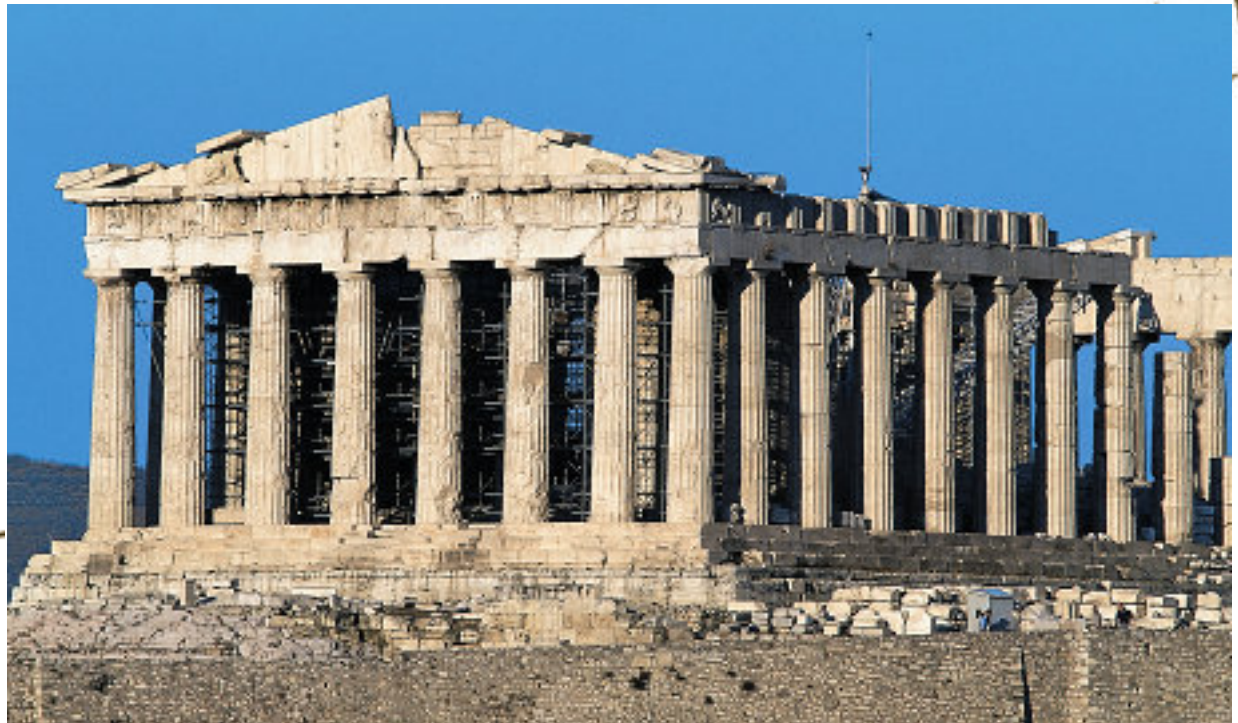
447–432 BCE Parthenon

1200 BCE 1100 BCE 1000 BCE 900 BCE 800 BCE 700 BCE 600 BCE 500 BCE 400 BCE 300 BCE 200 BCE 100 BCE



### Acropolis

The Acropolis looked something like this. From the monumental gateway, the propylaea, you can see the whole of the Parthenon temple.



### The Parthenon temple

And this is what the Parthenon temple looks like today. The ruins give an idea of its former glory.



0 The birth of Christ and the beginning of Christianity

c. 450 The Parthenon is turned into a church

0

100

150

200

250

300

350

400

450

500

550

600

# The Parthenon



A colorful temple: the Parthenon is the most famous temple of Greek Antiquity

The buildings on the Acropolis, the “Sacred Rock” of Athens, had been destroyed by the Persians during the Persian Wars. And so the city’s governor\* Pericles commissioned the famous sculptor Phidias and two architects to redesign the complex. At its center was the biggest and most beautiful of Greek temples: the Parthenon, which is roughly the same size as a soccer pitch.

Although all temples of this period are quite similar, architects constantly tried to improve the rigidly de-fined design of the building to achieve a perfect harmony. To this end, they used cleverly-devised proportions\* and little tricks that are not immediately apparent. The corner pillars, for example, are slightly thicker than the rest, because they are better-illuminated than the others, which makes them look thinner. Thanks to this trick, all of the pillars look exactly the same.

There was a 12-meter (39-foot) statue of the goddess Athena in the inner chamber of the Parthenon, in the so-called “cella”, that disappeared however shortly after completion.

**Started:**

447–432 BCE

**Location:**

Athens, Greece

**Architects:**

Iktinos and Kallikrates, under the supervision of the sculptor Phidias

**Size:**

30.8 m x 69.5 m  
(101 x 228 feet)

**Height of outside pillars:**

10.43 m (34.2 feet)

**Material:**

Marble

**Style:**

Greek Antiquity\*

**Special features:**

Made entirely of marble, including the roof tiles

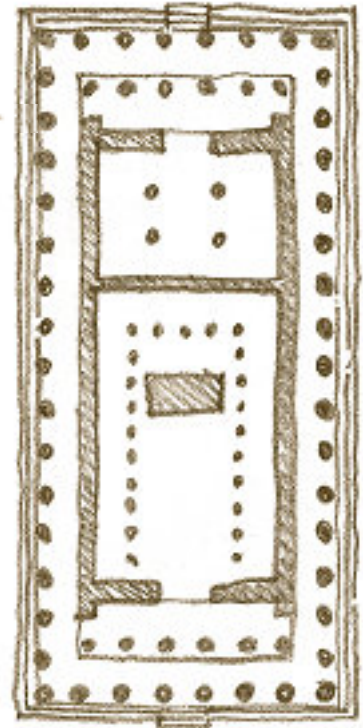
## Sculptures from the Parthenon frieze

The Parthenon was decorated on the inside and the outside with wonderful sculptural reliefs. Only a fraction of these have survived to this day and are now scattered in various museums.



## Ground plan\*

There were lots of pillars around the "cella", the inner chamber in which the goddess's statue once stood.



## The goddess Athena

It has only recently been discovered that Greek temples and statues were painted in bright colors. Tiny fragments of color have shown up under ultraviolet light. The figures' clothes and shields were decorated with colorful patterns, and pictures of animals or battle scenes.

**What colors would you paint this statue of Athena?**



## Three Types of Columns

Classical Antiquity can be divided into three main “orders”: Doric, Ionic and Corinthian. The difference becomes clear when you look at the columns.



### Doric

Doric columns are the only ones that don't have a base. The top end, called the capital, is very plain.



### Ionic

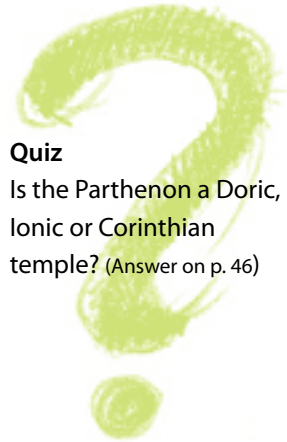
The capital of an Ionic column is in the shape of two thick scrolls.



### Corinthian

Corinthian columns, on the other hand, are decorated with leaves.

You can impress people if you can remember this!



### Quiz

Is the Parthenon a Doric, Ionic or Corinthian temple? (Answer on p. 46)

### Tip

You don't even need to go to Greece to see these sorts of columns. A lot of buildings in European cities were built in the neoclassical\* style. Munich's Königsplatz square, for example, was inspired by Greek architecture. Is there a building in your city that was built according to a Classical model?

1078 The Tower of London

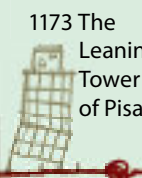


1177 The choir of Notre Dame is completed

1163 Building of Notre Dame starts



1173 The Leaning Tower of Pisa



1070

1080

1090

1100

1110

1120

1130

1140

1150

1160

1170

1180



## Notre Dame de Paris

Notre Dame in Paris was the model for many famous Gothic cathedrals.

**Started:**

1163

**Location:**

Paris, France

**Architects:**

Jean de Celles and Pierre de Montreuil

**Length:**

130 meters (426 feet)

**Width:**

48 meters (157 feet)

**Interior height:**

up to 35 meters (105 feet)

**Height of towers:**

69 meters (226 feet)

**Style:** Gothic\*

**Special features:**

Regarded as the model of all Gothic cathedrals\*

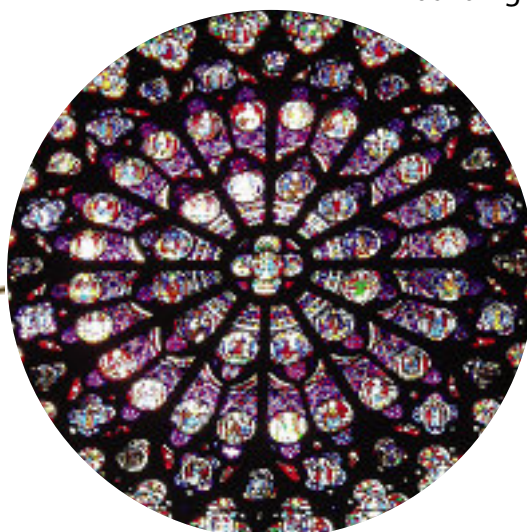
Bishop Sully of Paris wanted to build a cathedral in the very latest fashion, so he simply had the previous church demolished—even though it had only just been renovated. He wanted an ultra-modern Gothic church. When the foundation stone of Notre Dame was laid, it became the model for countless other cathedrals.

Notre Dame was the setting for many famous events. Joan of Arc was condemned to death here; Mary Queen of Scots was married in the cathedral; and Napoleon's coronation also took place in Notre Dame.

During the French Revolution the heads of the 28 statues of kings on the main West Front were knocked off, because the rioting mob was angry at all aristocrats. After that, the church was used as a wine store. And if Victor Hugo had not written the famous story of Quasimodo, the Hunchback of Notre Dame, this wonderful building might have fallen into rack and ruin.

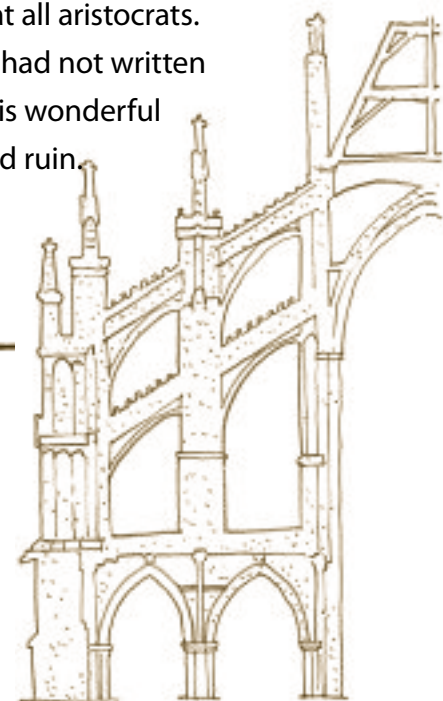
**The beautiful stained-glass window**

with a diameter of 12 meters (39 feet) is one of the largest in Europe. A window like this is called a "rose window" because it looks like a flower.



**Flying buttresses**

are a typical feature of Gothic buildings. They help to take the heavy weight of the roof off the walls, making it possible to put in large windows.





1200 The West Front is built

1250 Completion of the second tower and the transept fronts

1190

1200

1215

1230

1245

1260

1275

1290

1300

1315

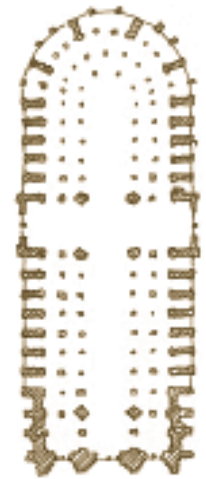
1330

1345



### The great West Front

was built slightly asymmetrically\* on purpose, so that it did not look too boring. What differences can you spot?



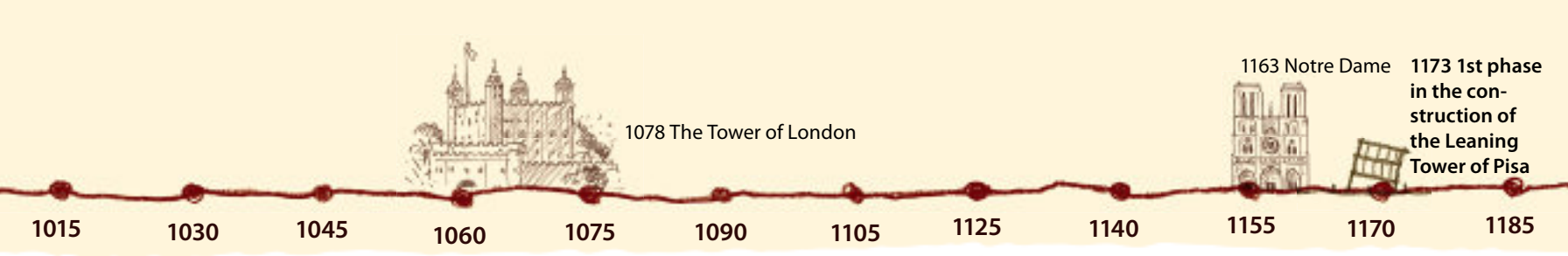
### Ground plan

There is usually a special word used to describe most church designs. Notre Dame is a five-apsed basilica\*.

*These funny creatures are called gargoyles. They keep the rainwater away from the church wall. What sort of face would you give your gargoyle?*





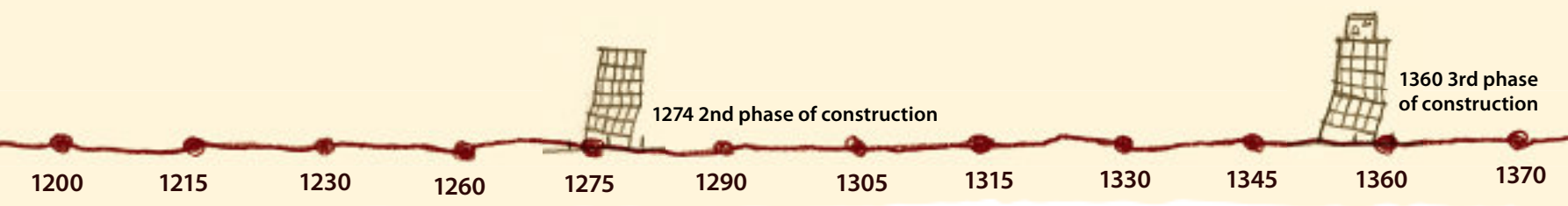


**Pisa's bell tower (called a campanile in Italian)**

The people of Pisa wanted a really special tower: higher than all the other towers in Italy, and round, too! But what has made it the most famous tower in the world?







## The Leaning Tower of Pisa

The bell tower has stood on Pisa’s Cathedral Square for more than 800 years. That is not even a particularly long time: some buildings are much older. And yet every additional year is a little miracle when it comes to this bell tower because it has continued to defy gravity!

When the people of Pisa laid the foundation stone of their campanile, they actually wanted to build the tallest bell tower in Italy that would be a visible sign of their wealth and success. And if there were trouble with the neighbors, the well-off at least could take refuge there. It was to be 100 meters (328 feet) high. When they were building the third level, the laborers had to take to their heels very quickly: the ground gave way on one side and their great tower seemed about to fall over!



If you want to build high in the sky, you must first make sure that you have a solid foundation\* that will bear the entire building’s weight—but the architect in Pisa hadn’t thought of that. And so the thin bottom plate and the first three floors sank about 4 meters (13 feet) into the ground.

The local people were so shocked that they took a 100-year break from building. Then they built the next four floors. The new architect—not the one who had started work on the tower, of course—attempted to balance out the tilt, but that didn’t really work, and the tower leaned further and further to one side.



**Started:**  
August 9, 1173

**Location:**  
Pisa, Italy

**1st architect:**  
Bonanno Pisano  
1173–84,  
Floors 1–3

**2nd architect:**  
Giovanni di Simone  
1274–84,  
Floors 4–7

**3rd architect:**  
Tommaso Pisano  
1360, belfry

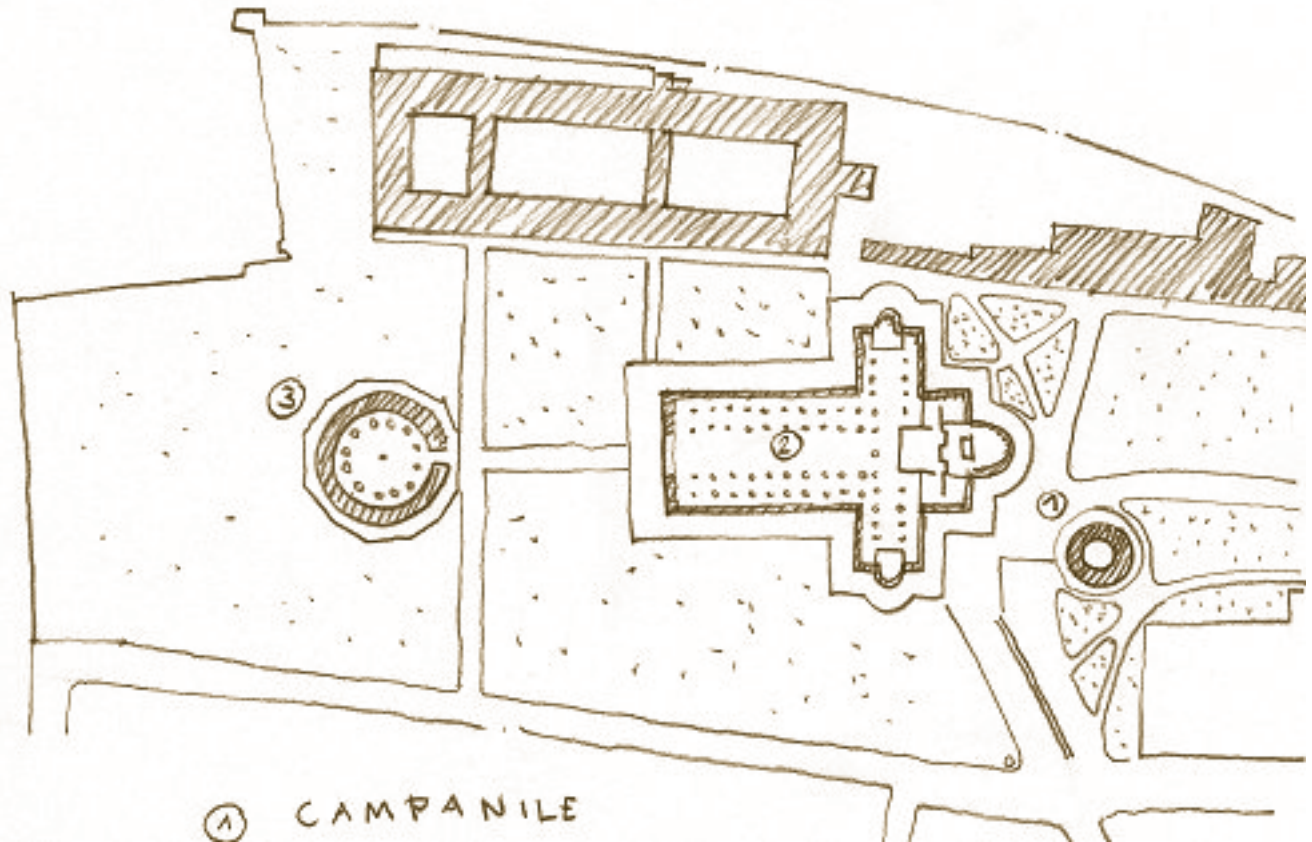
**Height:**  
54 m (177 feet)

**Style:**  
Romanesque\*

**Special features:**  
The tower leans at an angle of 4.43°

## Site plan

The tower ① stands at a small distance from the cathedral ②. You can also see the baptistry ③ on this site plan.

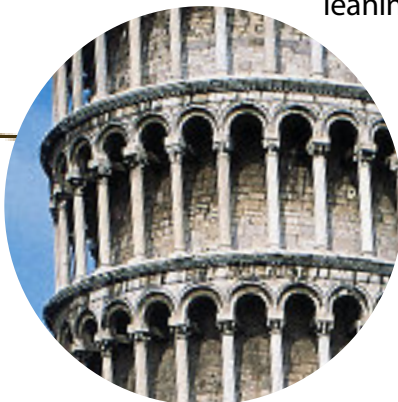


As the tower had still not toppled over a hundred years after that, its third and final architect constructed a belfry on top of it, like a little crown. On one side, two steps lead up to it. On the other, you have to climb four steps. If only they had used a plumb line\*!

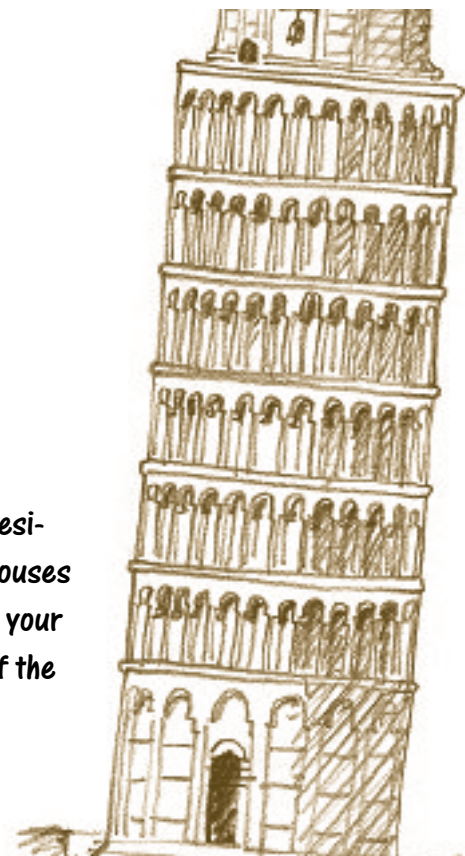
They have tried again and again to straighten it out, but nobody has quite managed. And that is why the Leaning Tower is as crooked as a banana, as well as leaning to one side!

## 30 columns

surround every floor. Can you work out how many columns there are altogether?



*How would you have designed the belfry that houses the seven bells? Draw your own top floor on top of the tower!*

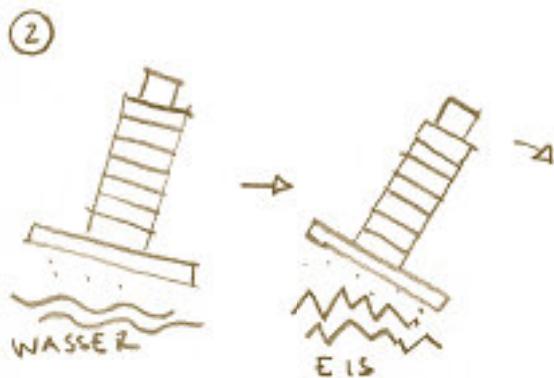




## Teetering on Tiptoe

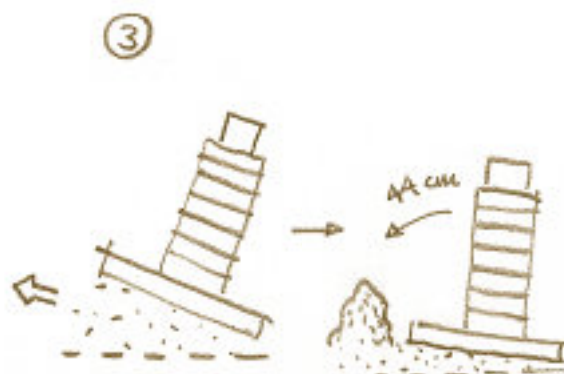
The tower really did need a bit of help: leaning further and further to one side over the centuries, the tower had to be closed to visitors in 1990. The risk that it could topple over and bury people underneath it was just too great!

Have you ever tried to move a tower made of building blocks into another position without it collapsing? What would you do? First, 18 steel rings were placed around the tower. One side of the foundation was weighed down with 800 tons of lead weights. That brought the leaning tower 2.5 cm closer to being straight, but looked very ugly.



A ring of concrete was then to be poured around the foundation and anchored to the ground. Before doing this, they had to stop the groundwater rising—and it was decided to freeze it. But do you know what happens when water turns to ice? It expands! The tower began to wobble and it looked as though its end might have been near!

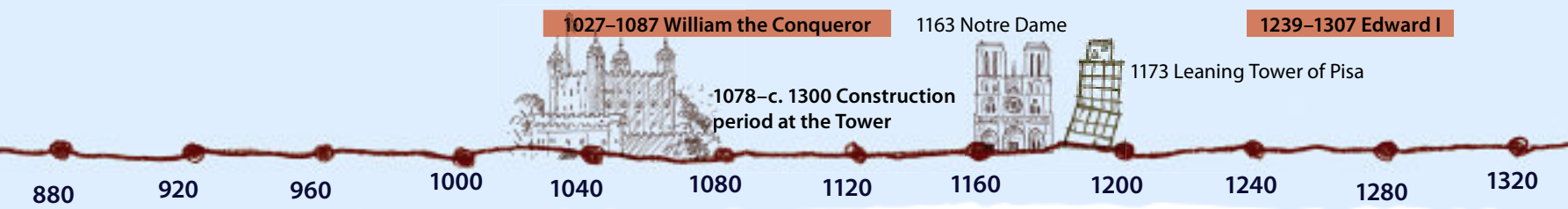
Sometimes, the simplest solution is the best: finally, 50 m<sup>3</sup> (1766 ft<sup>3</sup>) of soil and mud were dug out, very carefully, from underneath the bottom plate on one side. It was almost a miracle: the Leaning Tower of Pisa came 44 cm (17 inches) closer to being straight!



### Quiz

How high is the Leaning Tower of Pisa today?

(Answer on page 46)



# The Tower of London

With its countless tales both true and made up, the Tower of London is a perfect fairy-tale royal castle.

**Started:**

1078 (The White Tower completed)

**Construction period:**

Over 300 years

**Location:**

London, England

**Commissioned by:**

William the Conqueror

**Height:**

White Tower: approx. 30 meters (98 feet)

**Total area:**

approx. 18 acres

**Style:** Norman

**Material:** Stone

**Special feature:**

6 ravens as permanent residents

When William the Conqueror had the first stone building constructed in the 11th century to replace a wooden fort on the site, life for the people of London was still far from easy. This first building, the White Tower, still forms the heart of the complex, although a number of other buildings were added over the centuries.

In the olden days, the Tower was a royal palace; today it houses a display of historic weapons and armory, as well as England’s most precious treasure: the Crown Jewels.

The Tower was also a prison, and being “sent to the Tower” often meant death. The first prisoner, however, managed to escape over the wall using a rope which had been hidden in a wine barrel, while his drunken guards were fast asleep and snoring loudly. Other prisoners were not so lucky and many were executed in the Tower. Today people can visit the castle and discover its fascinating history.



**Ravens**

There have been at least six ravens in the Tower for centuries. They are well looked after and all have names. As legend has it, as long as there are ravens in the Tower, the United Kingdom will not fall!

**Tip**

If you apply 6–8 weeks in advance, you can be present at the Ceremony of the Keys which takes place every evening at seven minutes to ten. The tradition is over 700 years old and is thought to be the oldest ceremony in England. On the website <http://www.hrp.org.uk/TowerOfLondon/WhatsOn/ceremonyofthekeys.aspx> you can apply for a pass, which is issued free of charge.



1506 St. Peter's Basilica



1687 Parthenon destroyed



1632–1723 Restoration of the Tower by Christopher Wren and addition of the domes

1360 1400 1440 1480 1520 1560 1600 1640 1680 1720 1760 1800



### The Tower from the Thames

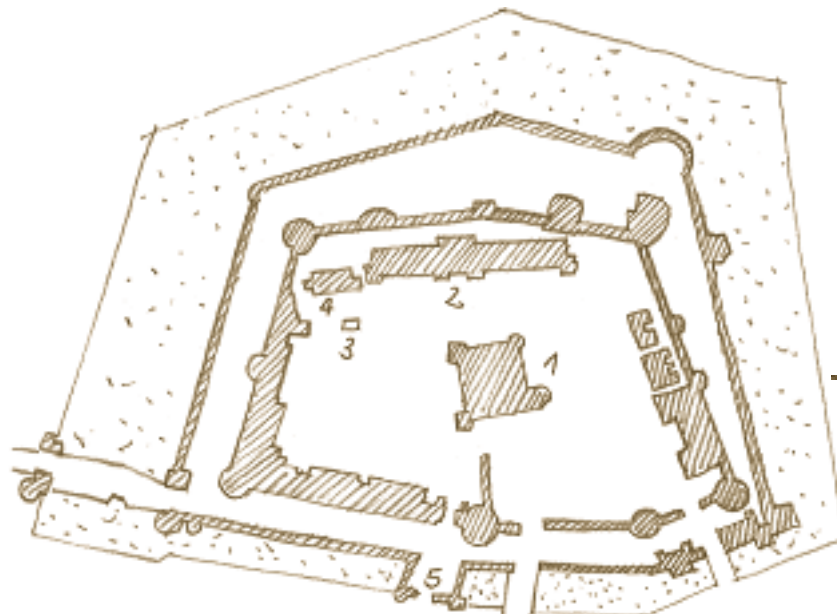
The light-colored stone, brought across from Normandy in France to build the White Tower, gave the main building in the complex its name.



### St. John's Chapel

built in 1080, St. John's Chapel is the oldest surviving Norman chapel.

- 1 White Tower
- 2 Waterloo Barracks
- 3 Scaffold site
- 4 Chapel
- 5 Traitors' Gate



### Ground plan

Two circular walls and a moat protect the precious Crown Jewels, which can be viewed on the ground floor of the Waterloo Barracks.



1450 The Parthenon becomes a mosque

1475–1564 Michelangelo

1506 Building of St. Peter's Basilica begins

1370 1385 1400 1415 1430 1445 1460 1475 1490 1505 1520 1535

### St. Peter's Basilica

Seen from the outside, it is difficult to see just how enormous St. Peter's Basilica really is. Above the front entrance is the small balcony from which the Pope gives his blessing.







# St. Peter's Basilica



The cathedral of Rome in the Vatican City: Many famous artists and architects worked on this basilica\*.

As long ago as 324 CE, Constantine the Great had a church built over the grave of the apostle St. Peter. Because this old basilica did not seem grand enough to Pope Julius 1200 years later, he simply had it demolished. In its place, he had a monumental new building constructed.

St. Peter's Basilica, the Pope's church, is one of the largest in the world. 60,000 people can attend mass here at the same time. That is six times as many people as fit into Notre Dame. An enormous dome was built above the tomb of the first pope: St. Peter.

A great many architects and sculptors were involved on the construction. One of the most famous was Michelangelo.



- 1 Entrance
- 2 St. Peter's tomb

**Started:**

April 18, 1506

**Location:**

Vatican City (a city-state in Rome, Italy)

**Architects:**

Bramante, Raphael, Michelangelo, Bernini, and many others

**Length:**

211 m (692 feet)

**Height:**

132 m (433 feet)

**Diameter of the dome:**

43 m (141 feet)

**Styles:**

Renaissance, Baroque

**Special features:**

With a surface area of 15,000 m<sup>2</sup> (161,400 ft<sup>2</sup>) St. Peter's is one of the biggest churches in the world

**Ground plan\***

The ground plan was originally in the shape of a Greek cross, which has four "arms" of equal length. The length of the nave\* converted it to a Latin cross.