FUNCTION MACHINES (TWO STEP)

BUILDING BLOCKS

NAME _____ CLASS _____ DATE _____

KEY IDEA

To find a function, ask: what has happened to the input to make the output?

x → × 3 → 3x

x → + 3 → x + 3

1 Find the function.

a) 3 → ☐ → 12

b) 20 → ☐ → 15

c) 18 → ☐ → 6

d) 7 → ☐ → 16

2 Find the function.

a) x → ☐ → 3x

b) x → ☐ → x + 7

c) x → ☐ → $\frac{x}{2}$

d) x → ☐ → x – 5

3 Write the two operations in the order they happen. Start with the first number.

a) 4 × 5 + 2 ☐ ☐

b) (4 + 2) × 5 ☐ ☐

c) 10 ÷ 2 – 3 ☐ ☐

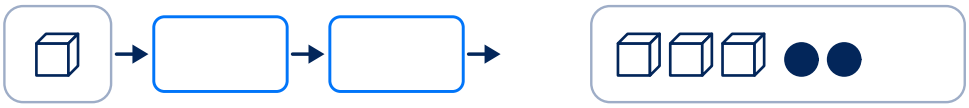
d) (10 – 4) ÷ 2 ☐ ☐

4 Find the missing operation.

a) 3 → × 2 → ☐ → 10

b) 5 → ☐ → – 1 → 14

5 A cube is x and a counter is 1. What two steps have happened?



6 Find two different functions for each machine.

a) 5 → ☐ → 15 or ☐

b) x → ☐ → 2x or ☐

FUNCTION MACHINES (TWO STEP)

SUPPORT

NAME _____ CLASS _____ DATE _____

KEY IDEA

x → × 3 → + 2 → 3x + 2

3x + 2: multiply by 3, then add 2

x → + 2 → × 3 → 3(x + 2)

3(x + 2): add 2 first (brackets), then multiply

1 Find the two functions.

a) x → ☐ → ☐ → 2x + 1

b) x → ☐ → ☐ → 5x – 3

c) x → ☐ → ☐ → 2(x + 1)

d) x → ☐ → ☐ → 4(x – 3)

e) y → ☐ → ☐ → $\frac{y}{2}$ + 5

f) y → ☐ → ☐ → $\frac{y + 5}{2}$

2 Fill in the boxes.

a) 2x – 5 means × ☐ then – ☐

b) $\frac{y}{3}$ + 1 means ÷ ☐ then + ☐

c) 4(a + 6) means + ☐ then × ☐

3 Find the missing function.

a) x → × 4 → ☐ → 4x + 9

b) x → ☐ → × 2 → 2(x – 7)

4 Lucy filled in this machine. She is wrong.

x → × 5 → + 1 → 5(x + 1)

a) Explain Lucy's mistake. .....

b) Write the correct functions. ☐ ☐

5 Match each expression to its machine. Write the letter.

3x + 1 ☐

3(x + 1) ☐

$\frac{x}{3}$ + 1 ☐

A x → + 1 → × 3 → ☐

B x → ÷ 3 → + 1 → ☐

C x → × 3 → + 1 → ☐

FUNCTION MACHINES (TWO STEP)

CORE

NAME _____ CLASS _____ DATE _____

KEY IDEA

Work out the order: in $6a + 2$ the $\times 6$ came first; in $6(a + 2)$ the $+ 2$ came first; in $\frac{b}{4} - 3$ the $\div 4$ came first.

Write the functions, not their inverses.

1 Find the two functions.

a) a → ☐ → ☐ → $6a + 2$

b) a → ☐ → ☐ → $6(a + 2)$

c) b → ☐ → ☐ → $\frac{b}{4} - 3$

d) b → ☐ → ☐ → $\frac{b - 3}{4}$

e) c → ☐ → ☐ → $c^2 + 1$

f) $2d$ → ☐ → ☐ → $6d - 1$

2 Tick the correct machines. Correct the functions in any that are wrong.

a) a → × 5 → + 1 → $5(a + 1)$ ☐ correct: ☐ ☐

b) b → ÷ 2 → + 5 → $5 + \frac{b}{2}$ ☐ correct: ☐ ☐

c) c → ÷ 4 → − 3 → $\frac{c - 3}{4}$ ☐ correct: ☐ ☐

3 Find two different ways to turn x into $2x + 4$.

x → ☐ → ☐ → $2x + 4$

x → ☐ → ☐ → $2x + 4$

4 This table shows inputs and outputs of a 2-step machine.

input	output
x	$4x - 1$
3	11
10	39

a) Write the two functions. ☐ ☐

b) Find the output when the input is 2.5 ☐

5 Use $a = 6$ to explain the difference between $\frac{a + 4}{2}$ and $\frac{a}{2} + 4$.

FUNCTION MACHINES (TWO STEP)

GREATER DEPTH

NAME _____ CLASS _____ DATE _____

1 Find the two functions. Be careful: the inputs are not single letters.

a) 2y → ☐ → ☐ → 6y + 5

b) 3m + 1 → ☐ → ☐ → 6m + 5

c) 4n → ☐ → ☐ → 2n – 3

d) p – 1 → ☐ → ☐ → 3p + 1

2 a) Find two different machines that turn x into 6x + 12.

x → ☐ → ☐ → 6x + 12

x → ☐ → ☐ → 6x + 12

b) Find three different machines that turn x into 4x.

→ ☐ → ☐ →

→ ☐ → ☐ →

→ ☐ → ☐ →

3 True or false? Circle your answer.

a) $\frac{x}{2}$ + 3 is made by ÷ 2 then + 3. TRUE FALSE

b) 3(x + 5) is made by × 3 then + 5. TRUE FALSE

c) × 2 then + 6 gives the same output as + 3 then × 2. TRUE FALSE

d) $\frac{x+4}{2}$ can be made by + 4 then ÷ 2, or by ÷ 2 then + 2. TRUE FALSE

4 These machines use powers and roots. Find the two functions.

a) x → ☐ → ☐ → $x^2 + 3$

b) x → ☐ → ☐ → $(x + 3)^2$

c) x → ☐ → ☐ → $\sqrt{x} - 1$

d) x → ☐ → ☐ → $2x^2$

CHALLENGE

5 Jo says, "x → × 3 → + 6 and x → + 2 → × 3 are the same machine." Test both machines with x = 4 and x = 10. Is Jo right? Explain.

Write the output of Jo's machines in two ways. ☐ or ☐