



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

CANDIDATE  
NAME

CENTRE  
NUMBER

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|

CANDIDATE  
NUMBER

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|--|--|--|--|



**MATHEMATICS (SYLLABUS D)**

**4024/13**

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.

**For Examiner's Use**

|  |
|--|
|  |
|--|

This document consists of **20** printed pages.



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

- 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]

---

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

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  $^{\circ}\text{C}$ , 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) ..... $^{\circ}\text{C}$  [1]

- (b) How many of these temperatures are within  $2.5^{\circ}\text{C}$  of  $1^{\circ}\text{C}$ ?

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

---

4

- 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]

---

5

7  $y$  is directly proportional to the square of  $x$ .

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

*Answer*  $y = \dots\dots\dots$  [2]

---

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

*Answer*  $x = \dots\dots\dots$  [2]

---

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

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

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]

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

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

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

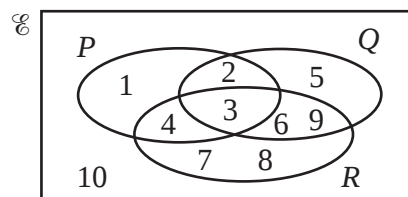
Answer (b) .....[1]

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

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

- 11 The Venn diagram shows the sets  $\mathcal{C}$ ,  $P$ ,  $Q$  and  $R$ .

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



- (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  $\mathcal{C}$ .  
Write down the probability that this element belongs to  $(P \cap Q) \cup (P \cap R)$ .

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

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

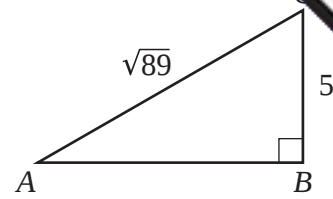
- (a) Find  $f(5)$ .

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

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

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

- 13 In the diagram,  $\hat{A}BC = 90^\circ$ ,  
 $BC = 5 \text{ cm}$  and  $AC = \sqrt{89} \text{ cm}$ .



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

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

- (b) Calculate  $AB$ .

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

- 14 Solve the simultaneous equations.

$$\begin{aligned} 3y &= 2x \\ x + 2y &= 21 \end{aligned}$$

Answer  $x =$  .....

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

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

(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]

---

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

Find

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

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

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

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

---

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.

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

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

(a) Find PQ.

Answer (a)

[2]

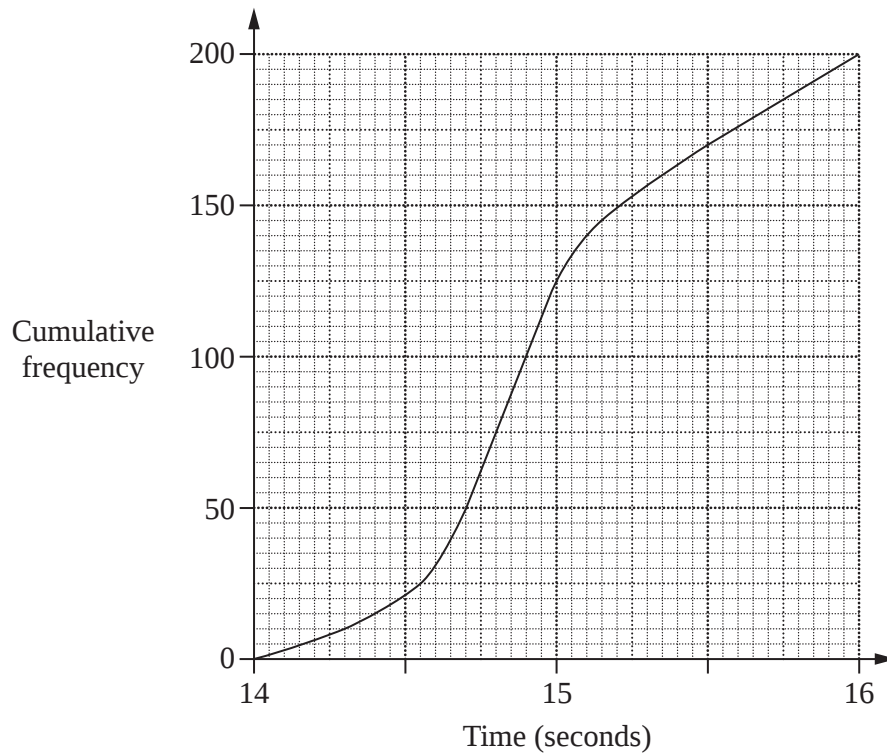
(b) Explain what the numbers in your answer represent.

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

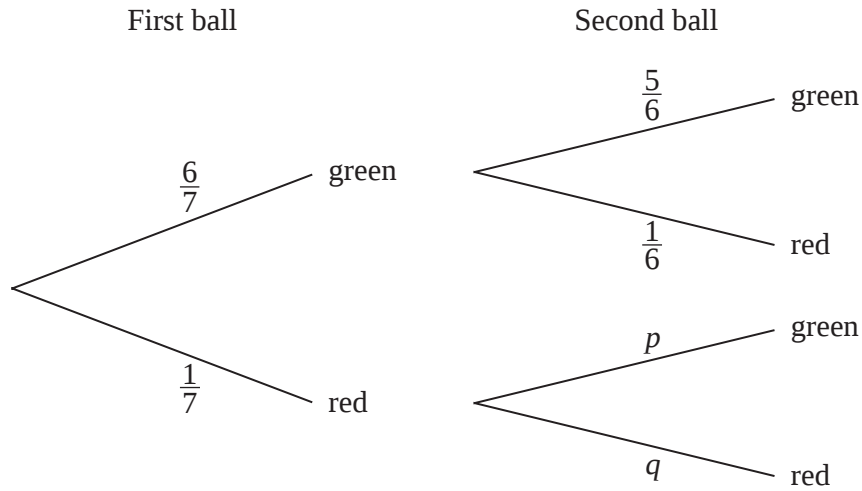
- (a) the lower quartile,

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

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

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

- 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.



- (a) Find the values of  $p$  and  $q$ .

Answer (a)  $p = \dots\dots\dots q = \dots\dots\dots$  [1]

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

- (i) both balls are green,

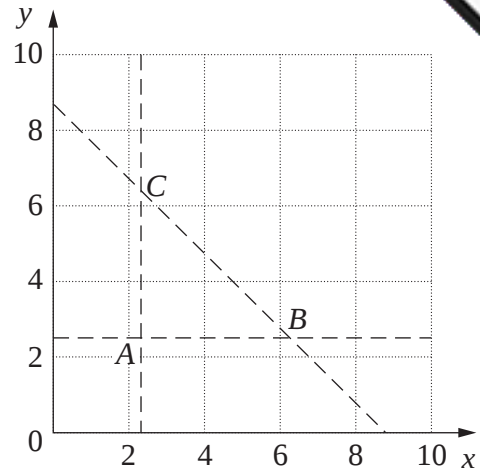
Answer (b)(i)  $\dots\dots\dots$  [1]

- (ii) the two balls have different colours.

Answer (b)(ii)  $\dots\dots\dots$  [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]

- 21  $ABC$  is a triangle.  
Angle  $A$  is  $62^\circ$ , correct to the nearest degree.  
Angle  $B$  is  $53.4^\circ$ , 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) 15823.769,

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

(ii) 0.0030489.

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

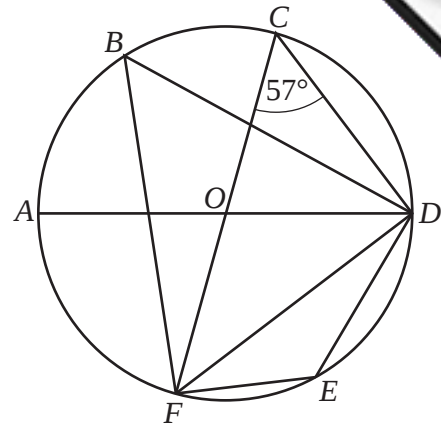
(b) Use your answers to part (a) to estimate, correct to **one** significant figure, the value of

$$15823.769 \times 0.0030489.$$

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  $\hat{FCD} = 57^\circ$ .



Find

(a)  $\hat{DEF}$ ,

Answer (a)  $\hat{DEF} = \dots\dots\dots [1]$

(b)  $\hat{FBD}$ ,

Answer (b)  $\hat{FBD} = \dots\dots\dots [1]$

(c)  $\hat{CFD}$ ,

Answer (c)  $\hat{CFD} = \dots\dots\dots [1]$

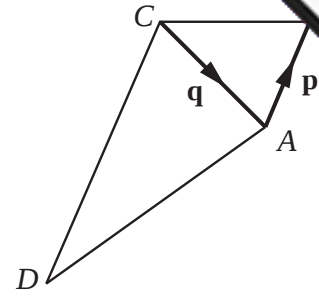
(d)  $\hat{AOF}$ .

Answer (d)  $\hat{AOF} = \dots\dots\dots [1]$

24 In the diagram,

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

$$\text{and } \vec{DC} = 3\vec{AB}.$$



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

Answer (a)  $\vec{DA} = \dots\dots\dots$  [1]

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

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

Answer (b)(i)  $\dots\dots\dots$  [1]

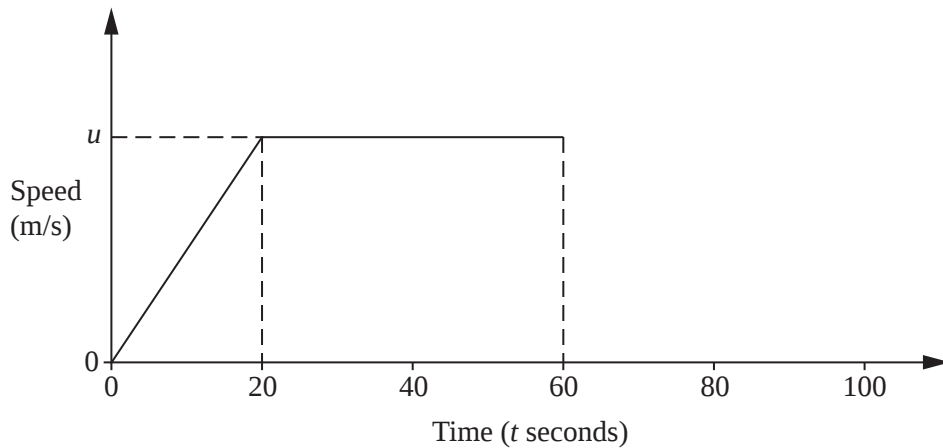
(ii) Express  $\vec{AE}$  in terms of  $\mathbf{p}$ ,  $\mathbf{q}$  and  $k$ .

Answer (b)(ii)  $\vec{AE} = \dots\dots\dots$  [1]

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

Answer (b)(iii)  $k = \dots\dots\dots$  [1]

25



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)  $t = \dots\dots\dots$  [2]

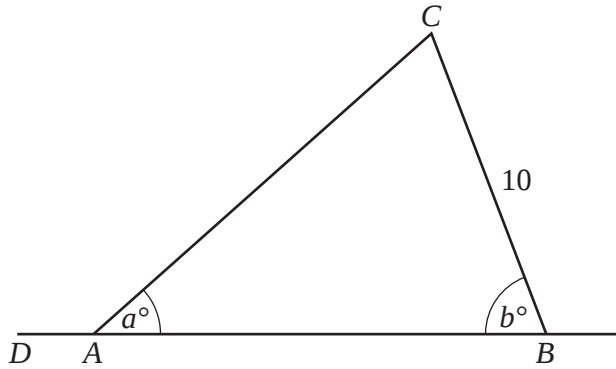
- (b) At  $t = 60$ , the car slows down with a constant deceleration.

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)  $t = \dots\dots\dots$  [2]

26



| $x^\circ$      | $a^\circ$     | $b^\circ$       |
|----------------|---------------|-----------------|
| $\sin x^\circ$ | $\frac{3}{5}$ | $\frac{24}{25}$ |
| $\cos x^\circ$ | $\frac{4}{5}$ | $\frac{7}{25}$  |
| $\tan x^\circ$ | $\frac{3}{4}$ | $\frac{24}{7}$  |

In the diagram,  $DAB$  is a straight line.

$BC = 10\text{ cm}$ ,  $\hat{CAB} = a^\circ$  and  $\hat{CBA} = b^\circ$ .

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

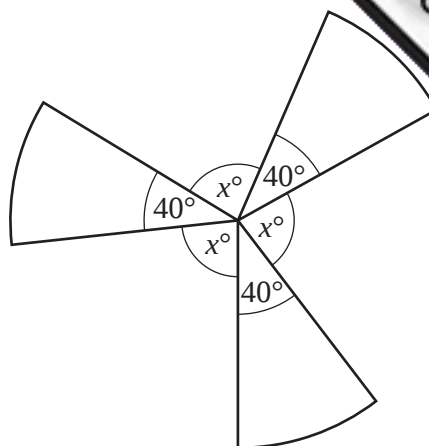
(a) Write down the value of  $\cos \hat{DAC}$ .

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

(b) Calculate  $AC$ .

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

- 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  $40^\circ$ .  
The angle between each pair of sectors is  $x^\circ$ .



- (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  $\pi$  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]