

Problems - Volumes & Areas

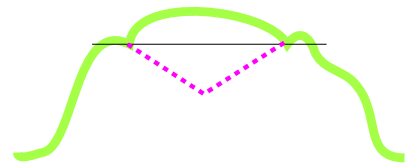
Simple situations - Ex1

The individual examples here involve the ability to visualise a problem situation and extract from it the basic formulae/expressions needed to provide a solution. Any calculations involved are relatively simple.

1. You are asked to clear an old foundation which has been covered with gravel/stones - ready for a new building construction. You have a 10m^3 lorry which is filled 10 times when clearing the site - which measures $10\text{m} \times 10\text{m}$. When you get down to the old foundation you find that it is covered with heavy metal plates which you remove. Unfortunately doing so reveals a hole like an inverted regular pyramid, $10\text{m} \times 10\text{m}$ on the surface and three metres deep in the middle (as shown in the second diagram opposite).

Have you removed enough material to completely fill the hole ready for building?

If you had encountered a circular hole like an inverted cone (10m in diameter) of the same depth which needed filling, would the answer to the above question be the same? Give reasons for your answers.



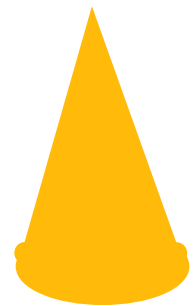
2. You are working on a road re-surfacing job in an area with very high winds. This high wind blows traffic cones all over the place, so you have been told to half fill them with concrete to stop them blowing away. You are using 250 cones each with a base circle of 300mm and a height of one metre. A fully loaded concrete lorry contains 10m^3 of concrete ready to pour.

How many lorry loads will you have to order?

How much concrete will be left over?

Which interpretation of "half full" did you use - half by height or half by volume?

Work out both alternatives and choose the cheaper!



3. You have been tasked with constructing a section of a high-speed rail track some half way up the side of a hill - for a distance of several kilometres. The civil engineer in charge has indicated that the side of the hill which will be above the track (which slopes at 45°) is safe if properly planted. However, the hill below the track needs to be buttressed with concrete and land fill to a 30° slope to take into account traffic loading from up to two high-speed trains and one other train on the three track stretch - which has a bed width of 40m .

The diagrams opposite show the hill itself with an average slope of about 40° and, below that, the 'ideal' cross-section for the rail track section to be constructed.

Work out how to position the track with respect to the hill in order not to have to transport land-fill to the site - which is expensive. Concrete for the track bed and buttress will be no more than 1m in thickness over the shaded region.

Describe your method in detail clearly. Only do calculations if absolutely necessary.

