

Teaching and Learning
Move On with your learners – numeracy

Module 3

Decimals, fractions and percentages 1

Session plan

Module 3: Fractions, decimals and percentages 1

Group: _____

Teacher: _____

Location: _____

Aims

- To review number operations involving decimals.
- To begin to explore strategies for analysing learners' errors.

Outcomes

Participants will be able to:

- add, subtract, multiply and divide decimal numbers
- order, approximate and compare decimals when solving practical problems
- approximate decimals by rounding up to two decimal places
- analyse learners' errors in decimal operations.

Activity and time	Teacher activity	Learner activity
Introduction and recap 20 mins	<ul style="list-style-type: none"> ● Recap on last session. ● Ask for any examples of how skills and approaches acquired last time have been used during the week with their learners. ● Ask for feedback on multiplication/division methods task, and request volunteers. ● Introduce aims and objectives using module 3 presentation slides 2 and 3. 	<ul style="list-style-type: none"> ● Listen and respond. ● Feedback. ● Volunteers demonstrate multiplication or division methods.
Mental maths 10 mins	<ul style="list-style-type: none"> ● Q and A for review: Difference between strategies needed for mental and written methods? Use module 3 presentation slides 4 and 5 to summarise feedback. 	<ul style="list-style-type: none"> ● Listen and respond. ● Feedback.

Activity and time	Teacher activity	Learner activity
<p>Introduction to fractions, percentages and decimals</p> <p>10 mins</p>	<ul style="list-style-type: none"> ● Ask learners to examine the progression chart in the <i>ANCC</i> to see how each concept is introduced through the levels. ● How do they introduce the concepts to their learners? (Use context: money, measure, interest rates etc.) Compare with activities in <i>ANCC</i>. 	<ul style="list-style-type: none"> ● Individual task and feedback. ● Listen and respond. ● Explore the <i>ANCC</i> as a teaching and learning resource.
<p>Decimals: addition and subtraction</p> <p>35 mins</p>	<ul style="list-style-type: none"> ● Brainstorm 'real-life' examples of decimals and record on whiteboard/flipchart. ● Relate to place value and the place value chart from last week. ● Q and A: What's the significance of the decimal point? ● Explain task: addition and subtraction of decimals. ● Lead group discussion on place value and relate this to whole numbers. ● Distribute the Decimals activity sheet and explain the task. 	<ul style="list-style-type: none"> ● Give examples of decimals. ● Paired discussion and response. ● Provide real-life examples. Individuals choose two of the decimal numbers and add and subtract them. ● Individuals to check their answers by estimation, and explain their methods to partner, using mini-whiteboards to demonstrate. ● Learners to begin work on the Decimals activity sheet. Complete for homework.

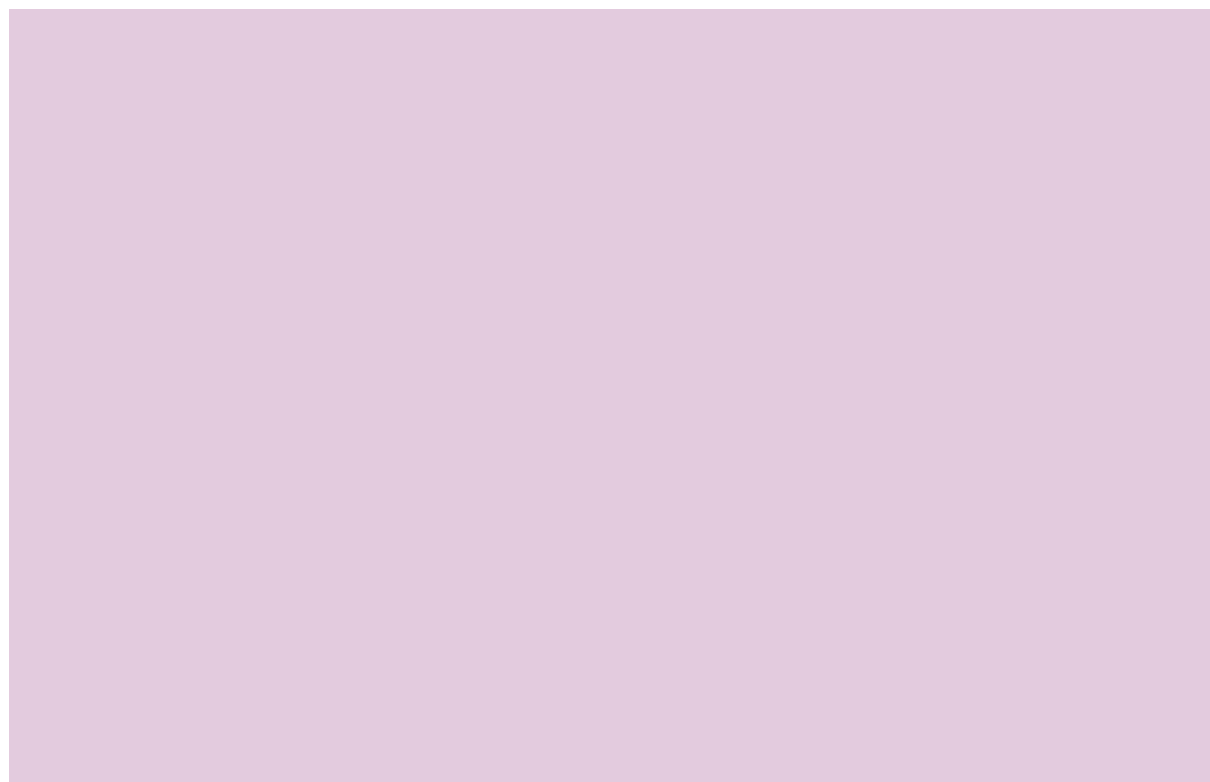
Activity and time	Teacher activity	Learner activity
Rounding 15 mins	<ul style="list-style-type: none"> Review rounding with group. Q and A: What does 'appropriate degree of accuracy' mean? 	<ul style="list-style-type: none"> Listen and respond. Discuss in pairs and then provide examples of appropriate degrees of accuracy according to context. Complete rounding tasks from Decimals activity sheet.
Break 15 mins		
Ordering decimals 10 mins	<ul style="list-style-type: none"> Use module 3 presentation slide 6 to set task. Take feedback to assess understanding. 	<ul style="list-style-type: none"> Small group task and feedback.
Decimal multiplication and division 20 mins	<ul style="list-style-type: none"> Demonstrate multiplication of decimals, by whole numbers and by decimals; see teacher's notes. Demonstrate and model division of decimals, both by whole numbers and by decimals. 	<ul style="list-style-type: none"> Listen and respond. Small group activity: create a concrete model of a simple question and explore strategies for where to position decimal point.
Individual work on decimals 20 mins	<ul style="list-style-type: none"> Set individual tasks and support individual learners. Encourage discussion in pairs and peer support. 	<ul style="list-style-type: none"> Individual work and discuss in pairs.
Error analysis: decimals 10 mins	<ul style="list-style-type: none"> Explain value of analysing learners' errors; use module 3 presentation slide 7 to support. Use module 3 presentation slide 8 to set task: diagnose the learner's errors in method. 	<ul style="list-style-type: none"> Listen and respond. Individual activity and then check with partner.

Activity and time	Teacher activity	Learner activity
Assign homework tasks 5 mins	<ul style="list-style-type: none"> ● Encourage independent learning. ● Set homework tasks, explaining the cross-curricular nature of some test-type questions. 	<ul style="list-style-type: none"> ● Listen and respond. ● Agree homework tasks.
Summary 10 mins	<ul style="list-style-type: none"> ● Revisit session aims and objectives using module 3 presentation slides 2 and 3. ● Summarise using module 3 presentation slide 9. ● Take feedback and questions. ● Give out Journal sheet for module 3. 	<ul style="list-style-type: none"> ● Listen and respond.

Resources/aids

- Module 3 PowerPoint presentation/OHP slides
- Handouts: Journal
- Activity sheets: Decimals; Decimals answers
- Supplementary materials: *Adult Numeracy Core Curriculum*
- Personal whiteboards
- Flipchart and markers.

Assessment evaluation



Individual learning planning

Learner	Skills	Activity/ Resources	Evaluation (where next?)

Teacher's notes

Module 3: Decimals, fractions and percentages 1

This session provides an opportunity to review the participants' understanding of numerical operations involving decimals, and to recap on some of the concepts underpinning the work covered by modules 1 and 2, such as estimation and approximation, and mental maths strategies.

Introduction and recap

Using Q and A, assess what the participants remember from last week's session. Ask for feedback from BODMAS and number test questions; demonstrate correct methods for those questions that have caused problems.

Ask participants to refer to their journals and any feedback they have had from learners about any of the activities or strategies that they have used since the last session.

Ask for feedback on the **Inter-session tasks** from module 2. Ask for volunteers to demonstrate an unfamiliar long multiplication or division method from the *Adult Numeracy Core Curriculum (ANCC)* or the Move On Maths Methods Module (File 2 Part 8) to the group.

Introduce the aims and outcomes of this module using **slides 1–3**.

Mental maths

Using Q and A, assess participants' understanding of the different strategies used for written and mental maths explored in module 2. Reinforce using **slides 4 and 5**.

Introduction to fractions, percentages and decimals

Encourage participants to explore the *Adult Numeracy Core Curriculum* as a teaching resource by asking them to examine the progression chart on pages 14 and 15 to see how each concept is introduced through the levels. Ask them to consider how they introduce the concepts to their learners, and start a group discussion. The response you should be guiding them towards is: 'Use context!' The contexts of money, measure, interest rates, sales, etc. are particularly useful, being familiar to most adults. Compare with the sample activities listed in the *ANCC*.

Decimals: addition and subtraction

Ask the participants to think of 'real-life' examples of decimals and record examples on the whiteboard or flipchart. Prompt if necessary. Examples may be drawn from familiar contexts identified previously (e.g. money).

Relate to place value and the place value chart from the last session, and recap on tenths, hundredths etc. Using Q and A, explore the significance of the decimal point, and establish the need to align figures correctly for addition and subtraction.

Individuals choose two of the decimal numbers and add, then subtract them. Support as necessary. Review the concept of approximation and estimation and ask individuals to check that their answers are 'ball park' figures, talking through their methods and reasoning with their partner, using mini-whiteboards to demonstrate.

Distribute the **Decimals** activity sheet and ask participants to begin answering the questions. Give support to individuals or small groups as required, and encourage peer support and modelling. Ask participants to complete the test-type questions before the next session.

Rounding

Ask participants: What does an 'appropriate degree of accuracy' mean? If you struggle to get a response, ask the following questions:

- What does £34.7901 mean? When would it be an *inappropriate* degree of accuracy? (Answer: Usually! We usually round to two decimal places, as we don't have a coin with a value of less than a penny.) Appropriate? (Answer: When working out things like compound interest rates or currency conversions – rounding too early may result in inaccuracy.)
- When is 15.013 seconds an appropriate level of accuracy? (Answer: Rarely: it is usually inappropriate. Most of us don't have the measuring devices, or the need, to work to this level of accuracy. Exceptions include timing a sprint race, where finishing times are recorded in seconds to three decimal places (milliseconds).)

Ask participants to work in pairs and provide examples of appropriate degrees of accuracy according to context. After feedback of examples, refer to questions involving rounding on the **Decimals** activity sheet. Support individually and ask participants to complete the questions for the next session.

How could participants use context to support their learners' understanding of degrees of accuracy and rounding?

Ordering decimals

Explain that ordering decimals in increasing or decreasing size is frequently assessed in the National Tests. Use **slide 6** to set the task. After participants have fed back the correct answers, ask them to explore the difficulties that a task like this may present their learners with.

- Line 1: rounding to approximate the value will not help! Where learners are not secure in the concept of place value, 8.3 may look literally 'smaller' than 8.25 or 8.21. This is a 'safe' strategy when ordering whole numbers of any size, but does not work with decimals.
- Line 2: same points with regard to the dangers of rounding to approximate, and 'length' of number, as above. Also stress the need to explain zeros as place holders (as in module 2 with whole numbers).
- Line 3: again, don't 'round up' to order decimals: compare units, then tenths, then hundredths etc.

Decimal multiplication and division

Set a relatively simply problem requiring the use of decimals, such as 'How much carpet do I need for a room 1.2 metres by 2.3 metres?' Ask participants to determine what operation is required – they haven't covered area yet! Ask them to use the long multiplication method they researched for the **Inter-session task** in module 2 to calculate the answer. What do they do with the decimal point? Encourage them to find their own solution. Support where necessary with hints: use a calculator to find the answer so they know where they are heading. Use their knowledge of place value: 'removing the decimal point' from the original numbers means what? (Multiplying by 10, in this example.) Ask for a volunteer to model a method to cope with the problem of where to position the decimal point in the answer. Support as required. Once learners have grasped that 'removing the decimal points' means that you have multiplied by factors of ten, and therefore putting them back in at the right place requires an inverse operation, they will need to practise to gain confidence.

Individual work on decimals

Repeat the process for decimal division, and ask participants to begin work on decimal division and multiplication questions on the **Decimals** activity sheet. Encourage peer support, but assess individual progress and support as required. After about 15 minutes, ask the group whether they have spotted any patterns, or discovered any shortcuts. Elicit response: count total number of digits to the right of the decimal point. This is the number of places there need to be behind the decimal point when you reposition it. Explain the danger (to understanding and confidence) if you ask learners to follow a method or shortcut without first understanding why.

Error analysis: decimals

Explain the value of analysing their learners' errors; use **slide 7** to support. Explore their prior knowledge of the purpose and benefits of error analysis. Explain that feedback given to learners in terms of ticks and crosses, where errors are not explored with the learner, is virtually worthless as a learning exercise. Check: are they proactive in analysing learner errors? Suggest that they might like to explore error analysis with their learners during the coming week. Use **slide 8** as a practical introduction to error analysis, and refer participants to the section on error analysis in the Move On Maths Methods Module (File 2 Part 8).


Assign homework tasks

Explain that some of the test-type questions on the **Decimals** activity sheet include skills not yet covered, but that this is realistic. (Test questions tend to cover several skills across more than one element of the curriculum.) Ask them to attempt the test-type questions before the next session, but not to panic if they can't complete some. Encourage them to take ownership of their learning by identifying their gaps against the curriculum. Are they in Measures, shape and space, or in Handling data? Reassure them that they will get input into these areas of the curriculum in future sessions. Use the 'gap identification' to explore the progression charts and the body of the curriculum. The more clearly they understand how the curriculum is structured, the more able they will be to support their learners.

Summary

Revisit the module aims and outcomes using **slides 2 and 3**. Summarise the key learning points for support strategies using **slide 9**. Distribute the **Journal** for module 3. Take any final questions.


Module 3 PowerPoint presentation



The National Certificate in Adult Numeracy

Level 2 Skills for Life Support Strategies

Module 3:
Decimals, percentages and fractions 1




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education and skills
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Aims

- ➔ To review problems involving decimals.
- ➔ To begin to explore strategies for analysing learners' errors.

2




Outcomes

Participants will be able to:

- ➔ add, subtract, multiply and divide decimal numbers
- ➔ order, approximate and compare decimals when solving practical problems
- ➔ approximate decimals by rounding to up to two decimal places
- ➔ analyse learners' errors in decimal operations.


3



Mental methods

- ➔ Break the calculation into manageable parts, e.g. $248 - 100 + 1$ instead of $248 - 99$.
- ➔ We say the calculation to ourselves and are therefore aware of what numbers are involved, e.g. $2000 - 10$ is not much less than 2000.
- ➔ We choose a strategy to fit the numbers, e.g. $148 - 99$ may be done differently from $84 - 77$, though they are both subtractions.
- ➔ We draw upon specific mathematical knowledge, an understanding of the number system, learnt number facts and so on.

4




Written methods

- ➔ We never change the calculation to an equivalent one, e.g. $148 - 99$ is done as it is.
- ➔ We don't say the numbers to ourselves, but start a procedure such as:

$$\begin{array}{r} 148 - \\ 99 \\ \hline \end{array}$$
- ➔ We always use the same method.
- ➔ We draw upon memory of a procedure, and possibly, though not necessarily, an understanding of how it works.

5




Ordering decimals

Arrange these numbers in order of increasing size:

8.3	8.25	8.21
0.12	0.1	0.099
2.61	2.601	1.978

6



Diagnosing errors

- ➔ Errors are often due to misconceptions rather than careless slips.
- ➔ Need to diagnose the misconception rather than simply re-teaching.
- ➔ An effective strategy is to ask the learner to explain or record how they worked out the answer, then deal with the misconception, perhaps by offering a different explanation or by using a different model.
- ➔ Be more proactive about addressing misconceptions.
- ➔ The learners themselves can identify many problems by systematically checking their answers.

7



Diagnosing a learner's errors: decimals

Your learner is making errors like these:

$$\begin{aligned}9.2 - 7.8 &= 1.4 \\5.07 - 1.3 &= 4.94 \\13.8 - 1.19 &= 0.19 \\24.2 - 6.9 &= 17.3\end{aligned}$$

Not all answers are wrong!

Check to see if you can identify where she is going wrong, by working through these examples using the same method as the learner above:

$$\begin{aligned}22.5 - 2.07 &= \\8.26 - 7.4 &= \end{aligned}$$

8



Summary

- ➔ Encourage learners to develop mental as well as written strategies.
- ➔ Use real life contexts to introduce decimals.
- ➔ Revisit place value when working with problems involving decimals.
- ➔ Encourage use of approximation and estimation to check sense of answers.
- ➔ Build test practice in at regular intervals.
- ➔ Analyse learners' errors to check for misconceptions.

9



Activity: Decimals

Addition (Level 1 questions)

Find the value of:

1. $0.63 + 2.56$
2. $7.35 + 18.6$
3. $24.6 + 18.34$
4. $15.34 + 201.6$
5. $67.3 + 0.04 + 15$
6. $164.7 + 1.643$
7. $4.5 + 8$
8. $4.44 + 44.4$
9. $6 + 3.8 + 0.23$
10. $26.3 + 0.04 + 56$

Check your answers by approximation and estimation.

Subtraction (Level 1 questions)

Evaluate the following:

1. $6.72 - 4.9$
2. $3.82 - 0.45$
3. $7.42 - 5.86$
4. $25.1 - 8.4$
5. $4.5 - 3.34$
6. $9.3 - 2.16$
7. $8.32 - 5.65$
8. $45.38 - 0.07$
9. $37 - 5.03$
10. $623.45 - 14.864$

Check your answers by approximation and estimation.

Test-type questions (Level 1)

Sam spends £43.83, £39.89 and £6.08 in a shop. How much did he spend in total?

Fred had £587.45 in his account. He deposited £435 and withdrew amounts of £178.26, £38.46 and £57.59. How much money has he in his account?

A company had a profit of £2.4 million in 2003 and a profit of £1.3 million in 2004. What was the total profit for the two years?

The temperature dropped from 2.750 °C to –5.360 °C. How far did the temperature fall?

The number of people attending the games was recorded in 000s. 254.4 attended Tuesday and 18.4 attended Wednesday. What was the total attendance for the two days?

Rounding

Correct the following to two decimal places: (Level 1)

- 1 0.374
- 2 0.865
- 3 0.518
- 4 0.3619
- 5 £13.785
- 6 £6.999
- 7 15.5281 m
- 8 120.0349 m
- 9 £0.0519
- 10 £130.0009

Correct the following to the nearest ten: (numbers less than 1000 are Level 1; questions and numbers above 1000 are Level 2)

- 1 234
- 2 1756
- 3 74 543
- 4 75 412

- 5 £548.67
- 6 £8531.57
- 7 3829 km
- 8 7434.98 km

Correct the following to the nearest 100: (numbers less than 1000 are Level 1; numbers more than 1000 are Level 2)

- 1 8464
- 2 926 547
- 3 £6592.34
- 4 £175.42
- 5 73 656 km
- 6 £1281.99
- 7 738 cm
- 8 2319 g
- 9 4819 kg
- 10 234.99 cm

Test-style questions

Correct £5.48 to the nearest 10p.

Correct 2.458 m to the nearest cm.

Correct 12.4645 km to the nearest metre.

Correct £271.78 to the nearest 10p.

Correct 4.735 km to the nearest 100 metres.

Correct 86.742 m to the nearest 10 cm.

Round £3.85 to the nearest £.

Round 23.56 thousand to the nearest 100.

Round 67.25 m to the nearest 0.1 m.

Correct 3.374 m to the nearest cm.

Multiplication

(up to two places is Level 1; more than two places is Level 2)

Exercise 1	Estimated answer
1 26.3×4	
2 3.8×7	
3 5.63×5	
4 22.51×16	
5 $\text{£}24.52 \times 23$	
6 $56.34 \text{ m} \times 15$	
7 $3.72 \text{ seconds} \times 42$	
8 $3.05 \text{ g} \times 142$	
9 $2.25 \text{ hours} \times 5$	
10 $\text{£}0.02 \times 84$	

Calculate the answers to the questions in exercise 1.

Estimate and then calculate the following:

- 1** 3.4×0.4
- 2** 5.6×0.2
- 3** 34.2×0.3
- 4** 38.5×0.6
- 5** 4.2×0.03
- 6** 15.8×0.06
- 7** 0.02×0.04
- 8** 0.06×0.002
- 9** $2.25 \text{ hours} \times 1.5$
- 10** $\text{£}30.24 \times 3.5$

Multiplication problems

(up to two places is Level 1; more than 2 places is Level 2)

£1 buys 1.2 dollars. How many dollars can be bought with £15?

A man earns £5.80 an hour for a 40-hour week. Any overtime is paid at time and a half. How much will he earn in a week where he works 43 hours?

If 1 foot equals 30.48 cm, how many cm is 6.5 feet?

Convert 2.6 inches into mm. (1 inch = 25.4 mm.)

Calculate the volume of a rectangular container with a length of 0.4 m, width of 0.3 m and height of 0.6 m. (Volume = length \times width \times height.)

One box weighs 6.3 kg. Calculate the total weight of 24 boxes.

What is 500×2.5 cm?

Estimate the volume of a circular sandpit with a radius of 1.2 m and a depth of 0.3 m?

Volume = 3 (this is π ('pi') rounded) \times radius \times radius \times depth.

Division

(up to two places is Level 1; more than two places is Level 2)

Estimate and then calculate the following:

1 $6.94 \div 2$

2 $7.02 \div 3$

3 $0.764 \div 4$

4 $7.24 \div 5$

5 $2.34 \div 100$

6 $4 \div 0.5$

7 $0.852 \div 0.02$

8 $14.3 \div 0.004$

9 $231 \div 1.1$

10 $0.274 \div 0.02$

Test-type questions

A 3.5 metre long bar is divided into 0.2 metre lengths. How many pieces are there?

2.5 litres of cola costs £2.30. What is the cost per litre?

5 miles is about 8 kilometres. How far is one mile in kilometres?

An oil tank contains 1750 litres. How many 0.6 litre cans can be filled from this tank?

Calculate the speed of a car travelling 80 miles in 2.5 hours. (Speed = distance \div time.)

Calculate the mean weight of the following: 16.3 kg, 18.6 kg and 15.9 kg.

Answers: Decimals

Addition

- 1 3.19
- 2 25.95
- 3 42.94
- 4 216.94
- 5 82.34
- 6 166.343
- 7 12.5
- 8 48.84
- 9 10.03
- 10 82.34

Subtraction

- 1 1.82
- 2 3.37
- 3 1.56
- 4 16.7
- 5 1.16
- 6 7.14
- 7 2.67
- 8 45.31
- 9 31.97
- 10 608.586

Test-type questions for decimals

- 1 £89.80
- 2 £748.14
- 3 £3.7 million (or £3,700,000)
- 4 8.11
- 5 272.8 thousand (or 272,800)

Rounding to two decimal places

- 1 0.37
- 2 0.87
- 3 0.52
- 4 0.36
- 5 £13.79
- 6 £7.00
- 7 15.53 m
- 8 120.03 m
- 9 £0.05 or 5p
- 10 £130

Rounding to the nearest ten

- 1 230
- 2 1760
- 3 74 540
- 4 75 410
- 5 £550
- 6 £8530
- 7 3830 km
- 8 7430 km (Hint: 4.98 may only be just under 5, but it is under 5, so round down – don't be tempted to start rounding up from the hundredths!)

Rounding to the nearest hundred

- 1 8500
- 2 926 500
- 3 £6600
- 4 £200
- 5 73 700 km
- 6 £1300
- 7 700 cm
- 8 2300 g
- 9 4800 kg
- 10 200 cm

Test-type questions in rounding

- 1 £5.50
- 2 2.46 cm
- 3 12.465 km (Hint: there are 1000 m in 1 km, so 12.4645 km = 12 km, 464.5 m.)
- 4 £271.80
- 5 4.7 km (This is the same as 4 km and 700 m 1000 m = 1 km.)
- 6 86.7 m (100 cm = 1 m, so 86.7 m = 86 m and 70 cm.)
- 7 £4.00
- 8 23.6 thousand, or 23 600
- 9 67.3 m (Hint: 0.1 m = 1/10 m – (remember place value), so 67.25 m = 67 m and 25 cm.)
- 10 3.37 m or 3 m 37 cm

Multiplication

Exercise 1: Estimated answers from the following approximations:

- 1 26×4
- 2 4×7
- 3 6×5
- 4 23×16
- 5 25×23
- 6 56×15
- 7 4×42
- 8 3×142
- 9 2×5
- 10 2×84 (£0.02 = 2p!)

Exercise 1: Evaluated answers:

- 1 105.2
- 2 26.6
- 3 28.15
- 4 360.16
- 5 £563.96
- 6 845.1 m
- 7 156.24 seconds
- 8 433.1 g
- 9 11.25 hrs
- 10 £1.68

Estimate then evaluate:

- 1 1.36
- 2 1.12
- 3 10.26

- 4 23.1
- 5 0.126
- 6 0.948
- 7 0.0008
- 8 0.00012
- 9 3.375 hrs
- 10 £105.84

Multiplication problems

- 1 \$18
- 2 £258.10 ($\text{£}5.80 \times 40$ hours for basic pay, plus 3 hours at time and a half: £8.70)
- 3 198.12 cm
- 4 66.04 mm
- 5 0.072 cm^3
- 6 151.2 kg
- 7 1250 cm (or 1.25 m)
- 8 1.296m^2 (Hint: you have been told to use 3 as an approximation of π , and to use the formula for volume = $3 \times \text{radius} \times \text{radius} \times \text{depth}$, so the calculation you need to perform is $3 \times 1.2 \times 1.2 \times 0.3$.)

Division problems

- 1 3.47
- 2 2.34
- 3 0.191
- 4 1.448
- 5 0.0234
- 6 8
- 7 42.6
- 8 3575

9 210

10 13.7

Division test-type questions

- 1** 17 pieces (You want to know how many lengths measuring 0.2 m you can cut from a bar 3.5 m long. With this type of question, you always need to round down!)
- 2** 92p
- 3** 1.6 km
- 4** 2916 cans
- 5** 32 mph
- 6** 16.9 kg (Hint: 'mean' is the most common form of average, and to calculate it we add the weights together and divide by the number of weights we have added. We round the answer to the degree of accuracy of the question: in this example, to one decimal place.)

Journal

Module 3: Decimals, fractions and percentages 1

What have you learnt from this module?

How will you apply skills/strategies learnt with learners within your organisation?