



Toilet roll roll

A do-at-home civil engineering activity for ages 4-18.

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Background

We all know what we use toilet roll for but what you might not know is how the work of civil engineers allows us to flush the toilet and send the toilet roll away once it has been used.

This is done by underground tunnels called sewers. Right now in London civil engineers are making a **tunnel that is so big you would be able to fit three double decker buses side by side in it!** One thing that is really important when designing sewers is to make sure they are built so they don't get clogged up. One way of doing this is to make sure that the angle (gradient) of the sewer is steep enough to make the sewage (water and other things, including toilet paper, in the sewer) moves fast enough so it does not get stuck.

Your challenge is to build towers out of toilet roll to move another toilet roll along it as fast as possible, to do this you will have to make sure the angle (gradient) is steep enough for gravity to move the toilet roll all the way along the towers and onto the landing zone.

We've adapted this activity to work for different age groups – 4-10s (primary), 11-16s (secondary) and 16-18s (sixth form) – to be completed in the home environment with minimal equipment.

What you'll need

- At least six tubes of toilet roll (don't worry these won't be wasted by the activity)
- A measuring tape or ruler
- A stopwatch
- Some books or packets to stack

Activity instructions

Use toilet rolls propped by books of differing numbers and thickness to set up a series of towers in ascending (get higher and higher each time) height. After you've built your slope as described, take another roll and unroll the paper a little, tucking the loose end under the bottom of the lowest roll of the slope it under the toilet roll tower that is at the bottom of the slope. Continue to unroll the paper of that roll until the toilet roll is sitting right at the top of the slope.

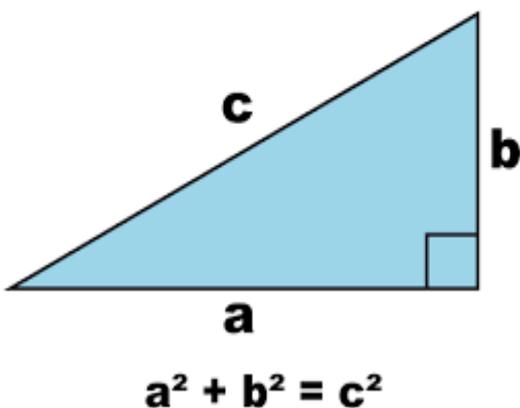


No need to limit yourself if you have more rolls available – the longer the track the better!

Then see if you can roll the toilet roll onto the landing zone (the floor at the bottom tower). This will take a lot of adjusting to get the slope (gradient) right to manage to get the roll to go all the way along the track and land at the bottom, just like civil engineers do when they are designing sewers.

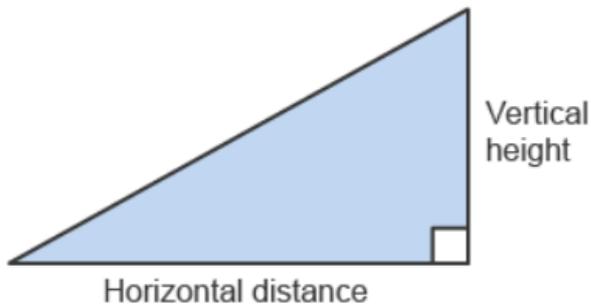
For 11-16 year olds

Triangles are an important shape in engineering as they are very strong and used to make buildings and other structures as secure as possible. There is a triangle in this activity formed by the floor (a), the highest tower (b) and the track of toilet roll sloping down (c). Your challenge is to find out how long the slope (c) in the triangle is by measuring the bottom side and the height of the triangle and using Pythagoras theorem.

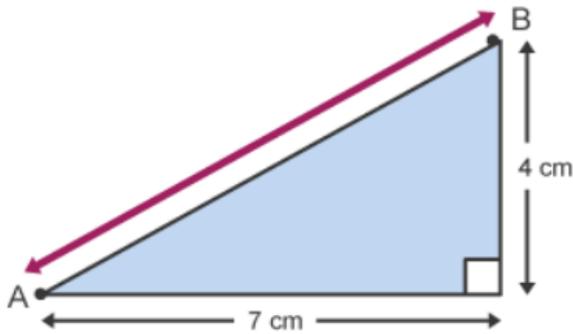


If you know the values of (a) and (b) you can also work out the gradient of the slope (c) using this formula.

$$\text{gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$



Example 1



$$\text{gradient of line } AB = \frac{\text{vertical height}}{\text{horizontal distance}}$$

$$\text{vertical height} = 4\text{cm}$$

$$\text{horizontal distance} = 7\text{cm}$$

$$\text{gradient} = \frac{4}{7}$$

For 16-18 year olds

Your final challenge is to calculate the speed of the rolling toilet roll, using this formula.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

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Info about all types of engineering careers (not just civil): Tomorrow's Engineers
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