# Teaching & Learning Plans

## Introduction to Equations

**Junior Certificate Syllabus**

Project Maths Tionscadal Mata
Development Team

# The Teaching & Learning Plans are structured as follows:

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**Aims** outline what the lesson, or series of lessons, hopes to achieve.

**Prior Knowledge** points to relevant knowledge students may already have and also to knowledge which may be necessary in order to support them in accessing this new topic.

**Learning Outcomes** outline what a student will be able to do, know and understand having completed the topic.

**Relationship to Syllabus** refers to the relevant section of either the Junior and/or Leaving Certificate Syllabus.

**Resources Required** lists the resources which will be needed in the teaching and learning of a particular topic.

**Introducing the topic** (in some plans only) outlines an approach to introducing the topic.

**Lesson Interaction** is set out under four sub-headings:

i. Student Learning Tasks – Teacher Input: This section focuses on teacher input and gives details of the key student tasks and teacher questions which move the lesson forward.

ii. Student Activities – Possible and Expected Responses: Gives details of possible student reactions and responses and possible misconceptions students may have.

iii. Teacher's Support and Actions: Gives details of teacher actions designed to support and scaffold student learning.

iv. Assessing the Learning: Suggests questions a teacher might ask to evaluate whether the goals/learning outcomes are being/have been achieved. This evaluation will inform and direct the teaching and learning activities of the next class(es).

**Student Activities** linked to the lesson(s) are provided at the end of each plan.

# Teaching & Learning Plan: Introduction to Equations

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## Aims

- To enable students to gain an understanding of equality
- To investigate the meaning of an equation
- To solve first degree equations in one variable with coefficients
- To investigate what equation can represent a particular problem

## Prior Knowledge

Students will have encountered simple equations in primary school. In addition they will need to understand natural numbers, integers and fractions. They should also be able to manipulate fractions, have encountered the patterns section of the syllabus, basic algebra, the distributive law and be able to substitute for example $x=3$ into $2x+5=11$.

## Learning Outcomes

As a result of studying this topic, students will be able to:

- gain an understanding of the concept of equality and what is meant by an equation
- understand the concept of balance (as in a traditional balance or a see-saw) and how it can be used to solve equations
- gain an understanding of what is meant by solving for an unknown in an equation
- solve first degree equations in one variable using the concept of balance

## Catering for Learner Diversity

In class, the needs of all students whatever their level of ability are equally important. In daily classroom teaching, teachers can cater for different abilities by providing students with different activities and assignments graded according to levels of difficulty so that students can work on exercises that match their progress in learning. For less able students, activities may only engage them in a relatively straightforward way and more able students can engage in more open–ended and challenging activities. This will cultivate and sustain their interest in learning. In this T & L Plan for example teachers can provide students with the same activities but with variations on the theme e.g. allow some students to do all the questions in a student activity, while selecting fewer questions for other students. Teachers can give students various amounts and different styles of support during the class for example, providing more clues.

In interacting with the whole class, teachers can make adjustments to suit the needs of students. For example, all students can be asked to solve the equation $3x + 4 = 10$, but the more able students may be asked to put contexts to this equation at an earlier stage.

 

Besides whole-class teaching, teachers can consider different grouping strategies to cater for the needs of students and encourage peer interaction. Students are also encouraged in this T & L Plan to verbalise their mathematics openly and share their work in groups to build self-confidence and mathematical knowledge.

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## Relationship to Junior Certificate Syllabus

| Topic Number | Description of topic<br>*Students learn about* | Learning outcomes<br>*Students should be able to* |
|---|---|---|
| 4.5 Equations and Inequalities | Using a variety of problem solving strategies to solve equations and inequalities. They identify the necessary information, represent problems mathematically, making correct use of symbols, words, diagrams, table and graphs. | • consolidate their understanding of the concept of equality<br>• solve first degree equations in one or two variables, with coefficients elements of Z and solutions also elements of Z<br>• solve first degree equations in one or two variables with coefficients elements of Q and solutions also in Q |

## Resources Required

A picture that demonstrates a balance, for example the one below

An algebra balance is optional

Whiteboard and markers or blackboard and chalk

Graph paper

 

| Lesson Interaction | | | |
|---|---|---|---|
| **Student Learning Tasks: Teacher Input** | **Student Activities: Possible and Expected Responses** | **Teacher's Support and Actions** | **Assessing the Learning** |
| **Section A: Introduction to equations and how to solve equations using the concept of balance** | | | |
| » What do you notice about each of the following?<br>$6 + 3 = 9$<br>$5 - 3 = 2$<br>$5 + 3 = 1 + 7$<br>$x = 4$.<br>$2x = x + x$<br>$3x = 2x + x = x + x + x$ | • The right hand side is equal to the left hand side.<br>• Both sides are equal.<br>• Both sides are balanced.<br>• They all have an equals sign | » Write each of the equations (opposite) on the board. | » Do students recognise that in order for an equation to be true both sides have to be equal? |
| » What does this picture represent?<br>  <br>» What is this apparatus called (Pointing to an algebra balance if one is available)? | • A balance or weighing scales | » Demonstrate an algebra balance if available. Alternatively if no such balance is available show the picture of a balance. State how these balances differ in appearance from an electronic balance that students may be more familiar with.<br>» Relate an equation to a seesaw if students are happier with the analogy of a seesaw than that of a balance. | » Do students recognise when the teacher speaks of a balance it is the type in the picture opposite that is being referred to rather than an electronic balance? |

 

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » Did you learn about the Law of the Lever in science and if so what does it state? | • The weight multiplied by the length from the fulcrum is equal on both sides if the balance is balanced.<br>• The balance is balanced if the weights on either side of the fulcrum are equal and the balancing point (fulcrum) is at the centre. | » Discuss the Law of the Lever and how it works for a balance. (The Law of the Lever states that a balance is balanced when the distance from the fulcrum multiplied by the weight on that side is equal for both sides.) | » Do students understand that for a balance to be balanced the weight on the right must equal that on the left provided the distance from the fulcrum is the same for both sides? |
| » In mathematics we are going to place the fulcrum at the centre of gravity and place the weights at the same distance from the fulcrum on both sides. | | » Draw an empty balance and show the fulcrum.  | » Can students verbalise the Law of the Lever or draw a diagram to represent it? |
| » What happens to an empty balance that is currently balanced, if we add a weight to the left hand side? | • It becomes unbalanced and the left hand side (the side with the extra weight) goes down and the right hand side (the side without the weight) goes up. | » Draw the following diagram on the board or demonstrate the action on an algebra balance.  | » Do students understand how a balance of this nature works? |
| » Having added a weight to one side, what do we need to do to the other side to keep the balance balanced? | • Add a weight of the same value to the other side. | » Explain how in order for a balance to remain balanced the weights on the right hand side have to equal those on the left hand side. | » Do students see that equal weights have to be added or removed from each side of a balance, if the balance is to remain balanced? |

 

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » Look at the equation $2x + 5 = 11$.<br><br>» Thinking about a balance what happens to the equation $2x + 5 = 11$ if we remove the 5 from the left hand side? | • It becomes unbalanced. | » Write an equation on the board for example $2x + 5 = 11$. | |
| » How can we restore the balance keeping the 5 removed from the left hand side? | • We must also remove the 5 from the right hand side. | | » Do students see that when something is added to or subtracted from one side of an equation it becomes unbalanced and in order for it to become balanced again the same value must be added to or subtracted from the other side of the equation? |
| » Complete question 1 on **Section A: Student Activity 1**.<br><br>**Note:** all the balances in these questions are balanced unless told otherwise. | | » Distribute **Section A: Student Activity 1**.<br>» Circulate to see how students are answering these questions. Make sure all students are aware of the statement at the top of the worksheet.<br>» Watch out for students trying to give values to the weights of the shapes. | » Are students able to successfully complete the activities? |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » How do question 2(a) and 2(c) on the **Student Activity** differ? | • Question 2(a) has $x$ and question 2(c) has $2x$. | | |
| » How would we write the problem in question 2(c) on the activity sheet as an equation?<br><br>» What value of $x$ makes this equation true?<br><br>» How did you get $x$=4? | • $2x = 8$<br><br>• $x = 4$<br><br>• Divided both sides of the equation by 2. | | |
| » When you have a problem what do you try to do?<br><br>» So if an equation is a problem, what do we try to do with it? | • Solve it.<br><br>• Solve it. | | |
| » Sometimes when given an equation like $2x = 8$, rather than saying find the value of $x$ that makes this equation true, the question will state solve for $x$.<br><br>» Now solve $3x = 27$ and write in your exercise book how you did this. | • $x = 9$. Divided both sides by 3 | | » Do students see the connection between having a problem and solving it and having an equation and solving the equation? |
| » Now make up examples of equations. | • Students work in pairs making up their own examples. | | » Can students make up examples of equations? |
| » Complete questions 2, 3 and 4 in **Section A: Student Activity 1**. | | » As you circulate ask individual students to explain their solutions. i.e. to verbalise their reasoning. | » Did the explanations given to question 2, 3 and 4 show understanding? |

 

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| **Section B: Backtracking and writing a simple algebraic equation to represent situations and how to solve these equations** | | | |
| » We are now going to play a game. I want you to think of a number but do not tell anyone what it is.<br><br>» Multiply your number by 2 and add 3.<br><br>» What is your answer? (Student A.) | » Student A calls out the number they thought of. | » Subtract 3 from the student's answer and then divide by 2. Tell student A what number he/she first thought of. | » Can students work out for themselves what is happening? |
| » What was your answer? (Student B)<br><br>» Why are you getting different answers? | • Another student calls out their answer.<br><br>• We thought of different numbers in the first place. | | |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » Divide into pairs with partners A and B.<br><br>» A is to think of a secret number between 1 and 10.<br><br>» B is now to tell A to multiply their secret number by a certain number and add another number to their answer.<br><br>» A is now to share their answer with B.<br><br>» B is now to calculate the number that A initially thought of and explain to A how they were able to do this.<br><br>» A and B are now to swap roles. | | » Do an example if necessary. | » Can all students explain how they were able to return to the original number? |
| » Now try problems that involve division instead of multiplication and subtraction instead of addition. | | » If necessary do an example using division and subtraction. | » Do all students understand that addition and subtraction by the same number are opposite operations?<br><br>» Do all students understand that multiplication and division by the same numbers are opposite operations? |

<table>
<tr><th>Student Learning Tasks: Teacher Input</th><th>Student Activities: Possible and Expected Responses</th><th>Teacher's Support and Actions</th><th>Assessing the Learning</th></tr>
<tr><td>» What you have been doing is an action called "backtracking".</td><td></td><td>» Draw on the board:<table><tr><td colspan="2">RULES FOR BACKTRACKING</td></tr><tr><td>Original action</td><td>Reverse action</td></tr><tr><td>+</td><td></td></tr><tr><td>-</td><td></td></tr><tr><td>x</td><td></td></tr><tr><td>÷</td><td></td></tr></table></td><td></td></tr>
<tr><td>» Describe backtracking in your own words to your partner.<br><br>» Write a definition of backtracking in your copybooks.</td><td>• Start at the last operation and do the opposite operation to what was originally done.<br><br>• If you add something to a number to get back to the original number you must subtract. If you multiply first then to get back you divide.</td><td></td><td>» Can students verbalise what is happening when they are backtracking?<br><br>» Do students understand backtracking?</td></tr>
<tr><td>» Complete question 1 on Section B: Student Activity 2.</td><td></td><td>» Distribute Section B: Student Activity 2.</td><td>» Can students complete the table?</td></tr>
<tr><td>Note: if we have an equation of the type $3x = 15$, we refer to the $x$ as the unknown. $3x$ and 15 are both terms. Terms without unknowns (15 in this case) are called constants.</td><td></td><td>» Write on the board:<br>» Unknown<br>» Terms<br>» Constant</td><td></td></tr>
<tr><td>» If we have an unknown and multiply it by 3 we get $3x$. If we then add 5 and this is equal to 11. Write an equation to express this.</td><td>» $3x + 5 = 11$</td><td></td><td></td></tr>
</table>

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » What are the terms in the equation $2y + 5 = 11$?<br><br>» What is the unknown in this equation $2y + 5 = 11$?<br><br>» What are the constants in this equation $2y + 5 = 11$? | • $2y$, 5 and 11.<br><br>• $y$<br><br>• 5 and 11 | | » Do students understand the difference between unknowns, terms and constants? |
| » How can algebra help with question 2 in **Student Activity 2**? | • Multiply $x$ the unknown by 3 giving $3x$, add 2 giving $3x+2$, this equals 11. So we have the equation $3x + 2 = 11$. | | |
| » Now complete question 2 | » Students should try this question, compare answers around the class and have a discussion about the answers. | » Monitor students' difficulties. | » If students appear to be having difficulty ask them to talk through their work so that they can identify the area of weakness. |
| » What does it mean to solve an equation? | • To solve an equation means to find the value of the unknown and if the unknown is replaced by this value the equation is true. | | » Do students see that an equation presents them with a problem that requires a solution?<br><br>» Do students see that solving the equation involves finding the unknown? |

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Teacher Reflections

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » There are two possible ways to write out the solution to an equation:<br><br>**Method 1**<br>» What is the first step when solving $2x + 3 = 11$?<br><br>» How do we write this?<br><br>» What is the next step? | • Subtract 3 from each side.<br><br>• $2x + 3 - 3 = 11 - 3$<br><br>• $2x = 8$ | » Present one or both of these methods.<br><br>» Talk students through each step of one or both methods.<br><br>» Write the following on the board:<br>**Method 1**<br>» Let students suggest each step in the solution. | » Do students understand the concept of balance as we solve this equation? |
| » What is our solution?<br><br>» How do we know if this value is correct? | • Divide each side by two.<br><br>• $x = 4$<br><br>• Replace the x in the original equation with 4 and check if the equation is true.<br><br>• 2(4) + 3 = 11. True. | » Write on the board:<br>$2x + 3 = 11$<br>$2x + 3 - 3 = 11 - 3$<br>$2x = 8$<br>$x = 4$<br><br>2(4) + 3 = 11. True. | |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| **Method** 2 Stabilisers Method<br>» Draw lines at the side of the equation as on the board. These are referred to as stabilisers. This is a similar idea to bike stabilisers.<br><br>» When you got good at riding a bicycle, what did you do with the stabilisers?<br><br>» When you get good at solving the equations you can abandon the stabilisers. | • Abandon them. | **Method** 2 Stabilisers Method<br><br>» Let students suggest each action.<br><br>$-3 \quad 2x + 3 = 11 \quad -3$<br>$\div 2 \quad 2x = 8 \quad \div 2$<br>$x = 4$ | |
| » Once again how do we check if this value is correct? | » Replace the $x$ in the original equation with 4 and check if it is true. | » 2(4) + 3 = 11. True.<br><br>» Emphasise replacing the unknowns with their answers.<br><br>» Use an algebra balance if available at this point | » Do students understand the steps involved in each line of the solution irrespective of the approach that is being adopted? |
| » If this was not true, what would it tell you? | » You made an error solving the equation.<br><br>» This value does not satisfy the equation. | | |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » Solve the equation<br><br>$2x + 3 = 7$ using either or both methods. | | » Write $2x + 3 = 7$ on the board.<br><br>» Check students' work.<br><br>» If a laptop and data projector are available in the classroom show some of the links mentioned in **Appendix A page 40**.<br><br>**Note:** The first link is very useful if students are experiencing difficulty grasping the basic concept. | » Does students' work show their understanding of solving equations<br><br>» Did students get the correct answer?<br><br>» Was students work laid out properly?<br><br>» Did students check their answers? |
| » Complete questions 3-7 **Student Activity 2**.<br><br>» How are parts a and c of these questions related? | » Parts a and c give the same answer. | » Circulate around the room, checking if students can answer questions and give assistance when needed.<br><br>» Students have to be encouraged to replace the unknown in their equations in order to check their solutions.<br><br>» If students are having difficulty allow them to talk through their work so that misconceptions can be identified. | » Are students using the correct layout for part c of the questions?<br><br>» Can students do backtracking?<br><br>» Can students write the problems as equations?<br><br>» Can students relate backtracking to equations? |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| **Reflection:**<br>» Write down what you learned about equations today.<br><br>» Write down anything you found difficult today.<br><br>» Complete **Student Activity 2**. | • What it means to solve an equation<br><br>• To find the value of the unknown that makes the equation true.<br><br>• Do the same to both sides of the equation, to keep it balanced. | » Circulate and take note of any difficulties students have noted and help them to answer them. | |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| **Section C: Dealing with variations in layout of equations of the form ax + b = c**<br>**Dealing with equations of the form ax + b = cx + d and variations of this layout** | | | |
| » How do we solve the equation $4p + 3 = 11$<br><br>» What is the solution of $4y + 3 = 11$<br><br>» What is the solution of $4p + 3 = 11$<br><br>» Does the unknown always have to be $x$? | • $y = 2$<br><br>• $p = 2$<br><br>• No, it can be any letter of the alphabet. | » Ask a student to write a solution on the board.<br><br>$-3 \mid 4p + 3 = 11 \mid -3$<br>$\div 4 \mid 4p = 8 \mid \div 4$<br>$p = 2$<br><br>$4(2) + 3 = 11$ True<br><br>**Note:** A student may use Method 1 if this is the preferred method. | » Do students realise any letter of the alphabet can be used for the unknown? |
| » What do you notice about these equations?<br><br>$3x = 6$<br><br>$6 = 3x$<br><br>$3x = 2 + 4$ | • They are all the same. | | » Do students appreciate that these equations are all the same? |
| » If the question had been written in the form: solve $2x + 3 = 11$, $x \in$ N, what would it mean?<br><br>» If the question stated solve $2x + 8 = 4$, $x \in$ Z, what would it mean? | • It would mean that the solution has to be a natural number.<br><br>• It would mean that the solution has to be an integer. | | » Do students recall what a natural number and an integer is? |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » Answer question1 **Section C: Student Activity 3**. | » Students should compare answers around the class and have a discussion about why the answers are not all agreeing. | » Distribute **Section C: Student Activity 3**.<br><br>» Circulate to check if students are solving the equations correctly and that the layout of their work is correct. | » Are students checking their answers?<br><br>» If students are having difficulty allow them to talk through their work so that they can identify their misunderstandings and misconceptions. |
| » What is different about the equation $9 = 2x + 5$ in comparison to the ones we have dealt with earlier?<br><br>» How can we solve the equation $9 = 2x + 5$. | • The unknown is now on the right hand side of the equation.<br><br>• Students verbalise how to solve this equation. | • Write the following on the board:<br><br>$9 = 2 + 5$<br>$-5$ : $9 = 2x + 5$ : $-5$<br>$\div 2$ : $4 = 2x$ : $\div 2$<br>$2 = x$<br><br>» Check $9 = 2(2) + 5$ True | » Do student see this as being the same as earlier equations except that the unknown is now on the right hand side of the equation? |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » What is different about this equation?<br><br>$2x + 5 = x + 9$<br><br>» How do you think you would solve this equation?<br><br>**Note:** The stabiliser method can also be used if preferred. | • $x$ appears on both sides and there are constants on both sides.<br><br>• Bring the terms with $x$ (the unknown) to one side, but keep the balance and then bring the constants to the other side keeping the balance.<br><br>$2x + 5 = x + 9$<br>$2x + 5 - 5 = x + 9 - 5$<br>$2x = x + 4$<br>$2x - x = x - x + 4$<br>$x = 4$<br><br>• Check 2(4) + 5 = 4 + 9 True | » Give students time to solve this equation and offer assistance where needed.<br><br>» Give students time to explore possibilities and to discuss what is happening.<br><br>» Encourage students to explain their reasoning.<br><br>» Write the following on the board:<br>$2x + 5 = x + 9$<br>$2x + 5 - 5 = x + 9 - 5$<br>$2x = x + 4$<br>$2x - x = x - x + 4$<br>$x = 4$<br>Check 2(4) + 5 = 4 + 9 True | » Are students gathering the unknowns to one side of the equation and the constants to the other side, while keeping the equation balanced?<br><br>» Are students still using stabilisers? |
| | • Students work on questions chosen from **Section C: Student Activity 3.** | » Select questions to do from **Section C: Student Activity 3**.<br><br>» Circulate and check the students' layout of their answers and calculations.<br><br>» Pay particular attention to students' work in questions 2, 3, 4, 6, 7, 8, 10, 11 and 12, if these questions were chosen. | » Are students using a clear layout for these questions and doing the calculations successfully?<br><br>» Are they differentiating between the unknowns and the constants?<br><br>» Are students using mathematical language in their discussions? |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » If we get an equation like $2x + 3 = 5x + 6$, write in your own words how you would solve this equation. | • Gather the terms with $x$ (unknown) to one side and the constants to the other side, keeping the equation balanced. | | » Are students' written explanations showing their understanding of how to solve equations? |
| **Section D: Forming an equation given a problem and relating a problem to a given equation** | | | |
| » Think of a story represented by the equation $4x = 8$. | • Mary has 4 times the number of pets she had last year and she now has 8.<br>• This week John saved four times the amount of money he saved last week. This week he saved €8.<br>• Michael is 4 times as old as Karen. Michael is 8. | » Look for a selection of stories that this equation could represent. | » Can students develop appropriate stories? |
| » Think of a story represented by the equation $4x + 5 = 53$. | » Students compose and compare equations.<br>• Think of a number, multiply it by 4, add 5 and the answer is 53.<br>• A farmer has 4 times the number of sheep he had last year and then buys 5 more. The total number of sheep he now has is 53. | | |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » Answer questions 1 - 12 **Section D: Student Activity 4**. | | » Distribute **Section D: Student Activity 4**<br><br>» Circulate and check students' work. Engage students in talking about their work.<br><br>» Ask individual students to do questions on the board. They should explain why they are doing each step. | » Are students capable of forming equations to represent the problems posed in **Section D: Student Activity 4**? |
| » Could the following story be represented by this equation $x + 2 = 25$? "2 new students enter a class and the class now has 26 students".<br><br>» Why? | • No.<br><br>• The equation should be $x + 2 = 26$ or the problem should state the class now has 25 students. | » Write the equation and students' suggestions on the board. | » Can the students relate the equation to the problem and can they see that there is often a different equation for each problem? |
| » How does this differ from saying the number of students double? | • The first situation is $x + 2$ and the second is $2x$. | | » Can students verbalise the difference between $2x$ and $x + 2$? |
| » In pairs develop problems that could be represented by the equations given in questions 13-16 of the **Student Activity 4**. Write your problems in words. | • Students explore **Section D: Student Activity 4**.<br><br>• Students should compare answers around the class and have a discussion. | » Check the examples that students are devising for the questions which can be represented by the equation.<br><br>» Allow students to share their problems. | » Can the students develop problems that could be represented by the equations? |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| **Section E: To show that equations can also be solved graphically** | | | |
| » In pairs discuss question 1 of **Section E: Student Activity 5**. | | » Distribute **Section E: Student Activity 5**.<br><br>» In pairs allow students to discuss question 1 of this activity. | » Are the students' explanations showing that they understand why the equation cannot be solved? |
| » Can $2x = 2x + 1$ be solved?<br><br>» Why do you give this answer? | • No it is not an equation. The left hand side does not equal the right hand side.<br><br>• The equation is not balanced. | | |
| » In pairs answer question 2 on **Student Activity 5**. | | » Circulate and see what answers the students are giving and address any misconceptions. | |
| » What is the value of $x$ when the line cuts the $x$ axis?<br><br>» Where did the line cut the $x$ axis? | • $y = 0$<br><br>• At the point (-3, 0). | | |
| » Solve the equation $x + 3 = 0$.<br><br>» Do you see any relationship between where the line cuts the $x$ axis and the solution got by algebra? | • $x + 3 - 3 = 0 - 3$.<br>$x = -3$<br><br>• Yes the solution was $x = -3$ and the point where the line cuts the x axis had an $x$ value of -3. | | » Do students see that the algebraic solution to the equation will be the $x$ value of the point where the line cuts the $x$ axis? |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » Answer the rest of the questions on **Student Activity 5**. | | » Check to see if the students' answers to these questions demonstrate that they understand how to solve equations graphically. | » Are students able to do questions 5 and 6 without referring to what they were asked to do in the previous questions? |
| **Section F: To solve equation involving brackets** | | | |
| » So we can now solve equations by algebra and by graph.<br><br>» How could you solve $2x + 7 = 13$ by trial and improvement (Inspection)?<br><br>» How do you prove that the solution you got is correct? | • Try $x = 1$, if it does not work try $x = 2$ and if that does not work try $x = 3$ etc.<br><br>• Substitute $x = 3$ as follows 2(3) + 7 = 13. | » Write 2(3) + 7 = 13 on the board. | » Do students know what is meant by trial and error? |
| » That was a simple one. What about $2x + 5 = -1$. | • This is more difficult and not as easy to predict the solution.<br><br>• $x = -3$ | | |
| » So while trial and improvement (Inspection) is a possible method of solving an equation, it is often very difficult to use unless the answer is 1, 2, 3 etc. | | » Write on the board:<br>$2x + 5 = -1$<br>$2(-3) + 5 = -1$<br>$-6 + 5 = -1$ True | » Do the students realise that it is not sufficient to guess, but the proposed solution must be checked using substitution? |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » How is the value of $2(3 + 4)$ found?<br>**Note:** Knowledge of the distributive law is important here. | » Add the 3 and 4 first and then multiply your answer by 2.<br><br>» First multiply each number in the brackets by 4 and then add the answers. | » Write on the board<br>$2(7) = 14$<br><br>$2(3) + 2(4)$<br>$= 6 + 8$<br>$= 14$ | |
| » We can also have brackets in an equation for example:<br>$2(x + 4) = 18$.<br><br>» How do you think we would solve<br>$2(x + 4) = 18$? | • Multiply each term inside the bracket by 2 and get $2x + 8 = 18$<br><br>• A student may write on the board:<br>$-8$ \| $2x + 8 = 18$ \| $-8$<br>$\div 2$ \| $2x = 10$ \| $\div 2$<br>\| $x = 5$ \| | » Allow students time to adopt an investigative approach here. Delay giving the procedure. | |
| » How would we solve $3(x - 2) = 2(x - 4)$? | • Multiply each term inside the bracket by 3 and get $3x - 6$. Multiply each term inside the other bracket by 2 to get $2x - 8$. Then do what you would normally do.<br><br>• A student may write on the board:<br>$3x - 6 = 2x - 8$<br>$3x - 6 + 6 = 2x - 8 + 6$<br>$3x = 2x - 2$<br>$3x - 2x = 2x - 2x - 2$<br>$1x = -2$<br>$3(-2 - 2) = 2(-2 - 4)$ True | » Allow students time to adopt an investigative approach here. Delay giving the procedure. | » Do students understand to remove the brackets from both sides? |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » Can you put in words what you do if brackets are present in an equation? | » Remove all the brackets by multiplying out before we start to solve the equation. | | |
| » Answer the questions in **Section F: Student Activity 6**. | » Students should compare answers around the class and have a discussion. | » Distribute **Section F: Student Activity 6**. Circulate and check students' work. | » Are students removing the brackets before they commence solving the equations?<br><br>» Are students clearly showing all steps involved in solving an equation?<br><br>» Are students continuing to check their answers? |
| **Reflection:**<br>» Write down what you learned about solving an equation if there are brackets present.<br><br>» Write down any questions you may have.<br><br>» Write down anything you found difficult today. | » Remove the brackets and then solve the equation. | » Circulate and note any difficulties or questions students have. | » If students are noting difficulties that they have allow them to talk through them so that can identify for themselves their misconceptions. |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| **Section G: To solve equations involving fractions** | | | |
| » How does one add $\frac{1}{2}+\frac{1}{3}$? | • Get a common denominator, which is the Least Common Multiple of 2 and 3 and is equal to 6.<br><br>**Note:** Allow students to articulate and explain how to add ½ and ⅓. | » Write the answer on the board.<br>$\frac{1}{2}+\frac{1}{3}$<br>$=\frac{3}{6}+\frac{2}{6}$<br>$=\frac{5}{6}$ | » Do students remember how to add simple fractions? |
| » Equations can also involve fractions for example:<br>$\frac{x}{2}+\frac{x}{3}=\frac{5}{6}$ | | » Allow students time to adopt an explorative approach here. Delay giving the procedure.<br><br>» Write the equation and its solution on the board as it evolves:<br>Solve the equation:<br>$\frac{x}{2}+\frac{x}{3}=\frac{5}{6}$<br>$\frac{3x+2x}{6}=\frac{5}{6}$<br>$\times 6 \mid \frac{5x}{6}=\frac{5}{6} \mid \times 6$<br>$\div 5 \mid 5x=5 \mid \div 5$<br>$x=1$ | » Are students extending their knowledge of addition of fraction?<br><br>**Note:** Students are more likely to learn with understanding if they have tried to extend their existing knowledge rather than be prescribed a "rule" to follow from the start. |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » Let's compare our answers around the class and see if we agree or not. | • Students offer their solutions and explain how they arrived at them. | » Write varied solutions on the board and allow students to talk through their work so that they can identify areas of misconceptions. | |
| » Answer all sections of question 1 in **Section G: Student Activity 7**. | $\frac{2x-2}{4}-\frac{x+1}{3}=1$<br>$\frac{3(2x-2)-4(x+1)}{12}=1$<br>$\frac{6x-6-4x-4}{12}=1$<br>$\times 12$ $6x-6-4x-4=12$ $\times 12$<br>$+10$ $2x-10=12$ $+10$<br>$2x=22$<br>$x=11$<br>Check $\frac{2(11)-2}{4}-\frac{11+1}{3}$<br>$\frac{22-2}{4}-\frac{12}{3}$<br>$\frac{20}{4}-4$<br>$5-4=1$ True | » Distribute **Section G: Student Activity 7**.<br>» Circulate and check students' answers.<br>» Ask individual students to do questions on the board when the class have done some of the work. Students should explain what they are doing in each step. | » Are students getting the correct common denominator and getting the correct solutions? |
| » In pairs do questions 2-12 from **Section G: Student Activity 7**. The equations formed from these questions will mostly be in fraction format. | | » Circulate and check students' work ensuring that all students can complete the task.<br>» Ask individual students to do questions on the board when the class have done some of the work. Students should explain what they are doing in each step. | » Are students forming the correct equations and solving them? |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| **Section H: Note the activities to date are for students taking ordinary level in the Junior Certificate where the variables and solutions are elements of Z. For students taking higher level in the Junior Certificate the variables and solutions can be elements of Q. Hence students taking higher level will need to cover the following activities. Students taking ordinary level can progress to the Reflection section of this T&L Plan.** | | | |
| » Give examples of numbers that are elements of **Z**?<br><br>» What is another name for the numbers that are elements of **Z**? | • -3, -2, -1, 0, 1, 2, 3, 4 etc.<br><br>• Integers | | |
| » Give examples of numbers that are elements of **Q**?<br><br>» What is the name for numbers that are elements of **Q**?<br><br>» Are negative and positive whole number elements of **Q**? | • ½, ¼, ¾ , etc<br><br>• Fractions<br><br>• Yes | | » Are students recognising the differences between an integer and a rational number?<br><br>» Can students verbalise the differences between natural numbers, integers and rationals? |
| » Solve the equations that are on the board. | • Students solve the equations. | » Write the following equations on the board:<br>$2x + 5 = 8$<br>$3x - 7 = 17$<br>$3x/5 = 13$<br>$2.5x = 45$<br>$1.5x + 3 = 22$ | |

| Student Learning Tasks: Teacher Input | Student Activities: Possible and Expected Responses | Teacher's Support and Actions | Assessing the Learning |
|---|---|---|---|
| » Complete the questions on **Section H: Student Activity 8**. | | » Distribute **Section H: Student Activity 8**.<br><br>» If students are having difficulties allow them to talk through them so that can identify their misconceptions for themselves. | » Are students using a clear layout for these questions and doing the calculations successfully? |
| **Reflection:**<br>» Work in groups and summarise what you know about equations, solving an equation and solutions. | • Both sides of a balanced equation are equal.<br><br>• When solving an equation you must perform the same operation to both sides of an equation.<br><br>• To solve an equation means to find a value for the unknown that makes it true.<br><br>• The solution is the value that makes an equation true. | » Circulate the class, asking questions where necessary and listen to students' conclusions. | » Do students know how to solve equations and what is meant by this action?<br><br>» Do students understand the terms:<br>• Equation<br>• Solve<br>• Solution? |
| » Make a list of key words you have learned and write an explanation for each word. | • Students write the key words into their copybooks and an explination of each one. | | » Can students write explanations for these words or verbalise this to the class? |

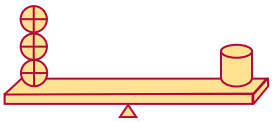
# Section A: Student Activity 1

Project Maths Tionscadal Mata Development Team

**1. Describe the balances labelled a, b, c and d below in two ways:**

**(i) using words and**

**(ii) using mathematical symbols.**



**(i) Words: the weight of three spheres is balanced by the weight of one cylinder**

**(ii) Symbols: 3s =c**

**(Assume all balances in these questions are balanced unless told otherwise)**

**a.** 

**b.** 

**c.** 

**d.** 

**2. What can you tell about the value of $x$ or $y$ in the following balances? Explain how you got your answer.**

**a.** 


**b.** 

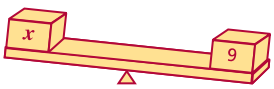

**c.** 


**d.** 

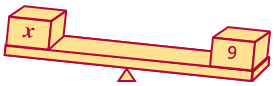

**e.** 


**f.** 


**3. If we know this balance is not balanced, what number can $x$ not be?**




**4. If $x$ = 8, what will we do to achieve balance?**



# Section B: Student Activity 2

Project Maths Tionscadal Mata Development Team

**1. Complete the table of rules for backtracking.**

| RULES FOR BACKTRACKING | |
|---|---|
| Original action | Reverse action |
| + | |
| - | |
| x | |
| ÷ | |

**2. John thinks of a number, multiplies it by 3 and adds 2 to his answer. The result is 11.**

**a. Using backtracking, what number did he think of?**

**b. Write an equation to represent this problem.**

**c. Solve the equation.**

**d. How are your answers for parts a and c related?**

**3. Sarah thinks of a number, multiplies it by 4 and adds 5 to her answer. The result is 25.**

**a. Using backtracking, what number did she think of?**

**b. Write an equation to represent this problem.**

**c. Solve the equation.**

**d. How are your answers for part a and c related?**

**4. Dillon thinks of a number, multiplies it by 3 and subtracts 5 from his answer. The result is 7.**

**a. Using backtracking, what number did he think of?**

**b. Write an equation to represent this problem.**

**c. Solve the equation.**

**d. How are your answers for part a and c related?**

# Section B: Student Activity 2 (cont.)

Project Maths Tionscadal Mata Development Team

**5. Saoirse thinks of a number and divides it by 2 and adds 5 to her answer. The result is 9.**

a. Using backtracking, what number did she think of?

b. Write an equation to represent this.

c. Solve the equation.

d. How are your answers for part a and c related?

**6. Susan thinks of a number and divides it by 3 and subtracts 5 from her answer. The result is 14.**

a. Using backtracking, what number did she think of?

b. Write an equation to represent this.

c. Solve the equation.

d. How are your answers for part a and c related?

**7. Solve the following equations and check solutions (Answers):**

a. $2x = 4$

b. $3x + 1 = 13$

c. $5x - 4 = 21$

d. $4x - 4 = 44$

e. $11x - 5 = 39$

f. $3x - 4 = 11$

# Section C: Student Activity 3

Project Maths Tionscadal Mata Development Team

1. **Solve the following equations and check solution which will be a natural number in each case:**

   **N.B. When asked to solve equations, always check answers.**

   a. $2x = 8$
   b. $40y = 160$
   c. $40z = 360$
   d. $2s + 1 = 9$
   e. $2t - 1 = 7$
   f. $5r - 8 = 17$
   g. $2x - 9 = -1$
   h. $2y - 15 = 31$
   i. $1 - 2c = -5$
   j. $8d - 168 = -16$

2. **Solve the following equation $4s + 7 = 19$, $x \in$ N.**

3. **Does the equation $6x + 12 = 8$, $x \in$ N have a solution? Explain.**

4. **Does the equation $6x + 12 = 8$, $x \in$ Z have a solution? Explain.**

5. **Is $x = -1$ a solution to the equation $2x + 10 = 8$? Explain your answer.**

6. **Is $x = 4$ a solution to the equation $2x + 5 = 10$? Explain your answer.**

7. **Is $x = 2$ a solution to the equation $-x + 3 = 1$? Explain your answer.**

8. **Examine this student's work. What do you notice?**

   $3x + 6 = 21$

   $3x + 6 - 6 = 21$

   $3x = 21$

   $x = 7$

# Section C: Student Activity 3 (cont.)

**9. Solve the following equations and check your solutions which will be an integer in each case:**

a. $3x - 7 = 2x$

b. $4t + 6 = 2t$

c. $1 + 2c = 7$

d. $42 = 7 - 5c$

e. $-42 = 5m - 7$

f. $-p = 72 + 2p$

g. $6 - 3k = 0$

h. $-9y = -y - 48$

i. $\frac{x}{3} = 5$

j. $\frac{x}{3} = -5$

**10. Is $x = 9$ a solution to the equation $5 - 2x = -13$? Explain your answer.**

**11. Is $r = 2$ a solution to the equation $-6r + 3 = r$? Explain your answer.**

**12. Examine this student's work. What do you notice?**

$5 - x = 21$

$5 - 5 - x = 21 - 5$

$-x = 16$

**13. Is $t = 4$ a solution to the equation $5t - 2 = 3t - 3$? Explain your answer.**

**14. Is $x = -2$ a solution to the equation $-6x + 3 = -x + 13$? Explain your answer.**

**15. Examine this student's work. Spot the errors, if any, in each case.**

| Student A | Student B | Student C |
|---|---|---|
| $4x + 4 = 6x - 6$ | $4x + 4 = 6x - 6$ | $4x + 4 = 6x - 6$ |
| $4x + 4 - 4 = 6x - 6 + 4$ | $4x + 4 - 4 = 6x - 6 - 4$ | $4x + 4 - 4 = 6x - 6 - 4$ |
| $4x = 6x - 2$ | $4x = 6x - 10$ | $4x = 6x - 10$ |
| $4x - 6x = 6x - 6x - 2$ | $4x - 6x = 6x - 6x - 10$ | $4x - 6x = 6x - 6x - 10$ |
| $-2x = -2$ | $2x = -10$ | $-2x = -10$ |
| $2x = 2$ | $2x = -10$ | $2x = 10$ |
| $x = 1$ | $x = -5$ | $x = 5$ |
| | | $4(5) + 4 = 6(5) - 6$ True |

# Section D: Student Activity 4

Project Maths Tionscadal Mata Development Team

1. Brendan thinks of a number, adds 3 and the answer is 15. Represent this statement as an equation. Solve the equation and check your answer.
2. Joanne thinks of a number then subtracts 5 and the answer is 10. Represent this statement as an equation. Solve the equation and check your answer.
3. A farmer has a number of cows and he plans to double that number next year, when he will have 24. Represent this statement as an equation. Solve the equation and check your answer.
4. A new student enters a class and the class now has 25 students. Represent this statement as an equation. Solve the equation and check your answer.
5. The temperature increases by 18 degrees and the temperature is now 15. Represent this statement as an equation. Solve the equation and check your answer.
6. A farmer doubles the amount of cows he has and then buys a further three cows. He now has 29. Represent this as an equation. How many did he originally have?
7. Emma and her twin brother will have a total age of 42 in 5 year's time. Represent this as an equation. How old are they at the moment?
8. A table's length is 6 metres longer than its width and the perimeter of the table is 24 metres. Allow $x$ to represent the width of the table write an equation to represent this information and solve the equation to find the width of the table.


9. Mark had some cookies He gave half of them to his friend John. He then divided his remaining cookies evenly between his other three friends each of whom got four cookies. How many
10. Chris has €400 in his bank account and he deposits €5 per week thereafter into his account. His brother Ben has €582 in his account and withdraws €8 per week from his account. If this pattern continues, how many weeks will it be before they have the same amounts in their bank accounts?
11. The sum of three consecutive natural numbers is 51. What are the numbers?
12. A ribbon is 30cm long and it is cut into three pieces such that each piece is 2cm longer than the next. Represent this as an equation? Solve the equation to discover how long each piece of ribbon is.
13. Write a story that each of the following equations could represent:

    i. $2x = 10$

    ii. $2x + 5 = 11$

    iii. $3x - 5 = 13$

    iv. $3x - 5 = 2x + 13$

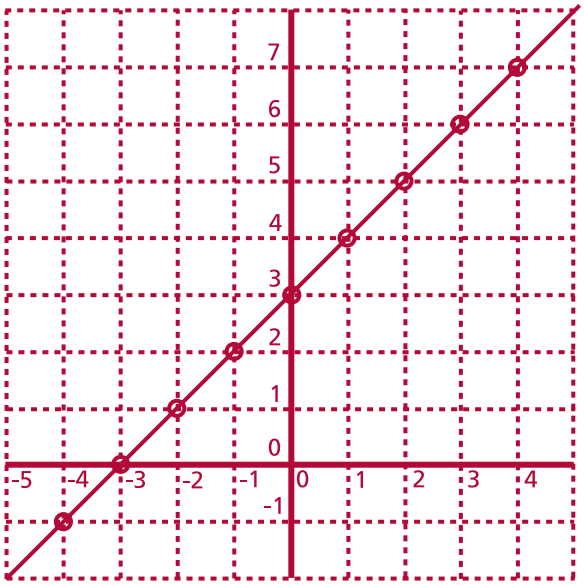
 

# Section E: Student Activity 5

Project Maths Tionscadal Mata Development Team

**1. Can you solve the equation $2x=2x+1$? Why or why not?**

**2.**




a. Make a list of 4 points on this line.

b. What is added to each $x$ to give the y value?

c. So is it true to say the line has equation $y = x + 3$?

d. Solve the equation $x + 3 = 0$ by algebra.

e. Can we read from the graph the point where $y = 0$ (or $x + 3 = 0$)?

f. Do you get the same answer when you graph the line $y = x + 3$ and find where it cuts the $x$ axis as you get when you solve the equation $x + 3 = 0$ by algebra?

**3. Complete the following table and draw the resulting line on graph paper.**

| $x$ | $y = 2x + 2$ |
|---|---|
| -2 | |
| -1 | |
| 0 | |
| 1 | |
| 2 | |
| 3 | |

a. Where does the line $y = 2x + 2$ cut the $x$ axis?

b. What is the $x$ value of the point where this line cuts the $x$ axis?

c. Solve the equation $2x + 2 = 0$ using algebra.

d. Do you get the same answer for the $x$ value of the point where the line $y = 2x + 2$ cuts the $x$ axis and from solving the equation $2x + 2 = 0$ using algebra?

# Section E: Student Activity 5 (cont.)

Project Maths Tionscadal Mata Development Team

**4. Complete the following table and draw the resulting line on graph paper.**

| $x$ | $y = 2x - 1$ |
|---|---|
| -2 | |
| -1 | |
| 0 | |
| 1 | |
| 2 | |
| 3 | |

a. Where does the line $y = 2x - 1$ cut the $x$ axis?

b. What is the $x$ value of the point where this line cuts the $x$ axis?

c. Solve the equation $2x - 1 = 0$ using algebra.

d. Do you get the same answer for the $x$ value of the point where the line $y = 2x - 1$ cuts the $x$ axis and from solving the equation $2x - 1 = 0$ using algebra?

**5. Given the table below find the solution to the equation $2x - 3 = 0$.**

| $x$ | $2x - 3$ |
|---|---|
| -3 | -6 |
| -2 | -5 |
| -1 | -4 |
| 0 | -3 |
| 1 | -2 |
| 2 | -1 |
| 3 | 0 |

**6. Solve the equation $2x - 6 = 0$ graphically.**

**7. Solve the equation $x + 5 = 0$ graphically.**

**8. Describe in your own words how to solve an equation graphically.**

# Section F: Student Activity 6

Project Maths Tionscadal Mata Development Team

1. Solve the following equations and check your solutions:

   a. $3(y - 2) = 3$
   b. $4(x - 2) = 8$
   c. $2(4 - x) = 6x$
   d. $5(t - 2) + 6(t - 3) = 5$
   e. $4(x - 1) + 3(x - 2) = 4$
   f. $4(p + 7) + 5 = 5p + 36$
   g. $5(q - 4) + 12 = 3(q - 3)$
   h. $2(x + 3) - 3(x + 2) = -2$
   i. $2(s - 1) + 3(s - 3) + s = 1$
   j. $3(x + 1) - (x + 5) = 0$
   k. $2(d + 3) + 3(d + 4) = 38$
   l. $(x + 1) + 5(x + 1) = 0$

2. Is $y=5$ a solution to the equation $2(y - 4) + 5 = 3(y + 2)$? Explain your answer.

3. Is $y=2$ a solution to the equation $(y - 4) + 6 = 3(y + 2) - 7$? Explain your answer.

4. a. These students each made one error, explain the error in each case.

| Student A | Student B | Student C |
|---|---|---|
| $2(x + 3) -7 = 3(x - 3) + 4$ | $2(x + 3) -7 = 3(x - 3) + 4$ | $2(x + 3) -7 = 3(x - 3) + 4$ |
| $2x + 3 - 7 = 3x - 9 + 4$ | $2x + 6 - 7 = 3x - 9 + 12$ | $2x + 6 - 7 = 3x - 9 + 4$ |
| $2x - 4 = 3x - 5$ | $2x - 1 = 3x + 3$ | $2x - 1 = 3x - 5$ |
| $2x - 4 + 4 = 3x - 5 + 4$ | $2x - 1 + 1 = 3x + 3 + 1$ | $2x - 1 + 1 = 3x - 5 - 1$ |
| $2x = 3x - 1$ | $2x = 3x + 4$ | $2x = 3x + 6$ |
| $2x - 3x = 3x - 3x - 1$ | $2x - 3x = 3x - 3x + 4$ | $2x - 3x = 3x - 3x + 6$ |
| $-1x = -1$ | $-1x = 4$ | $-1x = 6$ |
| $x = 1$ | $x = -4$ | $x = 6$ |

   b. Solve the equation correctly showing all the steps clearly.

5. Mary is 5 years older than Jack. Twice Mary's age plus 3 times Jack's age is 125. Write an equation to represent this information and solve the equation to find Mary's age.

6. The current price of an apple is $x$ cents. The price of an apple increases by 4 cents and Alan goes to the shop and buys 4 apples plus a magazine costing €2. His total bill came to €4.44.

7. Half of a number added to a quarter of the same number is 61. Write an equation to represent this information. Solve the equation to find the number?

8. Erica went shopping. She spent a quarter of her money on books, half of her money on shoes and €5 on food. She had €12 left. Write an equation to represent this situation. Solve the eqution to find how much money she had at the beginning of the day?

   a. Write an equation in terms of $x$ to represent her total bill in cents?

   b. Solve the equation. What does the answer tell you?

# Section G: Student Activity 7

Project Maths Tionscadal Mata Development Team

## 1. Solve the following equations and check your solutions:

**a.** $\frac{x}{4}+\frac{x}{8}=\frac{3}{8}$

**b.** $\frac{2x}{5}+\frac{x}{2}=\frac{9}{5}$

**c.** $\frac{x}{2}+\frac{x}{4}=24$

**d.** $\frac{x}{3}-\frac{x}{2}=\frac{5}{2}$

**e.** $\frac{x}{2}=-2$

**f.** $-\frac{x}{2}+1=7$

**g.** $\frac{2x-2}{4}-\frac{x}{4}=1$

**h.** $\frac{2x-2}{4}-\frac{x+1}{3}=1$

**i.** $\frac{x+3}{2}-\frac{x-3}{4}=9$

**j.** $\frac{x+2}{4}+\frac{1}{2}=20$

**k.** $\frac{x+4}{2}-x=5$

**l.** $\frac{x+3}{4}-5=\frac{3}{4}$

**m.** $\frac{x-2}{4}=\frac{2x-5}{6}$

**n.** $\frac{x}{2}+1=7$

**o.** $\frac{x+3}{4}-\frac{x+2}{3}=\frac{1}{2}$

**p.** $\frac{2x+3}{5}-\frac{x-1}{3}=\frac{2}{6}$

# Section G: Student Activity 7 (cont.)

Project Maths Tionscadal Mata Development Team

**2** Martha has a certain number of sweets in a bag and she gives half to Mary and Mary gets 20. How can this be represented as an equation? Solve the equation and check your answer.

**3** A father is $x$ years of age and is twice the age of his daughter, who is now 23. Find an equation in terms of $x$ to represent this situation and solve the equation.

**4** There are three generations in a family: daughter, mother and grandmother. The daughter is half the age of the mother and the grandmother is twice the age of the mother. The sum of their ages is 140. Write an equation to represent this situation and solve the equation to find the ages of each member of the family.

**5** A carpenter wished to measure the length and width of a rectangular room, but forgot his measuring tape. He gets a piece of wood and discovers the length of the room is twice as long as the piece of wood and the width of the room is half that of the wood. The owner says that the only information he can remember about the room is that its perimeter is 50 metres. Write an equation to represent this information, letting $x$ equal the length of the piece of wood. Solve the equation and explain your answer.

**6** Jonathan is half Jean's age and Paul is 3 years older than Jean. Given that the sum of their ages is 43, write an equation to represent this situation and solve the equation. What age is each person?

**7** A student took part in a triathlon which involved swimming, running and cycling. He spent ½ the time swimming that he spent running and 3 times the time cycling as he spent running. His total time was 45 minutes. Write an equation to represent this situation. Solve the equation and state how long he spends at each sport.

**8** Kirsty has just bought a new outfit consisting of a skirt, a shirt and shoes. She will not tell her mother the cost of the shoes, but her mother knows she spent all her pocket money of €220 on the outfit. Through a series of questions her mother discovers that she spent 4 times the amount she spent on the skirt on the shoes and she spent half the amount she spent on the skirt on the shirt. Write an equation to represent this information and find the cost of the shoes using this equation.

**9** There are $x$ chocolate buttons in a bag. Dan ate 6 chocolate buttons. Eamon then ate a quarter of the remaining chocolate buttons in the bag. There were now 90 chocolate buttons left in the bag. Write an equation to represent this information and solve the equation to find the number of chocolate buttons originally in the bag?

**10** Simplify $\frac{1}{x}+\frac{1}{2x}=\frac{1}{2}$ and hence solve for $x$.

**11** Simplify $\frac{1}{2x+1}+\frac{1}{x+2}$ and hence solve for $\frac{1}{2x+1}+\frac{1}{x+2}=\frac{6}{(2x+1)(x+2)}$ for $x$.

# Section H: Student Activity 8

Project Maths Development Team

## Higher level only
## Solution may be elements of Q.

1 Solve the equation $2x = 9$.

2 Solve the equation $2x - 5 = -3x - 7$.

3 Solve $\frac{2x-5}{5} - \frac{x-1}{3} = \frac{1}{2}$

4 Solve the equation $2(x - 3) - 3(x - 2) = 15$.

5 Solve the equation $5(x - 5) - 3(x - 2) + 4 = 0$.

6 Solve the equation $\frac{x}{3} + 5 = x$

7 An electric supplier has a fixed charge of €48 for every two months and also charges 9 cent per unit of electricity used.
(a). Write an equation to represent this information.
(b). The Gallagher family got a bill for €77.97 for the last 2 months. Use your equation to find how many units of electricity they used during this period .

8 3 is taken from a number and the result divided by 4. This is then added to half of the original number giving an answer of 47. Find the original number?

9 Julie went shopping. She spent one sixth of her money on books, an eight of her money on shoes and €5 on food. She had €13.50 left. Write an equation to represent this information. Solve the equation to find how much money she had at the beginning of the day?

10 The difference between a half of a number and a third of the same number is 34.5. What is the number?

11 The difference between one third of a number and 2 sevenths of the same number is $2\frac{1}{2}$

Find the number.

# Appendix A

Project Maths Tionscadal Mata Development Team

**Internet sites that will aid the teaching of this topic:**

**http://nlvm.usu.edu/en/nav/frames_asid_201_g_4_t_2.html?open=instructions&from=category_g_4_t_2.html**

**http://www.mathsisfun.com/algebra/add-subtract-balance.html**