

# Mystery of the Bones

## 1. The Scenario

The remains of four girls have been discovered in a recent archaeological find. There are four bones from each girl left but archaeologists don't know which bones belong together. You have been engaged as the mathematician to work out which bones belong to which girl and approximately how tall the girls were.

## 2. Background clues



By knowing the length of certain bones in the body, scientists can estimate a person's height. The bones used are the humerus (shoulder to elbow), radius (elbow to wrist), femur (thigh bone), or tibia (knee to ankle).

The formulas for approximate heights (in mm) for males and females are shown in this table:

Male height	Female height
$2.9 \times (\text{Length of humerus}) + 695$	$2.8 \times (\text{Length of humerus}) + 704$
$3.3 \times (\text{Length of radius}) + 846$	$3.3 \times (\text{Length of radius}) + 800$
$1.9 \times (\text{Length of femur}) + 800$	$2 \times (\text{Length of femur}) + 717$
$2.4 \times (\text{Length of tibia}) + 774$	$2.4 \times (\text{Length of tibia}) + 736$

## Example

For a tibia belonging to a male and which is 45cm long, we would estimate the height by using the formula:

$$H = 2.4 \times L + 774$$

Converting the length to millimeters first, we substitute  $L = 450$  to obtain:

$$H = 2.4 \times 450 + 774$$

$$H = 1854\text{mm}$$

Therefore, the tibia belongs to a man who is about 1.85 metres tall.

## 3. Your task

Look at the data table showing the length of various bones found at the site. The bones are numbered from 1 to 16 and the measurements are in millimeters. By examining each bone in turn, calculate the approximate height of the girl for each bone. Then match the bones to discover which bones go together and find the approximate height of each girl.

Bone	Calculation	Approximate Height (in metres)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

## Approximate Heights:

Girl A \_\_\_\_\_ Girl B \_\_\_\_\_

Girl C \_\_\_\_\_ Girl D \_\_\_\_\_

Data Table

<b>1</b> <b>Humerus</b> <b>235</b>	<b>2</b> <b>Tibia</b> <b>385</b>	<b>3</b> <b>Femur</b> <b>470</b>	<b>4</b> <b>Tibia</b> <b>407</b>
<b>5</b> <b>Radius</b> <b>170</b>	<b>6</b> <b>Radius</b> <b>210</b>	<b>7</b> <b>Radius</b> <b>260</b>	<b>8</b> <b>Humerus</b> <b>280</b>
<b>9</b> <b>Femur</b> <b>320</b>	<b>10</b> <b>Femur</b> <b>495</b>	<b>11</b> <b>Tibia</b> <b>260</b>	<b>12</b> <b>Humerus</b> <b>360</b>
<b>13</b> <b>Tibia</b> <b>315</b>	<b>14</b> <b>Humerus</b> <b>340</b>	<b>15</b> <b>Radius</b> <b>275</b>	<b>16</b> <b>Femur</b> <b>385</b>