

Name _____

Date _____

9.3 Functions and function machines — worked answers

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

A · Fluency — Forwards, backwards and in algebra.

- 1 A function machine does + 3. What comes out when 4 goes in?
Answer: 7
 $4 + 3 = 7.$
- 2 A function machine does + 3. What comes out when 10 goes in?
Answer: 13
 $10 + 3 = 13.$
- 3 A function machine does $\times 2$. What comes out when 4 goes in?
Answer: 8
 $4 \times 2 = 8.$
- 4 A function machine does $\times 2$. What comes out when 10 goes in?
Answer: 20
 $10 \times 2 = 20.$
- 5 A function machine does $- 5$. What comes out when 4 goes in?
Answer: -1
 $4 - 5 = -1.$
- 6 A function machine does $- 5$. What comes out when 10 goes in?
Answer: 5
 $10 - 5 = 5.$
- 7 A function machine does $\times 4$. What comes out when 4 goes in?
Answer: 16
 $4 \times 4 = 16.$
- 8 A function machine does $\times 4$. What comes out when 10 goes in?
Answer: 40
 $10 \times 4 = 40.$
- 9 A function machine does + 10. What comes out when 4 goes in?
Answer: 14
 $4 + 10 = 14.$

- 10** A function machine does $+$ **10**. What comes out when 10 goes in?
Answer: 20
 $10 + 10 = 20$.
- 11** A function machine does $\div$ **2**. What comes out when 4 goes in?
Answer: 2
 $4 \div 2 = 2$.
- 12** A function machine does $\div$ **2**. What comes out when 10 goes in?
Answer: 5
 $10 \div 2 = 5$.
- 13** A function machine does $\times$ **3**. What comes out when 4 goes in?
Answer: 12
 $4 \times 3 = 12$.
- 14** A function machine does $\times$ **3**. What comes out when 10 goes in?
Answer: 30
 $10 \times 3 = 30$.
- 15** A function machine does $-$ **8**. What comes out when 4 goes in?
Answer: -4
 $4 - 8 = -4$.
- 16** A function machine does $-$ **8**. What comes out when 10 goes in?
Answer: 2
 $10 - 8 = 2$.
- 17** A function machine does $+$ **3**. Something went in and 9 came out. What went in?
Answer: 6
Work backwards through the machine: the input was 6, because $6 + 3 = 9$.
- 18** A function machine does $\times$ **2**. Something went in and 12 came out. What went in?
Answer: 6
Work backwards through the machine: the input was 6, because $6 \times 2 = 12$.
- 19** A function machine does $-$ **5**. Something went in and 1 came out. What went in?
Answer: 6
Work backwards through the machine: the input was 6, because $6 - 5 = 1$.
- 20** A function machine does $\times$ **4**. Something went in and 24 came out. What went in?
Answer: 6
Work backwards through the machine: the input was 6, because $6 \times 4 = 24$.
- 21** A function machine does $+$ **10**. Something went in and 16 came out. What went in?
Answer: 6
Work backwards through the machine: the input was 6, because $6 + 10 = 16$.
- 22** A function machine does $\div$ **2**. Something went in and 3 came out. What went in?
Answer: 6
Work backwards through the machine: the input was 6, because $6 \div 2 = 3$.

- 23** A two-step machine does $\times 2$ then $+ 1$. What comes out when 2 goes in?

Answer: 5

First $2 \times 2 = 4$, then that $+ 1$ gives 5.

- 24** A two-step machine does $\times 2$ then $+ 1$. What comes out when 5 goes in?

Answer: 11

First $5 \times 2 = 10$, then that $+ 1$ gives 11.

- 25** A two-step machine does $\times 3$ then $- 2$. What comes out when 2 goes in?

Answer: 4

First $2 \times 3 = 6$, then that $- 2$ gives 4.

- 26** A two-step machine does $\times 3$ then $- 2$. What comes out when 5 goes in?

Answer: 13

First $5 \times 3 = 15$, then that $- 2$ gives 13.

- 27** A two-step machine does $+ 4$ then $\times 5$. What comes out when 2 goes in?

Answer: 30

First $2 + 4 = 6$, then that $\times 5$ gives 30.

- 28** A two-step machine does $+ 4$ then $\times 5$. What comes out when 5 goes in?

Answer: 45

First $5 + 4 = 9$, then that $\times 5$ gives 45.

- 29** A two-step machine does $\times 4$ then $+ 7$. What comes out when 2 goes in?

Answer: 15

First $2 \times 4 = 8$, then that $+ 7$ gives 15.

- 30** A two-step machine does $\times 4$ then $+ 7$. What comes out when 5 goes in?

Answer: 27

First $5 \times 4 = 20$, then that $+ 7$ gives 27.

- 31** A two-step machine does $- 1$ then $\times 3$. What comes out when 2 goes in?

Answer: 3

First $2 - 1 = 1$, then that $\times 3$ gives 3.

- 32** A two-step machine does $- 1$ then $\times 3$. What comes out when 5 goes in?

Answer: 12

First $5 - 1 = 4$, then that $\times 3$ gives 12.

- 33** A two-step machine does $\times 5$ then $- 6$. What comes out when 2 goes in?

Answer: 4

First $2 \times 5 = 10$, then that $- 6$ gives 4.

- 34** A two-step machine does $\times 5$ then $- 6$. What comes out when 5 goes in?

Answer: 19

First $5 \times 5 = 25$, then that $- 6$ gives 19.

- 35** The function is $y = x + 5$. What is y when $x = 3$?

Answer: 8

Substitute $x = 3$: $y = 8$.

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

Answer: 12

Substitute $x = 7$: $y = 12$.

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

Answer: 6

Substitute $x = 3$: $y = 6$.

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

Answer: 14

Substitute $x = 7$: $y = 14$.

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

Answer: 8

Substitute $x = 3$: $y = 8$.

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

Answer: 20

Substitute $x = 7$: $y = 20$.

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

Answer: -1

Substitute $x = 3$: $y = -1$.

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

Answer: 3

Substitute $x = 7$: $y = 3$.

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

Answer: 14

Substitute $x = 3$: $y = 14$.

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

Answer: 30

Substitute $x = 7$: $y = 30$.

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

Answer: 15

Substitute $x = 3$: $y = 15$.

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

Answer: 35

Substitute $x = 7$: $y = 35$.

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

Answer: Takes an input and produces one output by a rule

One input, one output, every time.

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

Answer: Work backwards, using the inverse of each operation

The inverse of $+ 3$ is $- 3$; the inverse of $\times 4$ is $\div 4$.

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

Answer: The reverse order

Last on, first off — like taking off shoes and socks.

50 What is the inverse of “ $\times 5$ ”?

- ☐ $\times 5$
- ☐ $\div 5$
- ☐ $+ 5$
- ☐ $- 5$

Answer: $\div 5$

Multiplying and dividing by the same number undo each other.

51 What is the inverse of “ $- 7$ ”?

- ☐ $- 7$
- ☐ $+ 7$
- ☐ $\times 7$
- ☐ $\div 7$

Answer: $+ 7$

Adding and subtracting the same number undo each other.

52 A machine does “ $\times 2$ then $+ 1$ ”. Written as a function that is ...

- ☐ $y = 2x$
- ☐ $y = 2x + 1$
- ☐ $y = 2(x + 1)$
- ☐ $y = x + 2$

Answer: $y = 2x + 1$

Double first, then add one. Brackets would change the order.

53 A machine does “ $+ 1$ then $\times 2$ ”. Written as a function that is ...

- ☐ $y = 2x + 1$
- ☐ $y = 2(x + 1)$
- ☐ $y = x + 2$
- ☐ $y = 2x$

Answer: $y = 2(x + 1)$

The bracket forces the addition to happen first.

- 54 Do “ $\times 2$ then $+ 1$ ” and “ $+ 1$ then $\times 2$ ” give the same output?

☐ Yes
☐ No

Answer: No

For $x = 3$ they give 7 and 8. Order matters.

- 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

Answer: Which input goes to which output

Each input has exactly one arrow leaving it.

C · Challenge — Undoing two steps.

- 56 A machine does “ $\times 3$ then $+ 4$ ”. The output is 25. What was the input?

Answer: 7

Undo in reverse: $25 - 4 = 21$, then $21 \div 3 = 7$.

- 57 A machine does “ $+ 6$ then $\times 2$ ”. The output is 30. What was the input?

Answer: 9

$30 \div 2 = 15$, then $15 - 6 = 9$.

- 58 A machine does “ $\times 5$ then $- 3$ ”. The output is 32. What was the input?

Answer: 7

$32 + 3 = 35$, then $35 \div 5 = 7$.

- 59 For $y = 4x - 5$, what is x when $y = 23$?

Answer: 7

$4x = 28$, so $x = 7$.

- 60 For $y = 2x + 9$, what is x when $y = 9$?

Answer: 0

$2x = 0$, so $x = 0$.

- 61 A machine doubles a number then subtracts 3. Write it as a function starting “ $y =$ ”.

Answer: $y = 2x - 3$

Double first, then subtract: $y = 2x - 3$.

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?

Answer: 30

$26 + 4 = 30$.

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

Answer: 750

$250 \times 3 = 750$ g.

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

Answer: 19

$$3 + 8 \times 2 = 19.$$

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

Answer: 20

$$25 - 15 = 10, \text{ and } 10 \div 0.5 = 20 \text{ calls.}$$

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

Answer: 420

$$7 \times 60 = 420 \text{ minutes.}$$

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

Answer: 3.5

$$350 \div 100 = 3.5 \text{ m.}$$

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

Answer: 29

$$5 + 12 \times 2 = 29.$$

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

Answer: 16

$$37 - 5 = 32, \text{ and } 32 \div 2 = 16.$$