TARGET GAME

Combine the two given numbers using one of the operations addition +, subtraction -, or multiplication x, and each number once and only once, to get as close to the target number as possible.

1. Target -10 with (-3) and (-5);
2. Target -60 with (-6) and (+9);
3. Target +45 with (-5) and (-9);
4. Target the minimum number you can get by combining (-9) and (+2).

Example: for -7 and +9,

use $(+9) - (-7) = +15$ to hit the maximum and $(+9) \times (-7) = (-63)$ to hit the minimum.

The nearest to -35 is $(-7) - (+9) = (-16)$ and the nearest to 0 is $(+9) + (-7) = (+2)$.

TARGET GAME RULES

The aim is to get as close to the target as possible. Players score 5 points if they hit the target. If nobody hits the target, players getting nearest to the target score 2 points.

This game can be played by a whole class with the teacher deciding on the best answer. Or it can be played by any number of players when they need to agree between themselves on the best answer for each round.

Cut out the cards on page 2. Mix up the numbered cards and place them face down. Also mix the target cards and place them face down.

Turn over the top two number cards and one target card. All the players must write down the two numbers and choose an operation to combine them to get as near to the target as possible. Then the players check their answers and the scores are recorded. The first player to reach 20 points wins the game.

HELP

Use of a number line to carry out the operations.

Think of numbers defined by both LENGTH and DIRECTION
positive numbers with a direction to the right
and negative numbers with a direction to the left.
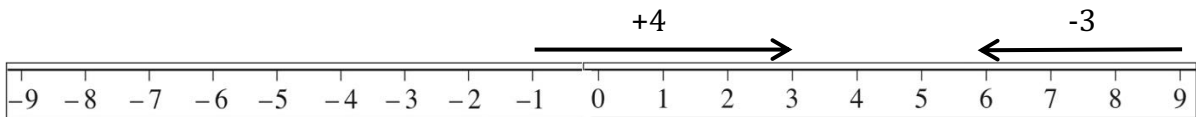
ADDITION

Start at 1st number. Move distance and direction given by 2nd number.

$$1 + (+4) = +3$$
$$-1 + (-4) = -5$$
$$+9 + (-3) = +6$$
$$+9 + (+3) = +12$$

SUBTRACTION

Reverse the direction of the number

$$-1 - (+4) = -5$$
$$-1 - (-3) = +2$$
$$+9 - (+4) = +5$$
$$+9 - (-3) = +12$$

MULTIPLICATION

Start at 0.
Move the distance given by one number the number of times given by the other
in the direction of that number if the other number is positive
knowing that the number line extends infinitely far in both directions

$$(-3) \times (+4) = -12$$
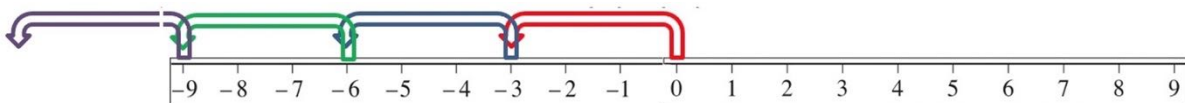
reversing the direction if the other number is negative

$(+4) \times (-3) = -12$ which shows that multiplying 2 integers gives the same answer in whichever order the numbers come, in other words multiplication is commutative.
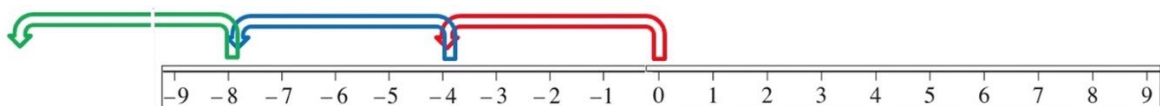
DIVISION

Work from the product: (-3) × (+4) = -12

$$so \ (-12) \div (-3) = (+4)$$
$$(-12) \div (+4) = (-3)$$

This target game can be played with the rule that all numbers must be integers.

You can vary the rules so that players can get nearer to the target using division of integers that give fractions as answers.

FRACTIONS – THE SAME RULES APPLY

$$\left(+\frac{3}{4}\right) \times (+4) = (+3) \qquad \Leftrightarrow \qquad (+3) \div (+4) = \left(+\frac{3}{4}\right)$$

$$\left(+\frac{3}{4}\right) \times (-4) = (-3) \qquad \Leftrightarrow \qquad (-3) \div (-4) = \left(+\frac{3}{4}\right)$$

$$\left(-\frac{3}{4}\right) \times (+4) = (-3) \qquad \Leftrightarrow \qquad (-3) \div (+4) = \left(-\frac{3}{4}\right)$$

$$\left(-\frac{3}{4}\right) \times (-4) = (+3) \qquad \Leftrightarrow \qquad (+3) \div (-4) = \left(-\frac{3}{4}\right)$$

NEXT

An advanced version of the game could be played with 3 numbers so that there are more cases to consider.

RULES FOR THE TARGET GAME

FOR EACH GAME YOU NEED TO CUT OUT AND MIX ONE SET OF CARDS. Use an envelope for the integer cards and another envelope for the targets.

For each round of the game pick 2 integer cards at random and one target card.

The aim is to get as close to the target as possible. Players score 5 points if they hit the target.

If nobody hits the target players getting nearest to the target score 2 points.

Mix up the numbered cards and place them face down.

Mix the target cards and place them face down.

Turn over the top two number cards and one target card.

All the players must write down the two numbers and choose an operation to combine them to get as near to the target as possible. Then check your answers with each other.

Agree on the points to be awarded and record the scores. The first player to reach 20 points wins the game.

0	+1	+2	+3	+4
+5	+6	+7	+8	+9
⁻1	⁻2	⁻3	⁻4	⁻5
⁻6	⁻7	⁻8	⁻9	MINIMUM
NEAREST TO ⁻10	NEAREST TO ⁺75	NEAREST TO 0	NEAREST TO ⁻7	MAXIMUM
NEAREST TO ⁻35	NEAREST TO ⁻60	NEAREST TO ⁺15	NEAREST TO ⁺45	NEAREST TO ⁺8

NOTES FOR TEACHERS

SOLUTION	
Target -10 with (-3) and (-5)	Nearest (-3) + (-5) = (-8)
Target -60 with (-6) and (+9)	Nearest (-6) × (+9) = (-54)
Target +45 with (-5) and (-9)	Nearest (-5) × (-9) = (+45)
Target the minimum number with (-9) and (+2)	Minimum (-9) - (+2) = (-11)

Why do this activity?

Through playing this game learners will get practice in number work with positive and negative integers in an enjoyable way. The desire to win will motivate learners to learn and remember their multiplication tables and to understand and remember the rules for numerical operations with positive and negative numbers. The game can be played frequently for a few minutes each time to reinforce the rules. Learners need to think mathematically, to try the 4 possible cases, and to decide which is nearest to the target. This will also reinforce the idea that addition and multiplication are commutative whereas subtraction and division are not commutative. Also the game reinforces the idea that addition an subtraction are inverse operations, and also multiplication and division are inverse operations.

Learning objectives

In doing this activity students will have an opportunity to:
* develop number sense;
* practice and deepen understanding of calculations with integers;
* learn to think of integers as directed numbers (or vectors);
* develop understanding of commutativity;
* develop understanding of inverse operations

Generic competences

In doing this activity students will have an opportunity to:
* think flexibly, be creative and innovative and apply knowledge and skills;
* develop the skill of visualization and interpreting and creating visual images to represent concepts

SUGGESTIONS FOR TEACHING

Explain to the class that they are going to play a game involving integers and that they need to learn how to play the game. Write -7 and +9 on the board and tell the class that they must combine these numbers using only + or – or × to get the largest (or maximum) answer. Ask the learners to try it and then to explain how they found the maximum. Similarly, they should combine the numbers to get the minimum answer.

As another example, tell them that they must find the nearest answer to zero. Explain the rules of the game, explain that you will give them 2 numbers and a target number and that the aim is to get as close to the target as possible. Players score 5 points if

they hit the target. If nobody hits the target players getting nearest to the target score 2 points. Play a few trial rounds of the game as a class until you are sure everyone understands what to do. Then tell the class that the first player to reach 20 points wins the game. Play the game with players keeping their own scores. You can make your own cards or copy and cut out the cards one page 3.

Organize the class so that the learners play the game in small groups with their own set of cards.

Key questions

- Tell me all the different ways you can combine the two numbers. Can you find any other ways to combine the two numbers?
- How close is your answer to the target? How do you know that?
- How many different ways can you combine the two numbers? Do some ways give the same answer every time?
- Show me the answers for combining the two numbers in all the different ways?
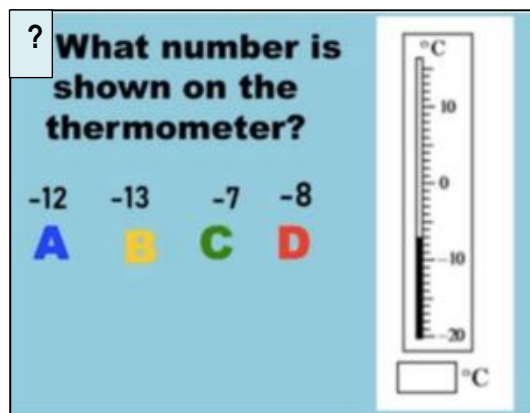- Which one of your answers is nearest to the target.

DIAGNOSTIC ASSESSMENT This should take about 5–10 minutes.

Write the question on the board, say to the class:
"Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 for D".

1. Notice how the learners respond. Ask a learner who gave answer A to explain why he or she gave that answer. DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
2. It is important for learners to explain the reasons for their answers. Putting thoughts into words may help them to gain better understanding and improve their communication skills.
3. Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
4. Ask the class to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers.
5. If the concept is needed for the lesson to follow, explain the right answer or give a remedial task.

? **What number is shown on the thermometer?**

-12 -13   -7   -8
A   **B**   **C**   **D**

The correct answer is: D

Follow up
Tug of War https://aiminghigh.aimssec.ac.za/tug-of-war/
Extremes https://aiminghigh.aimssec.ac.za/extremes/