# Upper and Lower Bounds. Error intervals

Error Intervals

Fill in the numbers in the min and max columns for these error intervals

Qu.	Number	Rounding	Min	≤	Number	<	Max
1	4	1 s.f.	3.5	≤	Number	<	4.5
2	20	1 s.f.	15	≤	Number	<	25
3	300	1 s.f.	250	≤	Number	<	350
4	6000	1 s.f.	5500	≤	Number	<	6500
5	0.4	1 s.f.	0.35	≤	Number	<	0.45
6	1.2	2 s.f.	1.15	≤	Number	<	1.25
7	28	2 s.f.	27.5	≤	Number	<	28.5
8	350	2 s.f.	345	≤	Number	<	355
9	0.36	2 s.f.	0.355	≤	Number	<	0.365
10	1.0	2 s.f.	0.995	≤	Number	<	1.05
11	15	nearest 5	12.5	≤	Number	<	17.5
12	20	nearest 10	15	≤	Number	<	25
13	300	nearest 100	250	≤	Number	<	350
14	6000	nearest 1000	5500	≤	Number	<	6500
15	0.4	nearest tenth	0.35	≤	Number	<	0.45
16	7	nearest whole number	6.5	≤	Number	<	7.5
17	28	nearest multiple of 4	26	≤	Number	<	30
18	350	nearest multiple of 50	325	≤	Number	<	375
19	640	nearest multiple of 20	630	≤	Number	<	650
20	1.99	to 2 dp	1.985	≤	Number	<	1.995

①

Choose ONE number from Box A and ONE number from Box B.

	Biggest Value	Smallest Value

Box A

5

10

Box B

2

4
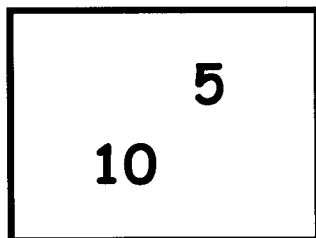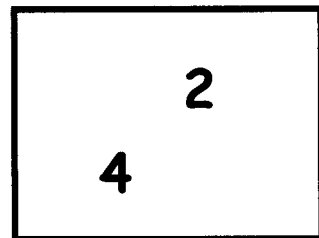
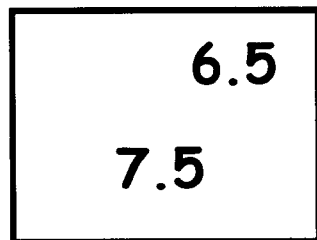|	Biggest Value	Smallest Value
$A + B$	$10+4 = 14$	$5+2 = 7$
$A - B$	$10-2 = 8$	$5-4 = 1$
$A \times B$	$10\times4 = 40$	$5\times2 = 10$
$A \div B$	$10\div2 = 5$	$5\div4 = 1.25$

Rather than having a box with two numbers in, the two numbers come from the error interval of the number Both numbers A and B are rounded to the nearest whole number.
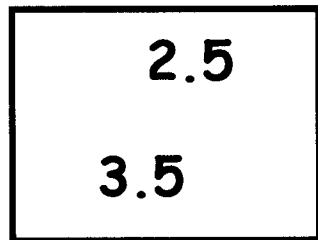
A = 7   the error interval is $6.5 \leq A < 7.5$

B = 3   the error interval is $2.5 \leq B < 3.5$

To make it like the first example you could set it up like this.

number A

6.5

7.5

number B

2.5

3.5

	Biggest Value	Smallest Value
$A + B$	$7.5 + 3.5$	$6.5 + 2.5$
$A - B$	$7.5 - 2.5$	$6.5 - 3.5$
$A \times B$	7.5×3.5	6.5×2.5
$A \div B$	$7.5 \div 2.5$	$6.5 \div 3.5$

②

Upper and Lower Bounds

1 Both numbers A and B are rounded to the nearest whole number.

$A = 8$ $B = 4$

$7.5 \leq A < 8.5$ $3.5 \leq B < 4.5$

	Biggest Value	Smallest Value
A + B	$8.5 + 4.5$	$7.5 + 3.5$
A - B	$8.5 - 3.5$	$7.5 - 4.5$
A × B	8.5×4.5	7.5×3.5
A ÷ B	$8.5 \div 3.5$	$7.5 \div 4.5$

2 Both numbers A and B are rounded to the nearest ten.

$A = 20$ $B = 10$

$15 \leq A < 25$ $5 \leq B < 15$

	Biggest Value	Smallest Value
A + B	$25 + 15$	$15 + 5$
A - B	$25 - 5$	$15 - 15$
A × B	25×15	15×5
A ÷ B	$25 \div 5$	$15 \div 15$

3 Both numbers A and B are rounded to 1 decimal place.

$A = 6.5$ $B = 2.4$

$6.45 \leq A < 6.55$ $2.35 \leq B < 2.45$

	Biggest Value	Smallest Value
A + B	$6.55 + 2.45$	$6.45 + 2.35$
A - B	$6.55 - 2.35$	$6.45 - 2.45$
A × B	6.55×2.45	6.45×2.35
A ÷ B	$6.55 \div 2.35$	$6.45 \div 2.45$

4 Both numbers A and B are rounded to 1 significant figure.

$A = 400$ $B = 20$

$350 \leq A < 450$ $15 \leq B < 25$

	Biggest Value	Smallest Value
A + B	$450 + 25$	$350 + 15$
A - B	$450 - 15$	$350 - 25$
A × B	450×25	350×15
A ÷ B	$450 \div 15$	$350 \div 25$

5 Rounded to the nearest whole number, A = 8 and B = 4. Find a) the minimum and b) the maximum value of   Round any answers to 2 dp

$$\frac{A + B}{A - B}$$

$$\text{Max} = \frac{\text{Max}}{\text{Min}} = \frac{8.5 + 4.5}{7.5 - 4.5} = 4.33$$

$$\text{Min} = \frac{\text{Min}}{\text{Max}} = \frac{7.5 + 3.5}{8.5 - 3.5} = 2.2$$
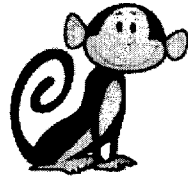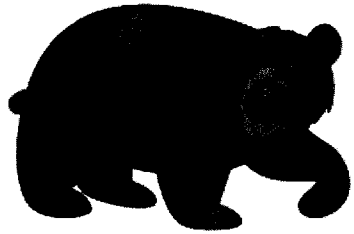
$$A(A - B)$$

$$\text{Max} = \text{Max} \times \text{Max}$$
$$= 8.5 \times (8.5 - 3.5) = 42.5$$

③ $$\text{Min} = \text{Min} \times \text{min}$$
$$= 7.5 \times (7.5 - 4.5) = 22.5$$

For 8 $7.5 \leq A < 8.5$
For 4 $3.5 \leq B < 4.5$

1) To the nearest kg the bear weighs 62 kg and the monkey 27 kg.

Monkey $26.5 \leq M < 27.5$

Bear $61.5 \leq B < 62.5$

a) What is the maximum possible combined weight of the two animals? $62.5 + 27.5$

b) What is the minimum possible combined weight of the two animals? $26.5 + 61.5$

c) What is the minimum possible difference between their two weights? $61.5 - 27.5$

d) What is the maximum possible difference between their two weights? $62.5 - 26.5$

e) Barry wants to transport 4 bears in his trailer. The maximum weight the trailer can handle is 250 kg to the nearest 10 kg. Can he be sure his trailer is strong enough to transport the bears?

Max weight of 4 bears is $4 \times 62.5 = 250$ kg

For the trailer $245 \leq T < 255$

$250 > 245$ so he cannot be sure the trailer is strong enough.

2) A man weighs 60 kg to the nearest 10 kg.
A chair can support 65 kg to the nearest kg.
Will the chair definitely support his weight?

$55 \leq M < 65$

$64.5 \leq C < 65.5$

$65 > 64.5$ so you cannot say the chair will definitely support the man.

3) It is estimated that 1200 people (rounded to the nearest 100) are going to attend a concert.
The concert hall holds 1250 people (rounded to the nearest 10)
Is the hall big enough?

Attendance $1150 \leq A < 1250$

Capacity $1245 \leq C < 1255$

May not be as $1250 > 1245$

④