Ministero dell'Istruzione, dell'Università, della Ricerca
Ufficio Scolastico Regionale Per Il Lazio
Liceo Scientifico Statale
"TALETE"

Modulo 3 MiniCLIL

Incontro 6: Math in England

L'incontro odierno ha lo scopo di presentare alla classe i metodi di approccio matematico utilizzati nei sistemi scolastici nel mondo anglosassone. In particolare si presenteranno esercizi utilizzati dalle commissioni di esame OCR nei livelli GCSE delle scuole secondarie inglesi.

Lezione

le esercitazioni sono estratte dal testo in figura qui sotto. Il materiale è distribuito in fotocopia e il lavoro è condotto in gruppo con l'aiuto di studenti di livello più avanzato (Peer to Peer Learning):
GCSE Mathematics, Exam Board OCR, The Revision Guide for Higher Level

CGP

GCSE Mathematics

Exam Board: OCR

The Revision Guide

Higher Level

Includes **Free** Online Edition

Rearranging Formulas

Carrying straight on from the previous page, now it's time for what to do if...

...there's a Square or Square Root Involved (B)

If the subject appears as a square or in a square root, you'll have to use steps 1 and 7 (not necessarily both).

EXAMPLE: Make v the subject of the formula $u = 4v^2 + 5w$.

There aren't any square roots, fractions or brackets so ignore steps 1-3 (this is pretty easy so far).

4) Collect all the subject terms on one side and all non-subject terms on the other.
$(-5w)$ $4v^2 = u - 5w$

5) It's now in the form $Av^2 = B$ (where $A = 4$ and $B = u - 5w$)

6) Divide both sides by 4 to give '$v^2 =$ ...' $(\div 4)$ $v^2 = \frac{u - 5w}{4}$

7) Square root both sides to get '$v = \pm$ ...' $(\sqrt{\ }\ )$ $v = \pm\sqrt{\frac{u - 5w}{4}}$ (Don't forget the $\pm$!)

EXAMPLE: Make n the subject of the formula $m = \sqrt{n + 5}$.

1) Get rid of any square roots by squaring both sides. $m^2 = n + 5$

($\sqrt{n}$ means the positive square root, so we don't need $\pm$ it.)

There aren't any fractions so ignore step 2.
There aren't any brackets so ignore step 3.

4) Collect all the subject terms on one side and all non-subject terms on the other.
(-5) $n = m^2 - 5$ This is in the form '$n =$ ...' so you don't need to do steps 5-7.

...the Subject Appears Twice (B)

Go home and cry. No, not really — you'll just have to do some factorising, usually in step 5.

EXAMPLE: Make p the subject of the formula $q = \frac{p + 1}{p - 1}$.

There aren't any square roots so ignore step 1.

2) Get rid of any fractions. $q(p - 1) = p + 1$ 3) Multiply out any brackets. $pq - q = p + 1$

4) Collect all the subject terms on one side and all non-subject terms on the other.
$pq - p = q + 1$

5) Combine like terms on each side of the equation. $p(q - 1) = q + 1$ (This is where you factorise — p was in both terms on the LHS so it comes out as a common factor.)

6) Divide both sides by $(q - 1)$ to give '$p =$ ...' $p = \frac{q + 1}{q - 1}$ (p isn't squared, so you don't need step 7.)

Factorising Quadratics

There are several ways of solving a quadratic equation as detailed on the following pages. You need to know all the methods as they sometimes ask for specific ones in the exam.

Factorising a Quadratic (B)

1) 'Factorising a quadratic' means 'putting it into 2 brackets'.
2) The standard format for quadratic equations is: $ax^2 + bx + c = 0$.
3) Most exam questions have $a = 1$, making them much easier. E.g. $x^2 + 3x + 2 = 0$ (Use next step for when $a \neq 1$.)
4) As well as factorising a quadratic, you might be asked to solve it. This just means finding the values of x that make each bracket 0 (see example below).

Factorising Method when a = 1 (B)

1) ALWAYS rearrange into the STANDARD FORMAT: $ax^2 + bx + c = 0$.
2) Write down the TWO BRACKETS with the x's in: $(x \quad)(x \quad) = 0$.
3) Then find 2 numbers that MULTIPLY to give 'c' (the end number) but also ADD/SUBTRACT to give 'b' (the coefficient of x). (Ignore any minus signs at this stage.)
4) Fill in the +/- signs and make sure they work out properly.
5) As an ESSENTIAL CHECK, expand the brackets to make sure they give the original equation.
6) Finally, SOLVE THE EQUATION by setting each bracket equal to 0.

You only need to do step 6) if the question asks you to solve the quadratic — if it just tells you to factorise, you can stop at step 5).

EXAMPLE: Solve $x^2 - x = 12$.

1) $x^2 - x - 12 = 0$ ← 1) Rearrange into the standard format.
2) $(x \quad)(x \quad) = 0$ ← 2) Write down the initial brackets.
3) 1 × 12 Add/subtract to give: 13 or 11
2 × 6 Add/subtract to give: 8 or 4
3 × 4 Add/subtract to give: 7 or 1
← 3) Find the right pairs of numbers that multiply to give c (= 12), and add or subtract to give b (= 1) (remember, we're ignoring the +/- signs for now).
$(x \quad 3)(x \quad 4) = 0$ This is what we want.
4) $(x + 3)(x - 4) = 0$ ← 4) Now fill in the +/- signs so that 3 and 4 add/subtract to give -1 (= b).
5) Check:
$(x + 3)(x - 4) = x^2 - 4x + 3x - 12$
$= x^2 - x - 12$ ✓
← 5) ESSENTIAL check — EXPAND the brackets to make sure they give the original equation.
But we're not finished yet — we've only factorised it, we still need to...
6) $(x + 3) = 0 \Rightarrow x = -3$
$(x - 4) = 0 \Rightarrow x = 4$
← 6) SOLVE THE EQUATION by setting each bracket equal to 0.

Bring me a biscuit or I'll factorise your quadratic...

Solving Equations

Now you know the basics of solving equations, it's time to put it all together into a handy step-by-step method.

Solving Equations Using the 6-Step Method (B)

Here's the method to follow (just ignore any steps that don't apply to your equation):

1) Get rid of any fractions.
2) Multiply out any brackets.
3) Collect all the x-terms on one side and all number terms on the other.
4) Reduce it to the form '$Ax = B$' (by combining like terms).
5) Finally divide both sides by A to give '$x =$ ', and that's your answer.
6) If you had '$x^2 =$ ' instead, square root both sides to end up with '$x = \pm$ '.

EXAMPLE: Solve $\frac{3x+4}{5} + \frac{4x-1}{3} = 14$

1) Get rid of any fractions. (×5), (×3) — Multiply everything by 5 then by 3.

$$\frac{5 \times 3 \times (3x+4)}{5} + \frac{5 \times 3 \times (4x-1)}{3} = 5 \times 3 \times 14$$

$$3(3x+4) + 5(4x-1) = 210$$

2) Multiply out any brackets. $9x + 12 + 20x - 5 = 210$

3) Collect all the x-terms on one side and all number terms on the other.

(−12), (+5) $9x + 20x = 210 - 12 + 5$

4) Reduce it to the form '$Ax = B$' (by combining like terms).

$29x = 203$

5) Finally divide both sides by A to give '$x =$ ', and that's your answer.

(÷29) $x = 7$ (You're left with '$x =$ ' so you can ignore step 6.)

Dealing With Squares (B)

If you're unlucky, you might get an x^2 in an equation. If this happens, you'll end up with '$x^2 = \ldots$' at step 5, and then step 6 is to take square roots. There's one very important thing to remember: whenever you take the square root of a number, the answer can be positive or negative...

EXAMPLE: Solve $3x^2 = 75$.

You always get a +ve and -ve version of the same number (your calculator only

Rearranging Formulas

Rearranging formulas means making one letter the subject, e.g. getting '$y =$ ' from '$2x + z = 3(y + 2p)$' — you have to get the subject on its own.

Use the Solving Equations Method to Rearrange Formulas (C)

Rearranging formulas is remarkably similar to solving equations. The method below is identical to the method for solving equations, except that I've added an extra step at the start.

1) Get rid of any square root signs by squaring both sides.
2) Get rid of any fractions.
3) Multiply out any brackets.
4) Collect all the subject terms on one side and all non-subject terms on the other.
5) Reduce it to the form '$Ax = B$' (by combining like terms). You might have to do some factorising here too.
6) Divide both sides by A to give '$x =$ '.
7) If you're left with '$x^2 =$ ', square root both sides to get '$x = \pm$ ' (don't forget the ±).

x is the subject term here. A and B could be numbers or letters (or a mix of both).

What To Do If...

...the Subject Appears in a Fraction (C)

You won't always need to use all 7 steps in the method above — just ignore the ones that don't apply.

EXAMPLE: Make b the subject of the formula $a = \frac{5b+3}{4}$.

There aren't any square roots, so ignore step 1.

2) Get rid of any fractions. (by multiplying every term by 4, the denominator) (×4) $4a = \frac{4(5b+3)}{4}$

$4a = 5b + 3$

There aren't any brackets so ignore step 3.

4) Collect all the subject terms on one side and all non-subject terms on the other. (remember that you're trying to make b the subject) (−3) $5b = 4a - 3$

5) It's now in the form $Ax = B$. (where $A = 5$ and $B = 4a - 3$)

6) Divide both sides by 5 to give '$b =$ '. (÷5) $b = \frac{4a-3}{5}$

b isn't squared, so you don't need step 7.