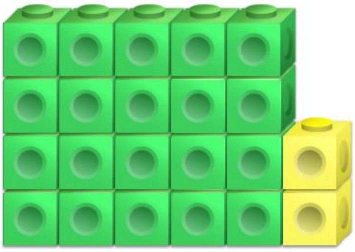
Problem of the Week: Week 1 (Summer 2): Year 8: Algebra: Arithmetic sequences and simple factorising

- Recognise arithmetic sequences and find the nth term
- Simplify and manipulate algebraic expressions by taking out common factors
- Solve linear equations, including factorising

Problem

This picture shows the 5th term of a pattern made with cubes to represent the sequence $4n + 2$.



- What in the picture shows that it's the 5th term?
- What in the picture shows that $4n$ is a part of the rule for the sequence?
- What in the picture shows that +2 is a part of the rule for the sequence?
- Describe the arrangement of cubes for the 24th term
- How many cubes would be in the 24th pattern?

Solutions

- 5th term is represented by the 5 columns
- $4n$ is shown by each column having 4 cubes, so each time a column is added there are 4 more cubes
- +2 is shown by the 2 yellow cubes at the end
- The 24th pattern would have 24 columns of 4 green cubes with 2 yellow cubes on the end
- To find the number of cubes in the 24th pattern:

  $(4 \times 24) + 2 = 98$ cubes

https://www.ncetm.org.uk/resources/47230 (secondary assessment materials)

Problem

The simple life

Which is the odd one out?

1. $(3x+4y)+2(x+2y)$
2. $4(2x+5y)-3(x+4y)$
3. $3(2x+3y)-(x-y)$
4. $3(x+3y)+(2x-y)$

Now combine pairs of expressions to get $5x+8y$. The only expressions that you are allowed to use are:

$(x+y)$ $(x+2y)$ $(x-2y)$ $(x+4y)$ $(2x+3y)$

You can pick any two of these expressions and add or subtract multiples of each.

How many solutions can you find?

Solutions

1. $(3x+4y)+2(x+2y) = 3x + 4y + 2x + 4y = 5x + 8y$
2. $4(2x+5y)-3(x+4y) = 8x + 20y - 3x - 12y = 5x + 8y$

3. $3(2x+3y)-(x-y) = 6x+9y-x+y = 5x+10y$
4. $3(x+3y)+(2x-y) = 3x+9y+2x-y = 5x+8y$

This shows that number 3 is the odd one out

Pairs of expressions to make **$5x + 8y$**

$(x + 2y) + 2(2x + 3y)$ $3(x + 4y) + 2(x - 2y)$ $3(2x + 3y) - (x + y)$ $6(x + y) - 1(x - 2y)$

https://nrich.maths.org/13207

Problem

Pete is solving a linear equation. He draws this bar model to help.

- What equation is Pete solving?
- What is the value of t?
- How do you know what the value of t is?

https://www.ncetm.org.uk/resources/47230 (secondary assessment materials)

solutions:

- Pete is solving the equation: $3t + 7 = 2t + 10$
- $t = 3$
- The diagram shows that $t + 7 = 10$, therefore $t = 3$

Problem

Tom says, when you factorise the expression ***$6xy + 3x - 12xy$***, the answer is:

$3xy(2 + 3x - 4)$

Is Tom right?

Give reasons for your answer

Solution:

Tom is wrong

Reason 1: when you multiply put $3xy(2 + 3x - 4)$, the answer is:

$6xy + 9x^2y - 12xy$

$= -6xy + 9x^2y$, this is not equivalent to $6xy + 3x - 12xy$

Reason 2: the common factors of each term in ***$6xy + 3x - 12xy$*** are:

3 and x, y is not a common factor, so the solution is:

$3x(2y + 1 - 4y)$

$= 3x(1 - 2y)$

HIAS HOME LEARNING