Write your name here

Surname	Other names

In the style of:
Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number

Candidate Number

Mathematics

Grade 9 type questions

Higher Tier

GCSE style questions arranged by topic

Paper Reference
1MA1/3H

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out**.

Information

- The total mark for this paper is
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

1 Lara asked 50 people which drinks they liked from tea, coffee and milk.

All 50 people like at least one of the drinks
19 people like all three drinks.
16 people like tea and coffee but do **not** like milk.
21 people like coffee and milk.
24 people like tea and milk.
40 people like coffee.
1 person likes only milk.

Lara selects at random one of the 50 people.

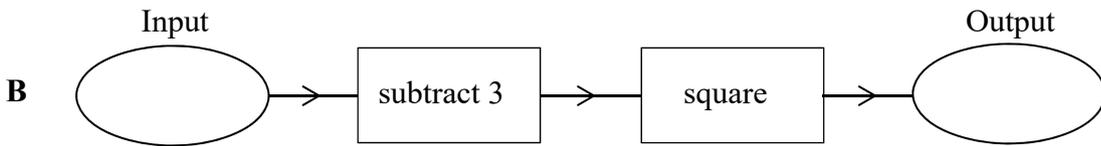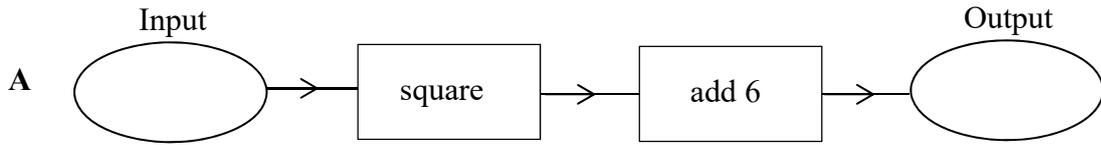(a) Work out the probability that this person likes tea.

....
(4)

(b) Given that the person selected at random from the 50 people likes tea, find the probability that this person also likes exactly one other drink.

....
(2)

(Total for Question 1 is 6 marks)

2   Here are two function machines, **A** and **B.**

Input   Output

A   ⬭ ──→ | square | ──→ | add 6 | ──→ ⬭

Input   Output

B   ⬭ ──→ | subtract 3 | ──→ | square | ──→ ⬭

Both machines have the same input.

Work out the range of input values for

which   the output of **A** is **less** than the output of **B**.

....

(Total for Question 2 is 4 marks)

3 **(a)** A function is represented by the following function machine.

Input ⎯⎯⎯ [× 2] ⎯⎯⎯ [+ 5] ⎯⎯⎯ Output
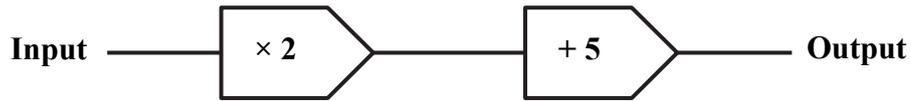
    (i) A number is input into the machine.
        The output is used as a new input.
        The second output is 11.

        Work out the number that was the **first input.**
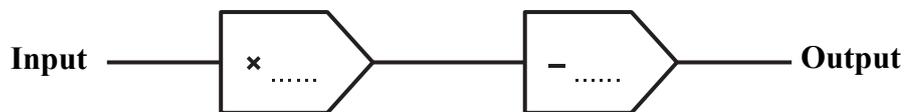
                                              (a)(i) ....
                                                  (2)

    (ii) A number is input into the machine.
         The output given is the same number.

         Work out the number.

                                              (ii) ....
                                                  (3)

(b) Another function machine is shown below.

Input ⎯⎯⎯ [× ......] ⎯⎯⎯ [– ......] ⎯⎯⎯ Output

    If the Input is 3, the Output is 5.

    If the Input is 7, the Output is 25.

    Use this information to fill in the two boxes.
                                                      (3)

                                    (Total for Question 3 is 8 marks)

4 Louis and Tara are investigating the growth in the population of a type of bacteria.
They have two flasks A and B.

At the start of day 1, there are 1000 bacteria in flask A.
The population of bacteria grows exponentially at the rate of 50% per day.

(a) Show that the population of bacteria in flask A at the start of each day forms a geometric progression.

(2)

The population of bacteria in flask A at the start of the 10th day is k times the population of bacteria in flask A at the start of the 6th day.

(b) Find the value of k.

....

(2)

At the start of day 1 there are 1000 bacteria in flask B.
The population of bacteria in flask B grows exponentially at the rate of 30% per day.

(c) Sketch a graph to compare the size of the population of bacteria in flask A and in flask B.

(1)

(Total for Question 4 is 5 marks)

5   An approximate solution to an equation is found using this iterative process.

$$x_{n+1} = \frac{(x_n)^3 - 3}{8} \text{ and } x_1 = -1$$

(a)   Work out the values of x_2 and x_3

$x_2 =$ ....

$x_3 =$ ....

(2)

(b)   Work out the solution to 6 decimal places.

$x =$ ....

(1)

(Total for Question 5 is 3 marks)

6   (a) By completing the square, find the roots of the equation

$$x^2 - 4x - 3 = 0$$

Give your answer in surd form.

(3)

(b) Show algebraically that $x^2 - 7x + 13$ has no real roots.

(3)

(Total for Question 6 is 6 marks)

7   Use an iterative formula to find the positive root of the equation

$$y = x^2 + x - 5$$

Give your answer to 5 decimal places.

$x =$ ....

(5)

(Total for Question 7 is 5 marks)

8 Here are the first six terms of a Fibonacci sequence.

$$1 \quad 1 \quad 2 \quad 3 \quad 5 \quad 8$$

The rule to continue a Fibonacci sequence is,

the next term in the sequence is the sum of the two previous terms.

(a) Find the 9th term of this sequence.

....
(1)

The first three terms of a different Fibonacci sequence are

$$a \qquad b \qquad a + b$$

(b) Show that the 6th term of this sequence is $3a + 5b$

(2)

Given that the 3rd term is 7 and the 6th term is 29,

(c) find the value of a and the value of b.

....
(3)

(Total for Question 8 is 6 marks)

9 (a) Factorise $y^2 + 7y + 6$

....
(2)

(b) Solve $6x + 4 > x + 17$

....
(2)

(c) n is an integer with $-5 < 2n \leqslant 6$

Write down all the values of n

....
(2)

(Total for Question 9 is 6 marks)

10 The function f is such that

$$f(x) = 4x - 1$$

(a) Find $f^{-1}(x)$

$f^{-1}(x) =$ ....
(2)

(Total for Question 10 is 2 marks)

11 (a) Show that the equation $x^3 + 4x = 1$ has a solution between $x = 0$ and $x = 1$

(2)

(b) Show that the equation $x^3 + 4x = 1$ can be arranged to give $x = \dfrac{1}{4} - \dfrac{x^3}{4}$

(1)

(c) Starting with $x_0 = 0$, use the iteration formula $x_{n+1} = \dfrac{1}{4} - \dfrac{x_n^{\,3}}{4}$ twice,

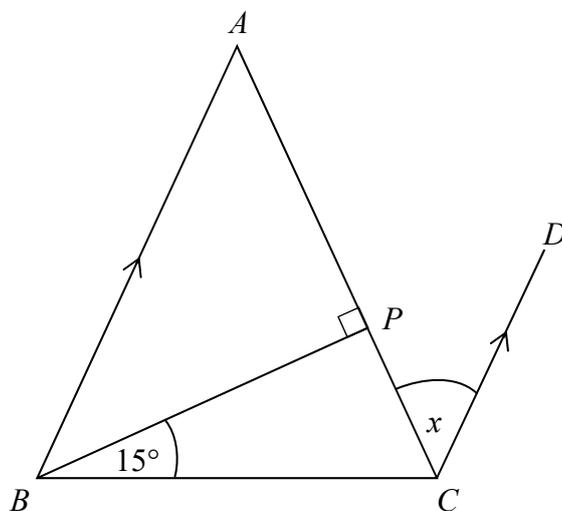to find an estimate for the solution of $x^3 + 4x = 1$

....

(3)

(Total for Question 11 is 6 marks)

12 *ABC* is a triangle with *AB* = *AC*

BA is parallel to *CD*.

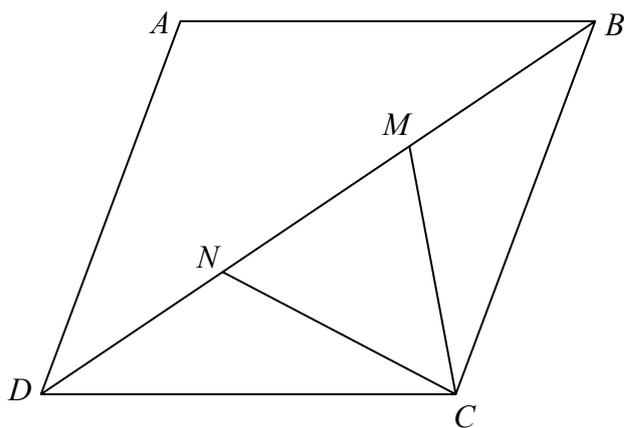

Diagram **NOT**
accurately drawn

Show that angle *x* = 30°

(3)

(Total for Question 12 is 3 marks)

13 *ABCD* is a rhombus.

M and *N* are points on *BD* such that *DN = MB*.

Prove that triangle *DNC* is congruent to triangle *BMC*.

(Total for Question 13 is 3 marks)

14 The pressure at sea level is 101 325 Pascals.

Any rise of 1 km above sea level decreases the pressure by 14%

For example,
at 3 km above sea level the pressure is 14% less than at 2 km

Work out the pressure at 4 km above sea level.

Give your answer to 2 significant figures.

.... Pascals

(Total for Question 14 is 4 marks)