Functional Numeracy for Food Security and Nutrition

Fixed Obligation Grant (FOG) – Award Number 999000442

Uno How's Basic Factsheets

Hints and tips to help you with your numeracy

To be used in conjunction with the Module 1 and Module 2 manuals: Calculating the area of your Farm and Estimating Seed Inputs, Fertiliser and Spray Requirements

Modules 1 and 2 can be accessed online at: http://www.agritechtalk.org/Uno How Introduction.html

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Metric Conversion Tables

Length

	Kilometre (km)	Metre (m)	Centimetre (cm)	Millimetre (mm)
Kilometre (km)		1000 m	100000 cm	1000000 mm
Metre (m)	0.001 km		100 cm	1000 mm
Centimetre (cm)	Not useful	0.01 m		10 mm
Millimetre (mm)	Not useful	0.001 m	10 cm	

Area

	Hectare	Square metre	Square centimetre
Hectare		10000 m^2	Not useful
Square metre (m^2)	0.0001 m^2		10000 cm^2
Square centimetre (cm^2)	Not useful	0.0001 m^2	

Volume

	Cubic metre (m^3)	Litres (l)	Millilitre (ml)
Cubic metre (m^3)		1000 l	1000000 ml
Litre (l)	0.001 m^3		1000 ml
Millilitre (ml)	Not useful	0.001 l	

Weight

	Metric tonnes (t)	Kilogram (kg)	Gram (g)	Milligram (mg)
Metric tonnes (t)		1000 kg	1000000 g	Not useful
Kilogram (kg)	0.001 t		1000 g	1000000 mg
Gram (g)	Not useful	0.001 kg		1000 mg
Milligram (mg)	Not useful	0.000001 kg	0.001 g	

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Hectares and Acres

- Measurements (of area, distance, length, weight etc.) are generally made using a **standard measure** that people can understand. The most commonly used international system of measurement is the **metric system** which includes the hectare, metre, kilogram etc.

- However, different countries often have their own local system of measurement, which people are more familiar with and so prefer to use.

- As fertiliser, seed, pesticide instructions are often given in international measures, it is important to know and understand the relationship between local and international measures.

- The relationship between local and international measures is provided in **conversion tables**.

- Within Uganda, farm area is commonly measured in acres rather than hectares (ha). An acre is quite a bit smaller than a hectare:

Conversion Table for Acres, Hectares (ha) and square metres (sq. m or m^2)

1 hectare = 2.47 acres (or use 2.5 if you are **estimating**)

1 acre = 0.405 hectares (or use 0.4 if you are **estimating**)

1 acre = 4050 square metres (or use 4000 if you are **estimating**).

- To convert an area of land in hectares to acres, you need to multiply it by 2.47 (**or** you can divide it by 0.405).

- To convert an area of land in acres to hectares, you need to multiply it by 0.405 (**or** divide it by 2.47).

- To convert an area of land in acres to square metres, you need to multiply it by 4050.

- To convert an area of land in square metres to acres, you need to divide it by 4050.

Examples for converting acres and hectares:

Conversion Table for Acres, Hectares (ha) and square metres (sq. m or m^2)

1 hectare = 2.47 acres (or use 2.5 if you are **estimating**)

1 acre = 0.405 hectares (or use 0.4 if you are **estimating**)

1 acre = 4050 square metres (or use 4000 if you are **estimating**).

1. Convert 3 hectares (ha) to acres:

= 3 x 2.47

Using the method learned in Module 1 ("multiplying larger decimals by long multiplication"), we can work out that:

3 x 2.47 = 7.41 acres

2. **Estimate** the size of a 3 hectare field in acres:

= 3 x 2.5

Using the method learned in Module 1 ("multiplying larger decimals by long multiplication"), we can work out that:

3 x 2.5 = 7.5 acres

3. What is the area of an 8 acre farm in hectares?

= 8 x 0.405

Using the method learned in Module 1 ("multiplying decimals"):

8 x 0.405 = 3.24 hectares

4. **Estimate** the area of an 8 acre farm in hectares.

= 8 X 0.4

Using the method learned in Module 1 ("multiplying decimals"):

8 X 0.4 = 3.2 hectares

5. Convert 2 acres into square metres:

= 2 X 4050 = 8100 square metres.

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How numbers are put together

- When working with numbers, it is important to understand why they are written the way they are.
- All numbers (big and small) are represented using digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.
- If a number is less than ten, then it can be represented by just one of these digits (e.g. 1 or 2 or 3 etc.)
- If a number is ten (10) or greater, but less than a hundred (100), then we need two digits to represent it. The digit on the left tells us how many sets of ten there are and the digit on the right tells us how many units (numbers less than ten) there are:
  E.g. The number 26. This is made up of 20 + 6 = 26

26

Tens:
The 2 on the left here represents the number 20. It tells us that there are two sets of ten in this number.

Units:
The 6 on the right tells us that there are 6 units in this number.

- If a number is a hundred (100) or greater, but less than a thousand (1000), then we need three digits to represent it. The digit on the left now tells us how many sets of a hundred there are, the digit in the middle tells us how many sets of ten there are, and the digit on the right tells us how many units (numbers less than ten) there are:
  E.g. The number 426. This is made up of 400 + 20 + 6 = 426

426

Hundreds:
The 4 on the left here represents the number 400. It tells us that there are four sets of a hundred in this number.

Tens:
The 2 represents the number 20. It tells us that there are two sets of ten in this number.

Units:
The 6 on the right tells us that there are 6 units in this number.

Similarly, if a number is a thousand (1000) or greater, but less than ten thousand (10000), then we need 4 digits to represent this number. This is made up of 7000 + 400 + 20 + 6

- E.g. 7426

Thousands Hundreds Tens Units

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Multiplication Table

x	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

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Hints and tips to help you with your numeracy

Essential Multiplication Tables

1x

1	x	1	=	1
2	x	1	=	2
3	x	1	=	3
4	x	1	=	4
5	x	1	=	5
6	x	1	=	6
7	x	1	=	7
8	x	1	=	8
9	x	1	=	9
10	x	1	=	10

2x

1	x	2	=	2
2	x	2	=	4
3	x	2	=	6
4	x	2	=	8
5	x	2	=	10
6	x	2	=	12
7	x	2	=	14
8	x	2	=	16
9	x	2	=	18
10	x	2	=	20

3x

1	x	3	=	3
2	x	3	=	6
3	x	3	=	9
4	x	3	=	12
5	x	3	=	15
6	x	3	=	18
7	x	3	=	21
8	x	3	=	24
9	x	3	=	27
10	x	3	=	30

4x

1	x	4	=	4
2	x	4	=	8
3	x	4	=	12
4	x	4	=	16
5	x	4	=	20
6	x	4	=	24
7	x	4	=	28
8	x	4	=	32
9	x	4	=	36
10	x	4	=	40

5x

1	x	5	=	5
2	x	5	=	10
3	x	5	=	15
4	x	5	=	20
5	x	5	=	25
6	x	5	=	30
7	x	5	=	35
8	x	5	=	40
9	x	5	=	45
10	x	5	=	50

6x

1	x	6	=	6
2	x	6	=	12
3	x	6	=	18
4	x	6	=	24
5	x	6	=	30
6	x	6	=	36
7	x	6	=	42
8	x	6	=	48
9	x	6	=	54
10	x	6	=	60

7x

1	x	7	=	7
2	x	7	=	14
3	x	7	=	21
4	x	7	=	28
5	x	7	=	35
6	x	7	=	42
7	x	7	=	49
8	x	7	=	56
9	x	7	=	63
10	x	7	=	70

8x

1	x	8	=	8
2	x	8	=	16
3	x	8	=	24
4	x	8	=	32
5	x	8	=	40
6	x	8	=	48
7	x	8	=	56
8	x	8	=	64
9	x	8	=	72
10	x	8	=	80

9x

1	x	9	=	9
2	x	9	=	18
3	x	9	=	27
4	x	9	=	36
5	x	9	=	45
6	x	9	=	54
7	x	9	=	63
8	x	9	=	72
9	x	9	=	81
10	x	9	=	90

10x

1	x	10	=	10
2	x	10	=	20
3	x	10	=	30
4	x	10	=	40
5	x	10	=	50
6	x	10	=	60
7	x	10	=	70
8	x	10	=	80
9	x	10	=	90
10	x	10	=	100

0x

Multiplying a number, as well dividing a number, by 0 is undefined and the answer will be 0.

Eg. 4 x 0 = 0
4 ÷ 0 = 0

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Hints and tips to help you with your numeracy

Multiplying and Dividing by 10, 100, 1000 etc.

- **Multiplying and dividing by 10, 100, 1000 etc. is an easy process.**

Multiplying by 10

- **If the number you are multiplying is a whole number, you simply add a zero to the end of it. For example, 7 x 10 = 70**
  26 x 10 = 260

- **If there is a decimal point, move the decimal point one place to the right.**

  For example, 0.6 x 10 = 6. (which is the same as 6.0 which is the same as 6)

  3.4 x 10 = 34. (which is the same as 34.0 which is the same as 34)

Multiplying by 100

- **If the number you are multiplying is a whole number, you simply add two zeros to the end of it. For example, 8 x 100 = 800**
  43 x 100 = 4300

- **If there is a decimal point, move the decimal point two places to the right. This is the same as multiplying it by 10 and then by 10 again (because 100 = 10 x 10)**

  For example, 0.9 x 100 = 90:
  Start by moving the decimal point one place to the right: 0.9 becomes 9. (same as 9.0)

  Then move the decimal point another place to the right: 9.0 becomes 90.

  Another example, 4.74 x 100: = 474
  First, move the decimal point once to the right: 4.74 becomes 47.4

  Then move it another place to the right: 47.4 becomes 474

Multiplying by 1000

- **When you multiply by a thousand 1000, add three zeros, or if there is a decimal point, move the decimal point three places to the right.**

  For example, 0.03 x 1000 = 30:
  Move the decimal point one place to the right: 0.03 becomes 0.3 (the same as 0.30)

  Then move the decimal point another place to the right: 0.30 becomes 3.0

  Finally, move it a third place to the right: 3.0 becomes 30

Dividing by 10

- **We do the same as multiplying by 10 but in reverse:**

- **If you have a whole number that ends in a zero then just remove the zero:**
  For example 20 ÷ 10 = 2~~0~~ = 2
  320 ÷ 10 = 32~~0~~ = 32

- **For other numbers, move the decimal point one place to the left:**

  For example 565 ÷ 10 = 56.5

Dividing by 100

- **We do the same as when multiplying by 100 but in reverse:**

- **If you have a whole number that ends in two zeros then just remove the two zeros:**
  For example 300 ÷ 10 = 3~~0~~~~0~~ = 3

- **For other numbers, move the decimal point two places to the left:**

  For example 7 6 8 ÷ 100 = 7.68

Dividing by 1000

- **Again, we do the same as when multiplying but in reverse:**

- **If you have a whole number that ends in three zeros then just remove the three zeros:**
  For example 6000 ÷ 10 = 6~~0~~~~0~~~~0~~ = 6

- **For other numbers, move the decimal point three places to the left:**

  For example 90.67 ÷ 1000:

  This is the same as 090.67 ÷ 1000

  0 9 0.67 ÷ 1000 = .0967 which is the same as 0.0967

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Hints and tips to help you with your numeracy

Rounding numbers off

- Sometimes we can do a calculation and get a very long answer, with many digits. If we do not need our answer to be so precise, we can round numbers off to make them easier to write, use and understand.
- Start by deciding how much you want to round off your number.
- Numbers can be rounded to part numbers (with decimal places) or whole numbers – the method is just the same
- Identify the position of the digit you are going to round off to.
- Then look at the next digit to its right. If this number is 5 or more, then you will need to add one (+1) to the digit you are rounding to. If it is less than 5, you can keep it as it is.
- Note: If the digit you want to round off to is a 9 and the number to its right is 5 or more, then the 9 will become a 0 and you will need to add one (+1) to the digit to its left.

For example:

Round off 256.686 to 1 decimal place (one number after the decimal point).

256.686 = 256.7

This is the digit we are rounding off to. Because the number to its right is greater than 5, we change it to a 7 (6+1).

Round off 7431.409 to a whole number (no decimal places)

7431.409 = 7431

This is the digit we are rounding off to. Because the number to its right is less than 5, we do not change it.

Round off 83657 to the nearest one thousand

83657 = 84000

This is the digit we are rounding off to. Because the number to its right is greater than 5, we change it to a 4 (3+1).

Round off 2.967 to 1 decimal places

2.957 = 3.0

This is the digit we are rounding off to. Because it is a 9 and the number to its right is a 5, we change it to a 0 and add 1 to the number to its left (2+1 = 3)

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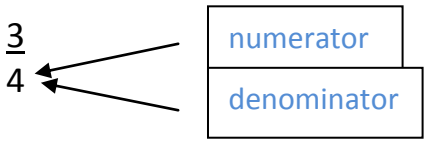
Hints and tips to help you with your numeracy

An introduction to Fractions

- Fractions are numbers that are not whole numbers. They are represented by numbers separated by the / sign or a —
- The number above line is called the numerator. The number below the line is the denominator.

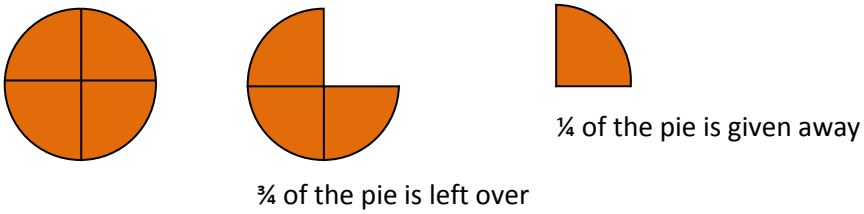


- When the numerator is less than the value of the denominator (such as above), the value of the fraction will be less than 1.

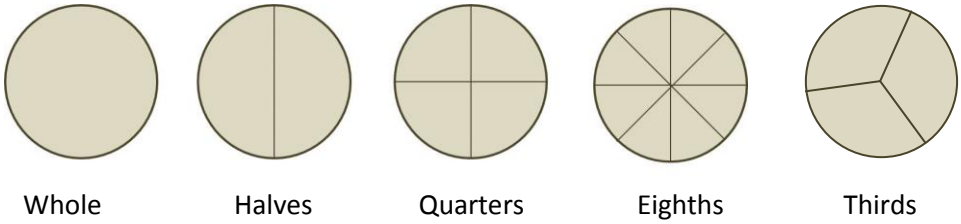
- If the numerator is greater than the denominator than the value of the number is greater than 1.

- Fractions can be explained by cutting up a pie into equal sized pieces for sharing. We can therefore think of the denominator as the number of pieces the whole has been cut into, and the numerator as the number of those pieces that are present.

  For example, this pie has been cut into 4 pieces and 1 piece is given away. This means that ¾ of the pie is left over and ¼ is given away.



- Some common fractions



- Fractions can be simplified if necessary. For example 5/3 is the same as 1 2/3. This is explained in the simplifying fractions factsheet

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Hints and tips to help you with your numeracy

Simplifying Fractions

- Fractions with the same value may be written in different ways.
- These are called equivalent fractions.
- For example,
  We can see from the boxes below that 1/2 has the same value as 3/6

- A fraction can be changed into an equivalent fraction by dividing or multiplying the numerator and denominator by the same number.
  For example,
  $\frac{1}{2} = \frac{1 \times 3}{2 \times 3} = \frac{3}{6}$ or, the other way around: $\frac{3}{6} = \frac{3 \div 3}{6 \div 3} = \frac{1}{2}$

- Simplifying fractions means writing down an equivalent fraction so that it has the smallest numerator and denominator values possible.

  For example, when simplifying 45/63, we can see that both 45 and 63 can be divided by 9 (their common factor). Therefore, to simplify it:

$$\frac{45}{63} = \frac{45 \div 9}{63 \div 9} = \frac{5}{7}$$

  To simplify 21/24, we can see that the common factor (a number that they can both be divided by) is 3:

$$\frac{21}{24} = \frac{21 \div 3}{24 \div 3} = \frac{7}{8}$$

- This means that fractions can only be simplified if the top (numerator) and bottom (denominator) numbers have a common factor. So, for example 19/24 cannot be simplified because 19 and 24 have no common factors.

- If the numerator (top number) is bigger than the denominator (bottom number) we call this an improper fraction – this will have a value greater than 1. We may want to simplify improper fractions too:

  For example: To simplify 42/8 we divide 42 by 8. This is 5 remainder 2 (because 5 x 8 = 40 and 42-40 = 2). This means that 42/8 = 5 with 2/8 left over. The 2/8 can be simplified further (because 2 and 8 have a common factor of 2) to ¼. Therefore, 42/8 is the same as 5¼.

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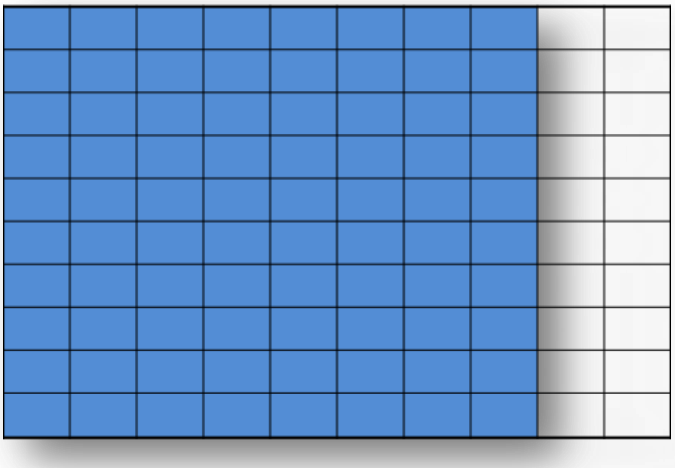
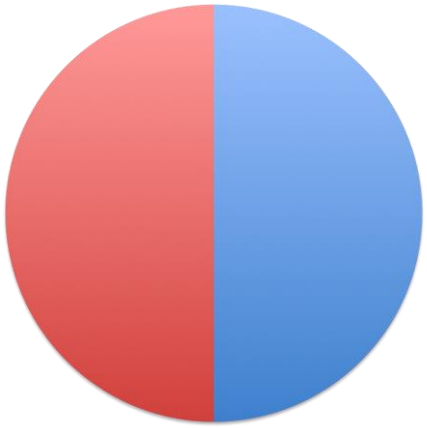
Hints and tips to help you with your numeracy

Percentages

- Percentage is a number or ratio expressed as a fraction of 100.
- % is the percentage sign.
- To put it simply, per cent means "out of 100".
- So 80 % means 80 out of 100 (80 % of this box is blue).



- A ***per cent*** can also be expressed as a ***decimal*** or a ***fraction***



A half can be written…

as a percentage: 50 %

as a decimal: 0.5

as a fraction: $\frac{1}{2}$

- To change a percentage to a decimal, divide by 100.
  For example, change 48% to a decimal: 48 ÷ 100 = 0.48
- In the same way, to change a decimal to a percentage, multiply by 100.
  For example, change 0.67 to a percentage: 0.67 x 100 = 67%
- To convert percentages to fractions, write the percentage as a fraction over 100 and then simplify.
  For example, 20% means $\frac{20}{100} = \frac{1}{5}$

It is important to know some equivalent fractions and percentages by heart:

$\frac{1}{2}$ = 50 %

$\frac{1}{4}$ = 25 %

$\frac{1}{10}$ = 10 %

$\frac{3}{4}$ = 75 %

$\frac{1}{5}$ = 20 %

- Examples:
  To find 20% of 30, convert the 20% to a decimal and then multiply by 30.
  20% = 0.2
  0.2 x 30 = 6

  Another way to find 20% of 30 is to first find 10% of 30 and then multiply by 2.
  10% of 30 is 30 ÷ 10 = 3
  2 x 3 = 6

  A third way would be to recognise that 20% is equivalent to one fifth, and so just divide 30 by 5.
  30 ÷ 5 = 6

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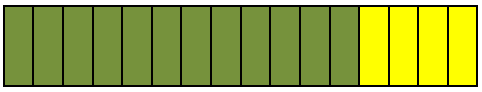
Ratio

- Ratio is used to compare two or more quantities of the same kind; in other words, it says how much of one thing there is compared to another thing.
- Ratio is demonstrated by the : symbol. For example, '12 green rectangles compared to 4 yellow rectangles ' can be written as 12 : 4.



- Ratios can be shown in different ways. For example, instead of the " : " we can use the word " to "; 12 to 4.
- We can also write ratios as fractions; 4/12.
- Often ratios can be simplified by dividing both parts of the ratio by the highest common factor. For example, 12 : 4 = 3 : 1 (both parts divided by 4). In other words, this ratio explains to us that for every 3 rectangles there is 1 yellow rectangle.

Example for calculating ratios:

A farmer has a field that is 2.5 hectares. He plants maize and sorghum in the ration of 2:3.

Imagine that the whole field is divided into 5 parts (2 + 3), 2 parts maize and 3 parts sorghum.

The 5 parts are equal to 2.5 hectares, therefore 1 part equals 2.5/5 which equals 0.5 hectares.

The farmer plants 2 parts maize and 3 parts sorghum so they would have 1 ha of maize (0.5 x 2) and 1.5 ha of sorghum (0.5 x 3).

If you want to check the calculations are correct, add up the number of ha of maize and sorghum. The total should be equal to 2.5 hectares.

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Checking your calculations

- It is always easy to make a mistake when carrying out a calculation. Even small errors in calculations can lead to significant loss of time, resources or money.

- When you have carried out a calculation, you can easily check it by:

- **Estimation**: this is when you round off the numbers you started with so that they are simpler to handle – you can then repeat your calculation to see if your new (estimated) answer is roughly the same as your original answer.

- **Reversing the calculation**: this is when you use your original answer and work backwards to see if you end up with the numbers you started with.

Estimation

- For example, you need to buy 504 bags of fertiliser, each costing $6.00 each. You work out this costs $3024.00

		5	0	4
x				6
	3	**0**	**2**	**4**
			~~2~~	

To check this answer by estimation:
504 is close to 500
500 x 6 = 5 x 6 x 100 = 3000, so the answer looks right.

Reversing

- People are less likely to make mistakes when adding or multiplying than when subtracting or dividing. Therefore, a useful way to check subtraction and division calculations is by reversing them.

- For example, you have $2540 and want to buy some goats which cost $55 each. By division, you work out that you can buy 46, and will have $10 over.

4 6 rem. 10

55) ~~2~~ ^{2}~~5~~ ^{25}4 ^{34}0

Step 1: 2 ÷ 55. Doesn't go so carry the 2 over.
Step 2: 25 ÷ 55. Doesn't go so carry the 25 over.
Step 3: 254 ÷ 55 = 4 rem. 34. Put 4 above the line. Carry the 34 over.
Step 4: 340 ÷ 55 = 6 rem. 10. Put 6 above the line. 10 is the final remainder.

To check this answer, you can multiply 46 x 55 = 2530.00 and then add on the remainder, which is 10, so 2530 + 10 = 2540, so the answer is correct.

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Germination Rates

Seeds need warmth, moisture and air to grow. When these three things are present in the right amounts, a healthy seed will swell and the young plant will begin to grow. This is called germination.

Even under the most ideal conditions, it is usual that not all seeds that are sown will germinate – it is quite normal that some of the seed will fail to grow. The **germination rate** of a batch of seed is the percentage of seed that germinates when sown in "ideal" conditions.

Germination rates depend on a lot of things. Some types of seed generally have lower germination rates than others (for example, carrots generally have lower germination percentages than bean crops). Germination rates are also affected by the health of the mother crop when it was growing in the field, pests and diseases in storage, the age of the seed and the conditions in which it has been stored (cool, dry conditions are best).

To determine the germination rate of a batch of seed

1. Place a sample of a minimum of 10 seeds (the more you use, the more accurate your test will be) an even distance apart on a **damp** paper towel. Fold the top of the paper towel over the seed and place it in a plastic bag. You can fold the towel up if it makes it easier to fit. Seal the bag loosely, to prevent the seed drying out but still allowing a little air to reach the seed.
2. Leave the damp, rolled towel in a warm spot for 2 to 5 days.
3. After this time, check the paper towel and count the number of seeds that have germinated.
4. Work out your germination percentage by dividing the number that have germinated by the total number of seeds sown and multiplying this figure by 100. For example, if you have 20 seeds and 17 germinate, your germination percentage will be 17/20 x 100 = 85%.

Knowing germination rates gives an idea how much seed should be sown to make best use of your land. For example, if you have one bag of seed with a germination rate of 60%, and another with a germination rate of 80%, you will need to sow more of the first batch of seed (per unit area) than the second. So, if you normally sow 3 seeds per sowing point for good quality seed (germination rate 80%), you can work out how many seed to sow at each point for the poorer seed (germination rate 60%). To do this, divide 80 ÷ 60 = 1.33. Therefore, by sowing 1.33 x 3 = 4 seeds per point for the poorer quality seed, you should still get the same number of plants emerging in the field.

Of course, germination is only the first step in growing a healthy crop. Even if your seed has a germination rate of 100%, due to all the challenges it will face in the field (drying out, poor soil, pests, diseases etc.), it is unlikely that all the seeds you sow will mature into healthy plants (this is called the field factor).

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Dilution rate

Dilution is the action of making something weaker in force, content, or value. For example, when we buy pesticides, they are very strong (concentrated) and need to be diluted with water before being used.

Pesticide labels often provide instructions on how to dilute. If these instructions are not followed carefully, you may end up applying too little or too much pesticide to your land. Pesticide dilution instructions often use either **dilution ratios** or **dilution percentages.**

Dilution Ratios

Ratios have already been covered in these factsheets and the principal remains the same when working out **dilution ratios**.

For example, how would you prepare a 15 litre solution with a 1:49 dilution ratio?

1. First work out the total number of "parts" that this ratio represents. This is 1 + 49 = 50.
2. This means that for every 50 parts of spray, 1 part should be chemical. As for percentages, we can express this as a decimal: 1/50 = 0.02.
3. Multiply this 0.02 x 15 litres = 0.3 litres. Therefore, for a dilution ratio of 1:49 you would need 0.3 litres of chemical mixed with 14.7 (which is 15 – 0.3) litres of water in your 15 litre spray tank.
4. The table below can be used to quickly calculate how much chemical concentrate you need, for a range of different dilution rates and volumes.

Some useful dilution ratios

Dilution Ratio	% of chemical required	Total RTU (ready to use) solution required			
		1 l	5 l	10 l	20 l
1:1	50%	500 ml	2.5 l	5 l	10 l
1:2	33 %	333 ml	1.67 l	3.3 l	6.6 l
1:4	20%	200 ml	1 l	2 l	4 l
1:5	17%	166ml	833ml	1.66 l	3.3 l
1:9	10%	100 ml	500 ml	1 l	2 l
1:10	9 %	90 ml	454 ml	910 ml	1.8 l
1:16	6%	60 ml	300 ml	590 ml	1.18 l
1:20	5 %	50 ml	250 ml	500 ml	1 l
1:32	3 %	30 ml	150 ml	300 ml	600 ml
1:40	2.5 %	25 ml	125 ml	250 ml	500 ml
1:50	2 %	20 ml	100 ml	200 ml	400 ml
1:64	1.5 %	15 ml	75 ml	150 ml	300 ml
1:80	1.25%	12 ml	62 ml	125 ml	250 ml
1:100	1 %	10 ml	50 ml	100 ml	200 ml

Dilution Percentages

Percentages have already been covered in these factsheets and the principal remains the same when working with **dilution percentages**.

For example, how would you prepare a 25 litre solution with a 10% dilution rate?

1. This means that for every 100 parts of spray solution, you need 10 parts of spray concentrate and 90 parts of water (100 - 10 = 90)
2. To find 10% of 25 litres you first convert 10% to a decimal:
3. 10% = 10/100 = 0.1
4. Multiply this 0.1 x 25 litres = 2.5 litres. This means that in order to have 10% dilution in your 25 litre spray tank, you need to mix 2.5 litres of chemical with 22.5 litres of water (which is worked out as 25 – 2.5 = 22.5 ***or*** can also be worked out as 0.9 x 25 = 22.5).

When dilution rates are not provided

Sometimes, instructions do not provide information on dilution rates, just guidance on how much chemical concentrate should be applied to an area of land. In this case, it is up to the user to decide how to dilute the spray, according to the sprayer that is being used.

For example, a pesticide label instructs you to spray at a rate of 5 litres of concentrate per hectare. You have 0.4 hectares of land and a sprayer with a tank that is 20 litres in volume, with one tankful covering an area of 250 m^2.

5 litres (5000ml) of chemical is required for 10000 square metres (1 ha). This is the same as 5000 ml per 10000 square metres. To find how much would be needed for 1 square metre, divide 5000 by 10000 = 0.5 ml/m^2.

Then, to find how much would be needed for 0.4 ha of land (4000 square metres), multiply 0.5 by 4000 = 2000ml.

Now you need to work out how to dilute it.

You know that your spray tank holds 20 litres and that one tankful covers 250m^2.

To find how much would be needed for a tankful multiply 0.5 ml/m^2 by 250 m^2 = 125ml.

You therefore need to add 125 millilitres (ml) of chemical to each spray tank that you apply and 19.875 (20 – 0.125 = 19.875) litres of water.

To work out how many tankfuls of spray you will need in total, divide the total volume of concentrate to be applied by the volume of concentrate in each tankful – that is 2000 ÷ 125 = 16.

Therefore, you will need to apply 16 tankfuls of solution to your 0.4 ha, each containing 125 ml of concentrate and 19.875 litres of water.

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Glossary

Addition /Adding	**Adding (or addition) means combining two or more numbers to make a bigger number that is called the total (or sum). It is recognised by the plus sign +**
Area	The size of a surface enclosed by boundaries, for example a table or a field. *See also square metre.*
Calculate	To work something out by mathematical methods.
Circumference	The distance around a circle.
Common factor	A number that divides exactly into two (or more) other numbers.
Convert	To change in the form of a measurement, different units, without a change in the size or amount.
Count	To name or list (the units of a group or collection) one by one in order to determine a total; number.
Data	A representation of a fact of figure.
Decimal number	A number that contains a *decimal point.* Numbers to the right of the decimal point indicate part numbers (less than 1), as tenths, hundredths and so on....
Denominator	The bottom number of a fraction. It indicates the number of parts into which one whole has been divided.
Diameter	The distance across a circle, crossing through its centre point.
Dimensions	The measurements that describe a shape. For example, the length and width of a rectangle.
Digit	Symbols that are used to represent numbers 0,1,2,3,4,5,6,7,8,9.
Dividing / Division	Finding out how many times one number "goes into" another. Dividing is the opposite of multiplication.
Equivalent fraction	Fractions that have the same value but are written in different ways (have different numerators and denominators).
Equal	Having the same mathematical value.
Estimating	Finding a value that is close enough to the right answer, usually with some thought or calculation involved.
Formula	A mathematical rule expressed in symbols.
Fraction	A number that is not a whole number.
Hectare	A common unit of measurement of large areas (e.g. fields). A hectare is 10,000 square metres, or the same area enclosed by a square with 100 metre sides.
Long division	Division in which each step of the division process is written down. It is normally used when dividing by numbers that have two or more digits (are greater than 10).
Long multiplication	Multiplication where both multiplying numbers have two or more digits (are greater than 10).
Lowest common denominator	The least common multiple of the denominators of a set of fractions. It simplifies adding, subtracting, and comparing fractions.
Measure	To work out the size or amount of something, using an instrument marked in standard

	units (e.g. measuring length in cm using a ruler).
Minus	To take away/ subtract. This is also the name of the - symbol.
Mixed fraction	A number that consists of a whole number combined with a part number.
Multiply / multiplication	The process of adding a number to itself a certain number of times.
Negative numbers	Numbers with a theoretical value less than zero, represented by the - sign.
Numeracy	The ability to understand and work with numbers.
Numerator	The top number of a fraction.
Pi	The ratio of a circle's circumference to its diameter. It is a constant number that approximately equals to 3.142.
Polygon	Two-dimensional shapes with straight sides. Polygons may be irregular in shape and may have many sides.
Positive numbers	Numbers with a value greater than zero, represented by the + sign.
Quantity	How much / many there is of something.
Percentage	A number expressed as a fraction of 100, demonstrated by the % symbol.
Plus	To add. This is also the name of the + symbol.
Radius	The distance from the centre point to the edge of a circle. Radius is half diameter.
Ratio	A relationship, normally quantity, between two numbers of the same kind, demonstrated by the : symbol.
Remainder	The amount left over once a number has been divided by another a whole number of times.
Rounding off	Simplifying a number, so that it does not have so many digits.
Simplify	To reduce (an equation, fraction etc.) to a simpler form by cancellation of common factors, regrouping of terms in the same variable.
Simplifying fractions	Calculating an equivalent fraction so that it has the smallest numerator and denominator values possible.
Square metre	A common unit of measurement of smaller areas (e.g. houses or small fields). A square metre is the area enclosed by a square with 1-metre sides.
Subtraction	Taking away a number (or numbers) from another number (which is normally larger) and working out what is left. Subtraction is the opposite of addition.
Sum	A word that means calculation OR can also mean the total.
Total	How much of something that you have after adding or multiplying two or more numbers together.
Units	Whole numbers (greater than 1) but with a value less than 10.
Zero	A number that signifies "nothing", though can usefully describe a numerical situation, such as temperature, speed, money etc.