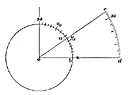
****

****

**Target Students:**  
Junior Certificate Ordinary and Higher (First Years)

**Prior Knowledge:**Multiples, factors and primes would have been covered to some extent in primary school. However it might be advisable to cover this area from scratch, assuming little or no prior knowledge.

**Area of Syllabus:**Strand 3, section 3.1  
“*Consolidate their understanding and their learning of factors, multiples, prime numbers in N*.”

**Duration:**  
1 to 2 classes. With weak classes it may take longer

**Objectives:**  
The class will engage with work which, traditionally, can be tedious and repetitive. The pupil activities are intended to cover the needs of the syllabus by providing a varied set of tasks which will be user-friendly to a 12/13 year old student.

**Learning Outcomes:**

At the end of using this methodology pupils will be able to:

* Complete a 16 by 16 ‘times tables’
* Identify the dual concept of multiples as ‘adding on the same amount each time’ and as ‘multiplying by a given number each time’
* Explain what is meant by the word ‘multiple’
* Find the LCM from the 16 x 16 table and extend this to finding the LCM without the table
* Find the factors of given numbers
* Verify the commutativity of multiplication (*a*x*b* = *b*x*a*)
* Verify the commutativity of multiplication (*a*x*b*)x*c* = *a*x(*b*x*c*)
* Find the HCF of two given numbers
* Find the HCF of three given numbers
* Use their knowledge of factors to break codes and to generate codes
* Extend their knowledge of factors to explain the concept of a prime number
* Identify all the prime numbers up to 100

**Resources:**Small coloured discs might be useful for some activities on the 16 x 16 square

Mainly using the activity resource files below:

**Pupil activities and Teacher input**This is done under 4 headings:   
**(1) Student Learning Activities and Teacher Support.**Details of the key tasks and questions, initiated by the teacher, which move the lesson forward. What resources are needed and what activities/homework are needed to consolidate and extend the learning. **(2) Expected reactions and challenges encountered by students.**Details of what the students will be doing, their expected reactions and evidence of possible misconceptions. **(3) Teacher Support in response to student reactions and challenges.**Details of teacher reactions/support in overcoming the pupil challenges and misconceptions identified at (2) above. This entails the teacher being able to identify which pupil (or group of pupils) requires more help than others and scaffold the support as required. **(4) Points of evaluation**Details of how the teacher will evaluate whether the goals/learning outcomes of this part are being achieved or not. This evaluation will involve assessing what degree of learning took place and will inform and direct the teaching and learning activities of the next class(es).This section may contain differentiated objectives. i.e.

* All pupils will be able to ...
* Some pupils will be able to ...
* A few pupils will be able to ...

|  |  |  |  |
| --- | --- | --- | --- |
| **(1) Student Learning Activities and Teacher Support.** | **(2) Expected reactions and challenges encountered by students.** | **(3) Teacher Support in response to student reactions and challenges.** | **(4) Points of evaluation** |
| **Task 1:** Hand out a copy of the [blank 16x16](http://www.projectmaths.ie/created-by-teachers/Factors_and_Prime_Numbers/Blank_16%20x%2016%20Square%20AND%20Sieve%20of%20Eratosthenes.docx) table to each pupil | The initial aim is to consolidate the idea that multiplication is just repeated addition. i.e. that the ‘times tables’ could be looked on as repeated addition or multiplication. | Ask the class not to fill in all of the blank table just yet.  Ask the class to focus on the first row which is shaded grey. (this is row 4)  Get them to fill in this row by adding 4 each time.  When this (repeated addition) is completed get the pupils to verbalise the multiplication for this row. Draw attention to the idea that this can be called the ‘4 times tables’ or ‘multiples of 4’  Repeat this procedure for the other two shaded rows (row 7 and row 13).  Choose another row and get the pupils to use ‘**repeated addition**’ to fill it in.  Finally choose another row and get pupils to use multiplication to fill it in. (The discretion of the teacher is to be used to decide whether calculators are to be used at this stage.  **Get the pupil to record the meaning of the word ‘multiple’**  Then get pupils to fill in the ‘what you have learned’ box at the bottom of the page.  The 16x16 square should then be completed by all students. It might be useful to have a completed one  ( [16x16 square](http://www.projectmaths.ie/created-by-teachers/Factors_and_Prime_Numbers/16%20x%2016%20Square%20AND%20Sieve%20of%20Eratosthenes%20(2).docx) ) printed out to aid weak pupils and allow them to check their work. | All pupils should be able to fill in the three shaded rows.  Some pupils will be able to explicitly explain the the idea of multiplication as repeated addition.  Teacher should identify different numbers in the grid and ensure that students can verbalise the two factors that give that number. All students should **write the meaning of the word “factor”** into the ‘what you have learned box’. |

|  |  |  |  |
| --- | --- | --- | --- |
| **(1) Student Learning Activities and Teacher Support.** | **(2) Expected reactions and challenges encountered by students.** | **(3) Teacher Support in response to student reactions and challenges.** | **(4) Points of evaluation** |
| **Task 2:** Use either the student’s 16x16 square or give out the [printed version](file:///C:\Users\User\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.Outlook\STWH5YT9\16%20x%2016%20Square%20AND%20Sieve%20of%20Eratosthenes.doc).  Then give out a clear plastic transparency to each pupil. | The pupils should now see this square as a list of multiples. We will build on this by doing work on common multiples. | Instruct the pupils to place the plastic transparency on top of the 16x16 square.  Present the class with the question: “*What is the lowest number that the 4 times-tables (multiples) and the 7 times-tables have in common ?*”  The pupils can use their 16x16 square to circle the 28. Then give the pupils the new word LCM.  Then ask more similar type questions.  e.g. “*What is the lowest number that the 4 times-tables (multiples) and the 8 times-tables have in common ?*”  “*What is the lowest number that the 4 times-tables (multiples) and the 10 times-tables have in common ?*”  At the end pose the question “*If we do not have the 16x16 grid how would we go about these problems ?*”  This helps them to remove the ‘crutch’ of the grid. | The pupil should use a non-permanent marker to circle the LCM.  Some pupils will need to work with the 16x16 square longer than others.  The methodology should be extended to more challenging questions of the LCM of two numbers and then to questions of the LCM of three numbers.  e.g.  “*What is the LCM of 4, 6 and 8 ?*”  The class should complete “[**Multiples Activity 1**](http://www.projectmaths.ie/created-by-teachers/Factors_and_Prime_Numbers/Multiples%20%20Activity%201.docx)” |

|  |  |  |  |
| --- | --- | --- | --- |
| **(1) Student Learning Activities and Teacher Support.** | **(2) Expected reactions and challenges encountered by students.** | **(3) Teacher Support in response to student reactions and challenges.** | **(4) Points of evaluation** |
| At this stage the class will already have used the grid to understand the idea of multiples and have completed “[**Multiples Activity 1**](http://www.projectmaths.ie/created-by-teachers/Factors_and_Prime_Numbers/Multiples%20%20Activity%201.docx)**”**. We now move on to using the grid to work with factors.  **Task 3:** This is a paired activity. Each pair of students should be given one of the 16x16 grids and the clear plastic transparency. | Pupils need reinforcement on the idea that there may be more than one set of factors for a number. They need to be able to differentiate between divisors and factors.  Also the commutativity of multiplication.  i.e. *a*x*b* = *b*x*a*    **NOTE:** After writing the definitions of divisors and factors the class should investigate the properties of commutativity and associativity of multiplication.  i.e. *a*x*b* = *b*x*a* and  is (*a*x*b*)xc = *a*(*b*x*c*) | The clear plastic transparency should be placed over the 16x16 grid. The pupils should work in pairs.  Ask the class to use a marker and circle the number 6 each time it occurs inside the grid (not on the red text).  Then get pupils to write down the number of ways this was achieved i.e. 1x6, 2x3, 3x2 and 6x1  Then ask are there any duplicates and eliminate them.  This will leave 1x6 and 2x3. Get pupils to write these down and identify them as the factors of 6. Make a list of the divisors.  Repeat the above procedure for 12.  Then repeat again for 30. In this case make sure that the 1x30, which is missing from the grid is found. Finally get class to do 48.  Move on to more similar questions.  Use the method above to identify the HCF of two numbers and then move on to the HCF of three numbers.  Example: “*Find the HCF of 12 and 20.”*  Example: “*Find the HCF of 14, 21 and 49.”*  Ask one student to give two numbers to be multiplied (*a* and *b* ≤ 16)  Use the 16x16 grid to get answer, where the row ‘*a*’ are the multiples of *a*.  Then use row ‘*b*’ as the multiples of *b* and check the result.  e.g 8x14 , Row 8 would be used first to get the 112 and then row 12 would be used then to verify the 112.  Similarly, for associativity  e.g. (3x5)x4 ? 3x(5x4) | The clear plastic transparency should be used and erased each time.  Monitor weaker pupils.  Other resources may be used to generate questions for this methodology.  Pupils will have written definitions of divisors and factors and should be able to explain these in their own words.  All pupils should be able to make up questions and verify the commutativity and associativity properties and have a written record of same. |

|  |  |  |  |
| --- | --- | --- | --- |
| **(1) Student Learning Activities and Teacher Support.** | **(2) Expected reactions and challenges encountered by students.** | **(3) Teacher Support in response to student reactions and challenges.** | **(4) Points of evaluation** |
| **Task 4:** This is a paired activity. Instruct the pupils to place the clear plastic transparency over the 100 square. We now use the Sieve of Eratosthenes to find all the primes under 100. | Pupil must be encouraged to ask themselves “*Is there any number, other than 1 which will divide into this number evenly ?*” | Instructions:1)Erase the 1   1. Put a circle around the first prime (i.e. 2) 2. Erase all the multiples of 2 3. Circle the next prime (i.e.) 3 4. Repeat steps as above until only thing left is the prime numbers less than 100   Classroom version of sieve of Eratosthenes <http://www.cut-the-knot.org/Curriculum/Arithmetic/Eratosthenes.shtml> | All pupils should be able to complete the Sieve of Eratosthenes  This will help them understand what is meant by the word ‘prime’.  It might also help if the sieve were used to eliminate the tables/multiples which we looked at in the 16x16 square. In this way pupils would see that the primes don’t fit into any of the multiples, therefore that is why they are prime. |

|  |  |  |  |
| --- | --- | --- | --- |
| **(1) Student Learning Activities and Teacher Support.** | **(2) Expected reactions and challenges encountered by students.** | **(3) Teacher Support in response to student reactions and challenges.** | **(4) Points of evaluation** |
| **Task 5:** This is back to an individual task.  Hand out a copy of the document “[Prime Factors Task](file:///C:\Users\User\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.Outlook\STWH5YT9\Prime%20Factors%20Task.doc)” | Although factors may be easy to identify. Breaking down any number to its prime factors is not as obvious. | Ask students to write 12 in the first box.  Then using the primes just found we say “*What is the first prime which will divide in evenly to 12 ?*”  Write the 2 in the first circle and then 6 in the second box. Continue like this, one prime at a time until the pupil has the following filled in.    **3** | It might also help if the sieve were used to eliminate the tables/multiples which we looked at in the 16x16 square. In this way pupils would see that the primes don’t fit into any of the multiples, therefore that is why they are prime.  The prime factors are easily identified in the circles.  All pupils should be able to complete the the handout “Prime Factors Task”.  Pupils should then move on to other similar problems from the teacher’s own resources or textbooks. |