**Activity 2 Worksheet: Using the mid-ordinate rule to calculate the materials for a road embankment**

# Practice question 1

You are constructing a road embankment with a cross-sectional base width of 10 metres as shown below. The embankment will be 15 metres long.

Calculate the amount of fill needed to construct the embankment.

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Remember to work through each step in turn.

**Step 1:** Plot the ‘x’ and ‘y’ co-ordinates on graph paper.

**Step 2:** Divide the base width of the cross-section into equal intervals. (5 would be a good choice)

**Step 3:** Determine the midpoint of each interval.

**Step 4:** Measure the height of the fill at each point.

**Step 5:** Calculate the area of each interval.

**Step 6:** Add up the areas of the segment to get the total area of the cross-section.

**Step 7:** Work out the total amount of material needed by multiplying the area of the cross-section by the length of the embankment.

# Practice question 2

Using the mid-ordinate rule to calculate the cross-sectional area of another road embankment with a base width of 12 metres divided into six equal segments. The heights are as given in the table below.

You can assume that the existing ground level is at 0 metres.

|  |  |
| --- | --- |
| **Position (m)** | **Proposed height (m)** |
| 0 | 2.5 |
| 2 | 3.0 |
| 4 | 5.0 |
| 6 | 5.0 |
| 8 | 5.0 |
| 10 | 3.0 |
| 12 | 2.5  |

Hint: Remember to work through each step in turn, starting by sketching the embankment. Embankments are an engineered structure; they have level tops and slopes which are graded to a specified angle, so you can plot this graph by joining the heights at each position with a straight line.

# Practice question 3

You are designing a road that must pass through uneven terrain. To create a level road, you will need to cut soil from higher areas and fill soil to lower areas. The cross-section of the terrain along a 10-metre stretch of road is given in the table and graph below.

Use the mid-ordinate rule to calculate how much material will need to be removed from site to create a suitable road. The road will be 9 metres wide.

|  |  |  |
| --- | --- | --- |
| **Position (m)** | **Existing elevation (m)** | **Desired elevation (m)** |
| 0 | 3.5 | 3.0 |
| 2 | 3.0 | 3.0 |
| 4 | 3.5 | 3.0 |
| 6 | 3.5 | 3.0 |
| 8 | 2.5 | 3.0 |
| 10 | 2.0 | 3.0 |



Hint: Remember to add in the proposed road level. You will need this to work out the areas of cut and fill.