2-STEP FUNCTION MACHINES (ALGEBRA)

BUILDING BLOCKS

NAME _____ CLASS _____ DATE _____

KEY IDEA

With algebra: $y \rightarrow \times 3 \rightarrow 3y$ $y \rightarrow + 3 \rightarrow y + 3$

Brackets are worked out first: $2 \times (3 + 4) = 2 \times 7 = 14$

1 Find the output.

a) a → × 5 → ☐

b) a → + 5 → ☐

c) b → ÷ 2 → ☐

d) b → − 1 → ☐

2 Write each of these using algebra.

a) 3 lots of p ☐

b) p add 4 ☐

c) p divided by 6 ☐

d) p take away 2 ☐

3 Work out.

a) $3 \times (2 + 5) =$ ☐

b) $3 \times 2 + 5 =$ ☐

c) $(8 - 2) \div 3 =$ ☐

d) $8 - 2 \div 2 =$ ☐

4 A cube is y and a counter is 1. A cube goes into each machine.
How many cubes and counters come out?

a)  → × 2 → + 3 →

cubes ☐ ones ☐

b)  → × 3 → + 1 →

cubes ☐ ones ☐

5 Find the output.

a) 4 → × 2 → + 5 → ☐

b) 6 → + 1 → × 3 → ☐

6 Tom says that $y \rightarrow \times 2 \rightarrow + 5$ gives $7y$. Test his idea with $y = 10$. Is Tom right?

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SUPPORT

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KEY IDEA

p → × 3 → + 4 → 3p + 4



Multiply first, then add.

p → + 4 → × 3 → 3(p + 4)

Add first, then multiply: brackets show the + 4 happened first.

1 Find the output.

a) x → × 2 → + 5 → ☐

b) x → × 4 → − 1 → ☐

c) y → ÷ 3 → + 2 → ☐

d) y → × 10 → − 3 → ☐

2 Find the output. You will need brackets.

a) a → + 3 → × 2 → ☐

b) a → − 1 → × 5 → ☐

c) b → + 4 → ÷ 2 → ☐

d) b → − 6 → × 3 → ☐

3 Circle the correct output.

a) c → × 3 → + 2 → ☐ 5c 3c + 2 3(c + 2)

b) c → + 2 → × 3 → ☐ 3c + 2 3(c + 2) 5c

4 Jake says the output of this machine is 7d.

d → × 3 → + 4 → 7d

a) Explain Jake's mistake. .....

b) What is the correct output? ☐

5 Fill in the boxes.

a) 5y − 3 means × ☐ then − ☐

b) $\frac{w}{4}$ + 1 means ÷ ☐ then + ☐

2-STEP FUNCTION MACHINES (ALGEBRA)

CORE

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KEY IDEA

m → × 7 → – 2 gives 7m – 2. m → – 2 → × 7 gives 7(m – 2). n → + 1 → ÷ 5 gives $\frac{n+1}{5}$

Use brackets (or a fraction bar) when + or – happens before × or ÷.

1 Find the output.

a) m → × 7 → – 2 → ☐

b) m → – 2 → × 7 → ☐

c) n → ÷ 5 → + 1 → ☐

d) n → + 1 → ÷ 5 → ☐

e) 2k → × 3 → + 1 → ☐

f) k → square → × 4 → ☐

2 Find the input.

a) ☐ → × 2 → + 3 → 6y + 3

b) ☐ → × 3 → – 5 → 12p – 5

c) ☐ → + 2 → × 5 → 5(3r + 2)

d) ☐ → ÷ 2 → + 6 → $\frac{q}{2} + 6$

3 Tick the correct machines. Correct the output of any that are wrong.

a) a → × 3 → + 2 → 5a ☐

b) b → + 2 → × 3 → 3b + 2 ☐

c) c → ÷ 4 → – 3 → $\frac{c-3}{4}$ ☐

d) d → × 2 → – 1 → 2d – 1 ☐

4 Complete the table for this machine.

input → × 2 → + 5 → output

input	output
x	
4y	
10	
	2a + 5

5 Does the order of the steps matter? Compare n → × 2 → + 6 with n → + 6 → × 2. Write both outputs and test them with n = 1.

2-STEP FUNCTION MACHINES (ALGEBRA)

GREATER DEPTH

NAME _____ CLASS _____ DATE _____

1 Write the output. Could one step do the same job? If so, write it.

a) a → × 2 → × 3 → ☐ → ☐ (1 step?)

b) a → + 5 → − 2 → ☐ → ☐ (1 step?)

c) a → × 4 → ÷ 2 → ☐ → ☐ (1 step?)

d) a → × 2 → + 3 → ☐ → ☐ (1 step?)

2 Find two different 2-step machines that turn x into 2x + 4.

x → ☐ → ☐ → 2x + 4 x → ☐ → ☐ → 2x + 4

3 Is each statement always, sometimes or never true? Circle your answer.

If it is sometimes true, give an example of when it is true and when it is not.

a) 2(n + 1) is even when n is a whole number. ALWAYS SOMETIMES NEVER

b) 4y − 1 is greater than 4(y − 1). ALWAYS SOMETIMES NEVER

c) $\frac{x}{2} + 3$ is equal to $\frac{x+3}{2}$ ALWAYS SOMETIMES NEVER

d) $k^2 + 1$ is greater than 2k. ALWAYS SOMETIMES NEVER

4 A cube is x and a counter is 1. This is the output of a 2-step machine.

 

x → ☐ → ☐ → ☐

Write the output in two different ways. ☐ or ☐

CHALLENGE

5 Fill in the missing operations.

x → ☐ → ☐ → 3(x − 4) y → ☐ → ☐ → $\frac{y}{2} - 7$

c) Explain why no 2-step machine that only uses + and − can turn x into 2x + 1.