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Foundation Mathematics

Topic 2 – Lecture 1: Using Algebraic Equations

Transposing Equations

Solving Simple Linear Equations

Scope and Coverage

This topic will cover:

- An introduction to the structure and transposition of equations
- Solving Simple, Linear, Equations

Learning Outcomes

By the end of this topic students will be able to:

- Recognise and transpose a range of algebraic expressions
- Solve a range of simple, linear equations through a range of techniques

Transposing Equations - 1

- We often present information in the form of an equation.
- An equation is a mathematical statement which equates two expressions to each other.
- E.g. 1000ml = 1 litre
- When dealing with equations we are often confronted with a statement in which there is an unknown quantity.

Transposing Equations - 2

For example:

- $3x + 4 = 22$ Here we have an unknown quantity x. To calculate x we need to transpose the equation. Doing this creates the following $3x = 22 - 4$
- $3x$ is therefore = 18 and $x = 6$

Transposing Equations - 3

- Actions must be equal to the expressions either side of the equals sign so:
- $3x + 4 = 22$

  To this equation we have subtracted 4 from both sides of the equation; if we wrote this out in full it would look like:
- $3x + 4 - 4 = 22 - 4$

Transposing Equations - 4

- The effect of this calculation is to give an equation of $3x = 18$
- To get the value of x we need to divide both sides of the equal sign by 3 therefore $3x/3 = 18/3$
- x is therefore = 6

Transposing Equations - 5

- The equation $3x - 4 = 23$ contains only the first power of x;
- The equation $5x^2 - 3x + 5 = 0$ contains x^2 as the highest power of x, that is the second power of x.

Transposing Equations - 6

- **Simple equations** are therefore those that relate to equations that contain only the first power of the unknown quantity.

$$7t - 5 = 4t + 7 \quad \text{and} \quad \frac{5x}{3} = \frac{2x+5}{2}$$

are both considered to be simple equations as they both contain unknown quantities of the first power.

Simple Equations - 1

- Consider the simple equation

$$\frac{x}{6} - 3 = 0$$

- We need to isolate the unknown on one side of the equals sign and the known value on the other side.

Solving Equations - 2

- The equation $\frac{x}{6} - 3 = 0$ can then be presented as $\frac{x}{6} = 3$
- In this way it can be seen that we now have the opportunity to solve the equation, that is we can find the value of x
- To do so we multiply both sides of the equation by 6 to give $\frac{x}{6} \times 6 = 3 \times 6$ therefore $x = 18$

Solving Equations - 3

Equations requiring addition and subtraction

- Solve x-4=8
  - If we add 4 to each side, we get $x-4+4 = 8+4 \therefore x=12$
  - Adding 4 to each side is the same as transferring -4 to the right hand side of the equals sign, in so doing the sign is changed from a minus to a plus. Thus $x-4=8$, $x = 8+4 \therefore x=12$
- Solve $x+5=20$
  - If we subtract 5 from each side, we get $x+5-5=20-5 \therefore x=15$

Solving Equations - 4

Equations containing the unknown quantity on both sides

- Group known and unknown quantities together on either side of the equals sign.

- Solve $7x+3=5x+17$
  - To find a value for x we need to rearrange (transpose) the equations

Solving Equations - 5

- Subtract $5x$ from both sides of the equals sign and subtract +3 from both sides.
- This gives:

  $7x - 5x = 17 - 3$, which when simplified is $2x = 14$
- By dividing both sides by 2 we get $x = 14/2$
  Therefore $x = 7$

Solving Equations - 6

Equations containing brackets

- When an equation contains brackets remove these first and then solve as before.
- Example:
  - Solve $2(3x+7) = 16$
  - Removing the bracket, $6x+14 =16$, $6x+14-14 = 16-14$, $6x=2$, $x=2/6$, $\therefore$ $x=1/3$

Solving Equations - 7

Equations containing fractions

- An equation containing fractions:
- Solve:

$$\frac{x-4}{3}-\frac{2x-1}{2}=4$$

Solving Equations - 8

- The lowest common multiple of 3 and 2 is 6 therefore we must multiply the numerators by 6
- This gives:

$$\frac{x-4}{3}\times 6-\frac{2x-1}{2}\times 6=4\times 6$$

$2(x\text{-}4) - 3(2x\text{-}1) = 24$ simplifying gives $2x\text{-}8\text{-}6x\text{+}3 = 24$, further simplification gives $\text{-}4x\text{-}5 = 24$

$\text{-}4x = 24\text{+}5$, therefore $\text{-}4x = 29$, and so $x = 29/\text{-}4$, ultimately $x = -(29/4)$

Solving Equations - 9

- Consider the following equation $\frac{5}{2x+5}=\frac{4}{x+2}$
- To solve this equation we need to find the lowest common multiple for the denominators which in this case is (2x+5)(x+2). Once we have the lowest common multiple we need to multiply the equation throughout. This gives:

$$\frac{5}{2x+5}\times(2x+5)(x+2)=\frac{4}{x+2}\times(2x+5)(x+2)$$

Solving Equations - 10

- By cancelling out on both sides of the equation we simplify
- This therefore gives $5(x+2) = 4(2x +5)$ which is the same as $5x +10 = 8x +20$
- Simplifying gives $5x – 8x = 10$ therefore $– 3x = 10$ therefore $x = - 10/3$

Expressions – real information

- If we can buy x number of light bulbs for $400 what is the cost of y light bulbs?
  - To simplify this information we can write an expression. Therefore 1 light bulb costs $\frac{400}{x}$
  - y light bulbs therefore cost $\frac{400}{x}$ x y or $\frac{400y}{x}\$$

Solving Equations - 1

- Perimeter – 56cm
- Long sides – 4cm longer than short sides

- Find the dimensions of the rectangle

Solving Equations - 2

- Let x cm= length of the shorter side, then (x+4)cm = length of the longer side
- Thus the total perimeter can be expressed as $x+x+(x+4)+(x+4)$ and simplified to $(4x+8)$cm
- Given that the total perimeter is 56 cm we can create an equation.

  $4x+8=56$ which is the same as $4x=56-8$, therefore $4x=48$, $x=12$
- Dimensions of rectangle are 16cm by 12cm.

Topic 2 – Using Algebraic Equations 1

Any Questions?

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