Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

0387967299

MATHEMATICS **0580/21**

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.

DC (LK/JG) 113303/2

1 A train leaves Zurich at 22 40 and arrives in Vienna at 07 32 the next day.

Work out the time taken.

hrs.	mins.
~~24~~ 23	~~00~~ 60
− 22	40
01	20

hrs.	mins.
01	20
+ 7	32
08	52

8 h 52 min [1]

2 From a sample of 80 batteries, 3 are faulty.

Work out the percentage of faulty batteries.

$\%\text{ of faulty batts} = \frac{\text{No. of faulty batts.}}{\text{Total no. of batts.}} \times 100\%$

$\Rightarrow$ " " " " $= \frac{3}{80} \times 100\%$

$\Rightarrow$ " " " " $= 3.75\%$

3.75 %

3 Write 1.27×10^{-3} as an ordinary number.

$\star\ 1.27 \times 10^{-3}$

$0.\overset{3}{0}\overset{2}{0}\overset{1}{1}.27$

0.00127

0.00127 [1]

4 Calculate $(2.1 - 0.078)^{17}$, giving your answer correct to 4 significant figures.

$\star\ (2.1 - 0.078)^{17} = 157862.7163\ldots$

$\simeq 157900$ (4 sig. figs.)

157900 [2]

5 Omar changes 2000 Saudi Arabian riyals (SAR) into euros (€) when the exchange rate is €1 = 5.087 SAR.

Work out how much Omar receives, giving your answer correct to the nearest euro.

€1 = 5.087 SAR $\Rightarrow x = \frac{2000\ \text{SAR}}{5.087\ \text{SAR}} \times €1$

x = 2000 SAR $\Rightarrow x =$ €393 (nearest euro)

€ 393 [2]

6 Find the lowest common multiple (LCM) of 36 and 48.

★ Multiples of 36: 36, 72, 108, 144, 180, ...

★ Multiples of 48: 48, 96, 144, ...

∴ LCM (36 and 48) = 144

144 ..... [2]

7 $y = mx + c$

Find the value of y when $m = -2$, $x = -7$ and $c = -3$.

★ $y = mx + c$

⇒ $y = (-2x-7) + (-3)$

⇒ $y = 14 - 3 = 11$

$y =$ 11 ..... [2]

8 $y = \frac{qx}{p}$

Write x in terms of p, q and y.

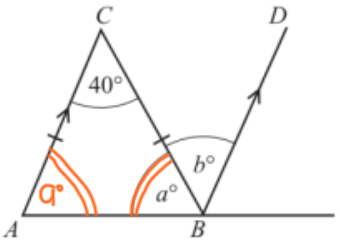
★ $y = \frac{qx}{p}$

⇒ $yp = qx$

⇒ $x = \frac{yp}{q}$

$x =$ $\frac{yp}{q}$ ..... [2]

9



NOT TO SCALE

Triangle ABC is isosceles and AC is parallel to BD.

Find the value of a and the value of b.

★ Finding a:

$2a + 40° = 180°$

$\Rightarrow a = 70°$

★ Finding b:

• From parallel lines,

$b = A\hat{C}B$

$b = 40°$

$a =$ 70°

$b =$ 40° [2]

10 The sides of an equilateral triangle are 9.4 cm, correct to the nearest millimetre.

Work out the upper bound of the perimeter of this triangle.

• 1 mm = 0·1 cm

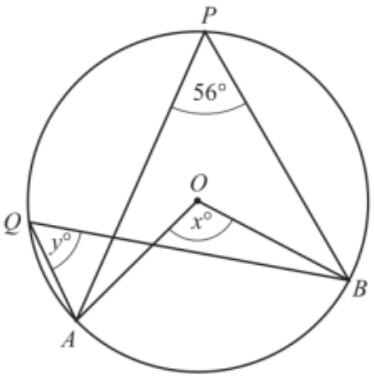
★ $l = \left(9.4 \pm \frac{0.1}{2}\right)$ cm

• UB(l) $= \left(9.4 + \frac{0.1}{2}\right)$ cm $= 9.45$ cm

∴ UB(P) $= (3 \times 9.45)$ cm $= 28.35$ cm

28·35 cm [2]

11



NOT TO SCALE

A, B, P and Q lie on the circle, centre O.
Angle $APB = 56°$.

Find the value of

(a) x,

$\star\ x = 2 \times A\hat{P}B$

$\Rightarrow\ x = 2 \times 56° = 112°$

$x =$ 112° [1]

(b) y.

$\star\ y = A\hat{P}B$

$\Rightarrow\ y = 56°$

$y =$ 56° [1]

12 Simplify $(16p^{16})^{\frac{1}{4}}$.

$\star\ (16p^{16})^{\frac{1}{4}}$

$\Rightarrow\ 16^{\frac{1}{4}}(p^{16})^{\frac{1}{4}}$

$\Rightarrow\ 2p^4$

$2p^4$ [2]

13 Solve the inequality.

$$n + 7 < 5n - 8$$

$\Rightarrow\ 7 + 8 < 5n - n$

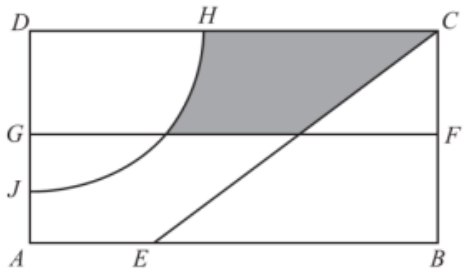
$\Rightarrow\ 15 < 4n$

$\Rightarrow\ \frac{15}{4} < n$

$\Rightarrow\ 3.75 < n$ or $n > 3.75$

$n > 3.75$ [2]

14



NOT TO SCALE

The diagram shows a rectangular garden divided into different areas.
FG is the perpendicular bisector of BC.
The arc HJ has centre D and radius 20 m.
CE is the bisector of angle DCB.

Write down two more statements using loci to describe the shaded region inside the garden.

The shaded region is

- nearer to C than to B
- nearer to CD than to CB
- more than 20m from D [2]

15 7, 5, 3, 1, −1, -3 (−2 between each term)

(a) Find the next term in this sequence.

-3 [1]

(b) Find the nth term of the sequence.

★ $a_n = a_1 + (n-1)d$

- $a_1 = 7$
- $d = -2$

9 − 2n [2]

⇒ $a_n = 7 + (n-1) \times -2$

⇒ $a_n = 7 - 2n + 2$

⇒ $a_n = 9 - 2n$

16 **Without using a calculator**, work out $\frac{6}{7} \div 1\frac{2}{3}$.

Show all your working and give your answer as a fraction in its lowest terms.

$\star \quad \frac{6}{7} \div \frac{2}{3}$

$\Rightarrow \quad \frac{6}{7} \div \frac{5}{3}$

$\Rightarrow \quad \frac{6}{7} \times \frac{3}{5}$

$\Rightarrow \quad \frac{18}{35}$

$\frac{18}{35}$ [3]

17 Five angles of a hexagon are each 115°.

Calculate the size of the sixth angle.

$\star$ Total of interior angles $= 180°(n-2)$

$(5 \times 115°) + x = 180°(6-2)$

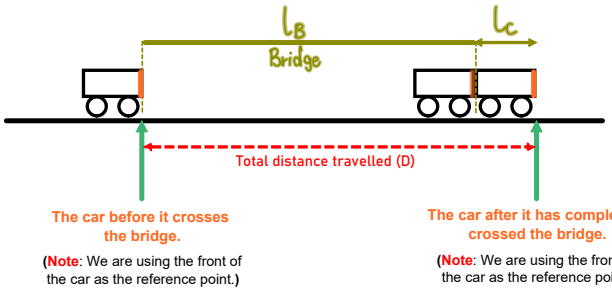
$\Rightarrow \quad 575° + x = 720°$

$\Rightarrow \quad x = 145°$

145° [3]

18 A car of length 4.3 m is travelling at 105 km/h.
It passes over a bridge of length 36 m.

Calculate the time, in seconds, it takes to pass over the bridge **completely**.



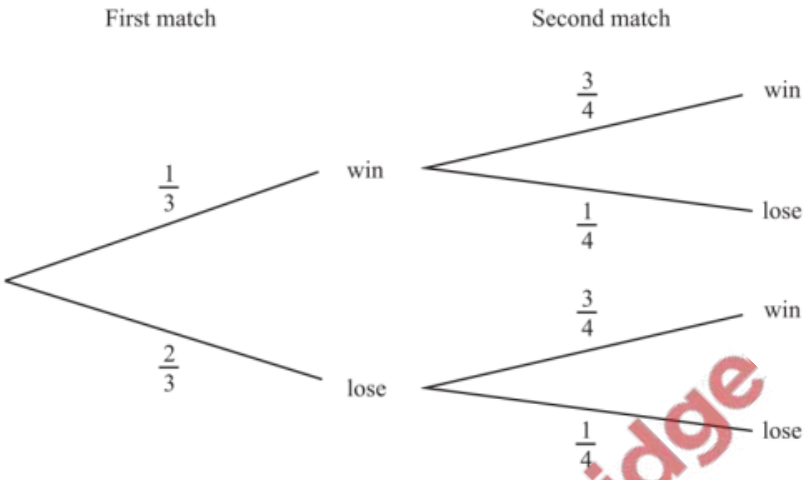
$\star \quad t = \frac{D}{v} = \frac{l_B + l_C}{v}$

$\Rightarrow \quad t = \frac{36\,m + 4{\cdot}3\,m}{\left(\frac{105\,km}{h}\right)} = \frac{40{\cdot}3\,m}{\left(\frac{105 \times 10^3\,m}{3600\,s}\right)}$

$\Rightarrow \quad t = 1{\cdot}38\,s$

1·38 s [3]

19 The probability of a cricket team winning or losing in their first two matches is shown in the tree diagram.



Find the probability that the cricket team wins at least one match.

$\star\ P = [P(W_1) \times P(L_2)] + [P(L_1) \times P(W_2)] + [P(W_1) \times P(W_2)]$

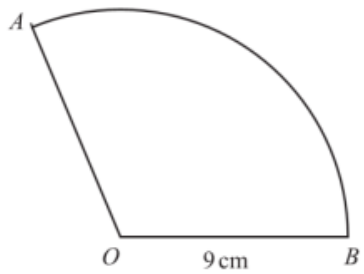
$\Rightarrow P = \left(\frac{1}{3} \times \frac{1}{4}\right) + \left(\frac{2}{3} \times \frac{3}{4}\right) + \left(\frac{1}{3} \times \frac{3}{4}\right)$

$\Rightarrow P = \frac{5}{6}$

$\frac{5}{6}$ ..... [3]

20 AB is an arc of a circle, centre O, radius 9 cm.
The length of the arc AB is 6π cm.
The area of the sector AOB is $k\pi$ cm^2.

Find the value of k.



NOT TO SCALE

★ A sector AOB = $k\pi$

$\Rightarrow \frac{\theta}{360^\circ} \times \pi(9)^2 = k\pi$

$\Rightarrow \left(\frac{81\theta}{360^\circ}\right)\pi = k\pi$

$\Rightarrow k = \frac{81\theta}{360^\circ}$

• Finding θ

$\Rightarrow$ Arc length $= 6\pi$

$\Rightarrow \frac{\theta}{360^\circ} \times 2\pi(9) = 6\pi$

$\Rightarrow \theta = 120^\circ$

$\therefore k = \frac{81 \times 120^\circ}{360^\circ} = 27$

$k =$ 27 [3]

21 y is directly proportional to the positive square root of x.
When $x = 9$, $y = 12$.

Find y when $x = \frac{1}{4}$.

★ $y \propto \sqrt{x}$

$\Rightarrow y = k\sqrt{x}$

• Finding k

when $x = 9$, $y = 12$

$12 = k\sqrt{9}$

$\Rightarrow k = 4$

★ $y = 4\sqrt{x}$

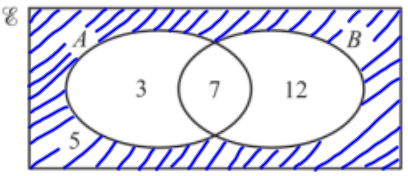
when $x = \frac{1}{4}$,

$\Rightarrow y = 4\sqrt{\frac{1}{4}}$

$\Rightarrow y = 2$

$y =$ 2 [3]

22



The Venn diagram shows the numbers of elements in each region.

(a) Find $n(A \cap B')$.

3 [1]

(b) An element is chosen at random.

Find the probability that this element is in set B.

★ $P = \frac{\text{No. of elements in Set B}}{\text{Total no. of elements}} = \frac{7+12}{5+3+7+12} = \frac{19}{27}$

$\frac{19}{27}$ [1]

(c) An element is chosen at random from set A.

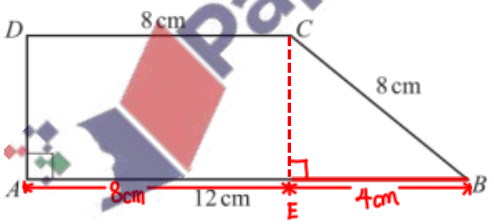
Find the probability that this element is also a member of set B.

★ $P = \frac{\text{No. of elements in A and B}}{\text{No. of elements in A}} = \frac{7}{3+7} = \frac{7}{10}$

$\frac{7}{10}$ [1]

(d) On the Venn diagram, shade the region $(A \cup B)'$. [1]

23



NOT TO SCALE

Calculate the area of this trapezium.

★ $A_{trapezium} = \frac{1}{2}(DC+AB) \times AD$

• Finding AD

$BC^2 = AD^2 + EB^2$

$\Rightarrow AD = (\sqrt{8^2 - 4^2})$ cm

$\Rightarrow AD = \sqrt{48}$ cm

$\Rightarrow A_{trapezium} = \left[\frac{1}{2}(8+12) \times 4\sqrt{3}\right]$ cm^2

$\Rightarrow A_{trapezium} = 69.3$ cm^2 (3 sig. figs.)

69.3 cm^2 [4]

24 Factorise completely.

(a) $2a+4+ap+2p$

$\Rightarrow 2(a+2)+p(a+2)$

$\Rightarrow (a+2)(2+p)$

$(a+2)(2+p)$ [2]

(b) $162-8t^2$

$\Rightarrow 2(81-4t^2)$

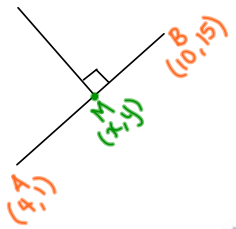
$\Rightarrow 2((9)^2-(2t)^2)$

$\Rightarrow 2(9+2t)(9-2t)$

$2(9+2t)(9-2t)$ [2]

25 A is the point (4, 1) and B is the point (10, 15).

Find the equation of the perpendicular bisector of the line AB.



• Finding M

$M\left(\frac{4+10}{2}, \frac{1+15}{2}\right)$

$M(7, 8)$

★ $y=mx+c$

• Finding m

$m \times m_{AB} = -1$

$\Rightarrow m \times \left(\frac{15-1}{10-4}\right) = -1$

$\Rightarrow m \times 7/3 = -1$

$\Rightarrow m = -\frac{3}{7}$

★ $y=-\frac{3}{7}x+c$

• Finding c

$8 = -\frac{3}{7}(7)+c$

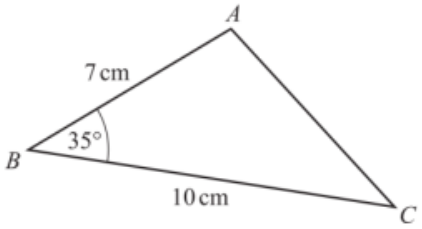
$\Rightarrow c = 11$

• $y=-\frac{3}{7}x+11$

$y=-\frac{3}{7}x+11$ [6]

Question 26 is printed on the next page.

26



NOT TO SCALE

(a) Calculate the area of triangle ABC.

$\star A_{\Delta ABC} = \frac{1}{2} \times AB \times BC \sin A\hat{B}C$

$\Rightarrow A_{\Delta ABC} = \left(\frac{1}{2} \times 7 \times 10 \sin 35°\right) cm^2$

$\Rightarrow A_{\Delta ABC} = 20{\cdot}1\ cm^2$ (3 sig. figs.)

20·1 ..... cm^2 [2]

(b) Calculate the length of AC.

$\star AC^2 = AB^2 + BC^2 - 2(AB)(BC)\cos A\hat{B}C$

$\Rightarrow AC = \left(\sqrt{7^2 + 10^2 - 2(7)(10)\cos 35°}\right) cm$

$\Rightarrow AC = 5{\cdot}86\ cm$ (3 sig. figs.)

$AC =$ 5·86 ..... cm [4]