



2.8D Function Machines: Fluency and Exam Drill

EDEXCEL 1MA1 · Calculator allowed · about 40 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** A function machine multiplies the input by 6. The input is 7. Work out the output.

(Total for Question 1 is 1 mark)

- 2** A function machine subtracts 9 from the input. The input is 15. Work out the output.

(Total for Question 2 is 1 mark)

- 3** A function machine multiplies the input by 3, then adds 5. The input is 4. Work out the output.

(Total for Question 3 is 2 marks)

- 4** A function machine adds 8 to the input, then divides the result by 2. The input is 10. Work out the output.

(Total for Question 4 is 2 marks)

- 5** A function machine multiplies the input by 8. The output is 72. Write down the input.

(Total for Question 5 is 1 mark)

- 6** A function machine adds 15 to the input then divides by 5. The output is 14. Work out the input.

(Total for Question 6 is 2 marks)

- 7** A function machine doubles the input then subtracts 3. The output is 19. Work out the input.

(Total for Question 7 is 2 marks)

- 8** A number enters Machine A which adds 4. The result goes into Machine B which multiplies by 5. The starting input is 6. Work out the final output.

(Total for Question 8 is 2 marks)

- 9** A function machine multiplies the input by 7 then subtracts 2. Write an expression in terms of x for the output.

(Total for Question 9 is 1 mark)

- 10** Given $f(x) = 3x + 5$. Work out $f(4)$.

(Total for Question 10 is 1 mark)

- 11** Let $f(x) = 2x - 7$ and $g(x) = x + 3$. Work out $g(f(2))$.

(Total for Question 11 is 2 marks)

- 12** A machine applies $f(x) = 3x + 2$ then a second machine applies $g(x) = x - 5$. Work out all values of x such that $g(f(x)) = 22$.

(Total for Question 12 is 3 marks)

- 13** A function f is linear: $f(x) = ax + b$. Given $f(2) = 11$ and $f(5) = 20$, work out a and b , then find the input that gives output 38.

(Total for Question 13 is 4 marks)

- 14** A machine multiplies the input by $\frac{3}{2}$ then subtracts 4. The output is 8. Work out the input.

(Total for Question 14 is 3 marks)

- 15** 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 15 is 4 marks)

Mark scheme · 2.8D Function Machines: Fluency and Exam Drill

Question 1

- **B1** 42 cao
- **Answer:** 42 (because $6 \times 7 = 42$).

Question 2

- **B1** 6 cao
- **Answer:** 6 (because $15 - 9 = 6$).

Question 3

- **M1** correct method shown, e.g. $3 \times 4 = 12$ and then $12 + 5$
- **A1** 17 cao
- **Answer:** 17 ($3 \times 4 + 5 = 17$).

Question 4

- **M1** attempt to add 8 then divide by 2, e.g. $(10 + 8) / 2$
- **A1** 9 cao
- **Answer:** 9 (because $(10 + 8) / 2 = 9$).

Question 5

- **B1** 9 cao
- **Answer:** 9 (because $\text{input} = 72 \div 8$).

Question 6

- **M1** reverse method applied, e.g. $14 \times 5 = 70$
- **A1** 55 cao ($70 - 15$)
- **Answer:** 55 (because $\text{input} = 14 \times 5 - 15 = 70 - 15 = 55$).

Question 7

- **M1** reverse method or simple algebra, e.g. $2x - 3 = 19 \rightarrow 2x = 22$
- **A1** 11 cao
- **Answer:** 11 (because $2x - 3 = 19 \rightarrow x = 11$).

Question 8

- **M1** apply A then B correctly, e.g. $(6 + 4) \times 5$
- **A1** 50 cao
- **Answer:** 50 (because $(6 + 4) \times 5 = 50$).

Question 9

- **B1** $7x - 2$ cao
- **Answer:** $7x - 2$.

Question 10

- **B1** 17 cao
- **Answer:** 17 ($3 \times 4 + 5 = 17$).

Question 11

- **M1** substitute 2 into f, e.g. $f(2) = 2 \times 2 - 7 = -3$
- **A1** 0 cao ($g(-3) = -3 + 3 = 0$)
- **Answer:** 0 ($f(2) = -3$, $g(-3) = 0$).

Question 12

- **M1** substitute and form equation: $g(f(x)) = (3x + 2) - 5 = 3x - 3$
- **M1** solve $3x - 3 = 22 \rightarrow 3x = 25$
- **A1** $x = 25/3$ cao
- **Answer: 25/3.**

Question 13

- **M1** form two equations: $2a + b = 11$ and $5a + b = 20$
- **M1** subtract to find $a = 3$
- **M1** substitute a to find $b = 5$
- **A1** input 11 cao (solve $3x + 5 = 38 \rightarrow x = 11$)
- **Answer: a = 3, b = 5, input = 11.**

Question 14

- **M1** form equation $(3/2)x - 4 = 8$ or equivalent
- **M1** isolate x : $(3/2)x = 12 \rightarrow x = 12 \times 2/3$
- **A1** 8 cao
- **Answer: 8.**

Question 15

- **M1** 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. $(k + 9)(k - 5) = 0$
- **A1** $k = 5$ or $k = -9$ cao
- **Answer: k = 5 or k = -9.**