

August 9th

Memory verse:

Nevertheless the foundation of God standeth sure,
having this seal,
The Lord knoweth them that are his.

2 Timothy 2:19

This verse is a comfort to all Christians. We belong to the Lord. We are His. He knows us. Younger children can learn the words in **bold**.

The Leaning Tower of Pisa¹

Do you remember the story of the tower that fell down on 21st February? We have another tower with a problem today but this one is still standing. On **August 9th** 1173 work began on the building of what must be the world's most famous *campanile* or bell tower. It would be 200 years before it was finished! The tower is so famous because it leans to one side as you can see from the picture.



The circular tower is made out of white marble with coloured marble decorations on the outside. At the base the walls are nearly 4 metres thick and this thins gradually to about 2 metres at the top.

Inside the tower is a spiral staircase with 296 steps – although the side on the right in the picture above has only 294 and you can guess why! You can see the columns and arches in the picture. There are 15 columns on the bottom storey. The other stories all have 30 columns apart from the smaller storey at the very top. This is the storey which houses the bells and you can see that the diameter of that storey is much smaller than that of the other stories. With such strong, thick walls you might wonder why the tower started to lean. The answer is in the foundations. Despite the thickness of the walls, the foundations of the tower do not go down much more than three metres. Nor do they spread out any further than the base of the tower itself. Not only that, underneath the tower is not solid rock but quite soft ground. In fact, the town of Pisa got its name from a Greek word that means “marshy ground”.



The construction of the tower was continually interrupted as the state of Pisa did battle with its neighbours Genoa, Lucca, and Florence. It was just as well that it was not all built at once. The constant interruptions allowed time for the tower's foundations to settle into the marshy ground before another storey was added. If it had all been built in one go, it would have probably fallen at once. The tower also survived earthquakes because of the marshy soil. The stiff tower does not resonate with the soft ground during an earthquake and so it has remained standing.

The tilt in the tower became apparent long before it was finished. The builders tried to put things right by, making the third, fifth and top stories shorter on the uphill side. This did not work and the tower continued to lean more and more. All sorts of ideas were tried during the following centuries to try to stabilize the tower but matters came to a head in 1989 when a bell tower in Pavia, Italy suddenly collapsed, killing several people. Bell towers had collapsed before, notably that of St Mark's in Venice, but this was the first time it had happened in Italy without the slightest warning.

The authorities closed the Leaning Tower of Pisa, in case it also suddenly fell, and began an effort to ensure that it was safe. Lead counter weights were stacked round the higher side and the bells

¹ See 21st February for a lesson about a tower that really fell down!

were removed to lessen the weight at the top. Cables were put round the tower at third storey height and anchored to the ground. Work began to stop the tower from leaning any further. It was decided that the best way to do this was to remove soil from the higher side to allow the tower to settle back to the position it was in during the 1830s. This was combined with work to strengthen the tower. It was ten years before the tower re-opened and was pronounced safe by the engineers. They calculated that it would be stable for at least 200 more years.

Something to make

Making a tower is always fun. You can use, Lego, Meccano, K'nex, plain wooden blocks, plastic cups, cardboard boxes collected from the local supermarket ...

You may enjoy trying to build a tower that touches the ceiling without collapsing. Can you build a tower that leans? Try doing this with large cardboard boxes. You could experiment with a counter weight (pile of books?) at the bottom.

A game to play

If you have a set of *Jenga* or *Tumbling Tower* blocks, now would be a good time to get them out (again if you played Jenga on 21st February!) and have a game. This game is just one of removing blocks from a tower in such a way that it does not fall down – when it is your turn. The strategy is to remove a block so that when the *next* player has his turn he cannot avoid removing a block that causes collapse. You could probably play this game with ordinary wooden blocks if you do not have a *Jenga* set.

Something to think about

There is a very well known parable that Jesus told about building on different kinds of foundation. You can read it in Matthew chapter 7 or Luke chapter 6. The rock in the parable is the “foundation of God” mentioned in today's memory verse.

Something to sing

There are a number of hymns which refer to Christ as the foundation of the church which would fit in well with today's lesson. For example “The Church's One Foundation” (343 in the 1977 edition of *Christian Hymns*) by Samuel Stone, usually sung to *Aurelia* by S S Wesley.² This hymn is in most hymnbooks. “Christ is Made the Sure Foundation”³ which is a translation of an ancient Latin hymn would be another choice. The tune is Westminster Abbey (153 in the 1977 edition of *Christian Hymns* with different words) the words are included in the Optional Resources files for today. The tune is really the last part of an anthem *O God Thou Art My God*⁴ by Henry Purcell (1659-1695) adapted for use with the hymn by Canon Ernest Hawkins. In the anthem the words for the part used for the hymn tune are just “Allelulia, Allelulia...” and if you do not know the tune already, singing it to Allelulias might be a good way to learn it before fitting in the words of the hymn.

A experiment to do

The leaning Tower of Pisa is also famous as the place where Galileo Galilei (1564-1642) is supposed to have carried out an interesting experiment.⁵ Galileo made important discoveries in the field of astronomy (see the lesson for 15th February) but he was interested in many other areas of science and mathematics as well. The experiment he carried out at the Leaning Tower was to do with gravity. There was a popular idea, based on a misconception of something the pagan

2 You can download words and music here: https://hymnary.org/text/the_churchs_one_foundation#tune and listen here: <https://my.hymnary.org/song/dynamic/11/the-churchs-one-foundation?toolkit=veroviostatic&width=1600>

3 You can download words and music here: https://hymnary.org/text/christ_is_made_the_sure_foundation and listen to the tune <https://my.hymnary.org/song/dynamic/122/christ-is-made-the-sure-foundation?toolkit=veroviostatic&width=1600>

4 You can hear it here: <https://www.youtube.com/watch?v=Cb4G-G6XyRo>

5 Some people think that he did not carry out this experiment but only rolled different balls down an inclined plain (slope).

philosopher Aristotle had taught, that if two objects, one heavy and one light were dropped together the heavier one would land first. This might seem likely but Galileo had worked out that it is not the case. His experiment involved taking two balls of the same size but different weights to the top of the tower. The two balls were dropped together and landed at the same time. The Leaning Tower would certainly be the perfect place for such an experiment. The lean would enable the experimenter to drop the balls without having to lean over the side much himself and also to easily observe the landing! In fact it is such a good idea that an enterprising science theme park in Perth, Australia has built a leaning tower specially, the Leaning Tower of Gingin, where children can climb up, drop weights (in the form of water-filled balloons) and observe them fall into the sand below.

You can repeat Galileo's experiment yourself – if you are careful! You need two similar pop bottles. One should be empty and the other half-full of water. You can drop these together through a bedroom window into your garden. **MAKE SURE NO ONE IS UNDERNEATH.**

Why do both bottles land together? This happens because the force of gravity acting on both objects is the same. Gravity acts on all masses equally and causes all objects to fall at the same constant rate.