UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/12**

Paper 1 **October/November 2010**

2 hours

Candidates answer on the Question Paper.

Additional Materials: 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 a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

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 80.

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1 **(a)** Evaluate $3\frac{1}{7} - 2\frac{1}{3}$.

Answer (*a*) .....[1]

(b) Evaluate $\frac{2}{9} \times 1\frac{7}{8}$, giving your answer as a fraction in its lowest terms.

Answer (*b*) .....[1]

---

2 **(a)** Evaluate $6.3 \div 0.09$.

Answer (*a*) .....[1]

(b) Find the decimal number that is exactly halfway between 3.8 and 4.3 .

Answer (*b*) .....[1]

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3 **(a)** Express 0.000 070 6 in standard form.

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Answer (*a*) .....[1]

(b) A house was bought for \$20 000 and sold for \$50 000.

Calculate the percentage profit.

Answer (*b*) .....% [1]

---

4 The temperatures, in °C , at midnight on 10 consecutive days were

4, 1, 0, –2, –1, –3, 1, –2, 3, –1.

(a) Find the difference between the highest and the lowest temperature.

Answer (*a*) .....°C [1]

(b) How many of these temperatures are within 2.5 °C of 1 °C ?

Answer (*b*) .....[1]

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5 **(a)** The mass of a container and its contents is 2.4 kg.
The mass of the contents is 750 g.

Calculate the mass, in kilograms, of the container.

Answer (*a*) ..... kg [1]

(b) Express the ratio 24 cm to 3 m in its lowest terms.
Give your answer in the form $p : q$, where p and q are integers.

Answer (*b*) ..... : .....[1]

---

6 Factorise

(a) $4t^2 - 9$,

Answer (*a*) .....[1]

(b) $3x^2 + 5x - 2$.

Answer (*b*) .....[1]

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7 y is directly proportional to the square of x.

Given that $y = 50$ when $x = 5$, find the value of y when $x = 3$.

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Answer $y =$ ..... [2]

---

8 Make x the subject of the formula $y = 2x^2 + 3$.

Answer $x =$ ..... [2]

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9 $\overrightarrow{AB} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$

(a) Find $|\overrightarrow{AB}|$.

Answer (*a*) .....[1]

(b) A is the point (0, 2).

(i) The equation of the line AB may be written $3y + 4x = k$.
Find the value of k.

Answer (*b*)(i) k = ...[1]

(ii) Find the coordinates of the midpoint of AB.

Answer (*b*)(ii) (..... , ...) [1]

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10 **(a)** Evaluate $5^0 - 5^{-1}$.

Answer (*a*) .....[1]

(b) Simplify $(5x^3)^2$.

Answer (*b*) .....[1]

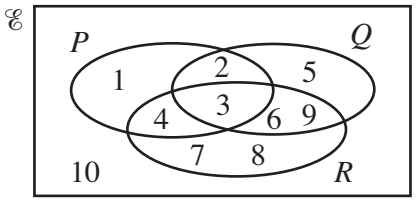
(c) Simplify $\left(\frac{16}{n^{16}}\right)^{\frac{1}{2}}$.

Answer (*c*) .....[1]

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11 The Venn diagram shows the sets $\mathscr{E}$, P, Q and R.

$\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$



(a) Find the value of $n(Q \cup R)$.

Answer (*a*) .....[1]

(b) List the elements of the set $P' \cap (Q \cup R)$.

Answer (*b*) {.....} [1]

(c) One element is chosen at random from $\mathscr{E}$.
Write down the probability that this element belongs to $(P \cap Q) \cup (P \cap R)$.

Answer (*c*) .....[1]

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12 $f(x) = 6 - \frac{x}{2}$

(a) Find f(5).

Answer (*a*) .....[1]

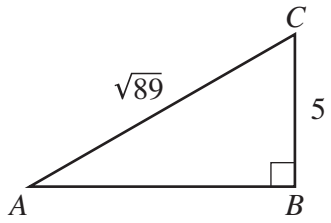
(b) Find $f^{-1}(x)$.

Answer (*b*) $f^{-1}(x)$ = ...[2]

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13 In the diagram, $A\hat{B}C = 90°$, $BC = 5$ cm and $AC = \sqrt{89}$ cm.



(a) What special kind of number is $\sqrt{89}$?

Answer (*a*) ..... [1]

(b) Calculate AB.

Answer (*b*) ..... cm [2]

---

14 Solve the simultaneous equations.

$$3y = 2x$$
$$x + 2y = 21$$

Answer $x =$ .....

$y =$ ..... [3]

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15 In a sale, a shopkeeper reduced the marked price of his goods by 20%.

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(a) The marked price of a book was \$20.

Calculate its price in the sale.

Answer (*a*) \$ .....[1]

(b) The price of a camera in the sale was \$60.

Calculate its marked price.

Answer (*b*) \$ .....[2]

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16 $\mathbf{A} = \begin{pmatrix} 2 & -3 \\ -1 & 0 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 5 & -4 \\ -2 & 2 \end{pmatrix}$

Find

(a) $2\mathbf{A} - \mathbf{B}$,

Answer (*a*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

(b) $\mathbf{A}^{-1}$.

Answer (*b*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

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17 A shop sells bunches of flowers.
One bunch contains 3 roses, 4 carnations and 5 freesias.
Another bunch contains 6 roses and 4 carnations.
Each rose costs 60 cents, each carnation costs 40 cents and each freesia costs 30 cents.

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This information can be represented by the matrices P and Q below.

$$P = \begin{pmatrix} 3 & 4 & 5 \\ 6 & 4 & 0 \end{pmatrix} \qquad Q = \begin{pmatrix} 60 \\ 40 \\ 30 \end{pmatrix}$$

(a) Find PQ.

Answer (*a*) [2]

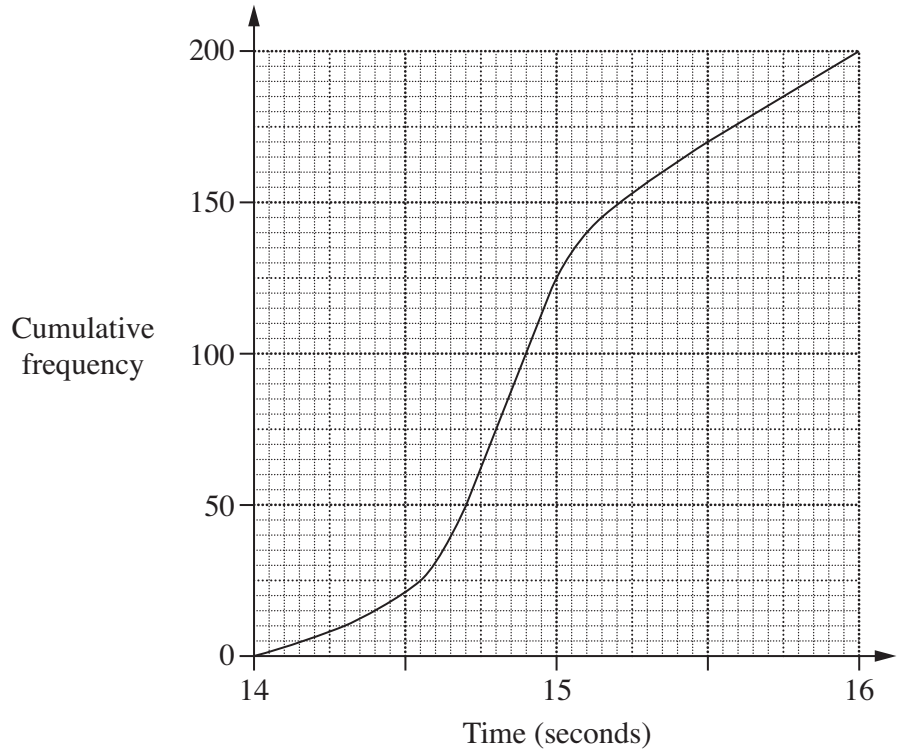
(b) Explain what the numbers in your answer represent.

Answer (*b*) .....

.....

..... [1]

18 The times taken for 200 children to run 100 m were recorded.
The cumulative frequency curve summarises the results.



Use the curve to find

(a) the lower quartile,

Answer (*a*) ..... seconds [1]

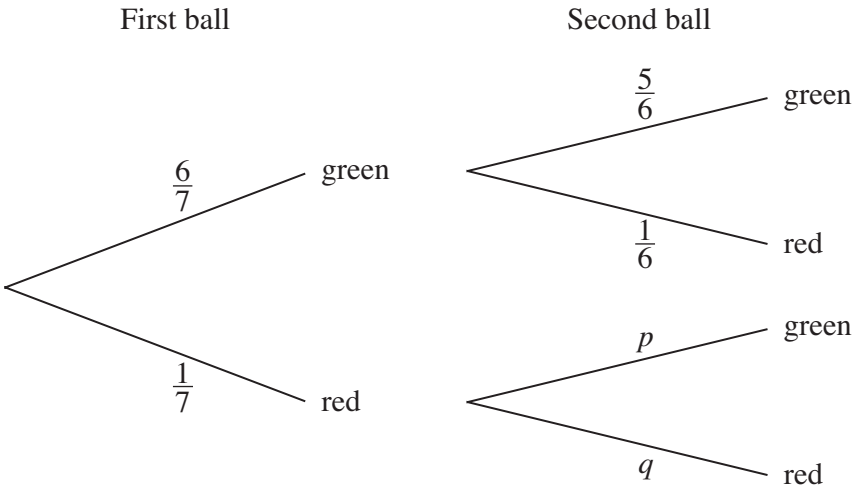
(b) the number of children who took at least 15.5 seconds.

Answer (*b*) ..... [2]

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19 A bag contains 7 balls, 6 of which are green and 1 is red.
Two balls are taken from the bag, at random, without replacement.
The tree diagram that represents these events is drawn below.

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(a) Find the values of p and q.

Answer (*a*) p = ... q = ...[1]

(b) Expressing each answer as a fraction in its simplest form, find the probability that

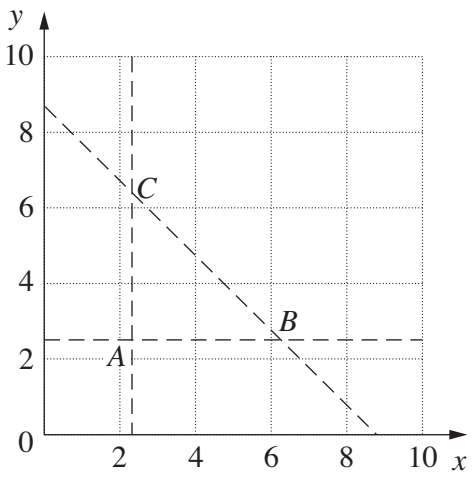
(i) both balls are green,

Answer (*b*)(i) .....[1]

(ii) the two balls have different colours.

Answer (*b*)(ii) .....[1]

20 The three lines
$3x = 7$,
$2y = 5$ and
$4x + 4y = 35$
intersect to form the triangle ABC,
as shown in the diagram.



The region **inside** the triangle ABC
is defined by three inequalities.
One of these is $2y > 5$.

(a) Write down the other two inequalities.

Answer (*a*) .....

..... [2]

(b) Find the point, with integer coordinates, that lies **inside** the triangle ABC and is closest to B.

Answer (*b*) (..... , ...) [1]

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21 ABC is a triangle.
Angle A is 62°, correct to the nearest degree.
Angle B is 53.4°, correct to the nearest tenth of a degree.

(a) Write down the lower bound for angle B.

Answer (*a*) .....[1]

(b) Calculate the upper bound for angle C.

Answer (*b*) .....[2]

---

22 **(a)** Express, correct to **two** significant figures,

(i) 15 823.769,

Answer (*a*)(i) .....[1]

(ii) 0.003 048 9.

Answer (*a*)(ii) .....[1]

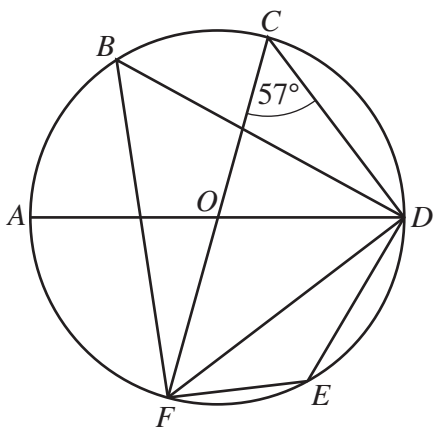
(b) **Use your answers to part (a)** to estimate, correct to **one** significant figure, the value of

$$15\,823.769 \times 0.003\,048\,9.$$

Answer (*b*) .....[2]

---

23 In the diagram, A, B, C, D, E and F lie on the circle, centre O.
AD and FC are diameters, and $F\hat{C}D = 57°$.



Find

(a) $D\hat{E}F$,

Answer (*a*) $D\hat{E}F =$ .....[1]

(b) $F\hat{B}D$,

Answer (*b*) $F\hat{B}D =$ .....[1]

(c) $C\hat{F}D$,

Answer (*c*) $C\hat{F}D =$ .....[1]

(d) $A\hat{O}F$.

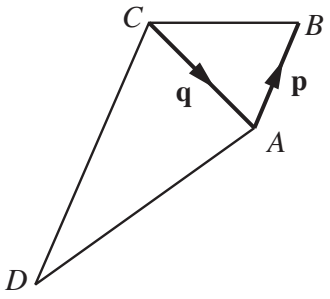
Answer (*d*) $A\hat{O}F =$ .....[1]

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24 In the diagram,

$\overrightarrow{AB} = \mathbf{p}$, $\overrightarrow{CA} = \mathbf{q}$

and $\overrightarrow{DC} = 3\overrightarrow{AB}$.



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(a) Express $\overrightarrow{DA}$ in terms of **p** and **q**.

Answer (*a*) $\overrightarrow{DA}$ = ...[1]

(b) E is the point such that $\overrightarrow{BE} = k\mathbf{q}$.

(i) Write down the name given to the special quadrilateral $ACBE$.

Answer (*b*)(i) .....[1]

(ii) Express $\overrightarrow{AE}$ in terms of **p**, **q** and k.

Answer (*b*)(ii) $\overrightarrow{AE}$ = ...[1]

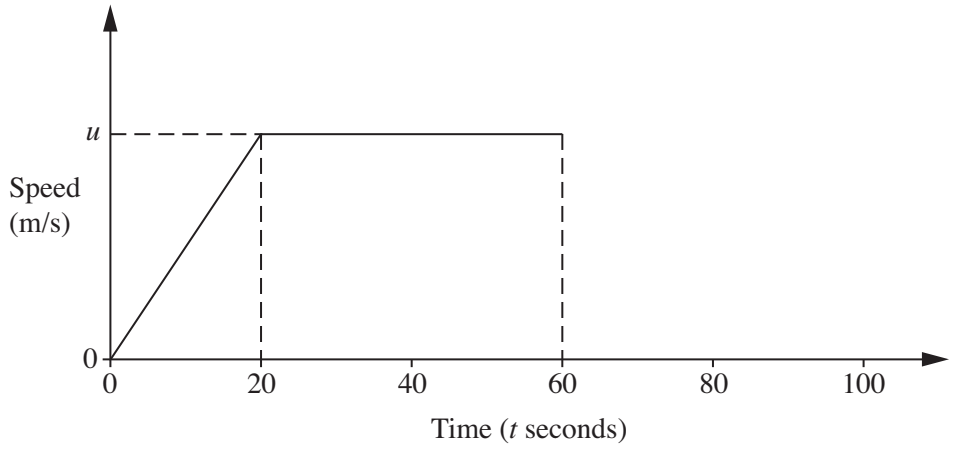
(iii) Given that D, A and E lie on a straight line, find the value of k.

Answer (*b*)(iii) k = ...[1]

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The diagram is the speed-time graph of part of the journey of a car.
From $t = 0$ to $t = 20$ the car moves with a constant acceleration.
From $t = 20$ to $t = 60$ the car moves with a constant speed of u metres per second.

(a) When $t = 20$ the car has travelled D metres from the start.

Calculate the value of t when the car has travelled $2D$ metres **from the start**.

Answer (*a*) $t =$ .....[2]

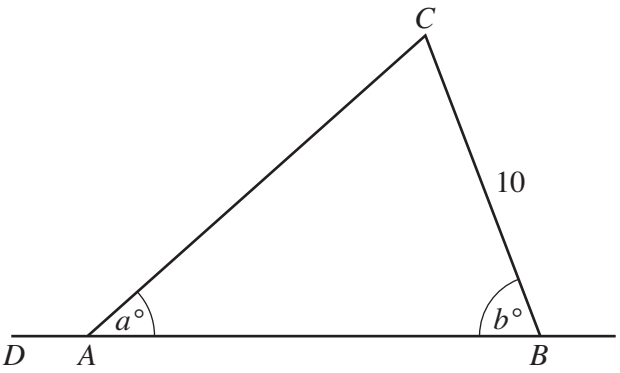
(b) At $t = 60$, the car slows down with a constant deceleration.
This deceleration is half of the acceleration between $t = 0$ and $t = 20$.

During this period of deceleration, calculate the value of t when the car has a speed of $\frac{u}{4}$ metres per second.

Answer (*b*) $t =$ .....[2]

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$x°$	$a°$	$b°$
$\sin x°$	$\frac{3}{5}$	$\frac{24}{25}$
$\cos x°$	$\frac{4}{5}$	$\frac{7}{25}$
$\tan x°$	$\frac{3}{4}$	$\frac{24}{7}$

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In the diagram, DAB is a straight line.
$BC = 10$ cm, $C\hat{A}B = a°$ and $C\hat{B}A = b°$.

Use as much information given in the table as is necessary to answer the following questions.

(a) Write down the value of $\cos D\hat{A}C$.

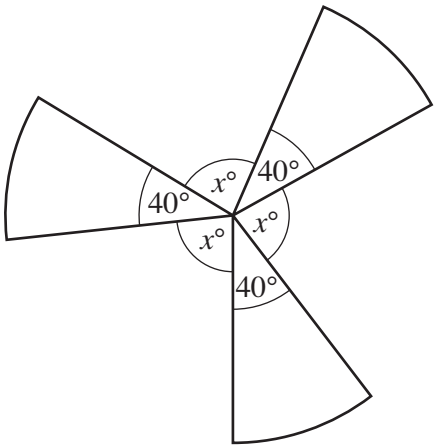
Answer (*a*) .....[1]

(b) Calculate AC.

Answer (*b*) $AC =$ ..... cm [3]

Question 27 is printed on the following page

27 The diagram shows a shape made from thin wire.
The shape is formed from 3 identical sectors of a circle, each with an angle of 40°.
The angle between each pair of sectors is $x°$.



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(a) State the order of rotational symmetry of the shape.

Answer (*a*) ..... [1]

(b) Calculate the value of x.

Answer (*b*) x = ... [1]

(c) **In this part take the value of π to be 3.**
Given that the **total** length of the wire is 60 cm, calculate the radius of one of the sectors.

Answer (*c*) ..... cm [3]

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