Team names: ____

Two key applications of algebra are to find unknown quantities by *solving equations* and to make expressions to *model relationships* or make predictions. Working with and simplifying equations is a useful skill for both but they can be represented in different ways.

Application Exercise 1

Backtracking is a method that shows the operations in order and works backwards to solve the equation:

The equation for converting °Celsius to °Fahrenheit is: $F = \dfrac{9C}{5} + 32$

This can be represented as: $\boxed{C} \xrightarrow{\times 9} \boxed{} \xrightarrow{\div 5} \boxed{} \xrightarrow{+32} \boxed{F}$

e.g. to convert 100°C to °F: $\boxed{100} \xrightarrow{\times 9} \boxed{900} \xrightarrow{\div 5} \boxed{180} \xrightarrow{+32} \boxed{212}$

…or 68°F backwards to °C: $\boxed{20} \underset{\div 9}{\overset{\times 9}{\leftarrow}} \boxed{180} \underset{\times 5}{\overset{\div 5}{\leftarrow}} \boxed{36} \underset{-32}{\overset{+32}{\leftarrow}} \boxed{68}$

Which of these temperatures is easiest to convert by backtracking?

(A) 37°C (B) $13\frac{1}{3}$°C (C) -40°F (D) 356°F

Application Exercise 2

A ‘mathemagical’ trick may be performed like so:

“Think of a number.

Multiply it by six.

Subtract four.

Halve it.

Add three.

What was your number?

You started with…”

Written **algebraically**:

$$y = \frac{6x - 4}{2} + 3$$

where x is the starting number and y is the final number. Or:

$$\boxed{x} \xrightarrow{\times 6} \boxed{} \xrightarrow{-4} \boxed{} \xrightarrow{\div 2} \boxed{} \xrightarrow{+3} \boxed{y}$$

To perform the trick, the mathemagician needs to work backwards but the equation may be simplified:

$$\begin{aligned} y &= \frac{{}^{3}\cancel{6}x - {}^{2}\cancel{4}}{{}^{1}\cancel{2}} + 3 \\ &= 3x \cancel{- 2 + 3} \\ &= 3x + 1 \end{aligned}$$

$$\boxed{x} \underset{\div 3}{\overset{\times 3}{\rightleftarrows}} \boxed{} \underset{-1}{\overset{+1}{\rightleftarrows}} \boxed{y}$$

So the mathemagician only needs to subtract one and divide by three to get the starting number. *Try performing this trick now.*

Which of these equations would make the best trick?

(A) $y = \dfrac{4(x - 1 + 5)}{2}$

(B) $x = \dfrac{2x + x}{3}$

(C) $y = \dfrac{2(3(x + 2) - 6) + 42}{6}$

(D) $4 = \dfrac{3(2x + 8)}{6} - x$

Minimum evidence: How would the trick be performed?

Application Exercise 3

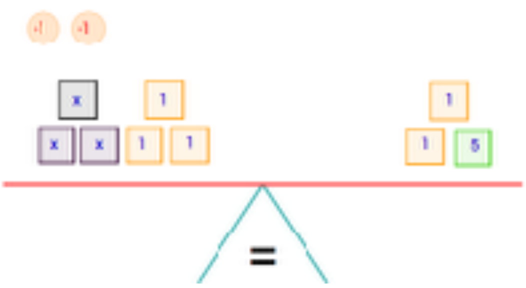
Balancing solves the equation by applying the same operation to both sides of the equal sign. This can be represented by scales or a see-saw.

Access online interactives: ggbm.at/PJttmZNY

Move the numbers until you have an x on one side and integers on the other, while keeping the equation balanced; to solve for x.

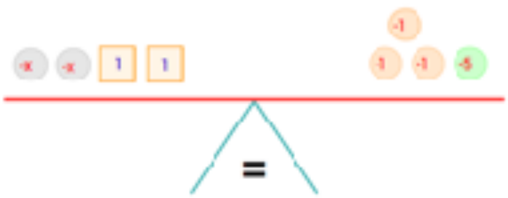
Which of these is easiest to solve by balancing?

(A)

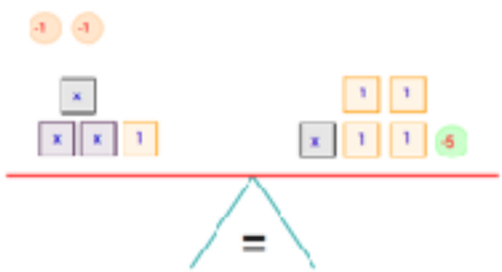


(B)

(C)



(D)



Application Exercise 4

The following are four representations of the same equation.

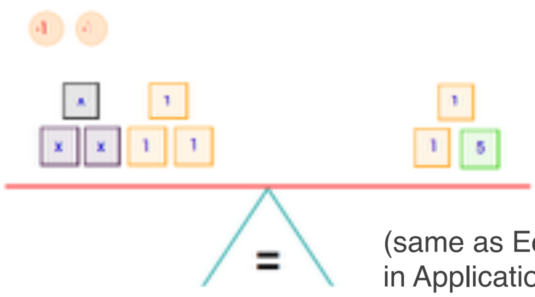
Which representation is the most helpful?

(A) Three more than half of four less than six times a number is seven.

(B) $$\frac{6x - 4}{2} + 3 = 7$$

(C) $$\boxed{x} \xrightarrow{\times 6} \boxed{} \xrightarrow{-4} \boxed{} \xrightarrow{\div 2} \boxed{} \xrightarrow{+3} \boxed{7}$$

(D)



(same as Equation A in Application Exercise 3)

Minimum evidence: Try solving the equation.

What are the advantages of each? Why does part D show 3x?