Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics B

Paper 2R

Tuesday 17 January 2017 – Morning
Time: 2 hours 30 minutes

Paper Reference
4MB0/02R

You must have: Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

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.**

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.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.
- Without sufficient working, correct answers may be awarded no marks.

Turn over ▶

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P 4 8 4 1 2 A 0 1 3 2

Pearson

Answer ALL ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 $\begin{pmatrix} 3+y & -3 \\ 2 & 1 \end{pmatrix}\begin{pmatrix} -2 \\ x \end{pmatrix} = \begin{pmatrix} -16 \\ 4 \end{pmatrix}$

Find the value of x and the value of y.

(Total for Question 1 is 4 marks)

2 A square based pyramid has a perpendicular height of 150 cm.

The length of a diagonal of the square base is $400\sqrt{2}$ cm.

Calculate the volume, **in m³**, of the pyramid.

$$\left[\text{Volume of a pyramid} = \frac{1}{3} \times \text{base area} \times \text{height}\right]$$

(Total for Question 2 is 4 marks)

3 There is a total of 360 students and teachers at a school.
A trip is organised and 65% of the students and teachers bought tickets to go on this trip.

(a) Work out how many of the students and teachers bought tickets to go on the trip.

(2)

The number of teachers, the number of male students and the number of female students who bought tickets to go on the trip are in the ratios 1 : 3 : 5

(b) Calculate the number of female students who bought tickets to go on the trip.

(2)

All the male students who bought tickets went on the trip but 4 of the female students who bought tickets did **not** go on the trip.

(c) Find the ratio of the number of male students who went on the trip to the number of female students who went on the trip.

Give your answer in its simplest form.

(3)

Question 3 continued

(Total for Question 3 is 7 marks)

4 A particle P is moving along a straight line through the fixed point O.
The displacement, s metres, of P from O at time t seconds is given by

$$s = t^3 - 27t + 55 \qquad t \geqslant 0$$

(a) Write down the distance, in metres, of P from O when $t = 0$

(1)

(b) Find an expression, in terms of t, for the velocity, v m/s, of P at time t seconds.

(2)

(c) Find the value of t when P is closest to O.

(2)

(d) Find the distance, in metres, of P from O when P is closest to O.

(1)

(e) Find the distance, in metres, travelled by P in the interval $0 \leqslant t \leqslant 5$

(3)

Question 4 continued

(Total for Question 4 is 9 marks)

5 All 50 students at *Holborn College* have to study at least one of Physics (P), Chemistry (C) and Biology (B).

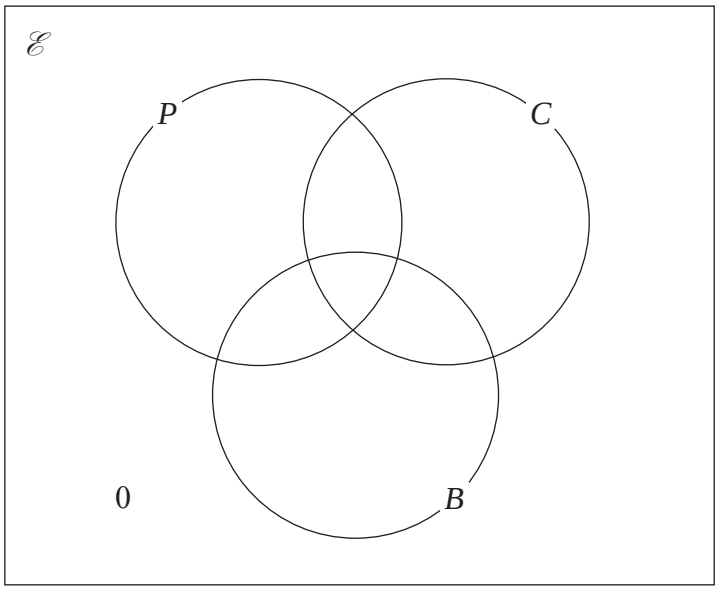
Of these 50 students

5 study all three subjects
12 study Physics and Biology
7 study Physics and Chemistry
13 study Chemistry and Biology
4 study Chemistry only

The number of students at *Holborn College* who study Biology only is three times the number of students at *Holborn College* who study Physics only.

Let x be the number of students at *Holborn College* who study Physics only.

(a) Complete the Venn diagram with all of this information.



(4)

(b) Find the value of x.

(2)

(c) Write down

(i) $n(B \cup P')$

(ii) $n([B \cup P] \cap C)$

(2)

A student at *Holborn College* is to be chosen at random.

Given that this student studies Physics,

(d) find the probability that this student does **not** study either Chemistry or Biology.

(2)

Question 5 continued

Question 5 continued

(Total for Question 5 is 10 marks)

6 $-5 < 5(x + 4) < 13$

where x is an integer.

Find all the possible values of x.

(Total for Question 6 is 4 marks)

7 The functions f, g and h are defined by

$$f: x \mapsto 3x - 1$$

$$g: x \mapsto 2x^2$$

$$h: x \mapsto \frac{1}{x+1} \qquad x \neq -1$$

(a) Find (i) $g(\sqrt{6})$

(ii) $h\left(-\frac{1}{3}\right)$

(2)

(b) Express $hf(x)$ in terms of x, simplifying your answer.

(1)

(c) Solve the equation

(i) $g(x) = \frac{25}{8}$

(ii) $gf(x) = x$

(7)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 10 marks)

8

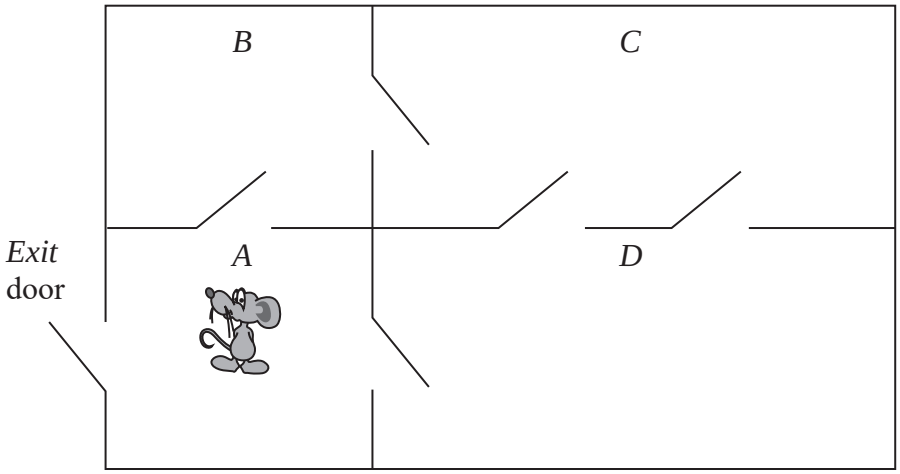


Figure 1

Sigmund is investigating the behaviour of his pet mouse, Morty, in a maze.
Figure 1 shows the maze with 4 rooms *A*, *B*, *C* and *D*. When Morty is in the maze, he can move around the maze leaving and entering rooms through two-way doors, shown in the diagram as

When in a room, Morty leaves the room and enters the next room by choosing a door at random. He is equally likely to choose any door in the room, including the door through which he entered the room.

Sigmund records a change of room as a move. So, *A* to *B* is one move, *A* to *B* to *C* is two moves. The investigation ends when Morty leaves room *A* by the *Exit* door.

(a) Morty is placed in room *A*, as shown in Figure 1.

(i) Write down the probability that the investigation will end after **one** move.

(1)

(ii) Find the probability that Morty will be back in room *A* after **two** moves.

(3)

(iii) Show that Morty is more likely to be in room *C* than to be in room *A* after **two** moves.

(3)

In a second investigation, Morty is placed in room *C*.

(b) Show that the probability that this investigation will end after **three** moves is 0.13 to 2 significant figures.

(3)

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Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 10 marks)

9

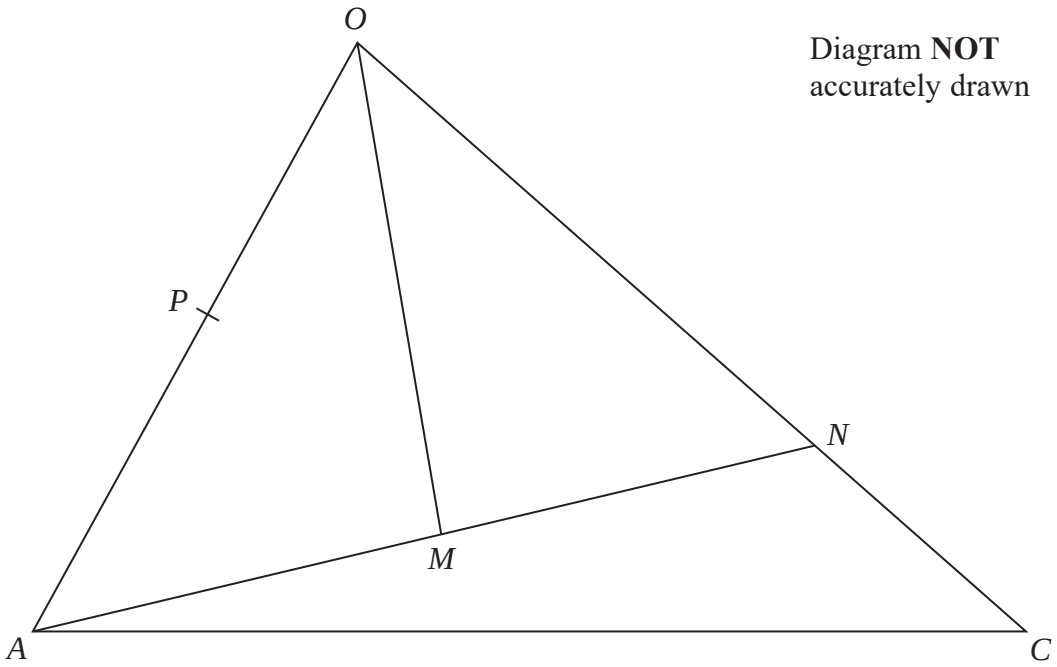


Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows the triangle *OAC*.

The point *N* on *OC* is such that $ON : OC = 5 : 6$
M is the midpoint of *AN*, and *P* is the midpoint of *OA*.

$\overrightarrow{OA} = 2\mathbf{a}$ and $\overrightarrow{OC} = 6\mathbf{c}$

(a) Find, in terms of **a** and **c** or **a** or **c**, simplifying your answer where possible,

(i) $\overrightarrow{AC}$ (ii) $\overrightarrow{ON}$ (iii) $\overrightarrow{OM}$

(5)

(b) Use a vector method to show that *PM* is parallel to *OC*.

(2)

The area of triangle *OAC* is 30 square units.

(c) Find the area of triangle *APM*.

(3)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 10 marks)

10

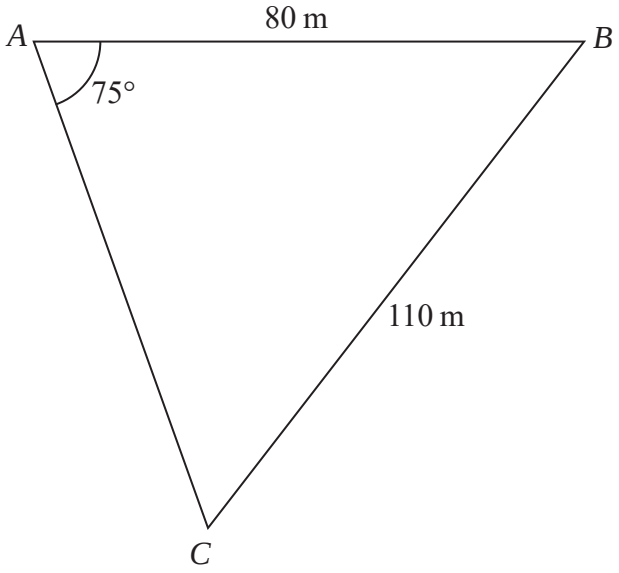


Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows a triangular field ABC on horizontal ground with $AB = 80$ metres, $BC = 110$ metres and $\angle BAC = 75°$

In this question, give **all** your answers to 3 significant figures.

Find

(a) the size, in degrees, of $\angle ACB$,

(3)

(b) the length, in metres, of AC.

(4)

M is the midpoint of BC.

(c) Find the length, in metres, of AM.

(3)

A vertical mast, PA is positioned at A. The angle of elevation of the top of the mast, P, from the point B is 41°

(d) Find the height, in metres, of the mast AP.

(2)

Q is the midpoint of AP and a straight cable joins Q to M.

(e) Find the length, in metres, of QM.

(2)

(f) Find the size, in degrees, of the angle of depression of the point M from the point Q.

(2)

$$\left[\begin{array}{c} \text{Sine Rule: } \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C} \\ \\ \text{Cosine Rule: } a^2 = b^2 + c^2 - 2bc\cos A \end{array}\right]$$

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 16 marks)

11 $(x + 3)$ is a factor of $3x^3 + kx^2 - 27x + 36$
where k is a constant.

(a) Show that $k = -4$

(2)

(b) Show that $3x^3 - 4x^2 - 27x + 36 = 0$ can be written in the form

$$\frac{27}{x} - \frac{36}{x^2} = px + q$$

where p and q are integers, giving the value of p and the value of q.

(3)

Question 11 continued

Question 11 continues on the next page

Question 11 continued

$$y = \frac{27}{x} - \frac{36}{x^2}$$

(c) Complete the table of values for $y = \frac{27}{x} - \frac{36}{x^2}$

Give your values of y to 1 decimal place where necessary.

x	1	1.25	1.5	2	3	4	5	6
y	-9		2			4.5	4.0	3.5

(3)

(d) On the grid, plot the points from your completed table and join them to form a smooth curve.

(3)

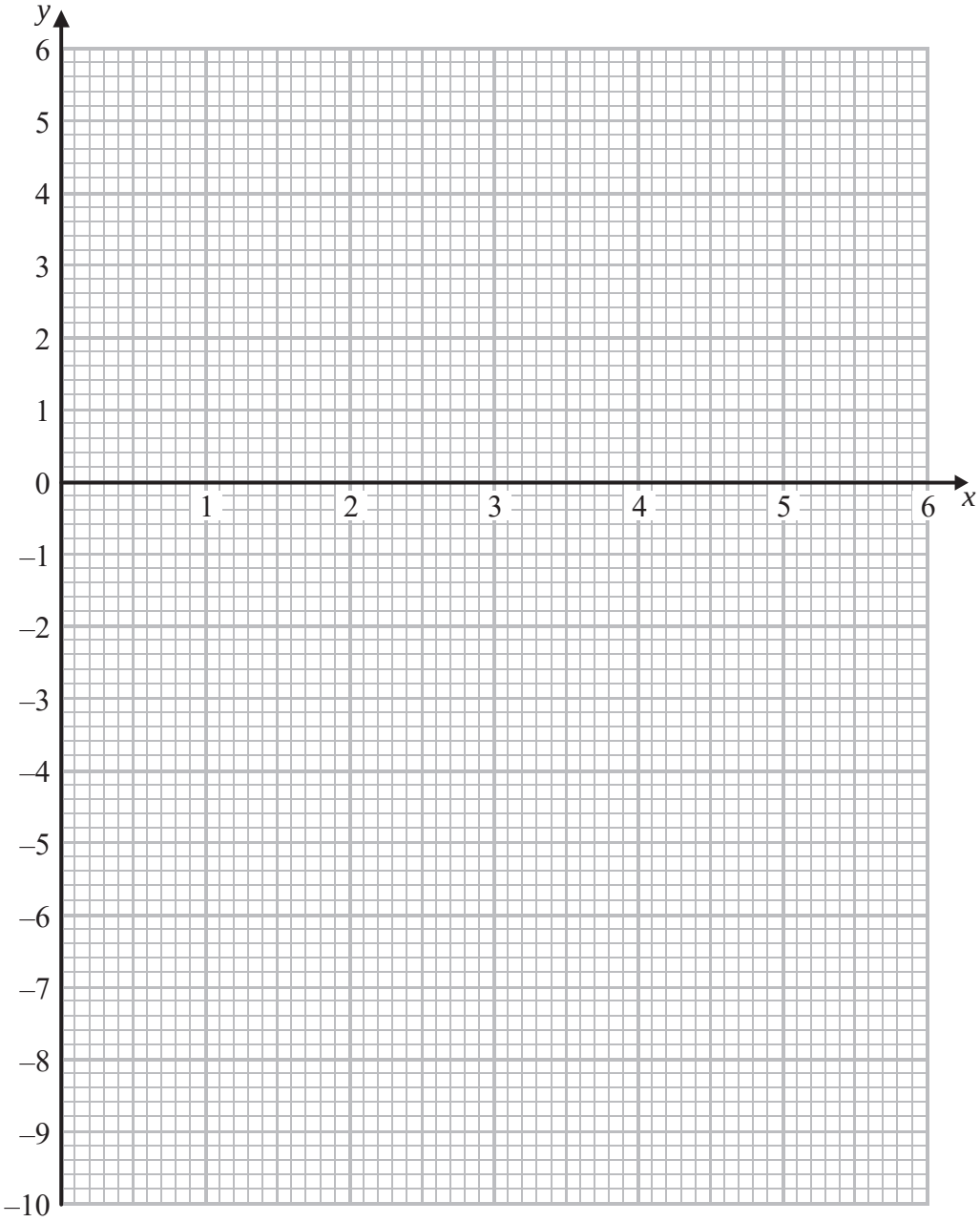
(e) For your value of p and your value of q found in part (b), draw on the same grid the straight line with equation $y = px + q$

(2)

(f) Hence find the **three** solutions of $3x^3 - 4x^2 - 27x + 36 = 0$

(3)

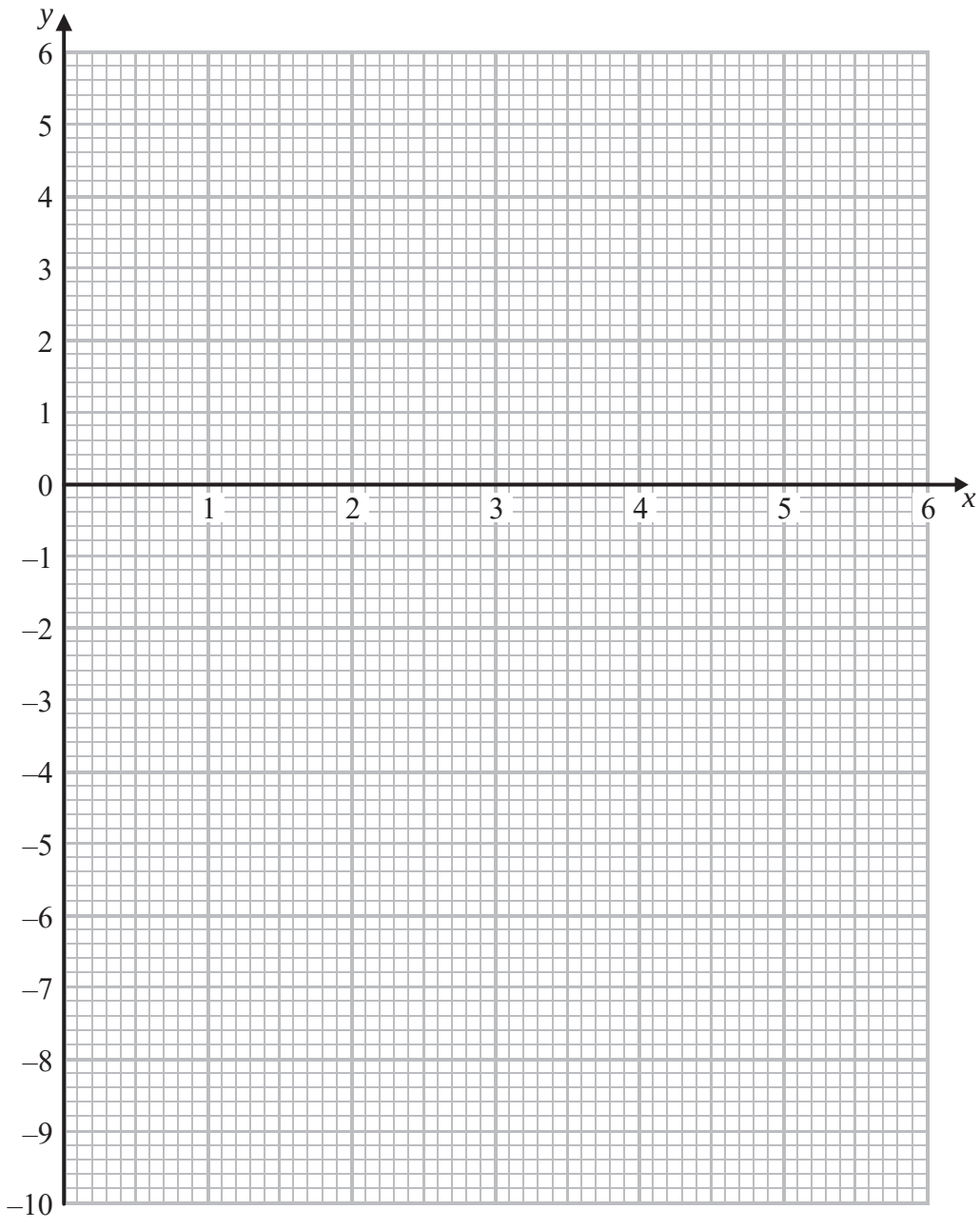
Question 11 continued



Turn over for a spare grid if you need to redraw your graph.

Question 11 continued

Only use this grid if you need to redraw your graph.



(Total for Question 11 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS