

**Example 17****Self Tutor**

Ling uses a ruler to measure the length of her pencil case. She records the length as 18.7 cm. Find the range of values in which the length may lie.

18.7 cm is 187 mm, so the measuring device must be accurate to the nearest half mm.

∴ the range of values is  $187 \pm \frac{1}{2}$  mm

The actual length is in the range  $186\frac{1}{2}$  mm to  $187\frac{1}{2}$  mm, which is 18.65 cm to 18.75 cm.

**Example 18****Self Tutor**

A rectangular block of wood was measured as 78 cm by 24 cm. What are the boundary values for its perimeter?

The length of the block could be from  $77\frac{1}{2}$  cm to  $78\frac{1}{2}$  cm.

The width of the block could be from  $23\frac{1}{2}$  cm to  $24\frac{1}{2}$  cm.

∴ the lower boundary of the perimeter is  $2 \times 77\frac{1}{2} + 2 \times 23\frac{1}{2} = 202$  cm

and the upper boundary of the perimeter is  $2 \times 78\frac{1}{2} + 2 \times 24\frac{1}{2} = 206$  cm

The perimeter is between 202 cm and 206 cm, which is  $204 \pm 2$  cm.

**Example 19****Self Tutor**

A paver is measured as 18 cm × 10 cm. What are the boundary values for its actual area?

The length of the paver could be from  $17\frac{1}{2}$  cm to  $18\frac{1}{2}$  cm.

The width of the paver could be from  $9\frac{1}{2}$  cm to  $10\frac{1}{2}$  cm.

∴ the lower boundary of the area is  $17\frac{1}{2} \times 9\frac{1}{2} = 166.25$  cm<sup>2</sup>

and the upper boundary of the area is  $18\frac{1}{2} \times 10\frac{1}{2} = 194.25$  cm<sup>2</sup>.

The area is between 166.25 cm<sup>2</sup> and 194.25 cm<sup>2</sup>.

This could also be represented as  $\frac{166.25 + 194.25}{2} \pm \frac{194.25 - 166.25}{2}$  cm<sup>2</sup>  
which is  $180.25 \pm 14$  cm<sup>2</sup>.