2.8 Function Machines: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The function machine below multiplies every input by 4.
input --> [x 4] --> output



(a) Work out the output when the input is 3. **(1)**

.....

(b) Work out the output when the input is 7. **(1)**

.....

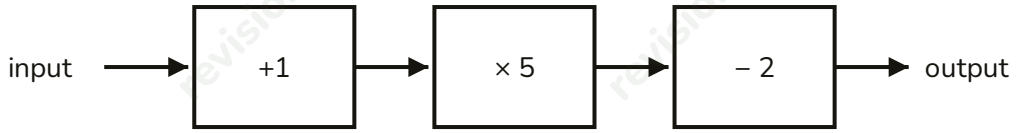
(c) Work out the output when the input is -2. **(1)**

.....

(Total for Question 1 is 3 marks)

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2 A function machine has three steps: input --> [+1] --> [x 5] --> [-2] --> output.



(a) Work out the output when the input is 3. **(1)**

.....

(b) Work out the output when the input is -2. **(2)**

.....

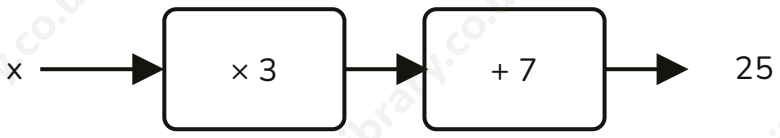
(c) The output is 13. Find the input. **(3)**

.....

(Total for Question 2 is 6 marks)

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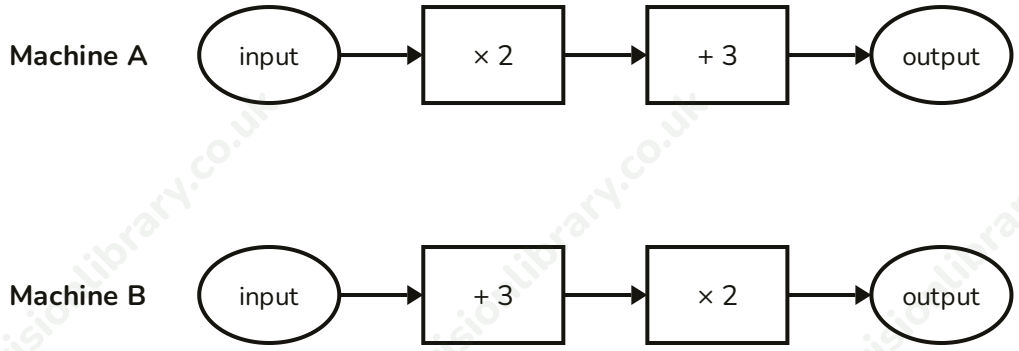
3 The equation 3x+7=25 can be shown as a function machine: x --> [x 3] --> [+7] --> 25. Use the function machine, working backwards, to find the value of x.



(Total for Question 3 is 2 marks)

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4 Machine A: input --> [x 2] --> [+3] --> output.
Machine B: input --> [+3] --> [x 2] --> output.
For an input of 4, work out the output of Machine A and the output of Machine B, and state whether the two machines give the same output.



(Total for Question 4 is 3 marks)

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5 Here is a function machine.
input --> [x 9] --> output
The output is 63. Work out the input.

(Total for Question 5 is 2 marks)

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6 Here is a function machine.
input --> [x 2] --> [+ 8] --> output
The input is n. (a) Write an expression for the output. (b) Work out the output when n = 10.

(Total for Question 6 is 3 marks)

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7 Which function machine represents 'multiply the input by 3, then subtract 5'?

- ☐ A) input --> [x3] --> [-5] --> output
- ☐ B) input --> [-5] --> [x3] --> output
- ☐ C) input --> [x5] --> [-3] --> output
- ☐ D) input --> [/3] --> [-5] --> output

(Total for Question 7 is 1 mark)

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8 Here is a function machine.
input --> [- 11] --> output
Work out the output when the input is each of 17, 11, 7.

(Total for Question 8 is 3 marks)

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9 Here is a function machine.
input --> [+ 7] --> output
Work out the output when the input is each of 19, 7, 13.

(Total for Question 9 is 3 marks)

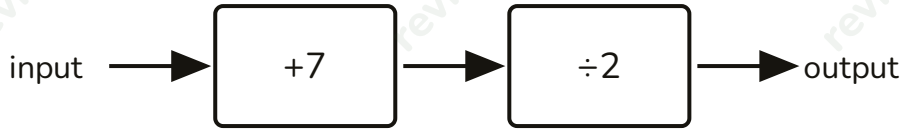
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10 Here is a function machine.
input --> [+ 6] --> output
The output is 23. Work out the input.

(Total for Question 10 is 2 marks)

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11 The function machine below has two steps.
input --> [+7] --> [/2] --> output
Work out the input for each output given.



(a) The output is 5. Find the input. **(2)**

.....

(b) The output is 1. Find the input. **(2)**

.....

(Total for Question 11 is 4 marks)

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12 Each part below shows a different function machine with input n. Select the expression that represents the output.

(a) input n --> [x 2] --> [+5] --> output. Which expression represents the output? **(1)**

- ☐ A) 2n+5
- ☐ B) 2(n+5)
- ☐ C) n/2+5
- ☐ D) 2n-5

(b) input n --> [+3] --> [x 4] --> output. Which expression represents the output? **(1)**

- ☐ A) 4n+3
- ☐ B) 4(n+3)
- ☐ C) n/4+3
- ☐ D) 4n-3

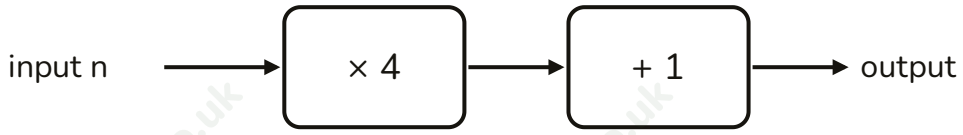
(c) input n --> [x 5] --> [-2] --> output. Which expression represents the output? **(1)**

- ☐ A) 5n-2
- ☐ B) 5(n-2)
- ☐ C) 5n+2
- ☐ D) (n-2)/5

(Total for Question 12 is 3 marks)

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13 A function machine has the rule: input n --> [x 4] --> [+1] --> output. Write down an expression, in terms of n, for the output.



(Total for Question 13 is 2 marks)

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14 A function machine multiplies the input by 8. The output is 72. Write down the input.

(Total for Question 14 is 1 mark)

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15 Given f(x) = 3x + 5. Work out f(4).

(Total for Question 15 is 1 mark)

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16 A machine applies f(x) = kx + 4. Applying the machine twice to the input 1 gives 49, i.e. f(f(1)) = 49. Find all possible values of k.

(Total for Question 16 is 4 marks)

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Mark scheme · 2.8 Function Machines: Test Pack

A correct answer earns full marks unless the question asks for working, a method, proof or explanation.

Question 1

(a) 12 cao **B1**

(a) Answer: 12

(b) 28 cao **B1**

(b) Answer: 28

(c) -8 cao **B1**

(c) Answer: -8

Question 2

(a) 18 cao **B1**

(a) Answer: 18

(b) -5 seen (correct value after the first two steps) **M1**

(b) -7 cao **A1**

(b) Answer: -7

(c) 15 seen (reverse the last step: 13+2) **M1**

(c) 3 seen (reverse the second step: 15/5) **M1**

(c) 2 cao (reverse the first step: 3-1) **A1**

(c) Answer: 2

Question 3

18 seen (25-7) **M1**

6 cao **A1**

Answer: 6

Question 4

11 seen (Machine A: 4x2=8, 8+3=11) **M1**

14 seen (Machine B: 4+3=7, 7x2=14) **M1**

correct conclusion: not the same (11 is not equal to 14), oe with both values shown **A1**

Answer: Machine A = 11, Machine B = 14; not the same

Question 5

uses inverse operations or works backwards **M1**

7 cao **A1**

Answer: 7

Question 6

attempts to build the expression **M1**

2n + 8 **A1**

28 cao **B1**

Answer: (a) 2n + 8, (b) 28

Question 7

A cao **B1**

Answer: A

Question 8

one output correct **B1**

two outputs correct **B1**

all outputs correct **B1**

Answer: 6, 0, -4

Question 9

one output correct **B1**

two outputs correct **B1**

all outputs correct **B1**

Answer: 26, 14, 20

Question 10

uses inverse operations or works backwards **M1**

17 cao **A1**

Answer: 17

Question 11

(a) 10 seen (reverse the division: 5 x 2) **M1**

(a) 3 cao **A1**

(a) Answer: 3

(b) 2 seen (reverse the division: 1 x 2) **M1**

(b) -5 cao **A1**

(b) Answer: -5

Question 12

(a) A cao **B1**

(a) Answer: A

(b) B cao **B1**

(b) Answer: B

(c) A cao **B1**

(c) Answer: A

Question 13

4n seen **M1**

4n+1 oe cao **A1**

Answer: 4n+1

Question 14

9 cao **B1**

Answer: 9 (because input = 72 ÷ 8).

Question 15

17 cao **B1**

Answer: 17 (3 x 4 + 5 = 17).

Question 16

substitute: f(1) = k + 4, then f(f(1)) = k(k + 4) + 4 **M1**

form quadratic: $k^2 + 4k + 4 = 49 \rightarrow k^2 + 4k - 45 = 0$ **M1**

factor or use formula, e.g. (k + 9)(k - 5) = 0 **M1**

k = 5 or k = -9 cao **A1**

Answer: k = 5 or k = -9.

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