Total Marks

Mathematics A
Paper 1H
(Calculator)
Higher Tier

Tuesday 7 January 2020 – Morning

Time: 2 hours plus your additional time allowance.

In the boxes below, write your name, centre number and candidate number.

Surname	
Other names	
Centre Number	
Candidate Number	

Q59756A

Pearson

YOU MUST HAVE

Ruler, protractor, compasses, writing and drawing equipment, calculator. Tracing paper may be used.

YOU WILL BE GIVEN

Diagram Book
Formulae Pages

INSTRUCTIONS

Answer ALL questions.

Without sufficient working, correct answers may be awarded no marks.

Answer the questions in the spaces provided in this Question Paper or on the separate diagrams – there may be more space than you need.

CALCULATORS MAY BE USED.

You must NOT write anything on the Formulae Pages. Anything you write on the Formulae Pages will gain NO credit.

INFORMATION

The total mark for this paper is **100**

The marks for EACH question are shown in brackets
– use this as a guide as to how much time to spend on each question.

You may be provided with models for Question 15 and Question 19

They are NOT accurate.

There may be spare copies of some diagrams.

ADVICE

Read each question carefully before you start to answer it.

Check your answers if you have time at the end.

Turn over

Answer all TWENTY TWO questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1. The point **A** has coordinates $(5, -4)$

    The point **B** has coordinates $(13, 1)$

    (a) Work out the coordinates of the midpoint of **AB**

    (2 marks)

    (_____ , _____)

(continued on the next page)

Turn over

1. continued.

   Line **L** has equation

   $$y = 2 - 3x$$

   (b) Write down the gradient of line **L**

   (1 mark)

   _____

(continued on the next page)

1. continued.

Line **L** has equation

$$y = 2 - 3x$$

(c) Does the point with coordinates $(100, -302)$ lie on line **L**?

You must give a reason for your answer.

(1 mark)

_____

_____

_____

_____

_____

(Total for Question 1 is 4 marks)

2.   **Find the lowest common multiple (LCM) of**

28 **and** **105**

_____

(Total for Question 2 is 2 marks)

3. **Look at the diagram for Question 3 in the**

    Diagram Book.

    It is NOT accurately drawn.

    It shows a shape.

    Four of the sides are marked: 9 cm, 12 cm, 6 cm

    and x cm

    All marked angles are right angles.

    The shape has area 129 cm^2

    Work out the value of x

    (4 marks)

    Answer space continues on the next page.

3. **continued.**

x = _____

(Total for Question 3 is 4 marks)

Turn over

4.   Look at the table for Question 4 in the
      Diagram Book.

      It shows information about the weights, in
      kilograms, of **40** babies.

      (a) Write down the modal class.
           (1 mark)

      _____

(continued on the next page)

4.   continued.

(b)   Work out an estimate for the mean weight of the

40 babies.

(4 marks)

_____ kg

(continued on the next page)

4. continued.

One of the **40** babies is going to be chosen at random.

(c) Find the probability that this baby has a weight of more than **5 kg**

(2 marks)

_____

(Total for Question 4 is 7 marks)

5.   **120** children go on an activity holiday.

The ratio of the number of girls to the number of boys is **3 : 5**

On Sunday, all the children either go sailing or go climbing.

$\dfrac{16}{25}$ of the boys go climbing.

Twice as many girls go sailing as go climbing.

Work out how many children go sailing on Sunday.

(6 marks)

Answer space continues on the next page.

Turn over

5.   continued.

_____

(Total for Question 5 is 6 marks)

6. (a) Write

   $$7 \cdot 8 \times 10^{-4}$$

   as an ordinary number.

   (1 mark)

   _____

   (continued on the next page)

6. **continued.**

(b) **Work out**

$$\frac{5 \cdot 6 \times 10^4 + 7 \times 10^3}{2 \cdot 8 \times 10^{-3}}$$

Give your answer in standard form.

(2 marks)

_____

(Total for Question 6 is 3 marks)

Turn over

7. (a) **Expand and simplify**

$$(m - 8)(m + 5)$$

(2 marks)

_____

(continued on the next page)

7.   continued.

(b) Factorise fully

$5y + 20y^2$

(2 marks)

_____

(continued on the next page)

7. continued.

(c) Simplify

$(p^2 + 3)^0$

(1 mark)

_____

(d) Solve

$$3(2x - 5) = \frac{9 - x}{2}$$

Show clear algebraic working.

(4 marks)

Answer space continues on the next page.

Turn over

7. **(d)** **continued.**

x = _____

(Total for Question 7 is 9 marks)

Turn over

8.   **Look at the diagram for Question 8 in the Diagram Book.**

It shows shape A and shape B on a grid.

Describe fully the single transformation that maps shape A onto shape B

_____

_____

_____

(Total for Question 8 is 2 marks)

9. Look at the diagram for Question 9 in the Diagram Book.

It is NOT accurately drawn.

It shows a right–angled triangle, **PRQ**

PR = 24·3 cm

Angle **RPQ = 63°**

Angle **PRQ** is a right angle.

Calculate the length of **PQ**

Give your answer correct to **3** significant figures.

(3 marks)

Answer space continues on the next page.

9.   **continued.**

_____ **cm**

(Total for Question 9 is 3 marks)

Turn over

10. **Look at the diagram for Question 10 in the Diagram Book.**

    The shaded region in the diagram is bounded by three lines.

    The equation of one of the lines is given.

    Write down the three inequalities that define the shaded region.

    _____

    _____

    _____

(Total for Question 10 is 3 marks)

11. Max invests **$6000** in a savings account for **3** years.

The account pays compound interest at a rate of **1·5%** per year for the first **2** years.

The compound interest rate changes for the third year.

At the end of **3** years, there is a total of **$6311·16** in the account.

Work out the compound interest rate for the third year.

Give your answer correct to **1** decimal place.

(3 marks)

Answer space continues on the next page.

11. **continued.**

_____%

(Total for Question 11 is 3 marks)

12. Look at the diagram for Question 12 in the Diagram Book.

It shows a cumulative frequency graph.

A total of **80** men and women took part in a race.

The cumulative frequency graph gives information about the times, in minutes, they took for the race.

(a) Use the graph to find an estimate for the interquartile range.

(2 marks)

_____ minutes

(continued on the next page)

Turn over

12. continued.

60% of the men took 50 minutes or less for the race.

No women took 50 minutes or less for the race.

(b) Work out an estimate for the number of men who took part in the race.

(3 marks)

Answer space continues on the next page.

12. (b) continued.

_____

(Total for Question 12 is 5 marks)

13. Look at the diagram for Question 13 in the Diagram Book.

It is NOT accurately drawn.

It shows a solid cube with sides w cm

The cube is placed on a table so that the whole of one face of the cube is in contact with the table.

The cube exerts a force of 56 newtons on the table.

The pressure on the table due to the cube is 0·14 newtons/cm^2

$$pressure = \frac{force}{area}$$

Work out the volume of the cube.

(4 marks)

Answer space continues on the next page.

Turn over

13. continued.

_____ **cm**^{3}

(Total for Question 13 is 4 marks)

14. Look at the diagram for Question 14 in the

Diagram Book.

It is NOT accurately drawn.

It shows parallelogram **EFGH**

EF = 9·3 cm

FG = 14·7 cm

Angle **EFG = 106°**

(a) Work out the area of the parallelogram.

Give your answer correct to **3** significant figures.

(2 marks)

_____ cm^2

(continued on the next page)

Turn over

14. **continued.**

(b) **Work out the length of the diagonal EG of the parallelogram.**

Give your answer correct to 3 significant figures.

(3 marks)

_____ **cm**

(Total for Question 14 is 5 marks)

15. **Look at the diagram for Question 15 in the Diagram Book.**

You may be provided with a model.

They are NOT accurate.

They show a cuboid of volume $V \text{ cm}^3$ with length $(2y + 5) \text{ cm}$, width $(3 - y) \text{ cm}$ and height $(y + 1) \text{ cm}$

(a) **Show that**

$$V = 15 + 16y - y^2 - 2y^3$$

(3 marks)

Answer space continues on the next page.

15. (a) continued.

(continued on the next page)

15. continued.

There is a value of **y** for which the volume of the cuboid is a maximum.

(b) Find this value of **y**

Show your working clearly.

Give your answer correct to **3** significant figures.

(5 marks)

Answer space continues on the next page.

Turn over

15. (b) continued.

y = _____

(Total for Question 15 is 8 marks)

16. Given that $P = \dfrac{2r - t}{u}$

$r = 58 \cdot 4$ correct to **3** significant figures.

$t = 20$ correct to **2** significant figures.

$u = 3 \cdot 6$ correct to **2** significant figures.

Work out the upper bound for the value of P

Show your working clearly.

Give your answer correct to **2** decimal places.

(3 marks)

Answer space continues on the next page.

16. **continued.**

_____

(Total for Question 16 is 3 marks)

17. **(a)** **Show that**

$$\left(6 + 2\sqrt{12}\right)^2 = 12\left(7 + 4\sqrt{3}\right)$$

Show each stage of your working.

(3 marks)

Turn over

17. continued.

(b) Simplify fully

$$\left(\frac{27f^{12}}{t^{15}} \right)^{-\frac{2}{3}}$$

(3 marks)

_____

(Total for Question 17 is 6 marks)

Turn over

18. There are **16** sweets in a bowl.

4 of the sweets are blackcurrant.

5 of the sweets are lemon.

7 of the sweets are orange.

Anna, Ravi and Sam each take at random one sweet from the bowl.

Work out the probability that the **5** lemon sweets are still in the bowl.

(4 marks)

Answer space continues on the next page.

18. continued.

(Total for Question 18 is 4 marks)

19. **Look at the diagram for Question 19 in the**

Diagram Book.

You may be provided with a model.

They are NOT accurate.

They show a cuboid ABCDEFGH

EH = 9 cm,

HG = 5 cm and

ED = 6 cm

Work out the size of the angle between AH and

the plane EFGH

Give your answer correct to 3 significant figures.

(4 marks)

Answer space continues on the next page.

Turn over

19. continued.

_____ °

(Total for Question 19 is 4 marks)

20. **Look at the diagram for Question 20 in the Diagram Book.**

The curve C has equation

$$y = 4(x - 1)^2 - a \qquad \text{where} \quad a > 4$$

Using the axes in the Diagram Book, sketch the curve C

On your sketch show clearly, in terms of a,

    (i)   **the coordinates of any points of intersection of C with the coordinate axes,**

    (ii) **the coordinates of the turning point.**

(Total for Question 20 is 4 marks)

21. The functions **f** and **g** are such that

$$f(x) = x^2 - 2x$$
$$g(x) = x + 3$$

The function **h** is such that

$$h(x) = fg(x) \quad \text{for} \quad x \geq -2$$

Express the inverse function $h^{-1}(x)$ in the form

$$h^{-1}(x) = \ldots$$

(5 marks)

Answer space continues on the next two pages.

21. continued.

21. continued.

$$h^{-1}(x) = \underline{\hspace{4cm}}$$

(Total for Question 21 is 5 marks)

22. Triangle **HJK** is isosceles with

$HJ = HK$ and $JK = \sqrt{80}$

H is the point with coordinates $(-4, 1)$

J is the point with coordinates $(j, 15)$ where $j < 0$

K is the point with coordinates $(6, k)$

M is the midpoint of **JK**

The gradient of **HM** is **2**

Find the value of **j** and the value of **k**

(6 marks)

Answer space continues on the next three pages.

22. **continued.**

22. continued.

22. continued.

j = _____

k = _____

(Total for Question 22 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS

END OF PAPER