Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

6212890302

MATHEMATICS **0580/22**

Paper 2 (Extended) **May/June 2016**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
Tracing paper (optional)
Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 70.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **11** printed pages and **1** blank page.

CAMBRIDGE International Examinations

[Turn over

1 Write 0.000057 4 in standard form.

5.74×10^{-5} [1]

2 Calculate.

$$\frac{3.07 + 2^4}{5.03 - 1.79}$$

5.89 [1]

3 Write 3.5897 correct to 4 significant figures.

3.590 [1]

4 A quadrilateral has rotational symmetry of order 2 and no lines of symmetry.

Write down the mathematical name of this quadrilateral.

Parallelogram [1]

5 8 9 10 11 12 13 14 15 16

From the list of numbers, write down

(a) the square numbers,

9 and 16 [1]

(b) a prime factor of 99.

$99 = 11 \times 9$

11 [1]

6 Simplify.

$\left(\frac{1}{2}x^{\frac{2}{3}}\right)^3 = \left(\frac{1}{2}\right)^3\left(x^{\frac{2}{3}}\right)^3$

$\frac{1}{8}x^2$ [2]

Cm ÷100000 Km

7 A map is drawn to a scale of 1 : 1 000 000.
A forest on the map has an area of 4.6 cm^2.

Calculate the actual area of the forest in square kilometres.

$4.6\text{cm}^2 \times (1000000)^2$

$= 4.6 \times 10^{12}\ \text{cm}^2 \xrightarrow{(\div 100000)^2} 460\text{km}^2$ 466 ..... km^2 [2]

8 Solve the inequality $\frac{x}{3} + 5 > 2$.

$\frac{x}{3} > 2 - 5$

$\frac{x}{3} > -3$

$x > -9$ ..... [2]

9 A regular polygon has an interior angle of 172°.

Find the number of sides of this polygon.

Ext angle = 180 − 172 = 8

$\frac{360}{n} = 8$ $\frac{360}{8} = n$ 45 ..... [3]

10 Make p the subject of the formula.

$$rp + 5 = 3p + 8r$$

$rp - 3p = 8r - 5$

$p(r - 3) = 8r - 5$

$p = \frac{8r - 5}{r - 3}$

$p =$ $\frac{8r - 5}{r - 3}$ ..... [3]

11 Shahruk plays four games of golf.
His four scores have a mean of 75, a mode of 78 and a median of 77.

Work out his four scores.

more than 1

median

$75 - 1 - 3 - 3 =$ 68 76 78 78 ..... [3]

12 Write the recurring decimal $0.3\dot{6}$ as a fraction.
Give your answer in its simplest form.
[$0.3\dot{6}$ means 0.3666…]

$x = 0.3666666\ldots$
$10x = 3.6666666\ldots$
$100x = 36.6666666\ldots$
$100x - 10x = 33$
$90x = 33$
$x = \frac{33}{90}$

..... [3]

13 The base of a triangle is 9 cm correct to the nearest cm.
The area of this triangle is 40 cm^2 correct to the nearest 5 cm^2.

Calculate the upper bound for the perpendicular height of this triangle.

Area of triangle $= \frac{1}{2} \times \text{base} \times h$

$h = \frac{\text{Area}}{\text{base}} \times 2$

LB 9 UB
8.5 base 9.5

LB 40 UB
37.5 Area 42.5

$h = \frac{42.5}{8.5} \times 2 = 10$

..... 10 ..... cm [3]

14 **Without using a calculator**, work out $2\frac{5}{8} \times \frac{3}{7}$.
Show all your working and give your answer as a mixed number in its lowest terms.

$2\frac{5}{8} = \frac{21}{8}$

$\frac{21}{8} \times \frac{3}{7} = \frac{9}{8} = 1\frac{1}{8}$

$1\frac{1}{8}$

..... [3]

15 $y = x^2 + 7x - 5$ can be written in the form $y = (x + a)^2 + b$.

Find the value of a and the value of b.

$(x + \frac{b}{2})^2 - (\frac{b}{2})^2 + c = y$

$(x + 3.5)^2 - (3.5)^2 - 5 = y$
$(x + 3.5)^2 - 17.25 = y$

$a =$ 3.5
$b =$ −17.25 ..... [3]

16 Solve the simultaneous equations.
Show all your working.

$3x + 4y = 14$ → Eq 1
$5x + 2y = 21$ → Eq 2

(×2) $10x + 4y = 42$

(−) $3x + 4y = 14$

$7x = 28$

$x = \frac{28}{7}$

$x = 4$

Eq 2 → $5x + 2y = 21$

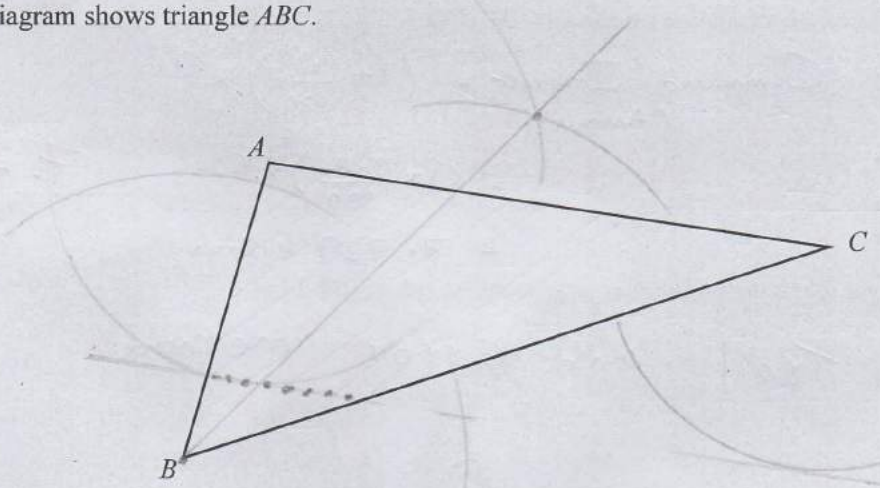
$5 \times 4 + 2y = 21$

$2y = 21 - 20 = 1 \Rightarrow y = \frac{1}{2} = 0.5$

$x =$ 4

$y =$ 0.5 [3]

17 The diagram shows triangle ABC.

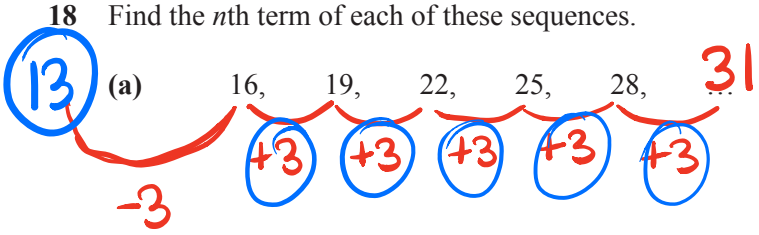


(a) **Using a straight edge and compasses only**, construct the bisector of angle ABC. [2]

(b) Draw the locus of points **inside** the triangle that are 3 cm from AC. [1]

18 Find the nth term of each of these sequences.

(a) 16, 19, 22, 25, 28, …



$13+3n$ ..... [2]

(b) 1, 3, 9, 27, 81, …

$n=1$ $n=2$ $n=3$ $n=4$ $n=5$

3^0 3^1 3^2 3^3 3^4

3^{n-1} ..... [2]

19 It is estimated that the world's population is growing at a rate of 1.14% per year.
On January 1st 2014 the population was 7.23 billion.

(a) Find the expected population on January 1st 2020.

$100\% + 1.14\% = 101.4\% = 1.0114$

$7.23 \times (1.0114)^6 =$ 7.74 ..... billion [2]

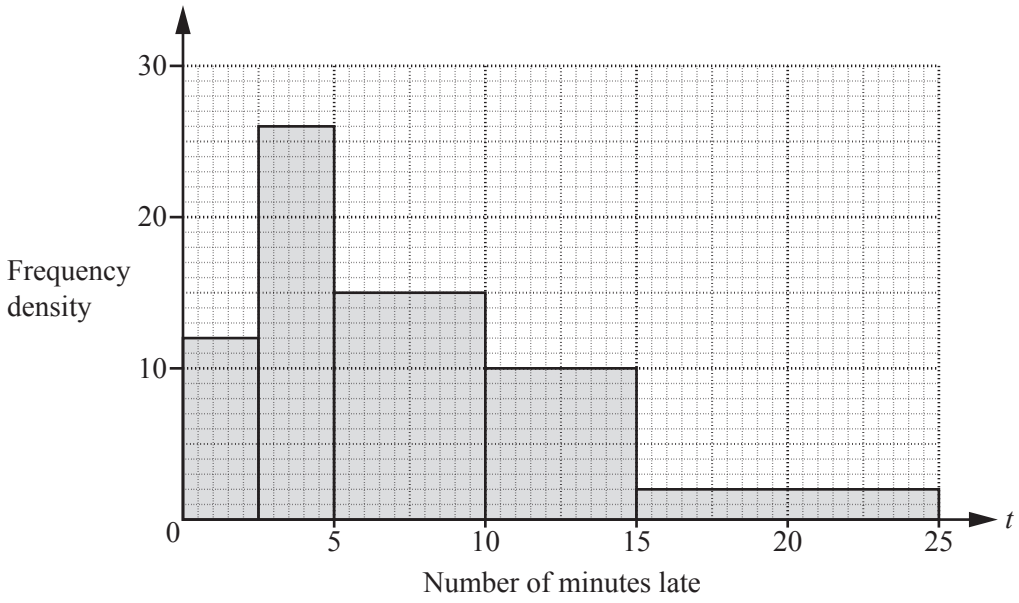
(b) Find the year when the population is expected to reach 10 billion.

$7.23 \times (1.0114)^n = 10$

$n = 29$

$2014 + 29 =$ 2043 ..... [2]

20 Deborah records the number of minutes late, t, for trains arriving at a station.
The histogram shows this information.



(a) Find the number of trains that Deborah recorded.

$(12 \times 2.5) + (26 \times 2.5) + (5 \times 15) + (5 \times 10) + (10 \times 2)$

240 ..... [2]

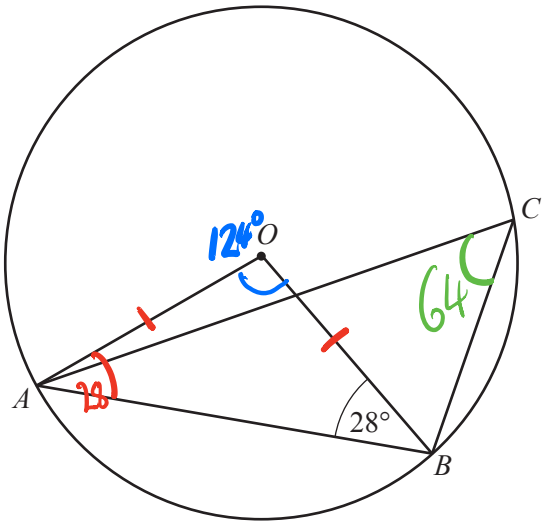
(b) Calculate the percentage of the trains recorded that arrived more than 10 minutes late.

$$\frac{\text{10 minutes late}}{\text{Total}} \times 100$$

$$= \left(\frac{(5 \times 10) + (10 \times 2)}{240} \right) \times 100 = 29.16\dot{}$$

29.2 .....% [2]

21



NOT TO SCALE

In the diagram, A, B and C lie on the circumference of a circle, centre O.

Work out the size of angle ACB.
Give a reason for each step of your working.

AOB is an isosceles triangle so angle BAO is 28
angle AOB is 124° as all angles in a triangle adds to 180°.
Angle ACB is half the angle at the center as ACB hits the circumference

Angle ACB = 28 [4]

22 $\mathbf{M} = \begin{pmatrix} 5 & 1 \\ -3 & -2 \end{pmatrix}$

(a) Work out $4\mathbf{M}$.

$4\begin{pmatrix} 5 & 1 \\ -3 & -2 \end{pmatrix}$

$\begin{pmatrix} 20 & 4 \\ -12 & -8 \end{pmatrix}$ [1]

(b) Work out $\mathbf{M}^2$.

$\begin{pmatrix} 5 & 1 \\ -3 & -2 \end{pmatrix}\begin{pmatrix} 5 & 1 \\ -3 & -2 \end{pmatrix} = \begin{pmatrix} 25-3 & 5-2 \\ -15+6 & -3+4 \end{pmatrix}$

$\begin{pmatrix} 22 & 3 \\ -9 & 1 \end{pmatrix}$ [2]

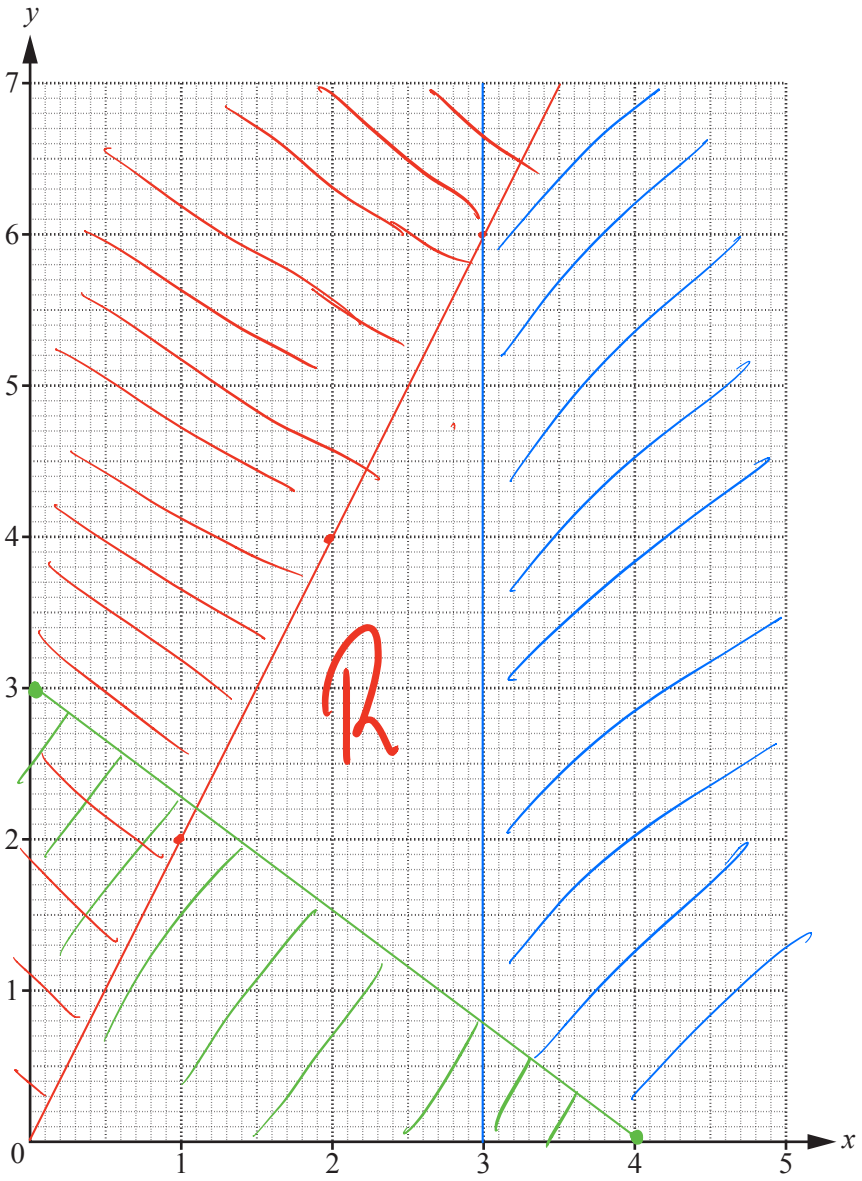
(c) Find $\mathbf{M}^{-1}$, the inverse of $\mathbf{M}$.

$M = \begin{pmatrix} 5 & 1 \\ -3 & -2 \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ $\begin{pmatrix} \quad & \quad \\ \quad & \quad \end{pmatrix}$ [2]

$\det(M) = (-2 \times 5) - (-3 \times 1) = -7$

$M^{-1} = \frac{1}{\det(M)}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix} = \frac{1}{-7}\begin{pmatrix} -2 & -1 \\ 3 & 5 \end{pmatrix}$

23



The region R satisfies these inequalities.

$y \leqslant 2x$ $\quad 3x + 4y \geqslant 12$ $\quad x \leqslant 3$

On the grid, draw and label the region R that satisfies these inequalities.
Shade the **unwanted** regions.

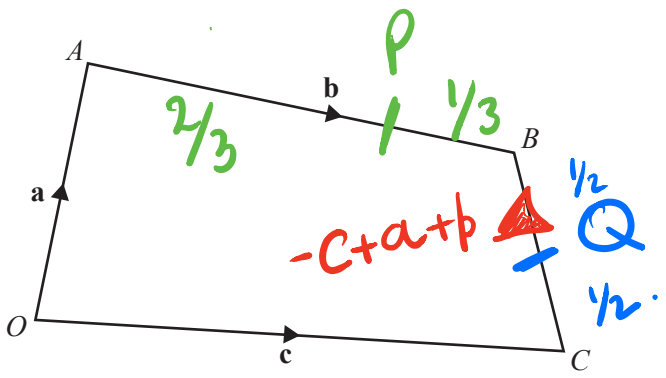
[5]

$3x + 4y = 12$

① $x = 4$ and $y = 0$

② $x = 0$ and $y = 3$

24



NOT TO SCALE

In the diagram, O is the origin, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{AB} = \mathbf{b}$.
P is on the line AB so that $AP : PB = 2 : 1$.
Q is the midpoint of BC.

Find, in terms of **a**, **b** and **c**, in its simplest form

(a) $\overrightarrow{CB}$,

$\overrightarrow{CB} =$ $-c+a+b$ [1]

(b) the position vector of Q,

$\overrightarrow{OQ} = c + \frac{1}{2}(-c+a+b)$

$\frac{1}{2}(a+b+c)$ or $\frac{1}{2}a+\frac{1}{2}b+\frac{1}{2}c$ [2]

(c) $\overrightarrow{PQ}$.

$\frac{1}{3}b - \frac{1}{2}(-c+a+b)$

$\frac{1}{3}b + \frac{1}{2}c - \frac{1}{2}a - \frac{1}{2}b$

$\frac{1}{2}c - \frac{1}{2}a - \frac{1}{6}b$

$\overrightarrow{PQ} =$ $\frac{1}{2}c - \frac{1}{2}a - \frac{1}{6}b$ [2]

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