

Bounds

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Worked example

Find the upper and lower bound:
 $x = 300$ to the nearest integer

$x = 300$ to the nearest ten

$x = 300$ to the nearest hundred

$x = 300$ to the nearest fifty

Your turn

Find the upper and lower bound:
 $x = 500$ to the nearest integer

Upper bound = 500.5

Lower bound = 499.5

$x = 500$ to the nearest ten

Upper bound = 505

Lower bound = 495

$x = 500$ to the nearest hundred

Upper bound = 550

Lower bound = 450

$x = 500$ to the nearest twenty

Upper bound = 510

Lower bound = 490

Worked example

Find the upper and lower bound:
 $x = 2.3$ to the nearest tenth

$x = 2.34$ to the nearest
hundredth

$x = 2.345$ to the nearest
thousandth

Your turn

Find the upper and lower bound:
 $x = 9.8$ to the nearest tenth

Upper bound = 9.85

Lower bound = 9.75

$x = 9.87$ to the nearest
hundredth

Upper bound = 9.875

Lower bound = 9.865

$x = 9.876$ to the nearest
thousandth

Upper bound = 9.8765

Lower bound = 9.8755

Worked example

Write the error intervals:

$x = 4000$ when rounded to 1 significant figure:

$x = 4000$ when rounded to 2 significant figures:

$x = 4000$ when rounded to 3 significant figures:

Your turn

Write the error intervals:

$x = 3000$ when rounded to 1 significant figure:

$$2500 \leq x < 3500$$

$x = 3000$ when rounded to 2 significant figures:

$$2950 \leq x < 3050$$

$x = 3000$ when rounded to 3 significant figures:

$$2995 \leq x < 3005$$

Worked example

Write the error intervals:

$x = 0.007$ when rounded to 1 significant figure:

$x = 0.0073$ when rounded to 2 significant figures:

$x = 0.00738$ when rounded to 3 significant figures:

Your turn

Write the error intervals:

$x = 0.02$ when rounded to 1 significant figure:

$$0.015 \leq x < 0.025$$

$x = 0.027$ when rounded to 2 significant figures:

$$0.0265 \leq x < 0.0275$$

$x = 0.0274$ when rounded to 3 significant figures:

$$0.02735 \leq x < 0.02745$$

Worked example

An object's length, x , is measured as 8 *cm* to the nearest centimetre. Write the error interval

An object's mass, y , is 54.3 *g* to the nearest tenth of a gram. Write the error interval

Your turn

An object's height, x , is measured as 87 *cm* to the nearest centimetre. Write the error interval

$$86.5 \leq x < 87.5$$

Worked example

$x = 350$ to the nearest ten,
 $y = 270$ to the nearest integer,
Find the upper and lower bound
 $x + y$

$$x - y$$

Your turn

$x = 720$ to the nearest ten,
 $y = 530$ to the nearest integer,
Find the upper and lower bound:
 $x + y$

Upper bound = 1255.5

Lower bound = 1244.5

$$x - y$$

Upper bound = 195.5

Lower bound = 184.5

Worked example

$x = 350$ to the nearest ten,
 $y = 270$ to the nearest integer,
 Find the upper and lower bound:

$$xy$$

$$\frac{x}{y}$$

$$\frac{y}{x}$$

Your turn

$x = 720$ to the nearest ten,
 $y = 530$ to the nearest integer,
 Find the upper and lower bound:

$$xy$$

$$\text{Upper bound} = 384612.5$$

$$\text{Lower bound} = 378592.5$$

$$\frac{x}{y}$$

$$\text{Upper bound} = 1.369216242$$

$$\text{Lower bound} = 1.347785108$$

$$\frac{y}{x}$$

$$\text{Upper bound} = 0.741958042$$

$$\text{Lower bound} = 0.7303448276$$

Worked example

A rectangle has width 12 m and length 5 m both measured to the nearest metre. Find the maximum and minimum area.

Your turn

A rectangle has width 34 m and length 2 m both measured to the nearest metre. Find the maximum and minimum area.

$$\text{Maximum} = 86.25\text{ m}^2$$

$$\text{Minimum} = 59.25\text{ m}^2$$

Worked example

An object's length is x cm.
It is measured as 2.4 cm to the nearest millimetre.
Write down the error interval for x

Your turn

An object's length is x cm.
It is measured as 3.5 cm to the nearest millimetre.
Write down the error interval for x

$$3.45 \leq x < 3.55$$

Worked example

A number, x , when truncated to 1 decimal place, is equal to 123.4 .
Write down the upper and lower bounds of x

Your turn

A number, x , when truncated to 1 decimal place, is equal to 567.8 .
Write down the upper and lower bounds of the number.

Upper bound = 567.9

Lower bound = 567.8

Worked example

A number, x , when truncated to 1 decimal place, is equal to 123.4 .
Write down the error interval for x

Your turn

A number, x , when truncated to 1 decimal place, is equal to 567.8 .
Write down the error interval for x

$$567.8 \leq x < 567.9$$

Worked example

A number, x , when truncated to 2 decimal place, is equal to 12.34 .
Write down the upper and lower bound

Your turn

A number, x , when truncated to 2 decimal place, is equal to 56.78 .
Write down the upper and lower bound

Upper bound = 56.79

Lower bound = 56.78

Worked example

A number, x , when truncated to 2 decimal place, is equal to 12.34 .
Write down the error interval for x

Your turn

A number, x , when truncated to 1 decimal place, is equal to 56.78 .
Write down the error interval for x

$$56.78 \leq x < 56.79$$

Worked example

$$A = BC^2$$

$B = 5$ correct to 1 significant figure
 $C = 6.4$ correct to 1 decimal place.

Calculate the upper bound of A

Your turn

$$X = YZ^3$$

$Y = 4$ correct to 1 significant figure
 $Z = 5.6$ correct to 1 decimal place.

Calculate the upper bound of X

811.6295625

Worked example

$$A = BC^3$$

$B = 5$ correct to 1 significant figure
 $C = 6.4$ correct to 1 decimal place.

Calculate the lower bound of A

Your turn

$$X = YZ^3$$

$Y = 4$ correct to 1 significant figure
 $Z = 5.6$ correct to 1 decimal place.

Calculate the lower bound of X

598.3385625

Worked example

$$A = 3(B - C)$$

$B = 15$ correct to 2 significant figures
 $C = 6.4$ correct to 2 significant figures.

Calculate the upper bound of A

Your turn

$$X = 5(Y - Z)$$

$Y = 14$ correct to 2 significant figures
 $Z = 5.6$ correct to 2 significant figures.

Calculate the upper bound of X

44.75

Worked example

$$A = 3(B - C)$$

$B = 15$ correct to 2 significant figures
 $C = 6.4$ correct to 2 significant figures.

Calculate the lower bound of A

Your turn

$$X = 5(Y - Z)$$

$Y = 14$ correct to 2 significant figures
 $Z = 5.6$ correct to 2 significant figures.

Calculate the lower bound of X

39.25

Worked example

$$A = \frac{B}{C - D}$$

$B = 15$ correct to the nearest integer

$C = 6.4$ correct to 1 decimal place

$D = 2.93$ correct to 3 significant figures

Calculate the upper bound of A

Your turn

$$X = \frac{W}{Y - Z}$$

$W = 51$ correct to the nearest integer

$Y = 4.6$ correct to 1 decimal place

$Z = 3.92$ correct to 3 significant figures

Calculate the upper bound of X

82.4

Worked example

$$A = \frac{B}{C - D}$$

$B = 15$ correct to the nearest integer

$C = 6.4$ correct to 1 decimal place

$D = 2.93$ correct to 3 significant figures

Calculate the lower bound of A

Your turn

$$X = \frac{W}{Y - Z}$$

$W = 51$ correct to the nearest integer

$Y = 4.6$ correct to 1 decimal place

$Z = 3.92$ correct to 3 significant figures

Calculate the lower bound of X

68.70748299

Worked example

$$A = \sqrt{\frac{B}{C}}$$

$B = 1.5$ correct to 2 significant figures
 $C = 6.47$ correct to 2 decimal places

Calculate the upper bound of A

Your turn

$$X = \sqrt{\frac{Y}{Z}}$$

$Y = 5.1$ correct to 2 significant figures
 $Z = 7.46$ correct to 2 decimal places

Calculate the upper bound of X

0.8311507299

Worked example

$$A = \sqrt{\frac{B}{C}}$$

$B = 1.5$ correct to 2 significant figures

$C = 6.47$ correct to 2 decimal places

Calculate the lower bound of A

Your turn

$$X = \sqrt{\frac{Y}{Z}}$$

$Y = 5.1$ correct to 2 significant figures

$Z = 7.46$ correct to 2 decimal places

Calculate the lower bound of X

0.8224902966

Worked example

A road is 3540m long, correct to the nearest 10m.

A person drives along the road in 315 seconds, to the nearest 5 seconds.

What could the person's greatest speed have been, to 1 decimal place, in kilometres per hour?

Your turn

A road is 4530m long, correct to the nearest 10m.

A person drives along the road in 205 seconds, to the nearest 5 seconds.

What could the person's greatest speed have been, to 1 decimal place, in kilometres per hour?

80.6 km/h

Worked example

Correct to two significant figures, the area of a square is 630 cm^2 . Calculate the lower bound for the perimeter of the square.

Your turn

Correct to two significant figures, the area of a square is 230 cm^2 . Calculate the lower bound for the perimeter of the square.

60 cm

Worked example

Correct to two decimal places, the volume of a solid cube is 15.63 cm^3 .
Calculate the lower bound for the surface area of the cube.

Your turn

Correct to two decimal places, the volume of a solid cube is 42.88 cm^3 .
Calculate the lower bound for the surface area of the cube.

73.5 cm^2

Worked example

Estimate:

$$12.3 + 456.78$$

$$13579 - 2468$$

$$\frac{86.42}{135.79} \times 0.0456$$

Your turn

Estimate:

$$8.76 + 54.321$$

59

$$86420 - 7531$$

82000

$$\frac{246.8}{9.7531} \times 0.00654$$

0.14