

## Upper and Lower Bounds – www.m4ths.com

(Starter) Round each number below to the given level of accuracy.

7.43 to 1 decimal place	23.6 to the nearest integer	23 to 1 significant figure	103 to the nearest 10	35mm to nearest cm
7453 to 3SF	25.7 to 1SF	0.34 to 1SF	0.0056 to 1SF	0.0998 to 3dp

(1) Complete each of the following:

- (a) Peters height ( $h$ ) is 150cm correct to the nearest 10cm. This can be written as  $145 \leq h < \underline{\hspace{1cm}}$ .
- (b) The distance ( $d$ ) from Kings Lynn to London is 105 miles to the nearest 5 miles. This can be written as  $\underline{\hspace{1cm}} \leq d < 107.5$ .
- (c) The length of a worm ( $l$ ) is 1.4cm correct to 1 decimal place. This can be written as  $\underline{\hspace{1cm}} \leq l < \underline{\hspace{1cm}}$ .

(2) Find the lower bound (LB) and upper bound (UB) for each of the following:

2.3 correct to 1dp LB =    UB=	560 correct to 2SF LB =    UB=	0.5 correct to 1 SF LB =    UB=	345 correct to 3SF LB =    UB=	19.65 correct to 2dp LB =    UB=
13cm to 1cm LB =    UB=	15mm to 1mm LB =    UB=	½ litre to 100ml LB =    UB=	0.465 to 3SF LB =    UB=	50 to 2 SF LB =    UB=

(3) A rectangle has side lengths 8cm and 7cm. Both are correct to the nearest cm.

- (a) Find the upper and lower bounds of the dimensions. (*Drawing a table may help*)
- (b) Find the maximum and minimum area.
- (c) Find the maximum and minimum perimeter.

(4)  $x = 3.5$ ,  $y = 12$  and  $z = 230$ . All values are correct to 2 significant figures.

- (a) Find the upper and lower bounds for each value. (*Drawing a table may help*)
- (b) Find the maximum and minimum values of each of the following: (i)  $x + y - z$  (ii)  $xyz$  (iii)  $(x - y) \div z$

(5) A bottle of Lemonade holds 1lt correct to the nearest 100ml. Glasses hold 100ml correct to the nearest 10ml. Find the maximum and minimum possible number of glasses that can be filled from the bottle.

(6) A room is 15m by 12m both correct to the nearest 50cm. Desks are square shaped and 90cm in width correct to the nearest 10cm. Find the maximum possible number of desks that can fit in the room. (*You may assume that the desks have all 4 legs on the floor and are not stacked on top of other desks.*)

(7) The formula  $I = 2TQ^2$  is used in an experiment.

- (a)  $T = 10$  and  $Q = 2.4$  both correct to 2SF. Find the maximum and minimum possible values of  $I$ .
- (b) In a second experiment  $I = 140$  and  $T = 13$  both correct to the nearest integer. Find the maximum and minimum possible values of  $Q$ .

(8) Complete each of the following inequalities and state what the interval **could** represent in the box below it:

$\underline{\hspace{1cm}} \leq 14 < 14.5$	$2.75 \leq \underline{\hspace{1cm}} < 2.85$	$535 \leq 540 < \underline{\hspace{1cm}}$	$n - 0.5 \leq n < \underline{\hspace{1cm}}$	$147.5 \leq 150 < \underline{\hspace{1cm}}$

(9) The volume of a **closed** cube is  $104.6\text{cm}^3$  correct to 1dp. Find the maximum possible surface area of the cube.

(10) Fred travels 50 miles home correct to the nearest 5 miles. He travels at a speed of 12 miles per hour correct to the nearest integer. If he wants to arrive home by 10.15am what is the latest he can possibly leave to ensure he will be home in time? Give your answer to the nearest minute.

(11) An arc of a sector has length 12cm and radius 90mm both correct to the nearest 5mm. What is the minimum size the angle at the centre of the arc can be? Give your answer to 3SF.