## *WS5.07 Investigation into the Distribution of Foot Lengths*

Below is the spread sheet data for "Right Foot Lengths" for 200 students taken from ***Census At School***. The data is in ascending order. There are 20 pieces of data in each column.

| | *A* | *B* | *C* | *D* | *E* | *F* | *G* | *H* | *I* | *J* |
|---|---|---|---|---|---|---|---|---|---|---|
| ***1*** | 12 | 20 | 22 | 23 | 24 | 24.9 | 25 | 26 | 28 | 29 |
| ***2*** | 12 | 20 | 22 | 23 | 24 | 25 | 25 | 26 | 28 | 30 |
| ***3*** | 12.5 | 20 | 22 | 23 | 24 | 25 | 25 | 26 | 28 | 30 |
| ***4*** | 13 | 20 | 22 | 23 | 24 | 25 | 25 | 26 | 28 | 30 |
| ***5*** | 15 | 20 | 22 | 23 | 24 | 25 | 25 | 27 | 28 | 30 |
| ***6*** | 15 | 20 | 22 | 23 | 24 | 25 | 25 | 27 | 28 | 30 |
| ***7*** | 17 | 20 | 22 | 23 | 24 | 25 | 25.2 | 27 | 28 | 30 |
| ***8*** | 17 | 20 | 22 | 23 | 24 | 25 | 25.5 | 27 | 28 | 30 |
| ***9*** | 18 | 21 | 22 | 23 | 24 | 25 | 25.6 | 27 | 28 | 30 |
| ***10*** | 19 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30.2 |
| ***11*** | 20 | 21 | 22 | 23.1 | 24 | 25 | 26 | 27 | 28.2 | 32 |
| ***12*** | 20 | 21 | 22 | 23.5 | 24 | 25 | 26 | 27 | 28.5 | 32 |
| ***13*** | 20 | 21 | 22.5 | 23.5 | 24 | 25 | 26 | 27 | 29 | 34 |
| ***14*** | 20 | 21 | 22.6 | 23.5 | 24 | 25 | 26 | 27 | 29 | 34 |
| ***15*** | 20 | 21 | 22.7 | 23.6 | 24 | 25 | 26 | 27 | 29 | 34 |
| ***16*** | 20 | 21 | 23 | 24 | 24.1 | 25 | 26 | 27 | 29 | 35 |
| ***17*** | 20 | 21.2 | 23 | 24 | 24.5 | 25 | 26 | 27 | 29 | 35 |
| ***18*** | 20 | 21.4 | 23 | 24 | 24.5 | 25 | 26 | 27 | 29 | 35 |
| ***19*** | 20 | 21.6 | 23 | 24 | 24.5 | 25 | 26 | 27.5 | 29 | 35 |
| ***20*** | 20 | 22 | 23 | 24 | 24.5 | 25 | 26 | 28 | 29 | 35.2 |

Mean = 24.6 cm  Standard Deviation = 4.06 cm ≈ 4 cm

Fill in the following table:

| *3 standard deviations below the mean* | *2 standard deviations below the mean* | *1 standard deviation below the mean* | *Mean* | *1 standard deviation above the mean* | *2 standard deviations above the mean* | *3 standard deviations above the mean* |
|---|---|---|---|---|---|---|
| | | | 24.6 cm | 28.6 cm | | |

| | |
|---|---|
| From the table above, count how many numbers are between 1 standard deviation below the mean and 1 standard deviation above the mean? | What percentage of the 200 numbers is to be found within 1 standard deviation of the mean? |
| From the table above, count how many numbers are between 2 standard deviations below the mean and 2 standard deviations above the mean? | What percentage of the 200 numbers is to be found within 2 standard deviations of the mean? |
| From the table above, count how many numbers are between 3 standard deviations below the mean and 3 standard deviations above the mean? | What percentage of the 200 numbers is to be found within 3 standard deviations of the mean? |

**The mean height of a group is 166.6cm and the standard deviation is 13.3cm.**

Based on an assumption that the distribution of heights is approximately normal, use the empirical rule for the following questions:

**(i)** 68% of this school's students have heights between _____ cm and _____ cm.

**(ii)** What percentage of students have heights between 140 cm and 193.2 cm?

**(iii)** A school tour is being organised. All students can apply to go on it. There is a rollercoaster at one location on the tour. You have to be over 140cm to be allowed on the rollercoaster. What percentage of students are not tall enough to ride the rollercoaster?