DECIMAL PLACES AND SIGNIFICANT FIGURES

DECIMAL PLACES

Sometimes you are required to give a shorter answer than the one which you have worked out.

Example 1

3.68472 is your answer, but you are asked to give the answer

"correct to 2 decimal places"

The answer will then be:

3.68 (correct to 2 decimal places).

In order to arrive at this answer, you must look at the **third** number after the decimal point, even though, in your answer, there will be only **two** figures after the point.

If the third number is

0, 1, 2, 3 or 4

then the second number will remain the same (as in the example given above).

If the third number is

5, 6, 7, 8 or 9

then the second number is increased by 1.

Example 2

Give 3.68872 correct to 2 decimal places.

Look at the third figure after the point, it is 8, and because it is in the group 5, 6, 7, 8, 9 then the second figure is increased by 1 so the answer is:-

3.69 correct to 2 decimal places.

You may be asked to give a number correct to **any** number of decimal places. **Remember** if you are asked to give a number correct to 1 decimal place, you look at the 2**nd** figure.

1 decimal place, you look at the 2nd figure.

2 decimal places, you look at the 3rd figure.

3 decimal places, you look at the 4th figure.

4 decimal places, you look at the 5th figure, etc.

Example 3

12,051 correct to 1 decimal place = 12.1
(The 2nd figure is 5, so increase 0 by 1, giving 1.)

12,051 correct to 2 decimal places = 12.05
(The 3rd figure is 1, so the 5 remains the same.)

Example 4

0.675 correct to 1 decimal place
(The 2nd figure is 7, so the 6 is increased by 1)

0.675 correct to 2 decimal places = 0.68
(The 3rd figure is 5, so the 7 is increased to 8).

Example 5

0.0517 correct to 1 decimal place = 0.1

0.0517 correct to 2 decimal places = 0.05

0.0517 correct to 3 decimal places = 0.052

Example 6

16.97 correct to 1 decimal place = 17.0

Exercise 1

Write down why these answers are true

1. 16.00726 correct to 1 d.p. = 16.0

2. 16.00726 correct to 2 d.p. = 16.01

3. 16.00726 correct to 3 d.p. = 16.007

4. 16.00726 correct to 4 d.p. = 16.0073

Exercise 2

Write each of these numbers correct to:

a) 1 decimal place
b) 2 decimal places

1. 63.147

2. 4.093

3. 5.088

4. 1.008

5. 3.927

SIGNIFICANT FIGURES

The amount of approximation required in a number may be described in another way by saying how many **significant figures** are required.

To find how many significant figures a number contains count **all** figures in the number **except** zeros at the **beginning** or **end** of the number.

Example 1

3625.4 has 5 significant figures

0.0023 has 2 significant figures

360 has 2 significant figures

You may be asked to approximate a given number correct to so many significant figures. This process is carried out in exactly the same way as for decimal places. When examining the first figure we are discarding use the groups 0 – 4 and 5 – 9.

Example 2

8.619 has 4 significant figures, **most** important is the figure **8** in the units column.

8.619 = 9 correct to 1 significant figure

8.619 = 8.6 correct to 2 significant figures

8.619 = 8.62 correct to 3 significant figures

Example 3

23.61 has 4 significant figures, the figure '2' is the most important.

23.61 = 20 correct to 1 significant figure (**not** just 2; we need to put in a zero to show that we mean twenty).

23.61 = 24 correct to 2 significant figures

23.61 = 23.6 correct to 3 significant figures

NOTE that the 2 (in 23) means **two tens.**

Example 4

127.9 has 4 significant figures

127.9 = 100 correct to 1 significant figure (needs 2 zeros as "spacers" to make the 1 mean 1 hundred).

127.9 = 130 correct to 2 significant figures

127.9 = 128 correct to 3 significant figures

Example 5

4309 has 4 significant figures. Notice that we count the zero between 3 and 9 as it is in the middle of the number and is surrounded by significant figures

4309 = 4000 correct to 1 significant figure

4309 = 4300 correct to 2 significant figures

4309 = 4310 correct to 3 significant figures

Here, the 4 in 4309 means **four thousand.**

Example 6

0.273 has 3 significant figures

0.273 = 0.3 correct to 1 significant figure

0.273 = 0.27correct to 2 significant figures

Example 7

0.0915 has 3 significant figures

0.0915 = 0.09 correct to 1 significant figure

0.0915 = 0.092 correct to 2 significant figures

Exercise 3

a) correct to 1 significant figure

b) correct to 2 significant figures

c) correct to 3 significant figures

1. 14.7541
2. 165.5
3. 37654.21
4. 0.4915
5. 0.007086

APPROXIMATION OR ESTIMATIONS

Often we do not need to give an exact answer and are asked to give a rough idea of an answer.

Example 1

If you spend 53p you may say that you have spent ‘about 50p’.

If you spend 57p you may say that you have spent approximately 60p.

If you spend 55p we round this up to 60p.

So if you spend 50, 51, 52, 53 or 54, we say it is approximately 50p and if you spend 55, 56, 57, 58 or 59, we would say that it is approximately 60p.

A question may ask for the answer 'to the nearest 100' 'or 10' as in the following:

Example 2

304 x 17. 304 is approximately 300 and 17 is approximately 20.

So 300 x 20 is 6000, so the answer to 304 x 17 will be in the region of 6000.

Example 3

If you were to buy a car costing £3750, you would say that this was £4000 to the nearest £1000 or that it was £3800 to the nearest £100.

Example 4

If you and three friends went out for a meal and the bill came to £12.47 you would each pay approximately £3.00.

Example 5

Estimate 334 x 18 to the nearest 100. 334 is about 300 and 18 is about 20.

So the answer will be in the region of 6000.

Estimate the same sum to the nearest 10.

334 is roughly 330 and 18 is roughly 20.

So the answer will be in the region of 6600.

Example 6

33 x 6 = 198

You can use this information to work out examples using the same numbers but having different values:

e.g. 3.3 x 6 = 19.8

33 x 0.6 = 19.8

3.3 x 0.6 = 1.98

3.3 x 0.06 = 0.198

0.33 x 0.6 = 0.198

Exercise 4

Estimate the following:

1. 34 x 17 to the nearest 100 by rounding off the numbers to nearest 10.
2. 233 x 117 to the nearest 100 by rounding off the numbers to nearest 10.
3. 346 x 274 to the nearest 100 by rounding off the numbers to nearest 10.
4. $\frac{346}{47}$
5. $\frac{3.46}{47}$

Exercise 5

If 13 x 4 = 52 give the answers to the following:

1. 1.3 x 4
2. 1.3 x 0.4
3. 0.13 x 0.4
4. 0.13 x 4
5. 0.13 x 0.04

ANSWERS

Exercise 1

16.00726	correct to 1 d.p. = 16.0 because 2nd figure after d.p. = 0
16.00726	correct to 2 d.p. = 16.01 because 3rd figure after d.p. = 7
16.00726	correct to 3 d.p = 16.007 because 4th figure after d.p. = 2
16.00726	correct to 4 d.p. = 16.0073 because 5th figure after d.p. = 6

Decimal Places

Exercise 2

1. 63.1 (to 1 d.p.) 63.15 (to 2 d.p.)
2. 4.1 (to 1 d.p.) 4.09 (to 2 d.p)
3. 5.1 (to 1 d.p.) 5.09 (to 2 d.p.)
4. 1.0 (to 1 d.p.) 1.01 (to 2 d.p.)
5. 3.9 (to 1 d.p.) 3.9. (to 2 d.p.)

Significant Figures

Exercise 3

	1 sig. figure	2 sig. figure	3 sig. figure
1.	10	15	14.8
2.	200	170	166
3.	40000	38000	37700
4.	0.5	0.49	0.492
5.	0.007	0.0071	0.00709

Exercise 4

1. 600 2. 27600 3. 94500 4. 7 5. 0.07

Exercise 5

1. 5.2 2. 0.52 3. 0.052 4. 0.52 5. 0.0052

Special Case

Applies when there is only one figure after the number of decimal places or significant figures being considered and that figure is a 5.

Rule: Round to the nearest even number

Example 1 Corrected to 1 decimal place

65.65 becomes 65.6 (i.e. rounded down)
65.75 becomes 65.8 (i.e. rounded up)

Example 2 Corrected to 3 significant figures

12 350 becomes 12 400
12 850 becomes 12 800

Example 3 Corrected to the nearest whole number

31.5 becomes 32
32.5 becomes 32

Example 4 Corrected to the nearest thousand

7 500 becomes 8 000
8 500 becomes 8 000

This is a **"British Standard"** and the reason for this is to reduce errors. If all the numbers ending in five were rounded up, then all the errors would be in the same direction. When some are rounded up and some rounded down the total result of the errors is compensated.