Network News *E018 scoring rubric*

Math Domain

☑ Number/Quantity	☐ Shape/Space	☑ Function/Pattern
☐ Chance/Data	☐ Arrangement	

Math Actions (possible weights: 0 through 4)

2 Modeling/Formulating	2 Manipulating/Transforming
3 Inferring/Drawing Conclusions	2 Communicating

Math Big Ideas

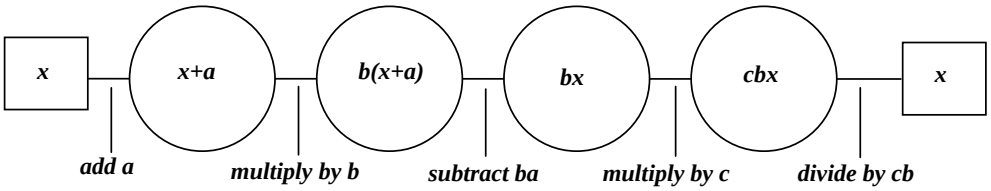
☐ Scale	☐ Reference Frame	☐ Representation
☐ Continuity	☐ Boundedness	☐ Invariance/Symmetry
☐ Equivalence	☐ General/Particular	☐ Contradiction
☐ Use of Limits	☐ Approximation	☐ Other

The intent of this task is to have students demonstrate arithmetic computation skills, specifically the relation between addition and its inverse, multiplication and its inverse, and the effects of the distributive law.

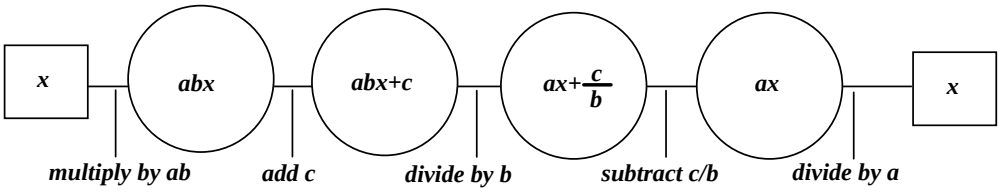
It takes some care to follow the operations in the network correctly, but in the end, the "in" number should be identical to the "out" number for any branch of the network.

Students will often manage to design a workable path by using a multiple of the numbers in any given branch, without changing the order of the arithmetic processes. Another approach is to design a branch that uses only addition and subtraction, or multiplication and division. It may take some work to balance the terms, but the result is less interesting than the combined operations demonstrated in the given branches.

Why do these networks work? To look at the problem algebraically, each branch of the network has either this structure:



or this structure:



If you use any numbers ***a***, ***b*** and ***c***, provided no one of them is zero, this procedure guarantees that the number ***x*** that emerges is simply the number that was put in.

Elementary students may describe this as a process in which the multiplications and divisions "balance out" or "cancel out." Even though the numbers that are being added and subtracted are not the same, whichever is done first is immediately acted upon by a multiplication or a division, which has the net effect of enlarging its value or reducing it so that it matches the net result of its inverse operation.

	partial level	full level
Modeling/ Formulating (weight: 2)	Make a new branch with **only** addition/subtraction **or multiplication/division**	Make a new branch with **both** addition/subtraction **and** multiplication/division
Transforming/ Manipulating (weight: 2)	Make no more than one error per branch.	Do all computations correctly.
Inferring/ Drawing Conclusions (weight: 3)	Argue that opposite operations compensate for each other.	Additionally, take the distributive property into account.
Communicating (weight: 2)	Give a somewhat complete verbal, iconic or symbolic explanation.	Give a clear, complete explanation, possibly using more than one representation.