Rounding and Bounds

Round to 1 d.p, 2 d.p., 3 d.p

46.3827	46.4	46.38	46.383

Round to 1 s.f., 2 s.f. 3 s.f

618,352	600,000	620,000	618,000
0·0004186	0·0004	0·00042	0·000419

Error Intervals

$x = 6.2$ t 1 d.p. Write an error interval for x

$$6.15 \leq x < 6.25$$

$x = 4.19$ to 2 d.p. Write an error interval for x

$$4.185 \leq x < 4.195$$

$x = 63,200$ to 3 s.f.

$$63,150 \leq x < 63,250$$

Exercise Write error intervals

1) $y = 16.4$ to 1 d.p.

$$16.35 \leq y < 16.45$$

2) $p = 4.567$ to 3 d.p.

$4.5665 \leq p < 4.5675$

Lower Bound Upper Bound

3) $q = 840$ to 2 s.f.

$835 \leq q < 845$

4) $r = 89,100$ to 3 s.f.

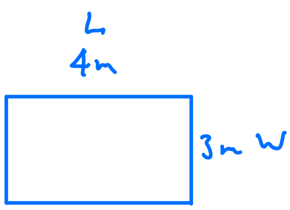
$89,050 \leq r < 89150$

5) $h = 0.004$ to 1 s.f.

$0.0035 \leq h < 0.0045$

Bounds

Ex1



Suppose a carpet measures 4m by 3m with each measurement to nearest metre

$3.5\text{m} \leq L < 4.5\text{m}$

$2.5\text{m} \leq W < 3.5\text{m}$

Find upper and lower bounds for the area

upper bound $= \underset{\text{biggest}}{4.5} \times \underset{\text{biggest}}{3.5} = 15.75\ \text{m}^2$

lower bound $= \underset{\text{smallest}}{3.5} \times \underset{\text{smallest}}{2.5} = 8.75\ \text{m}^2$

$8.75\,m^2 \leq \text{Area} < 15.75\,m^2$

A more realistic example. Suppose the measurements are correct to nearest 10cm

$3.95m \leq L < 4.05\,m$

$2.95m \leq W < 3.05\,m$

lower bound $= 3.95 \times 2.95 = 11.65\,m^2$

upper bound $= 4.05 \times 3.05 = 12.35\,m^2$

$11.65\,m^2 \leq \text{Area} < 12.35\,m^2$

Ex2 A boy runs 100m in 15 seconds
Distance is measured to nearest metre and time to nearest second.
Find upper and lower bounds for his speed

$99.5m \leq \text{Distance} < 100.5m$

$14.5s \leq \text{Time} < 15.5s$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

upper bound for speed $= \frac{100.5}{14.5} = \frac{\max}{\min}$ $6.93\,m/s$

lower bound for speed $= \frac{99.5}{15.5} = \frac{\min}{\max}$ $6.42\,m/s$

Upper and Lower Bounds

Addition Lower Bound for $A + B$

$A_{min} + B_{min}$

Upper Bound for $A + B$

$A_{max} + B_{max}$

Subtraction Lower Bound for $A - B$

$A_{min} - B_{max}$

Upper Bound for $A - B$

$A_{max} - B_{min}$

Multiplication Lower Bound for $A \times B$

$A_{min} \times B_{min}$

Upper Bound for $A \times B$

$A_{max} \times B_{max}$

Division Lower Bound for $\frac{A}{B}$

$= \frac{A_{min}}{B_{max}}$

Upper Bound for $\frac{A}{B}$

$= \frac{A_{max}}{B_{min}}$