

Name _____

Date _____

9.3 Functions and function machines — worksheet

Use function machines and mapping diagrams, find inputs from outputs, and write a function algebraically. · 69 questions · Show your working.

Remember

- A **function** turns each input into exactly one output.
- A **function machine** shows the operations in order, left to right.
- To go forwards, apply the operations in order.
- To go **backwards**, use the **inverse** of each operation, in **reverse order**.
- Inverses: + and −; $\times$ and $\div$.
- Order matters. “ $\times 2$ then + 1” is $y = 2x + 1$; “+ 1 then $\times 2$ ” is $y = 2(x + 1)$.
- A **mapping diagram** draws an arrow from each input to its output.
- Writing the machine as $y = \dots$ turns it into algebra, which is where Unit 11 picks it up.

A · Fluency — Forwards, backwards and in algebra.

- 1 A function machine does + 3. What comes out when 4 goes in?

- 2 A function machine does + 3. What comes out when 10 goes in?

- 3 A function machine does $\times 2$. What comes out when 4 goes in?

- 4 A function machine does $\times 2$. What comes out when 10 goes in?

- 5 A function machine does − 5. What comes out when 4 goes in?

- 6 A function machine does − 5. What comes out when 10 goes in?

- 7 A function machine does $\times 4$. What comes out when 4 goes in?

- 8 A function machine does $\times 4$. What comes out when 10 goes in?

- 9 A function machine does + 10. What comes out when 4 goes in?

- 10 A function machine does + 10. What comes out when 10 goes in?

- 11 A function machine does $\div 2$. What comes out when 4 goes in?

- 12** A function machine does $\div 2$. What comes out when 10 goes in?
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- 13** A function machine does $\times 3$. What comes out when 4 goes in?
-
- 14** A function machine does $\times 3$. What comes out when 10 goes in?
-
- 15** A function machine does $- 8$. What comes out when 4 goes in?
-
- 16** A function machine does $- 8$. What comes out when 10 goes in?
-
- 17** A function machine does $+ 3$. Something went in and 9 came out. What went in?
-
- 18** A function machine does $\times 2$. Something went in and 12 came out. What went in?
-
- 19** A function machine does $- 5$. Something went in and 1 came out. What went in?
-
- 20** A function machine does $\times 4$. Something went in and 24 came out. What went in?
-
- 21** A function machine does $+ 10$. Something went in and 16 came out. What went in?
-
- 22** A function machine does $\div 2$. Something went in and 3 came out. What went in?
-
- 23** A two-step machine does $\times 2$ then $+ 1$. What comes out when 2 goes in?
-
- 24** A two-step machine does $\times 2$ then $+ 1$. What comes out when 5 goes in?
-
- 25** A two-step machine does $\times 3$ then $- 2$. What comes out when 2 goes in?
-
- 26** A two-step machine does $\times 3$ then $- 2$. What comes out when 5 goes in?
-
- 27** A two-step machine does $+ 4$ then $\times 5$. What comes out when 2 goes in?
-
- 28** A two-step machine does $+ 4$ then $\times 5$. What comes out when 5 goes in?
-
- 29** A two-step machine does $\times 4$ then $+ 7$. What comes out when 2 goes in?
-
- 30** A two-step machine does $\times 4$ then $+ 7$. What comes out when 5 goes in?
-
- 31** A two-step machine does $- 1$ then $\times 3$. What comes out when 2 goes in?
-
- 32** A two-step machine does $- 1$ then $\times 3$. What comes out when 5 goes in?
-
- 33** A two-step machine does $\times 5$ then $- 6$. What comes out when 2 goes in?
-
- 34** A two-step machine does $\times 5$ then $- 6$. What comes out when 5 goes in?
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35 The function is $y = x + 5$. What is y when $x = 3$?

36 The function is $y = x + 5$. What is y when $x = 7$?

37 The function is $y = 2x$. What is y when $x = 3$?

38 The function is $y = 2x$. What is y when $x = 7$?

39 The function is $y = 3x - 1$. What is y when $x = 3$?

40 The function is $y = 3x - 1$. What is y when $x = 7$?

41 The function is $y = x - 4$. What is y when $x = 3$?

42 The function is $y = x - 4$. What is y when $x = 7$?

43 The function is $y = 4x + 2$. What is y when $x = 3$?

44 The function is $y = 4x + 2$. What is y when $x = 7$?

45 The function is $y = 5x$. What is y when $x = 3$?

46 The function is $y = 5x$. What is y when $x = 7$?

B · Reasoning — Inverses and why order matters.

47 What does a **function machine** do?

- ☐ Stores numbers
- ☐ Takes an input and produces one output by a rule
- ☐ Counts
- ☐ Draws graphs

48 How do you find the input when you know the output?

- ☐ Guess
- ☐ Apply the same operations again
- ☐ Work backwards, using the inverse of each operation
- ☐ Divide by the output

49 In a two-step machine, in what order do you undo the steps?

- ☐ The same order
- ☐ The reverse order
- ☐ Either order
- ☐ Only the first

- 50** What is the inverse of “ $\times 5$ ”?
- ☐ $\times 5$
 - ☐ $\div 5$
 - ☐ $+ 5$
 - ☐ $- 5$
- 51** What is the inverse of “ $- 7$ ”?
- ☐ $- 7$
 - ☐ $+ 7$
 - ☐ $\times 7$
 - ☐ $\div 7$
- 52** A machine does “ $\times 2$ then $+ 1$ ”. Written as a function that is ...
- ☐ $y = 2x$
 - ☐ $y = 2x + 1$
 - ☐ $y = 2(x + 1)$
 - ☐ $y = x + 2$
- 53** A machine does “ $+ 1$ then $\times 2$ ”. Written as a function that is ...
- ☐ $y = 2x + 1$
 - ☐ $y = 2(x + 1)$
 - ☐ $y = x + 2$
 - ☐ $y = 2x$
- 54** Do “ $\times 2$ then $+ 1$ ” and “ $+ 1$ then $\times 2$ ” give the same output?
- ☐ Yes
 - ☐ No
- 55** In a mapping diagram, what do the arrows show?
- ☐ The rule's name
 - ☐ Which input goes to which output
 - ☐ The size of the numbers
 - ☐ Nothing

C · Challenge — Undoing two steps.

- 56** A machine does “ $\times 3$ then $+ 4$ ”. The output is 25. What was the input?
- _____
- 57** A machine does “ $+ 6$ then $\times 2$ ”. The output is 30. What was the input?
- _____
- 58** A machine does “ $\times 5$ then $- 3$ ”. The output is 32. What was the input?
- _____
- 59** For $y = 4x - 5$, what is x when $y = 23$?
- _____
- 60** For $y = 2x + 9$, what is x when $y = 9$?
- _____
- 61** A machine doubles a number then subtracts 3. Write it as a function starting “ $y =$ ”.
- _____

D · Word problems — Charges, conversions and bills.

- 62** A shop adds \$4 delivery to any order. What is the total on an order of \$26, in dollars?

- 63** A recipe triples for a party. How much flour for a party, if one batch needs 250 g?

- 64** A taxi charges \$3 plus \$2 a km. What is the fare for 8 km, in dollars?

- 65** A phone plan costs \$15 plus \$0.50 a call. A bill is \$25. How many calls were made?

- 66** A machine converts hours to minutes. What comes out when 7 goes in?

- 67** A machine converts metres to centimetres. Something went in and 350 came out. What went in, in metres?

- 68** A printer charges \$5 setup plus \$2 a poster. What is the cost of 12 posters, in dollars?

- 69** A printer charges \$5 setup plus \$2 a poster. A bill is \$37. How many posters?
