

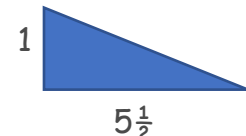
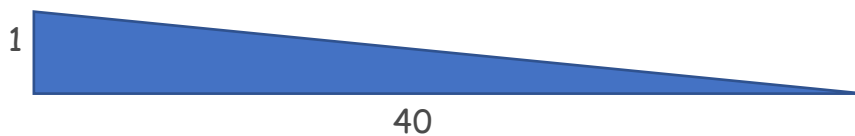
INCLINES

Setting the scene.

1. Do you find it easier to cycle up hill or down hill?
2. Why do things that fall off a table land on the floor and not the ceiling?
3. When apples fall from a tree, why do they land on the ground and not fly off into the sky?

FACT - Gravity is the force that attracts all objects towards the centre of the earth.

It is gravity that makes things fall to the ground and it is gravity that makes going up hill harder ... for you and for trains. For most railways, the wheels go round to move a train along the track and they are able to climb a gentle slope. We measure the steepness of a slope - it is called the gradient. Most trains can manage a gradient of 1 in 40. That means to go up one metre you have to travel along 40 metres.



On mountain railways steeper gradients are needed. The solution is to mount a toothed rack between the rails and provide a cog on the locomotive. In this way the locomotive can crawl up steep gradients. On the Snowdon Mountain Railway, the steepest gradient is 1 in $5\frac{1}{2}$



The logo of the Snowdon Mountain railway shows a rack and a cog wheel

Did you know...? A cog wheel is also known as a pinion.

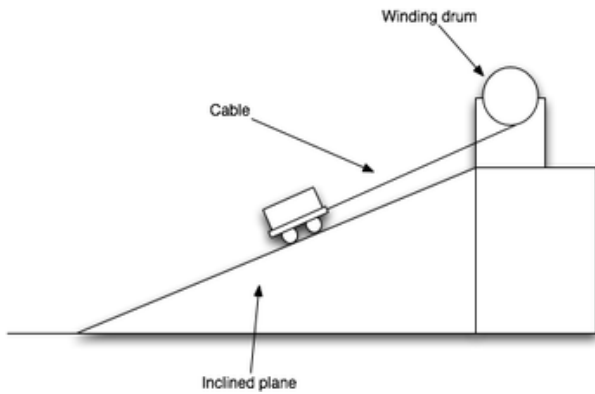
Challenge 1 - Can you find an object in your home that is 1 cm tall and measure 40 cm and $5\frac{1}{2}$ cm from it? Make a ramp for each distance; which is the steeper?



Challenge 2 - Next time you are on a trip, look out for a road sign like this one. It warns of a steep hill.

Did you know that triangular signs like this are warnings?

Several Welsh railways and quarries, including the Talylyn Railway, used inclines to move wagons up and down steep hills. A cable pulls a wagon up the incline and also controls the descent. In some cases, a wagon going downhill was used to pull another wagon uphill. This diagram and photo show you an incline;-



Challenge 3 - Imagine what might happen if the cable on an incline snapped; can you write a short story about it?

Challenge 4 - Can you complete this crossword? Hint - the first six answers all appear in this document. We have also included one letter to help you unlock the puzzle

1. [down] a measure of steepness
2. [down] a wheel with teeth
3. [across] teeth laid between the rails to help a locomotive climb a steep hill
4. [across] the force that attracts objects towards the centre of the earth
5. [across] another word for a wheel with teeth
6. [down] a slope where wagons can be pulled up by a cable
7. [down] opposite to left
8. [across] going up a hill
9. [down] a place from where coal is dug out
10. [across] the time between sunset and sunrise.

