2.7 Function Machines and Inverse Operations: 2-hour Pack

Calculators not allowed · about 120 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Solve b/9 = 12

(1)

2 A function machine is shown.
input -> [÷ 7] -> [- 2] -> output
Write down the inverse function machine, in the order in which the operations are done to get from the output back to the input.

(2)

3 Solve 9p - 12 = 24

(2)

4 Solve 7 - 3p = 4

(2)

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5 A function machine is shown.
input -> [- 5] -> [÷ 6] -> output
Write down the inverse function machine, in the order in which the operations are done to get from the output back to the input.

(2)

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6 Reverse the function: the machine does add 7. Work out the input when the output is 12.

(2)

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7 I think of a number, x. I multiply it by 7 and then add 4. Write an expression for the result.

(2)

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8 Solve 6b + 14 = -4

(2)

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9 I think of a number, n. I subtract 11 and then divide the result by 7. Write an expression for the result.

(2)

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10 Solve t/5 - 13 = -6

(2)

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11 I think of a number, n. I add 2 and then multiply the result by 5. Write an expression for the result.

(2)

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12 A function machine is shown.
input -> [- 4] -> [÷ 2] -> output
The output is 0. Work out the input.

(2)

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13 Solve b - 9 = -11

(1)

---

14 A function machine is shown.
input -> [+ 2] -> [- 7] -> output
The output is 3. Work out the input.

(2)

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15 Solve b/5 - 15 = -12

(2)

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16 A two-step machine does: multiply by 3, then subtract 4. Work out the output for input 6 and show the two steps.

(3)

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17 Solve a/2 - 7 = 3

(2)

---

18 A function machine is shown.
input -> [x 4] -> [÷ 5] -> output
The output is 4. Work out the input.

(2)

---

19 I think of a number, t. I multiply it by 3 and then add 9. Write an expression for the result.

(2)

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20 Solve b/3 + 7 = -1

(2)

---

21 A function machine is shown.
input -> [- 3] -> [x 9] -> output
The output is 72. Work out the input.

(2)

---

22 I think of a number, x. I multiply it by 6 and then add 4. Write an expression for the result.

.....

.....

(2)

---

23 Solve 6t - 4 = 68

(2)

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24 The machine does: add 10, then divide by 2. For each input, find the output.

(a) Input 6 **(1)**

.....

(b) Input 0 **(1)**

.....

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25 Solve b/6 - 9 = -1

(2)

---

26 A function machine is shown.
input -> [÷ 7] -> [x 5] -> output
Write down the inverse function machine, in the order in which the operations are done to get from the output back to the input.

(2)

---

27 Solve 11 - 6a = 5

(2)

---

28 I think of a number, m. I multiply it by 5 and then add 3. Write an expression for the result.

(2)

---

29 Solve a - 2 = 13

(1)

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30 I think of a number, t. I subtract 4 and then divide the result by 8. Write an expression for the result.

(2)

31 Solve a - 19 = -27

(1)

32 Solve n + 17 = 22

(1)

33 Work backwards: a machine does add 4 then multiply by 2. The final output is 18. What was the original input?

(2)

34 Solve x - 14 = -20

(1)

35 Solve t/4 + 10 = 15

(2)

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36 Solve 9a = -63

(1)

37 I think of a number, t. I add 9 and then multiply the result by 7. Write an expression for the result.

(2)

38 A pen costs x pence. Write an expression for the cost of 3 pens and a 6p ruler. Write an expression for the result.

(2)

39 I think of a number, n. I subtract 12 and then divide the result by 7. Write an expression for the result.

(2)

40 I think of a number, n. I multiply it by 4 and then add 8. Write an expression for the result.

(2)

41 I think of a number, m. I multiply it by 8 and then add 10. Write an expression for the result.

(2)

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42 Solve p + 7 = 20

(1)

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43 A function machine does: add 5. Work out the output when the input is 3.

(1)

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44 A machine does: square the number, then add 4. Work out the output for input 5.

(2)

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45 A machine does: add 3, multiply by 4, then subtract 6. The final output is 26. Work backwards to find the original input, showing each inverse step clearly.

(3)

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46 A three-step machine does: subtract 2, multiply by 5, then add 1. The final output is 26. Work backwards to find the original input, showing each inverse step clearly.

(4)

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47 A function machine does: multiply by 4. Work out the output when the input is 6.

(1)

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48 A function machine does: multiply by 3, then add 2. Work out the output when the input is 5.

(1)

---

49 A function machine does: subtract 7. Work out the input if the output is 10.

(1)

---

50 A function machine does: add 9. Work out the input when the output is 15.

(1)

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51 A two-step machine does: multiply by 4, then subtract 3. Work out the output for input 5, showing both steps.

(2)

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Mark scheme · 2.7 Function Machines and Inverse Operations: 2-hour Pack

Question 1

b = 108 cao — B1

Answer: **b = 108**

Question 2

inverse operations identified (at least half correct) — M1

+ 2, x 7 cao — A1

Answer: **+ 2, x 7**

Question 3

correct first step (undoing the + or - or reordering) — M1

p = 4 cao — A1

Answer: **p = 4**

Question 4

correct first step (undoing the + or - or reordering) — M1

p = 1 cao — A1

Answer: **p = 1**

Question 5

inverse operations identified (at least half correct) — M1

x 6, + 5 cao — A1

Answer: **x 6, + 5**

Question 6

recognition of inverse: input = output - 7 — M1

5 cao — A1

Answer: **5**

Question 7

one correct operation applied to the letter, eg a product or a sum — M1

7x + 4 oe cao — A1

Answer: **7x + 4**

Question 8

correct first step (undoing the + or - or reordering) — M1

b = -3 cao — A1

Answer: **b = -3**

Question 9

one correct operation applied to the letter, eg a product or a sum — M1

(n - 11) ÷ 7 oe cao — A1

Answer: **(n - 11) ÷ 7**

Question 10

correct first step (undoing the + or - or reordering) — M1

t = 35 cao — A1

Answer: **t = 35**

Question 11

one correct operation applied to the letter, eg a product or a sum — M1

5(n + 2) oe cao — A1

Answer: **5(n + 2)**

Question 12

uses the inverse operations in reverse order — M1

4 cao — A1

Answer: **4**

Question 13

b = -2 cao — B1

Answer: **b = -2**

Question 14

uses the inverse operations in reverse order — M1

8 cao — A1

Answer: **8**

Question 15

correct first step (undoing the + or - or reordering) — M1

b = 15 cao — A1

Answer: **b = 15**

Question 16

correct first step 6 x 3 = 18 — M1

correct second step 18 - 4 = 14 — M1

14 cao — A1

Answer: **14**

Question 17

correct first step (undoing the + or - or reordering) — M1

a = 20 cao — A1

Answer: **a = 20**

Question 18

uses the inverse operations in reverse order — M1

5 cao — A1

Answer: **5**

Question 19

one correct operation applied to the letter, eg a product or a sum — M1

3t + 9 oe cao — A1

Answer: **3t + 9**

Question 20

correct first step (undoing the + or - or reordering) — M1

b = -24 cao — A1

Answer: **b = -24**

Question 21

uses the inverse operations in reverse order — M1

11 cao — A1

Answer: **11**

Question 22

one correct operation applied to the letter, eg a product or a sum — M1

6x + 4 oe cao — A1

Answer: **6x + 4**

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Question 23

correct first step (undoing the + or - or reordering) **M1**

t = 12 cao **A1**

Answer: **t = 12**

Question 24

(a) 8 cao **B1**

(a) Answer: **8**

(b) 5 cao **B1**

(b) Answer: **5**

Question 25

correct first step (undoing the + or - or reordering) **M1**

b = 48 cao **A1**

Answer: **b = 48**

Question 26

inverse operations identified (at least half correct) **M1**

÷ 5, x 7 cao **A1**

Answer: **÷ 5, x 7**

Question 27

correct first step (undoing the + or - or reordering) **M1**

a = 1 cao **A1**

Answer: **a = 1**

Question 28

one correct operation applied to the letter, eg a product or a sum **M1**

5m + 3 oe cao **A1**

Answer: **5m + 3**

Question 29

a = 15 cao **B1**

Answer: **a = 15**

Question 30

one correct operation applied to the letter, eg a product or a sum **M1**

(t - 4) ÷ 8 oe cao **A1**

Answer: **(t - 4) ÷ 8**

Question 31

a = -8 cao **B1**

Answer: **a = -8**

Question 32

n = 5 cao **B1**

Answer: **n = 5**

Question 33

inverse steps attempted: 18 / 2 = 9 or 9 - 4 **M1**

5 cao **A1**

Answer: **5**

Question 34

x = -6 cao **B1**

Answer: **x = -6**

Question 35

correct first step (undoing the + or - or reordering) **M1**

t = 20 cao **A1**

Answer: **t = 20**

Question 36

a = -7 cao **B1**

Answer: **a = -7**

Question 37

one correct operation applied to the letter, eg a product or a sum **M1**

7(t + 9) oe cao **A1**

Answer: **7(t + 9)**

Question 38

one correct operation applied to the letter, eg a product or a sum **M1**

3x + 6 oe cao **A1**

Answer: **3x + 6**

Question 39

one correct operation applied to the letter, eg a product or a sum **M1**

(n - 12) ÷ 7 oe cao **A1**

Answer: **(n - 12) ÷ 7**

Question 40

one correct operation applied to the letter, eg a product or a sum **M1**

4n + 8 oe cao **A1**

Answer: **4n + 8**

Question 41

one correct operation applied to the letter, eg a product or a sum **M1**

8m + 10 oe cao **A1**

Answer: **8m + 10**

Question 42

p = 13 cao **B1**

Answer: **p = 13**

Question 43

8 cao **B1**

Answer: **8**

Question 44

correctly squares the input, e.g. $5^2 = 25$ **M1**

29 cao **A1**

Answer: **29**

Question 45

reverses the last step correctly, e.g. 26 + 6 = 32 **M1**

reverses the second step correctly, e.g. 32 / 4 = 8 **M1**

5 cao (after reversing the first step, 8 - 3) **A1**

Answer: **5**

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Question 46

reverses the last step correctly, e.g. 26 - 1 = 25	**M1**
reverses the second step correctly, e.g. 25 / 5 = 5	**M1**
reverses the first step correctly, e.g. 5 + 2 = 7	**M1**
7 cao	**A1**

Answer: **7**

Question 47

24 cao	**B1**

Answer: **24**

Question 48

17 cao	**B1**

Answer: **17**

Question 49

17 cao	**B1**

Answer: **17**

Question 50

6 cao	**B1**

Answer: **6**

Question 51

correctly applies the first step, e.g. 4 x 5 = 20	**M1**
17 cao	**A1**

Answer: **17**

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