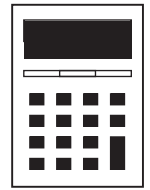


GCSE MATHEMATICS

Number Machines



These questions have been taken or modified from previous AQA GCSE Mathematics Papers.

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided.
- If your calculator does not have a π button, take the value of π to be 3.14 unless another value is given in the question.

Information

- The marks for questions are shown in brackets.
- The quality of your written communication is specifically assessed in questions that are indicated with an asterisk (*).

Advice

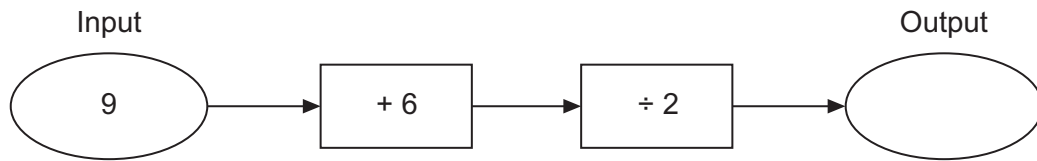
- Read each question carefully before you start to answer it.
 - In all calculations, show clearly how you work out your answer.
 - Use the number of marks for the question as a guide to the amount of time you need to spend.
 - Look at previous parts of the question, e.g. a), b), c) i) as there may be information there you need to answer later parts.
 - Check your answer is realistic and appropriate.
 - For calculator decimal numbers always write your full calculator display in the working out area and then, if you need to, round the answer on the answer line.
-

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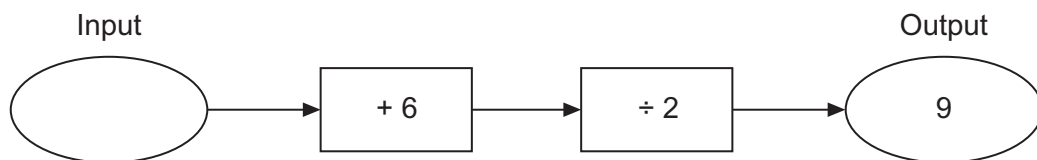
1 (a) Here is a number machine.



Work out the output when the input is 9.

Answer (1 mark)

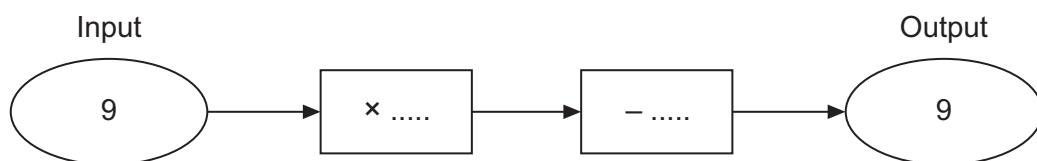
1 (b) Here is the same number machine.



Work out the input when the output is 9.

Answer (1 mark)

1 (c) Here is a different number machine.

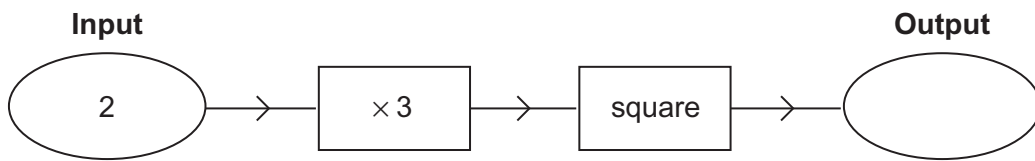


Complete possible operations for this number machine.

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.....

(1 mark)

2 (a) Here is a number machine.

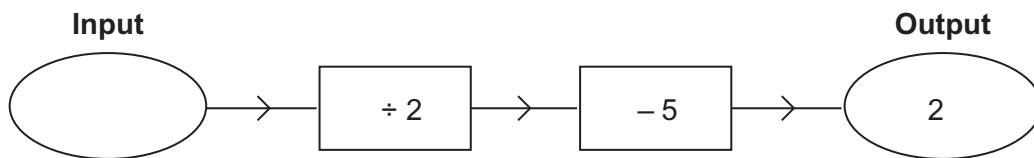


Work out the output when the input is 2

[1 mark]

Answer _____

2 (b) Here is another number machine.

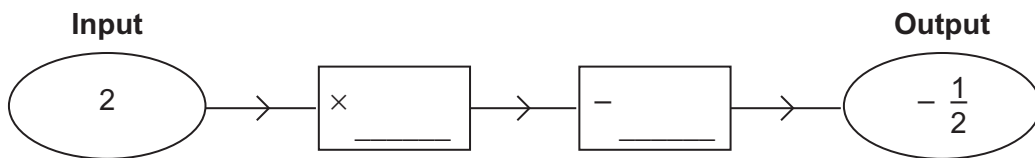


Work out the input when the output is 2

[2 marks]

Answer _____

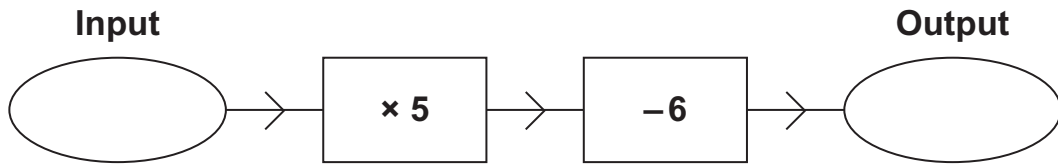
2 (c) Here is another number machine.



Fill in possible values for the operations when the input is 2 and the output is $-\frac{1}{2}$

[1 mark]

3 Here is a number machine.

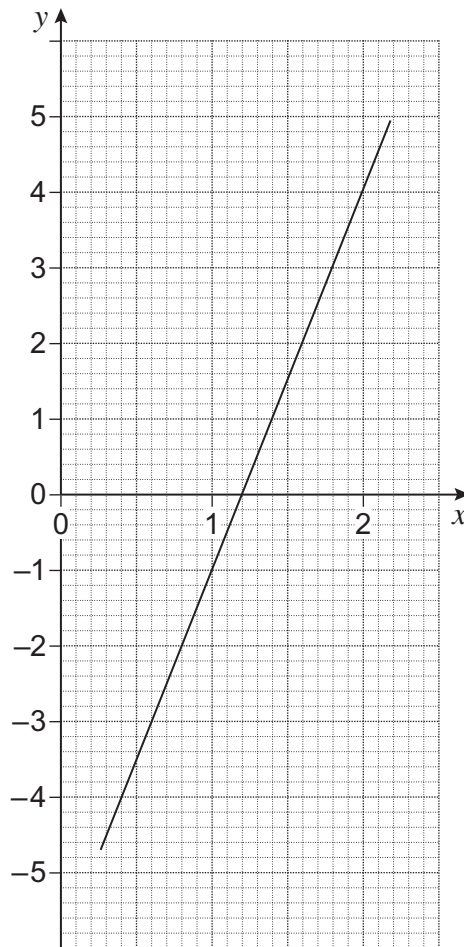


3 (a) What is the output when the input is -3 ?

.....

Answer (1 mark)

3 (b) Here is a graph of $y = 5x - 6$

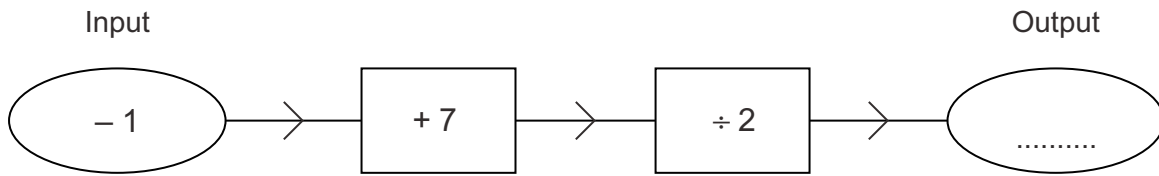


Find the input value for the number machine that gives the same output value.
You **must** show clearly how you obtain your answer.

.....
.....
.....

Answer (2 marks)

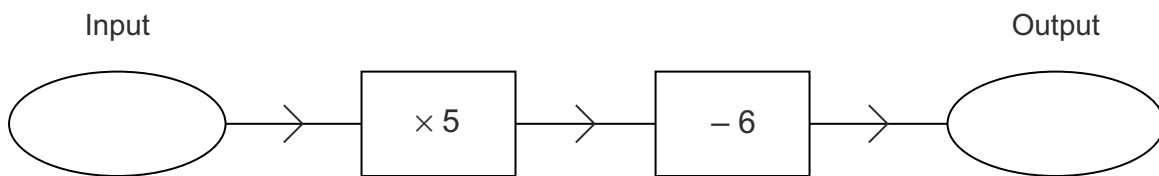
4 (a) Here is a number machine.



Calculate the output when the input is -1

(1 mark)

4 (b) Here is a different number machine.



The output is equal to the input.

Work out the input.

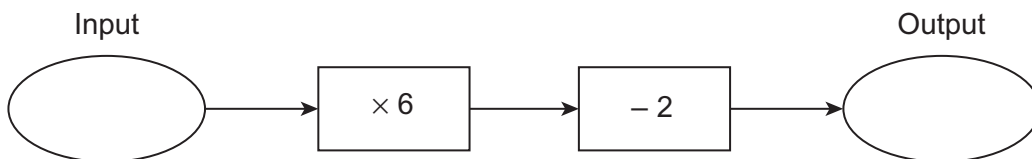
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Answer (3 marks)

5 Here is a number machine.



The output is twice the input.

Work out the input.

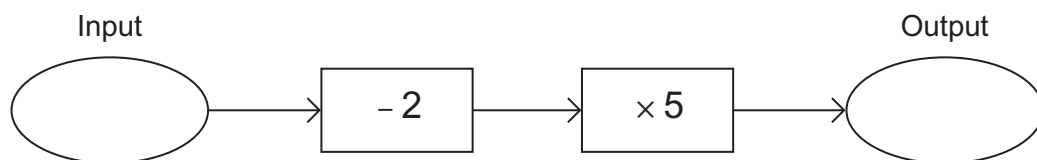
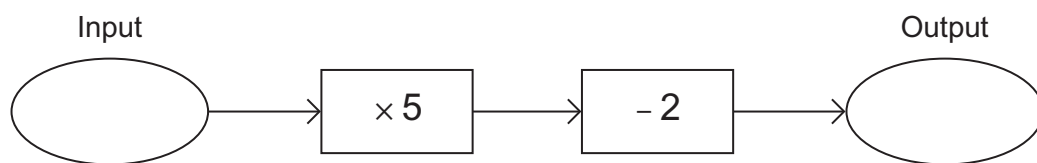
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Answer (3 marks)

6 Here are two number machines.



When the inputs are equal,

show that the **difference** between the outputs is always 8

[3 marks]

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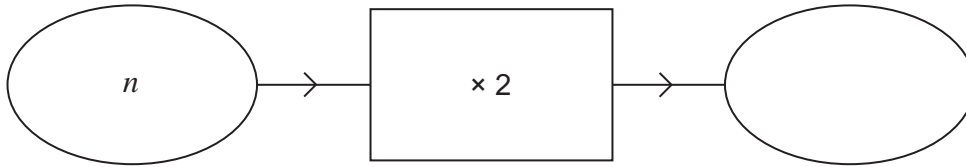
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7 Here are three number machines.

7 (a) Fill in an algebraic expression for the output.

[1 mark]



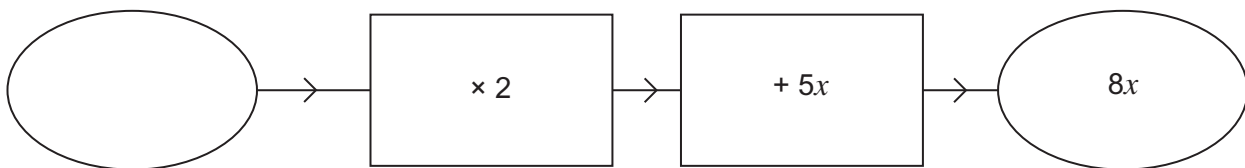
7 (b) Fill in an algebraic expression for the input.

[1 mark]

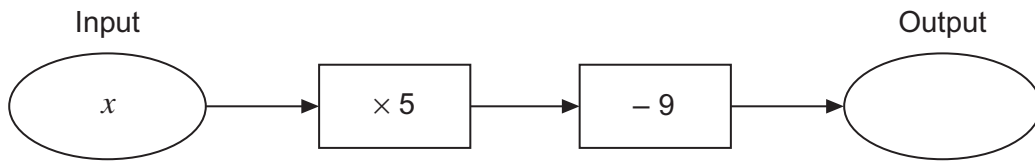


7 (c) Fill in an algebraic expression for the input.

[2 marks]



8 Here is a number machine.



The output is three times the input.

Work out the input x .

.....

.....

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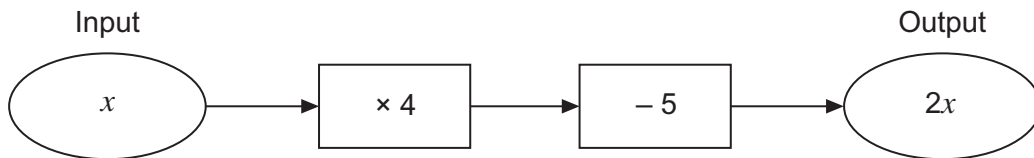
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$x =$ (4 marks)

9 Here is a number machine.



Work out the value of x .

[3 marks]

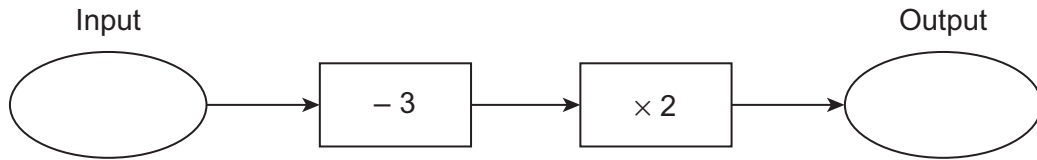
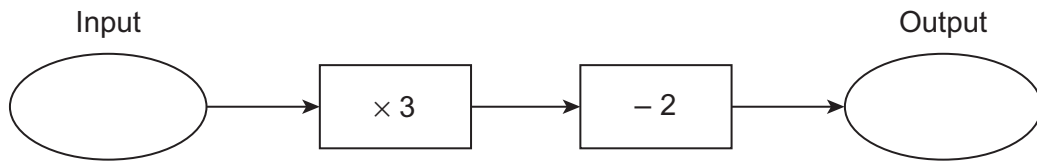
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$x =$

10 Here are two number machines.



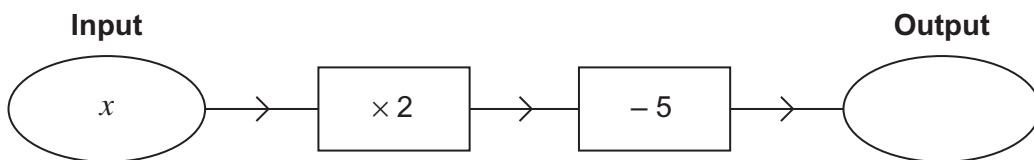
The same number is put into each machine.
The two outputs are equal.

What number is put in?

.....
.....
.....

Answer (4 marks)

11 Here is a number machine.



The output is four times the input.

Use algebra to work out the value of x .
You **must** show your working.

[4 marks]

.....
.....
.....

$x =$

12

The two sets of instructions give identical outcomes.

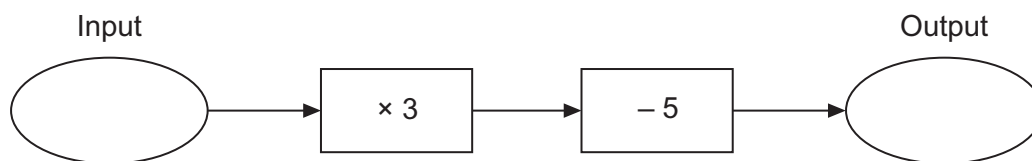
Complete the tables to show this.

First set	
Instruction	Expression
Start with x	x
Double it	$2x$
Double again	
Add 6	
Outcome	

Second set	
Instruction	Expression
Start with x	x
Add 4	
Multiply by 4	
Subtract 10	
Outcome	

(3 marks)

*13 Here is a number machine.



When the input is a the output is b .

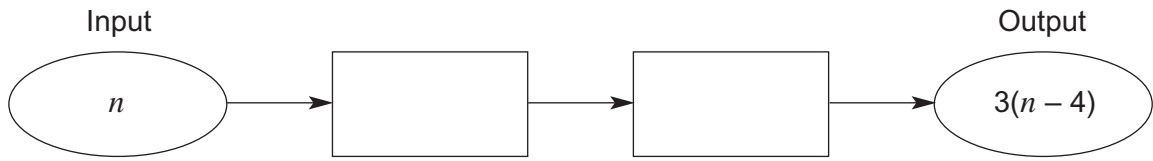
When the input is $a + b$ the output is 64

Work out the values of a and b .
Do **not** use trial and improvement.
You **must** show your working.

[4 marks]

$a =$ _____ $b =$ _____

14 Here is a number machine.



14 (a) Write an operation in each box to make the number machine work. (2 marks)

14 (b) Work out the value of n when the input and output are equal.

.....
.....
.....

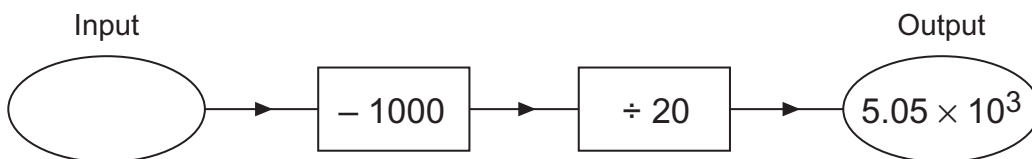
Answer $n =$ (2 marks)

15 (a) Work out $(6.45 \times 10^6) \times (2.5 \times 10^{-4})$

Write your answer in standard form.

Answer (2 marks)

15 (b) Here is a number machine.



Work out the **input** when the output is 5.05×10^3

Write your answer in standard form.

Answer (3 marks)