Education Scotland
Foghlam Alba

Time

Professional Learning Resource

This resource is part of the suite of the Numeracy Professional Learning Resources

For Scotland's learners, with Scotland's educators

Do luchd-ionnsachaidh na h-Alba, le luchd-foghlaim Alba

Contents

Introduction

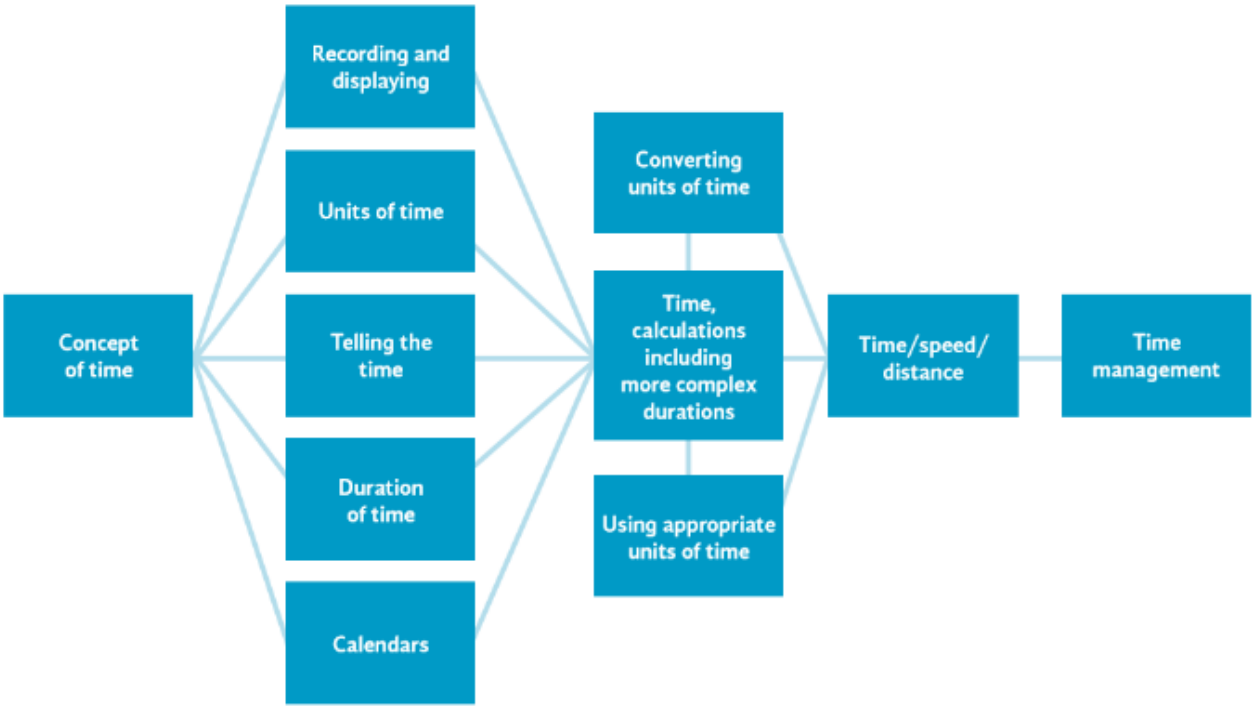
Developing an understanding of the recording and measurement of time is an essential life skill that allows organisation of events and activities, and supports effective time management. The use of standard units of time allows communication using a common language and using timetables can help to develop mental agility in relation to time calculations.

Progression within this concept develops from the knowledge that the passing of time is something that can be measured to being able to perform complex speed and distance calculations.

Time calculations are something that can be used daily and it is beneficial to raise awareness of this regularly and support learners to understand the relevance of the skills they are developing in real life contexts.

This resource aims to support practitioners in developing a deeper understanding of teaching and learning approaches relating to time and to develop pedagogical understanding in relation to the progression of teaching time.

National Numeracy and Mathematics Progression Framework[1]
Time



[1] Further guidance on using the National Numeracy and Mathematics Progression Framework can be found by clicking here.

Early Level

The table below includes the experiences and outcomes related to 'Time' at early level. The experiences and outcomes should be used in the planning of learning, teaching and assessment. It is important to note that the benchmarks are designed to support teacher professional judgement in progress towards and achievement of a level. There are a range of different experiences that learners need to be exposed to before these can be achieved.

Experiences & Outcomes	**Benchmarks**
I am aware of how routines and events in my world link with times and seasons, and have explored ways to record and display these using clocks, calendars and other methods. **MNU 0-10a**	• Links daily routines and personal events to time sequences. • Names the days of the week in sequence, knows the months of the year and talks about features of the four seasons in relevant contexts. • Recognises, talks about and where appropriate, engages with everyday devices used to measure or display time, including clocks, calendars, sand timers and visual timetables. • Reads analogue and digital o'clock times (12 hour only) and represents this on a digital display or clock face. • Uses appropriate language when discussing time, including before, after, o'clock, hour hand and minute hand.

Effective Learning and Teaching Approaches

Careful consideration should be given to the spaces, interactions and experiences we provide, ensuring that opportunities for learners to develop the concept of time permeates across all.

Spaces

Rich, carefully considered learning spaces both outdoor and indoor can offer learners practical opportunities to develop their concept of time. The choice of experiences on offer should reflect an environment of open-ended possibilities in which children can feel intrinsically motivated to explore and investigate time through play. Selecting appropriate and engaging resources can enhance interactions, leading to creativity and curiosity.

Open-ended materials offer the potential for creative explorations through child-initiated and adult initiated learning experiences. Spaces should be planned to provide a balance of opportunities for learners to play, explore, investigate and question. Practitioners should ensure that planning for learning is carefully balanced and is both responsive and intentional in design. These opportunities should enable learners to make sense of time in the world around them, whilst also ensuring learners' needs are being met through their engagement with all experiences and outcomes presented within early level.

Please see the 'Guidance Document' for additional information for learning and teaching approaches at early level.

There are many different ways of permeating time across the learning spaces. Some examples of how to do this are provided below.

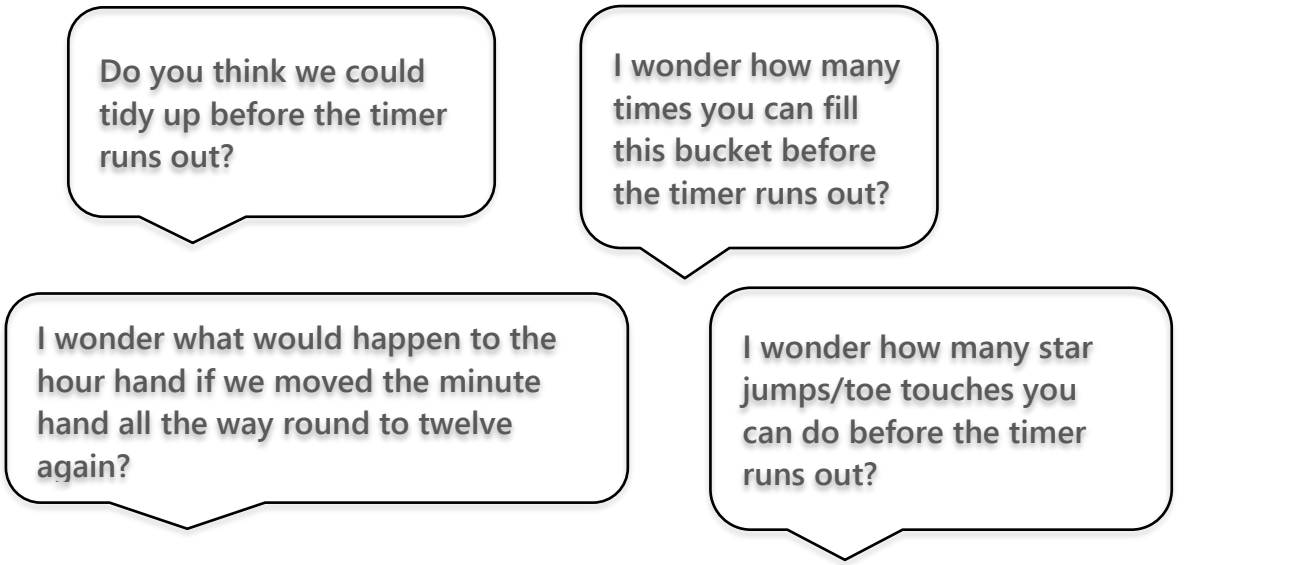
- Visual timetables to illustrate the idea of now, next, morning and afternoon displayed.
- Calendars displayed with days of the week and months of the year.
- A range of clocks, digital and analogue, displayed.
- Displaying editable countdowns to events. '3 days until our concert'.
- Provide a range of timing devices, e.g. stop watches and sand timers.
- Provide old and broken clocks and watches.
- Wall displays or floor books displayed with photographs over time.
- Birthday charts displayed.
- Provide books that contain 'time' themes within them.

Interactions – One of the roles of the Adult/ Practitioner

One of the roles of the practitioner is to determine what the child could learn through their own interests using high quality interactions. Practitioners should support learners to extend their learning of time through encouragement of creativity and curiosity. Careful observation is an important assessment tool as is knowing when to stand back and give learners time to investigate by themselves. It is important to notice when learners are more receptive to further support from the adult and address any misconceptions that may cause challenges at later stages.

Language can be used as a powerful vehicle for the teaching and understanding of time. When interacting with learners, practitioners can model the use of relevant vocabulary in meaningful contexts. This allows learners to make links between the spoken word and the associated learning. Using language in the correct context regularly will support learners' understanding.

- Next we will have story time. After that it will be lunch time.
- I wonder who has a birthday next month?
- I wonder what you will do after you eat your snack?
- What day is it today?
  What day was it yesterday?



Practitioners should also embed numbers in everyday conversations.

Experiences and Routines

Experiences of everyday activities are important, both indoor and outdoor.

Learners should be beginning to understand that certain events occur at a defined time each day. This can be developed through lots of personal experiences with time (snack time, lunch time, story time). This allows learners to connect time with daily routines.

At early level, learners will develop a sense of order through repeated routine. Displaying visual timetables and involving learners in discussions relating to these can be extremely useful in allowing learners to sequence their day using appropriate vocabulary. At this level, these timetables can be pictorial and learners can be involved in selecting the sequence of events as appropriate.

Time is an abstract concept at this stage therefore it is essential to continually reinforce the concept of before/after and yesterday/today/tomorrow in daily interaction. This will support the concept of time becoming integrated into learners' daily lives and vocabulary. Regularly using language such as first, next, soon, later, early and late within everyday contexts will also support this.

Links to real life regular events which are personal to each learner can be brought into daily dialogue, for example ‘Judo on a Friday’ or ‘Going to Gran’s on a Sunday’. Close links with parents and carers will support this discussion. Further examples that could develop the concept of time are noted below.

Sequencing stories when retelling and acting out.

Providing opportunities to sequence events in the lives of learners, e.g. breakfast, lunch, dinner, going to bed.

Record events over time using photographs using wall displays or floor books. Learners can notice changes that took place over time.

Learners bring in photos of when they were a baby and discuss the different ways they have changed.

The difference between day and night could be investigated through taking a walk in the daylight and where possible repeating this once it gets dark. Comparisons between these walks could be made and further dialogue surrounding what learners typically do during the day compared to what they do at night could be discussed.

The concept of seasons is a longer time interval and therefore more abstract. Outdoor learning with a multi-sensory approach will be beneficial as learners can be encouraged to discuss and observe changes in the weather and the outdoor environment. It can be beneficial to provide opportunities for multi-sensory approaches which allow learners to explore their senses for example, the crunching of the leaves or snow, the sound of pouring rain or the feel of snow as this provides learners with rich ‘hands on’ memorable experiences.

What do you notice?

I wonder why the trees look different in each of these pictures?

I wonder why we are wearing jackets in that photo but not that one?

I wonder what happened next?

Awareness of Time

Time is everywhere around us and learning environments should reflect that. Analogue clocks, digital displays, timers, calendars and timetables could be permanent fixtures in establishments. Old clocks and watches could be left out for learners to take apart and investigate which may promote discussion and further exploration.

I wonder why there are numbers on this?

I wonder what these could be used for?

Using timers and stopwatches as part of everyday activities should be commonplace and used by practitioners and learners. Sand timers can be used to develop the concept of minutes when timing a race or a challenge, playing a board game or baking.

Having access to timers throughout the learning environment will encourage learners to use these as they engage in playful experiences. Learners can also be encouraged to come up with their own 'one minute' challenges. Further examples of how they can be used can be found on page six.

Other experiences can be provided to develop an understanding of the passing of time.

Design a weather station and collect data over a period of time.

Watch an ice cube melt.

'Count' how many seconds it takes for a ball to roll down a hill.

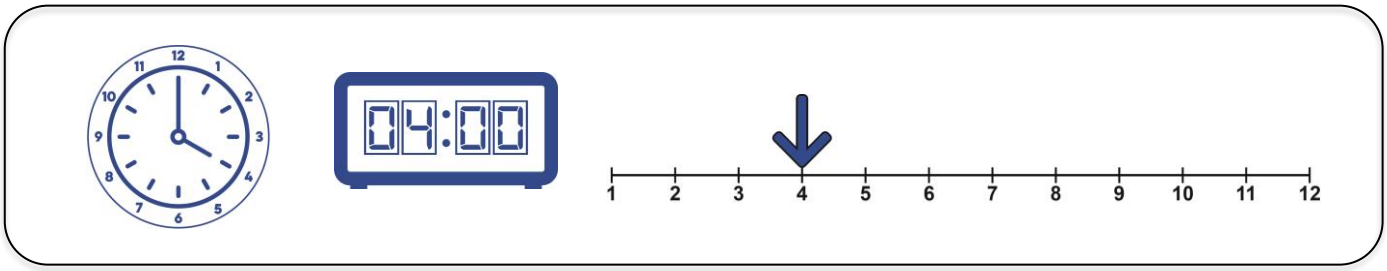
Create time lapse videos.

Plant seeds and watch them grow over time.

When exploring the wider community it is important to highlight where clocks are visual such as on the town hall or at the bus stop. If you are using public transport, learners can be made aware of timetables, information screens and announcements to help develop their understanding of how time is used in these contexts.

As learners progress through early level they should be supported to read o'clock in both analogue and digital form. Discussion around the different parts of a clock are useful and the differences between the way an analogue and digital clock look should be discussed. This can be incorporated into daily activities such as 'we will tidy up at 11 o'clock' and 'lunch is at 1 o'clock' as this will help them to develop the language of time.

In addition to displaying o'clock on an analogue and digital clock, it can also be useful to display this on a 1-12 number line as this will reinforce the concept of before and after. Giant number lines can also be drawn in the playground where learners can jump forwards and backwards and then represent this on a clock.



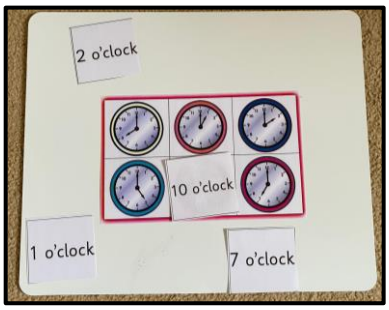
Learners could create a 'human clock' by first of all lining up in a row holding the numbers 1-12 in the correct order. Once they have the line created, they can be supported to create a circle to simulate the layout of an analogue clock. Two further learners can be the hour and minute hand. Additionally, learners could be provided with opportunities to create their own clocks using paper plates or other circular items. Games such as 'What's the Time, Mr. Wolf?' and 'Clock in the Tower' can help to reinforce vocabulary.

Songs, rhymes and stories can be useful in developing a sense of time. There are a number of 'days of the week' and 'months of the year' songs available on free online platforms. Some stories that may be useful in developing the concept of time are listed below:

- The Very Hungry Caterpillar (Eric Carle)
- What's the Time, Mr. Wolf? (Debi Gliori)
- The Very Busy Spider (Eric Carle)
- The Clock Struck One (Trudy Harris).

Opportunities to use real clocks will continue to develop learners' skills and understanding. Given individual clocks, learners can be asked to show various o'clock times. It is important to spend time discussing the differences between analogue and digital clocks and display the same time in different formats.

Once learners have had practical experience of using clocks, they can move onto using pictorial representations of clocks alongside this. They can be given a mix of digital and analogue clocks and asked to find the pairs. Playing matching games such as ‘snap’ and ‘matching pairs’ with digital and analogue clocks can also reinforce the concept. Learners can also be given a card and asked to find someone who has the same time as them but in a different format.



Learners have to match the written words to the analogue picture. A digital format could also be used.

There are many digital games and applications which can reinforce the concept of o’clock, some of these can be found on interactive board software already in classrooms and many free online resources are also available.

Points to consider

- The concept of time is very abstract, particularly at this stage and therefore needs revisited daily through real and relevant concepts.
- It is easier for learners to sequence their day if they have established routines.
- Vocabulary such as yesterday, today, and tomorrow are easier to understand when they are linked to a specific event or activity that makes the concept of time concrete.
- Ensure correct terminology is used such as, ‘one minute’ rather than ‘a minute’.
- It is important to take care in the language we use. Saying ‘give me a second’ and ‘I’ll be there in a minute’ may cause confusion.

Links to other curricular areas

Number
- Counting on and back.

Literacy
- Story sequencing.

Expressive Arts
- Creating visual information based on their experiences of the seasons.
- Sequencing and retelling stories.

Science
- Using senses to explore the world around them.

Social Studies
- Describing and recording the weather in relation to seasons.

Reflective questions

- **How do we ensure that the concept of time is reinforced daily?**
- **How can we ensure learners are making links in their learning and being able to apply and transfer skills across the curriculum?**
- **How do we continue to reinforce the concept of routines and set times whilst also allowing learner choice in activities?**

First Level

The table below includes the experiences and outcomes related to 'Time' at first level. The experiences and outcomes should be used in the planning of learning, teaching and assessment. It is important to note that the benchmarks are designed to support teacher professional judgement in progress towards and achievement of a level. There are a range of different experiences that learners need to be exposed to before these can be achieved.

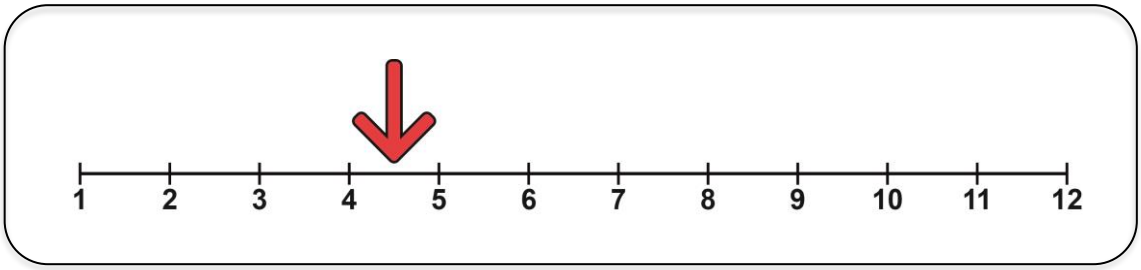
Experiences & Outcomes	Benchmarks
I can tell the time using 12 hour clocks, realising there is a link with 24 hour notation, explain how it impacts on my daily routine and ensure that I am organised and ready for events throughout my day. **MNU 1-10a** I can use a calendar to plan and be organised for key events for myself and my class throughout the year. **MNU 1-10b** I have begun to develop a sense of how long tasks take by measuring the time taken to complete a range of activities using a variety of timers. **MNU 1-10c**	• Tells the time using half past, quarter past and quarter to using analogue and digital 12 hour clocks. • Records 12 hour times using am and pm and is able to identify 24 hour notation, for example, on a mobile phone or computer. • Records the date in a variety of ways, using words and numbers. • Uses and interprets a variety of calendars and 12 hour timetables to plan key events. • Knows the number of seconds in a minute, minutes in an hour, hours in a day, days in each month, weeks and days in a year. • Orders the months of the year and relates these to the appropriate seasons. •Selects and uses appropriate timers for specific purposes.

Effective Learning and Teaching Approaches

Clocks

Early level skills using o'clock should be revised. At first level, half past, quarter past and quarter to timings should be introduced, again using both analogue and digital clocks.

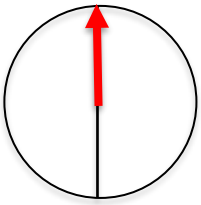
To support learners with the concept of half past and quarter to/past, lots of reinforcement of halves and quarters is essential. To introduce half past it may be useful to return to using a one to twelve horizontal number line and positioning the hand half way between two numbers.



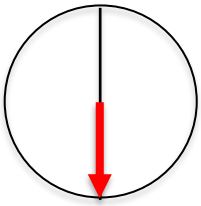
Learners could discuss ‘half past 4’ for example, and investigate the fact that this is half way between 4 and 5 o’clock and because of this we say ‘half past 4’.
Investigate what this looks like on a digital and analogue clock.

I wonder what would happen to the hour hand if we moved the minute hand to the six?

Folding paper plate clocks in half can enhance the concept of ‘half’. The minute hand for half past can be introduced as a position before discussing the number the minute hand points to.



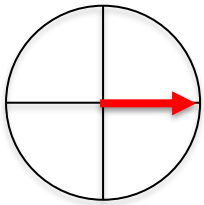
When the minute hand points to the top it is o’clock.



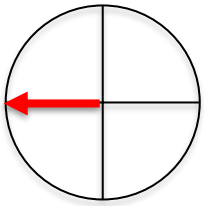
When the minute hand points to the bottom it is half past

This can then be progressed onto a real analogue clock and learners asked to notice which numbers the minute hand is pointing to at o’clock and half past. At this stage, learners can be provided with individual clocks and asked to create given times.

The process of splitting a clock face into quarters can then be introduced, with quarter past and quarter to investigated.



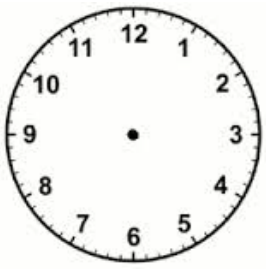
When the minute hand points to the right it is quarter past.



When the minute hand points to the left it is quarter to

It is important that learners know there are 60 minutes in one hour. This can be represented on a number line to further enhance understanding. Half of 60 is 30, a quarter of 60 is 15. This should also be displayed on a circular clock for learners, and they can also create their own representations of it by creating their own clocks.

If there are 60 minutes in an hour, how minutes are there in half an hour?



60 ÷ 2 = ?

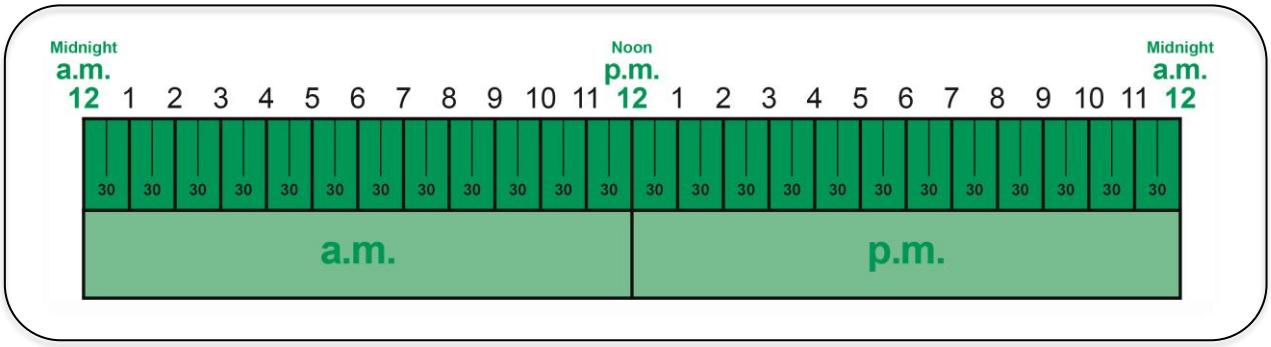
$\frac{1}{2}$ of 60?

Practitioners can develop the concept of half past, quarter past and quarter to by encouraging learners to participate in some of the tasks below.

- Play counting games that reinforce counting in multiples of 5.
- Use groups of 5 objects and a number line to count.
- Become familiar with the different ways to read the time aloud (eight forty-five/ quarter to 9 can be challenging for learners).
- Play a human clock game and reinforce the position of the hour hand as not directly pointing at the number for quarter to/past.
- Regularly use language such as, ‘we will go to PE at 2:30’, ‘assembly is at quarter to ten’.
- Provide opportunities to count the minute spaces on the clock to know there are 60.
- Encourage learners to wear watches if they have them.

For some learners it may be worth introducing only the hour hand only to begin with and once they are secure with this concept the minute hand can be introduced.

When learning about a.m. and p.m. timings, it is useful to introduce the terms midnight and noon/midday. The use of a number line like the one below can support the teaching and learning of this concept. Explain that our day is split into two parts, a.m. and p.m. and show them a number line like the one below. If the time we are looking at is in the morning then it is a.m. and if the time we are looking at is in the afternoon or evening then it is p.m.



Key questions to support learning may include:

- What is the time half an hour earlier/later?
- What is the time one and a half hours earlier/later?

Knowing the number of seconds in a minute, minutes in an hour and hours in a day is a skill that should be developed at first level. There are a numbers of ways of reinforcing these concepts.

- Use timers to see how many jumps/hops/star jumps can be carried out in one minute.
- Use counters or blocks to create a concrete visual of a clock – 5 counters between each number. 60 counters can represent 60 minutes and also 60 seconds if the second hand goes around.
- Use interactive timers for class challenges such as tidying up or lining up.
- Provide opportunities for learners to choose the type of timer to use for different activities and justify their choice.

When introducing twenty four hour notation it is important to discuss where this is seen in real life, for example mobile phone clocks, car clocks or computer clocks. Learners only need to read 24 hour notation at this level, conversions will be taught at second level. Bringing this into daily routines and asking learners to point out where they see 24 hour notation each day can enhance this concept. The world around us is rapidly becoming a digital world and learners may be more aware of digital time, therefore it is also important to highlight examples of analogue clocks in the real world, for example train station clocks or church clocks.

Key questions to support learning may include:

- Can you create a picture or display to explain why 6:45 a.m. is the same as quarter to 7?
- How could we work out how many minutes are in an hour/day/week?
- My birthday is in 4 days, how many hours is that?
- Has anyone noticed numbers on digital clocks where the hours are bigger than twelve? Where did you see this?
- What is the best timer to use for this task? Why?

Calendars and Timetables

Early level skills in relation to the days of the week should be reinforced alongside awareness of months of the year. At first level this should develop onto learners knowing the order of the months of the year, being able to relate these to the appropriate season and knowing how many days are in each week, month and year.

Examples of ways in which this can be developed are noted below.

- Display a class calendar and discuss the date at the start of each day.
- Give out cards with the months of the year, learners have to order them correctly and sort into seasons.
- Each learner given a month of the year card and they have to find the person with the month before/after card.
- Provide learners with a set of four ‘seasons’ cards. Teacher say the name of a month and ask learners to hold up the correct season.
- Teacher say the numbers. 28, 29, 30 or 31 and learners hold up a month card that has that exact number of days in it.
- Learn rhymes with the number of days in each month.
- Class calendar display with events such as trips, special assemblies, various festivals and other events relative to the class. Learners can be asked to populate this.

It is important that learners are exposed to the date represented in both words and numbers.

Monday, 5th July 2021	**05.07.2021**	**5/7/21**

Learners should be aware that there are seven days in a week and as they progress through first level they can be further challenged through discussion around how many days there are in, for example, three weeks.

Activities incorporating sequencing events and dates can promote rich discussions. Cards could be given with various dates and learners asked to put them in the correct order.

a) **26th January** | **1st January** | **15th January** | **14th January**

b) **10th October** | **10th December** | **10th February** | **10th March**

c) **3rd May** | **3rd January** | **3rd July** | **3rd March**

This could then then be extended to learners calculating durations of time in days, crossing over months.

The local swimming pool was due to open on the 22nd September.
It opened up 11 days late.

On which date did the pool open?

Susan thinks it opened on 33rd September.
Tariq thinks it opened on 2nd October.
James thinks it opened on 3rd October.
Sam thinks it opened on 4th October.
Who is correct? Why?

Learners will require lots of dialogue around this type of question. Concrete and electronic calendars should be used to begin with. Once learners are confident using the calendars, these can be removed.

Twelve hour timetables should be introduced, for example, simple transport timetables or television schedules. Learners should be provided with a wide range of timetables and given a range of tasks to support them to develop skills in interpreting them.

The pupils in P4 plan a book fair.

Book Fair	
Time slot	**Class**
9:15 am – 9:45 am	P1
9:45 am – 10:15 am	P2
10:15 am – 10:45 am	P3
10:45 am – 11:15 am	P4
11:15 am – 11:45 am	P5
11:45 am – 12:15 pm	P6
12:15 pm – 12:45 pm	P7

Which class was at the book fair at 11 am?

Which classes were at the book fair in the afternoon?

Key questions to support learning may include:

- How many months are in one year? Which month comes before/after_____?
- In which month would we be most likely to _____?
- If I go on holiday in five weeks, how many days is that?
- Which two consecutive months could I be thinking of which have a total of 61 days? Are there any other months this could be?
- What is the date and day before Friday 1st March? Why are there two potential answers?

Points to consider

- Quarter past and to require regular reinforcement and daily practice. It is essential that learners are secure with half past and quarter past before moving onto quarter to
- It doesn't need to be light outside for it to be a.m. or dark for it to be p.m.
- The number of days in each month is very abstract and needs a great deal of reinforcement. Use of physical calendars is important when introducing this concept.

Links to other curricular areas

Number
- Using number to solve time problems.

Fractions
- Halves and quarters.

Data and Analysis
- Interpreting timetables.

Mathematics, impact on the world
- Roman numerals.

Physical Education
- Recording number of movements in a set time.

Science
- Relating movement of sun and moon to the length of a day, a month and a year.

Social Studies
- Measuring and recording weather over a period of time.

Religious and Moral Education
- World celebrations in different faiths.

Digital Technologies
- Using technology to enhance learning – digital clocks, timetables and timers.

Reflective questions

- **What activities do you do on a regular basis to encourage learners to apply other knowledge and understanding of the number of days in each month and the order of the months in each year?**
- **How are you developing learners' competence and confidence in working with time intervals in real-life, relevant situations?**
- **How can we encourage all school staff to use the vocabulary of time in daily school routines?**

Second Level

The table below includes the experiences and outcomes related to 'Time' at second level. The experiences and outcomes should be used in the planning of learning, teaching and assessment. It is important to note that the benchmarks are designed to support teacher professional judgement in progress towards and achievement of a level. There are a range of different experiences that learners need to be exposed to before these can be achieved.

Experiences & Outcomes	Benchmarks
I can use and interpret electronic and paper-based timetables and schedules to plan events and activities, and make time calculations as part of my planning. **MNU 2-10a** I can carry out practical tasks and investigations involving timed events and can explain which unit of time would be most appropriate to use. **MNU 2-10b** Using simple time periods, I can give a good estimate of how long a journey should take, based on my knowledge of the link between time, speed and distance. **MNU 2-10c**	• Reads and records time in both 12 hour and 24 hour notation and converts between the two. • Knows the relationships between commonly used units of time and carries out simple conversion calculations, for example, changes $1\frac{3}{4}$ hours into minutes. • Uses and interprets a range of electronic and paper-based timetables and calendars to plan events or activities and solve real life problems. • Calculates durations of activities and events including situations bridging across several hours and parts of hours using both 12 hour clock and 24 hour notation. • Estimates the duration of a journey based on knowledge of the link between speed, distance and time. • Chooses the most appropriate timing device in practical situations and records using relevant units, including hundredths of a second. • Selects the most appropriate unit of time for a given task and justifies choice.

Effective Learning and Teaching Approaches

Clocks and durations

At second level, learners should be provided with opportunities to tell the time using minutes to and minutes past, and read times to the nearest minute using both analogue and digital displays.

At this level learners should develop their skills in reading five minute and one minute intervals. For some learners, it is worth ensuring that they are confident in using 'minutes past' before moving on to 'minutes to'.

Previously, learners will have had experience of identifying 24 hour notation. At second level this should be extended to reading and recording time in both 12 hour and 24 hour notation, and being able to convert between the two notations.

These skills could be developed by:

- Providing lots of practical activities in the use of clocks, both digital and analogue – questions can be led by both the teacher and learners.
- Playing games – there are many free available online, including board games and card games.
- Making references to the time throughout the day when changing activities or making plans.

Once learners are confident in reading different time notations, they can be provided with opportunities to apply their learning to real life situations.

London Heathrow Flight Arrival Times	
Dubai	08:10
Paris	10:35
Berlin	13:44
New York	15:18
Tokyo	19:36

Jane arrives on the flight from Tokyo.

She is due to meet friends in London for dinner at 7:45 p.m.

Do you think she will arrive for dinner in time? Explain why.

Can we convert between 12 hour and 24 hour notation to help solve this problem?

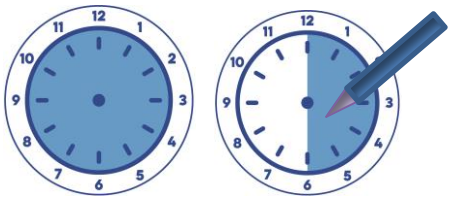
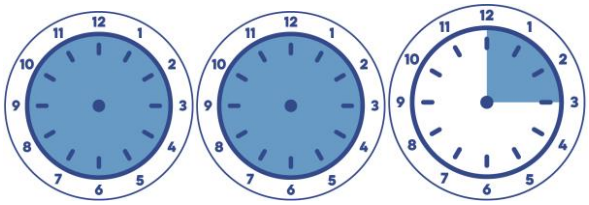
Can we link this problem to real life, considering why Jane might not make it on time?

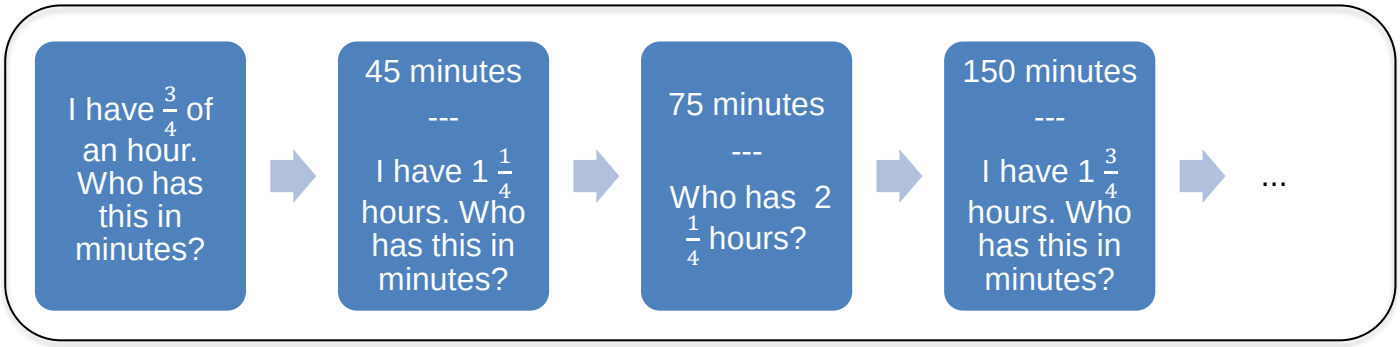
Can we plan a journey like this? Which digital planning tools could we use?

The relationship between hours and minutes should be explored at second level, and learners should be encouraged to carry out conversions, including simple fractions of an hour. This can be developed by linking the concept of fractions with the concept of time.

Learners can be given opportunities to count the number of minutes on clocks that have common fractions shaded. They could also be asked to make their own similar displays using durations of their choice.

Activities such as ‘fill in the blanks’ or loop games can also be used the reinforce this.

	$\frac{3}{4}$ hour →	… minutes
	$1\frac{1}{2}$ hours →	90 minutes
	2 … hours →	135 minutes



Time calculations involving counting forwards and backwards in hours and minutes should be introduced, leading onto durations that bridge the hour. Progression through the types of questions that could be asked are demonstrated below.

Learners could initially be given clocks to calculate the durations for each type of question, and when they are confident doing so, move on to calculating time durations without them.

counting forwards and backwards in hours and minutes

- A party starts at 5:45 p.m. It lasts one hour and thirty minutes. When does it finish?
- A TV programme starts at 6:25 p.m. and ends at 8:40 p.m. How long does it last?

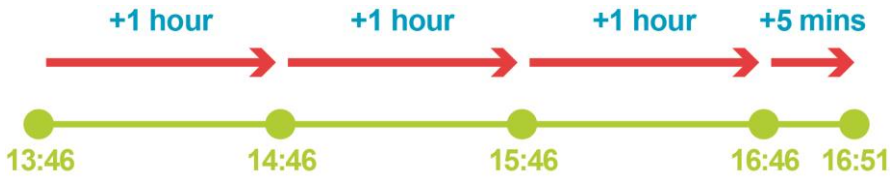
calculating durations crossing from a.m. to p.m.

- The Smith family are going on holiday to Inverness from their home in England. They left home at 9:55 a.m. and arrived at the hotel at 2:30 p.m. How long did their journey last?

working in 24 hour time

- A school disco started at 19:30 and ended at 21:15. How long did the disco last?
- How long does the 23:20 train from Glasgow take to travel to Edinburgh if it arrives at 00:17?

Many learners will find using an empty number line helpful when calculating time durations.

I board the 13:46 train to Inverness. If I arrive at 16:51, how long did the journey take me?	

It may be useful to share different strategies that learners have used in order to demonstrate the alternative ways of finding the answer to time problems.

Once learners are confident at calculating time durations they can then move on to investigating the link between distance, speed and time. At second level, they should be able to use simple time periods to estimate the length of a journey given the distance and the travelling speed.

A bar modelling approach may support this. The example below demonstrates how a bar modelling approach could be used to solve problems.

Simon cycles 90 km and travels at an average speed of 30 km per hour. How long does his journey take him?

90 km		
30 km	**30 km**	**30 km**
1 hour	**?**	**?**

It is important to note that although we teach the metric system, we still measure road distances in miles, and that speed is generally measured in miles per hour. It is also important to discuss why this is an overall speed and why average speed does not necessarily mean that something travelled at this speed consistently throughout a journey.

Learners should carry out practical tasks and investigations involving timed events and use timers, including digital, that include tenths and hundredths of a second. This could be supported through individual, group or class activities. Some examples of these are noted below.

- Timing short practical activities such as exercises in seconds only and discuss the need for tenths and hundredths of a second.
- Recording local, national and worldwide sporting events – calculate the differences in times.
- Making links to decimal place value.

Learners should also be given opportunities to select the most appropriate unit of measuring time. One way of doing this is by asking them to work in groups to discuss and share the types of events we might measure in:

- years
- months
- weeks
- days
- hours
- minutes
- seconds etc.

They could also be provided with flashcards displaying different units of time and asked to hold up the one they think would be most appropriate for measuring certain events, such as the examples below. There may be more than one appropriate answer, for example the length of a family holiday could be a number of days or weeks. It is worthwhile taking the time to discuss this.

I am forty now, how long until I am 55?	Brushing our teeth.	Time between lunch and dinner.	How long we are at school for each day?
How long it is between the Spring and October holidays?	Carrying out 10 star jumps.	To jump in the air and land on both feet.	

Key questions to support learning may include:

- Show me as many different ways as you can of representing 1:30 p.m. (concrete and pictorial also encouraged).
- How many hours are there in $2\frac{1}{4}$ days?
- If we were measuring _____ what would be the most appropriate unit of time measurement? Why?
- On a digital clock showing 24 hour time, over a whole day, how many times does a 5 appear?
- Calculate the starting time, given the finish time.

These are in addition to the examples that have been given above. All examples can be adapted or used as a starting point.

Calendars and Timetables

At second level, learners should be provided with opportunities to use calendars to plan events and solve real-life problems. A class calendar can support this, with learners being asked to add important events such as birthdays, holidays and class events to it.

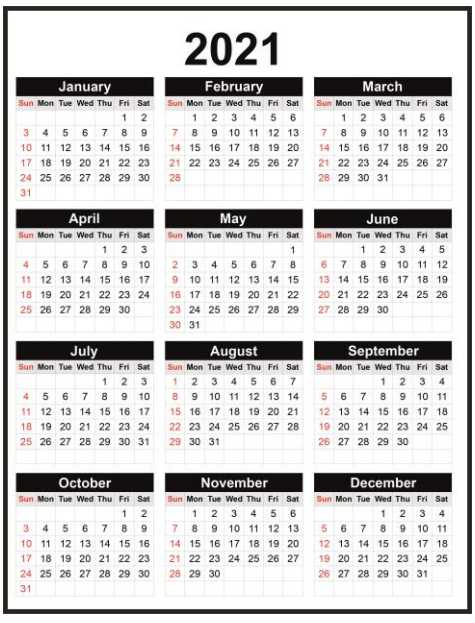
Some schools may also be able to provide access to a secure digital classroom calendar through platforms such as Glow. Questions can then be asked in relation to the information that has been populated.

- How many months (or weeks) are there between the first and last birthday in our class this year?
- How many days, weeks and months are we in Primary _____ for?
- What is the longest period of time between school holidays?
- In which month do we attend school the most? How many days is it?

It can also be beneficial to provide learners with opportunities to explore different types of paper and digital calendar layouts, including desk, wall and diary styles. Discussion about why different layouts are used can support understanding of calendars and their use.

November 2020

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					
Notes:						



2021

January

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

March

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

At this stage learners should also be exposed to a wide range of both paper and digital timetables and schedules. These may include:

- bus, ferry or train timetables
- television or cinema schedules
- school timetables
- sporting event schedules.

Learners can use these to plan activities such as school trips or their ideal weekend activities. When learners are secure in reading timetables and using them to plan events they can progress to multi step problems.

A show finishes at 10:45 pm.

A family takes 15 minutes to get from the show to the bus station.

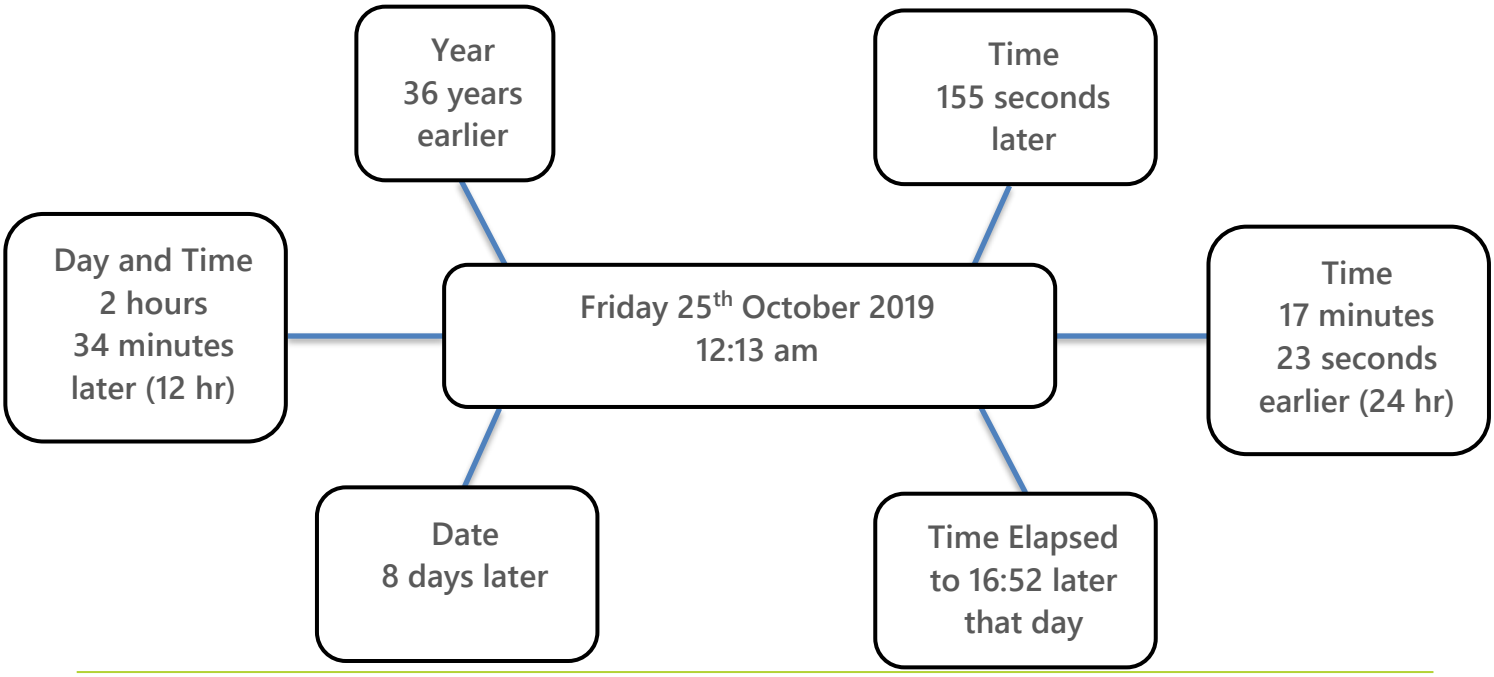
BUS TIMETABLE

Buses leave from	9:00 am
and then every 15 minutes until	7:30 pm

From 7:30 pm buses run every 45 minutes.

Use the table to work out how long they will have to wait for a bus.

Learners should be encouraged to engage in activities that allow them to make links between the use of calendars, 12/24 hour notation and calculations of time intervals using different units of time.



Points to consider

- Learners need to be secure in calculating durations of time using concrete materials (mini individual clocks) before moving on to abstract calculations. Lots of practical work will be required for some learners, and the use of empty number lines may help support abstract thinking.
- Reinforcement of the number of seconds in one minute, minutes in one hour and hours in a day is essential in overcoming the misconception that time is measured in base 10.
- Reinforcement of fractions and decimal fractions will support learners to develop their skills in this area. Concrete and pictorial representations may be useful to support this.

Links to other curricular areas

Number
- Decimal fractions.

Fractions and decimal fractions
- Equivalent forms.

Estimation and rounding
- Rounding to the nearest minute.

Measurement
- Simple speed, distance time calculations.

Information handling
- Reading and presenting data.

Physical Education
- Improving and measuring levels of fitness.

Religious and Moral Education
- Calendar of world celebrations and events.

Technologies
- Investigating the development of methods of calculating time over the years.

Reflective questions

- **What opportunities do learners have to discuss the relevance and appropriateness of converting between units of time?**
- **How well do we use concrete materials to support the teaching of time at this level?**
- **How are we teaching appropriate strategies for calculating time durations which include bridging?**
- **How well do we build in opportunities for learners to use real life and relevant situations?**

Third Level

The table below includes the experiences and outcomes related to 'Time' at third level. The experiences and outcomes should be used in the planning of learning, teaching and assessment. It is important to note that the benchmarks are designed to support teacher professional judgement in progress towards and achievement of a level. There are a range of different experiences that learners need to be exposed to before these can be achieved.

Experiences & Outcomes	Benchmarks
Using simple time periods, I can work out how long a journey will take, the speed travelled at or distance covered, using my knowledge of the link between time, speed and distance. **MNU 3-10a**	•Applies knowledge of the relationship between speed, distance and time to find each of the three variables. •Calculates time durations across hours and days.

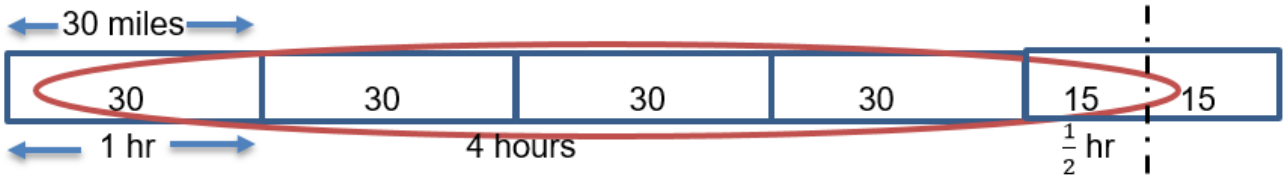
Effective Learning and Teaching Approaches

Calculating speed, distance and time

Although some learners may choose to apply their knowledge of using formulae, practitioners could encourage the use of a range of appropriate strategies when calculating speed, distance and time to ensure that learners grasp the relationship between each variable.

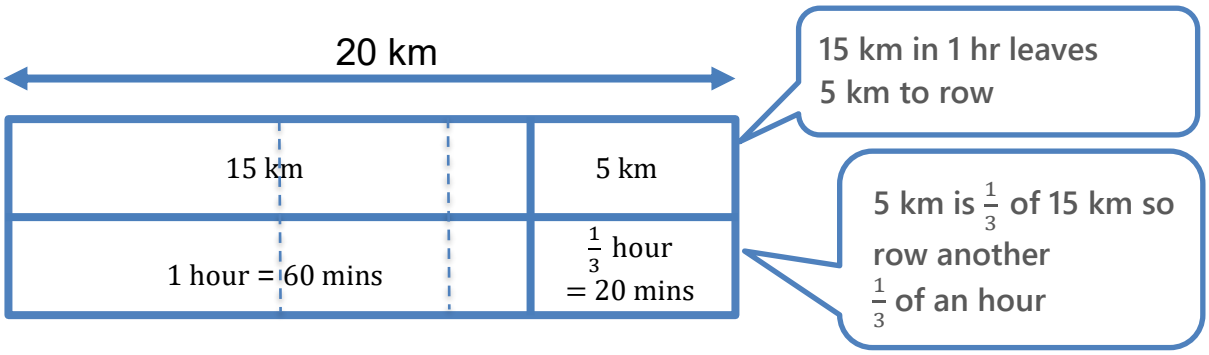
Bar modelling may offer learners a familiar strategy to help them confidently interpret questions and determine the reasonableness of solutions, especially as they develop their understanding of problems involving fractions of an hour.

What is the total distance travelled at an average speed of 30 mph for $4\frac{1}{2}$ hours?



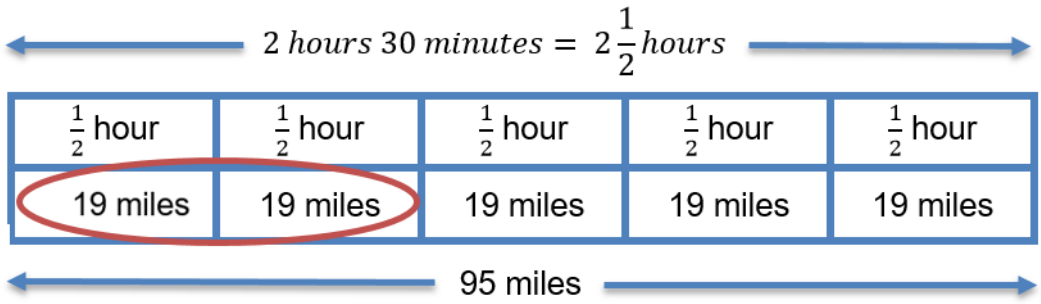
The total distance travelled in $4\frac{1}{2}$ hours is 135 miles.

Alfie sets a new local record rowing speed of 15 km/hr on a 20 km river course.
Calculate how long it took Alfie to complete the course.



Alfie completes the course in 1 hour 20 minutes (80 minutes).

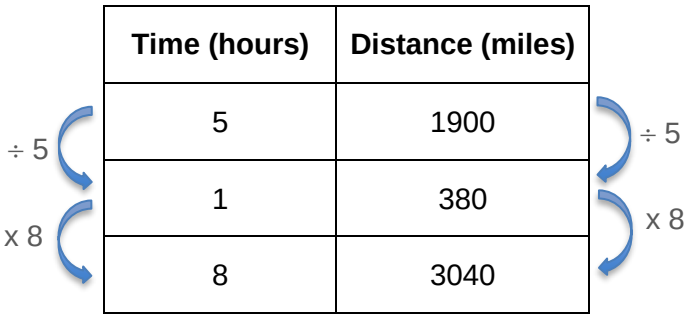
A car journey of 95 miles takes 2 hours and 30 minutes.
Calculate the average speed of the car.



The average speed of the car is 38 mph

Learners may also find using proportional reasoning a useful method for solving problems, especially where a change of units is required.

A plane travels a distance of 1900 miles in 5 hours.
Calculate how far it will travel in 8 hours at the same average speed.



Time (hours)	Distance (miles)
5	1900
1	380
8	3040

The plane will travel 3040 miles.

A rocket is flying at a speed of 12 m/s. Calculate its speed in km/hr.

	Time (secs)	Distance (m)	
	1	12	
x 60	60	720	x 60
x 60	3600	43 200	x 60

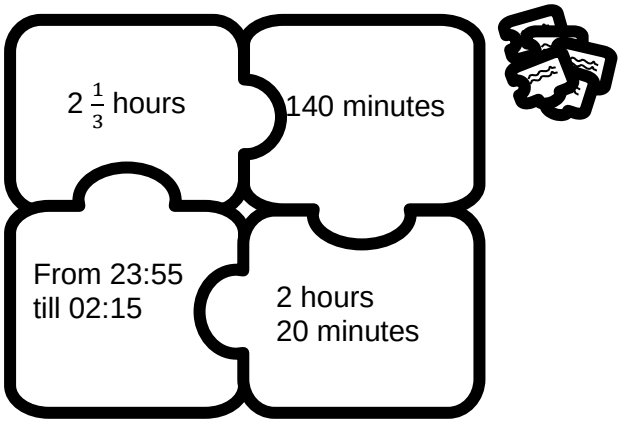
60 seconds = 1 min
60 minutes = 1 hr

43 200 m = 43·2 km. **The rocket is travelling at 43·2 km km/hr.**

Time durations

Developing fluency in converting between minutes and equivalent simple fractions of an hour is essential to allow learners to tackle more complex calculations. Practitioners should provide plenty of practice using these skills to ensure that learners overcome misconceptions when calculating time durations.

The use of multiple choice diagnostic questions and other activities such as matching cards can help learners to recall their skills and assess their understanding.



Ross estimates that his train journey will take $2\frac{3}{4}$ hours. Which of these answers matches Ross' estimate? Show your working to explain why you have chosen your answer.

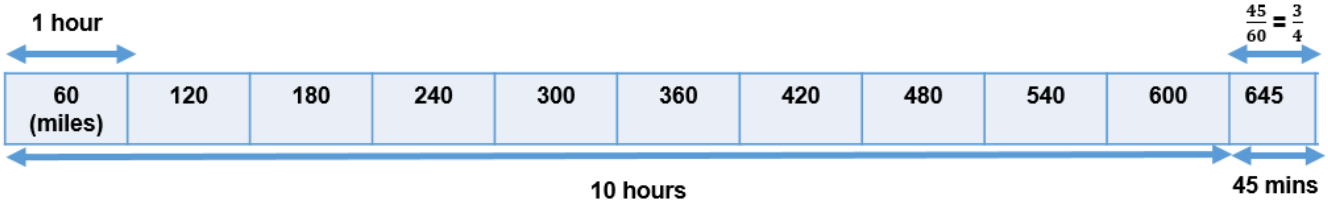
A The journey takes 2 hours and 34 minutes
B The journey takes 234 minutes
C The journey takes 2 hours 45 minutes
D The journey takes 3 hours 15 minutes

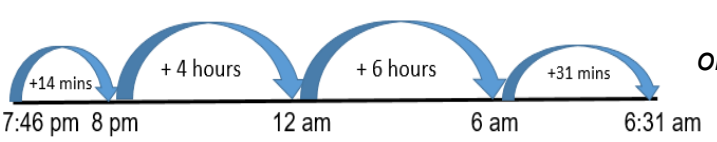
It is important that learners are given the opportunity to solve problems in a variety of contexts and that practitioners emphasise the importance of communicating solutions clearly in the context of problems.

An empty number line may continue to be helpful when calculating times of arrival or departure, or time intervals across a number of days. It should be recognised that there are a number of ways in which to arrive at a correct answer and learners will benefit from opportunities to explore these.

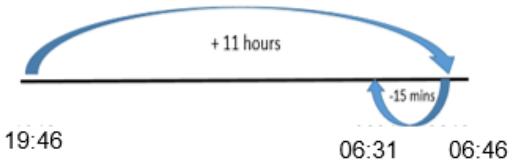
A train departs Inverness at 19:46 on Tuesday night, travelling a distance of 645 miles to London at an average speed of 60 miles per hour.

Calculate the arrival time of the train. Give you answer in 12 hour time.





or perhaps



Answer: 6:31 am on Wednesday

Resources such as class calendars or timetables can be used in examples, including learner generated questions.

Anderwood High Academic Calendar | **2019 to 2020**

Aug 2019						
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Sep 2019						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Oct 2019						
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Nov 2019						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Dec 2019						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Jan 2020						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Feb 2020						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

Mar 2020						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Apr 2020						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May 2020						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Jun 2020						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Jul 2020						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

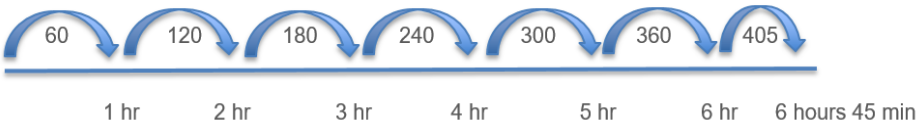
Holiday

Lauren is planning a study timetable for the mathematics assessment on Thursday January 16th.

She studies for 45 minutes in the library every Friday, when she is *in* school.

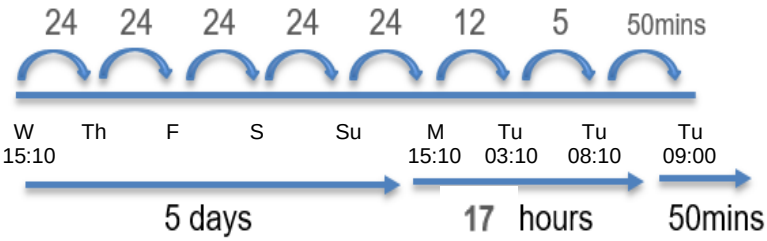
Use the calendar to help find how many hours of study Lauren completes between returning from the October holiday and the mathematics assessment?

9 Fridays $45 \times 9 = 405$ minutes



Lauren studies for 6 hours and 45 minutes.

We finish school on Wednesday 12th February at 15:10 and return on Tuesday 18th February at 09:00.
Can you tell me how long this is in days, hours and minutes?
Can you express this using different units of time?
How many ways can you show me?



5 days 17 hours 50 minutes
137 hours 50 minutes
8270 minutes, etc.

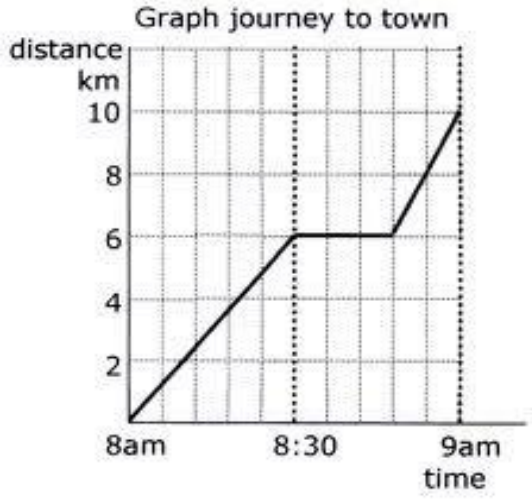
Learners should be provided with opportunities to develop their skills in information handling to solve basic graph based questions.

This graph shows a cyclist's journey into town.
What was their average speed between 8 am and 8:30 am?

Distance	Time
6 km	30 mins
12 km	60 mins

x 2 (6 km → 12 km) x 2 (30 mins → 60 mins)

The cyclist's average speed was 12 km/hr.



During the journey, the cyclist's tyre was punctured and they had to stop to repair it.
At what time did they set off after repairing the tyre?

8:30 am + 18 minutes = 8:48 am is when they set off

Key questions to support learning may include:

- Is it normally quicker to travel by bus/train to school rather than walking? Why? What does this tell us about the relationship between distance, speed and time?
- Can you explain why we usually use the word average when discussing speed?
- Why do you think it makes sense to measure various distances, speeds and times using different units?

Points to consider

- Learners may need to practise finding fractional amounts of 60 and bridging across multiples of 60 to help develop fluency in skills needed for time.
- It may help learners understand the concept of calculating speed, distance and time if questioning reflects their own lives. Consider using examples that fit your local context, such as school buses or local ferries.
- Some learners may interpret graphs as showing acceleration.

Links to Other Curriculum Areas

Fractions
- Uses knowledge of fractions and carry out calculations.

Proportion
- Solves problems in which related quantities are increased or decreased proportionally.

Information Handling
- Sources and interprets information or collects data, making use of digital technology where appropriate.

Physical Education
- Comparing speeds and times to analyse performance in sport.

Science
- Calculating differences in speed when investigating friction.

Social Studies
- Using relevant numeracy skills to interpret data, for example comparing river speed from field work to a river model.

Technologies
- Write code that manipulates the speed of objects in a game.

Reflective Questions

- **How can we encourage learners to use their mental agility when solving time problems?**
- **What strategies can we introduce to help learners become more fluent in solving speed, distance and time problems before moving on to using formulae?**
- **How can we support practitioners from STEM subjects to lead the development of practical aspects of time in Information Handling?**

Fourth Level

The table below includes the experiences and outcomes related to 'Time' at fourth level. The experiences and outcomes should be used in the planning of learning, teaching and assessment. It is important to note that the benchmarks are designed to support teacher professional judgement in progress towards and achievement of a level. There are a range of different experiences that learners need to be exposed to before these can be achieved.

Experiences & Outcomes	Benchmarks
I can research, compare and contrast aspects of time and time management as they impact on me. **MNU 4-10a** I can use the link between time, speed and distance to carry out related calculations. **MNU 4-10b**	•Demonstrates effective time management skills, for example, working with different time zones or making plans, including across midnight. •Carries out calculations involving speed, distance and time involving decimal fraction hours. •Calculates time durations across hours, days and months.

Effective Learning and Teaching Approaches

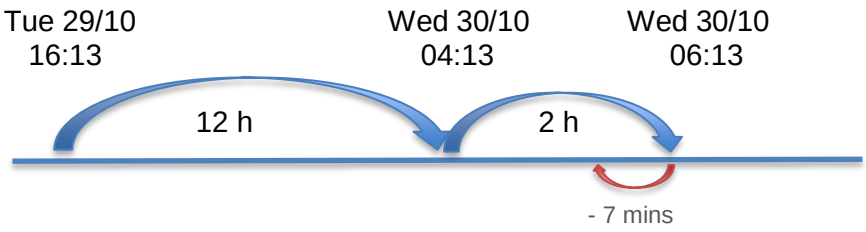
Complex problems involving time calculations can often be solved using a number of valid strategies, and learners may benefit from opportunities to explain their solutions using a variety of suitable methods.

Helen flew from Sydney, Australia to Los Angeles (LA), USA on Tuesday 29th October.

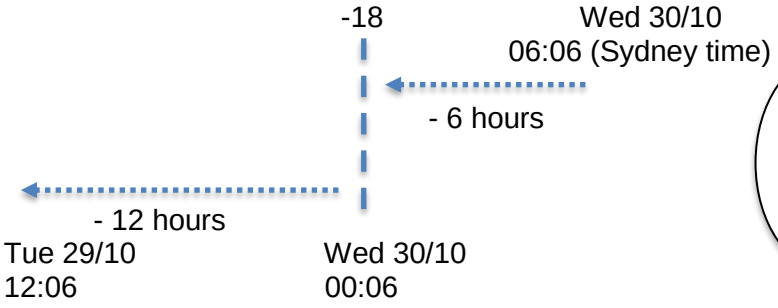
Her plane departs from Sydney at 16:13 local time, and lands 13 hours 53 minutes later in LA.

Sydney's time zone is 18 hours ahead of Los Angeles. When did Helen land in LA (local time)?

Step One



Step Two



The plane landed on Tuesday 29th October at 12:06 (Los Angeles time).

Learners benefit from tackling a wide variety of problems in both familiar and unfamiliar contexts, which will allow them to consider the effect of time on travel and business and help develop skills for life and work.

ESRIT Manufacturing plc, based in Scotland, is sourcing a new part for their machinery and the Operations Manager is drawing up a shortlist of potential suppliers.

ESRIT cannot restart production without the part, so it is essential that it arrives at ESRIT's factory by 7 am on Monday.

(a) Which of the following suppliers will be included in the shortlist?

(b) Which supplier do you think the Operations Manager should choose, and why?

E-Z-Parts, Paris France

Delivery by truck 

Leave Paris Sunday 18:15 (local time)

Expected delivery in 13 hours 40 minutes

£3900 including delivery

PARIS IS 1 HOUR AHEAD OF SCOTLAND

Parts2U, Mumbai India

Delivery by air courier 

Leave Mumbai Monday 02:30 (local time)

Expected delivery in 10 hours 10 minutes

£3700 including delivery

MUMBAI IS 5 HOURS 30 MINUTES AHEAD OF SCOTLAND

Masterpart, Helsinki Finland

Delivery by ship 

Leave Helsinki Saturday 17:00 (local time)

Expected delivery in 39 hours 35 minutes

£4000 including delivery

HELSINKI IS 2 HOURS AHEAD OF SCOTLAND

In this instance, there are two options that fit the criteria and the argument could be made for either of them to be the option to choose. Learners may benefit from taking part in paired or group discussions that result from tackling decision making problems such as these.

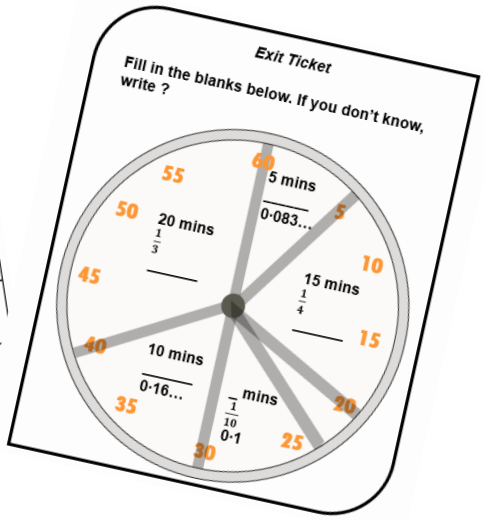
Learners should have lots of opportunities to solve problems where they use decimal fractions of hours. It is important that learners have a secure understanding of the link between fractions and decimal fractions.

Working with minutes as a fraction and decimal fraction of an hour provides a useful context in which to consolidate this understanding.

Learners benefit from being able to recall quickly the most commonly used equivalences, and should be able to find others either mentally or with a calculator. Practitioners can offer regular opportunities for practice through low stakes assessments, diagnostic quizzes and other activities.

Find the time

Time Interval	Fraction	Simple Fraction	Decimal Time
6 minutes	$\frac{6}{60}$	?	0·1 hour
?	$5\frac{15}{60}$	$5\frac{1}{4}$	5·25 hours
4 hours 12 minutes	?	$4\frac{1}{5}$	4·2 hours
9 hours 40 minutes	$9\frac{40}{60}$	$9\frac{2}{3}$	?



Learners may sometimes confuse decimal fractions of hours with minutes, and this misconception could be addressed using appropriate diagnostic questions.

A car travels a distance of 209 miles at an average speed of 57 mph.

Which of these answers is correct? Explain your answer.

A $T = \frac{D}{S} = \frac{209}{57} = 3 \cdot 66\ hours$

The journey takes 4 hours and 6 minutes

B $T = \frac{D}{S} = \frac{209}{57} = 3 \cdot 66\ hours$

The journey takes 3 hours and 40 minutes

C $T = \frac{D}{S} = \frac{209}{57} = 3 \cdot 66\ hours$

The journey takes 366 minutes

The journey takes 3 hours and 40 minutes because I know that 0.66 hours is the same as $\frac{2}{3}$ of an hour which is 40 minutes.

Learners should be given opportunities to solve problems that combine calculating distance, speed or time with other mathematical skills and in contexts from other areas of the curriculum, for example in Business and Administration, PE or Science.

The sun is $1{\cdot}496 \times 10^8$ km from Earth.

Light travels at $2{\cdot}998 \times 10^5$ km/sec.

How many seconds does it take for light from the sun to reach Earth?

At the regional 10 km championships, a runner's average speed is 9 km/hr.

Their goal is to increase this speed by at least 12% in the national finals.

The runner completes the final 10 km race in 54 minutes.

Has the runner reached their performance goal?

You program a journey tracker system for a parcel delivery company using in-vehicle software.

Van 7752 **Driver** A Brown	**Time taken**	**Distance**
Leaving Edinburgh city centre	20 minutes	5 miles
On Motorway	40 minutes	50 miles
Arriving Dundee city centre	15 minutes	5 miles

Complete the distance/time graph on the grid below to show the van journey.

The software is programmed to sound an audible warning to the driver if a van is travelling above the speed limit, which is 30 mph in town and 70 mph on the motorway.

The driver tells your manager that he did not receive any warnings during the journey.

The manager asks you to check this information. Is the driver telling the truth?

Can you prove to your manager that the driver is being dishonest?

Key questions to support learning may include:

- When using formulae to calculate speed, distance or time, how can you check that your answer is reasonable?
- How carefully do you manage your time? What tools help you manage your time?
- What do you notice about the gradient of lines on a distance/time graph?

Points to consider

- Prior knowledge and skills that are required must be reviewed and refreshed before tackling problems at this level.
- When working across time zones, learners will need to consider carefully the associated language (hours ahead, hours behind) when choosing to count on or count back.
- Careful attention must be paid to the link between minutes and decimal fractions of hours.

Links to Other Curriculum Areas

Fractions
- Chooses the most efficient form of fractions [or] decimal fractions when making calculations.

Information Handling
- Interpreting graphical data, for example, gradient.

Powers and Roots
- Expressing numbers in scientific notation.

Physical Education
- Analysis of performance. Planning sport activities.

Science
- Linking speed, acceleration and force.

Social Studies
- The impact of globalisation.

Technologies
- Using hardware and software which supports business activities.

Reflective Questions

- **How can we build opportunities into lessons for reviewing the appropriate knowledge and skills from earlier levels required for successful learning at fourth level?**
- **Which topics could we combine with time to provide learners' opportunities to tackle problems that deepen their knowledge and understanding in numeracy?**
- **How can the study of time offer learners the chance to develop the problem solving and project planning skills crucial to success in further study of Mathematics, Applications of Mathematics or other STEM subjects in the senior phase?**

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