Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/01**

Paper 1

October/November 2003

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 in the spaces provided on the Question Paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

The number of marks is given in brackets [ ] at the end of each question or part question.
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.

The total of the marks for this paper is 80.

ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

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This document consists of **15** printed pages and **1** blank page.

University of Cambridge
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ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER.

1 **(a)** Find the fraction which is exactly halfway between $\frac{1}{7}$ and $\frac{4}{7}$.

(b) Subtract 370 grams from 3.7 kilograms.
Give your answer in kilograms.

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

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

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2 Express $7\frac{1}{2}\%$

(a) as a decimal,

(b) as a fraction in its simplest form.

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

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

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3 Evaluate

(a) $12\frac{1}{3} - 9\frac{3}{5}$,

(b) $8.4 \div 0.02$.

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

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

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4 **(a)** Write down the square root of $6\frac{1}{4}$.

(b) State which of the following numbers are irrational

$$\sqrt{2} \times \sqrt{8}, \qquad \frac{22}{7}, \qquad \pi, \qquad 2\sqrt{3}\,.$$

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

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

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5 The highest air temperature recorded is 58.8 °C.
The lowest air temperature recorded is −89.2 °C.

(a) What is the difference between these two temperatures?

(b) The lowest air temperature recorded in Britain is 62 °C higher than −89.2 °C.
Find the lowest air temperature recorded in Britain.

Answer (*a*)..... °C [1]

(*b*) ..... °C [1]

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6 **(a)** Find the lowest common multiple of 12, 30 and 66.

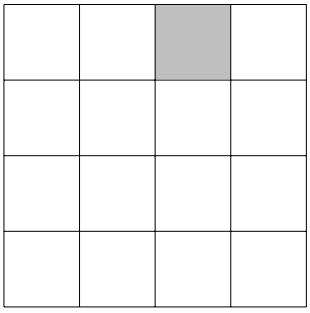
(b) Three lightships flash simultaneously at 6 00 a.m.
The first lightship flashes every 12 seconds, the second lightship every 30 seconds and the third lightship every 66 seconds.
At what time will the three lightships next flash together?

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

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

7 **(a)** Shade three more squares so that the completed square grid has rotational symmetry of order 4.

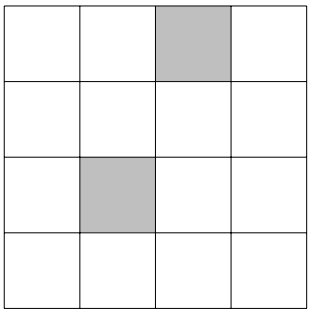
Answer (*a*)



[1]

(b) Shade one more square so that the completed square grid has one line of symmetry.

Answer (*b*)



[1]

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8 **(a)** Write down the following numbers in order of size, starting with the smallest

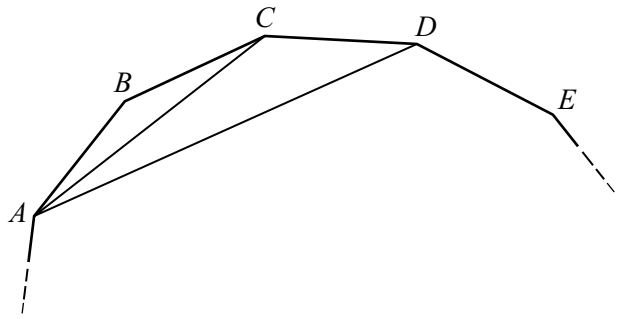
−0.29, −1.5, 0, −0.3, −4.

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

(b) The thickness of a sheet of paper is 8×10^{-4} cm.
Find the thickness of two sheets of paper, giving your answer in standard form.

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

9



The diagram shows part of a regular polygon with n sides.
Each interior angle of this polygon is 156°.

Find

(a) the value of n,

(b) $A\hat{C}D$,

(c) $A\hat{D}C$.

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

(*b*) $A\hat{C}D$ = ... [1]

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

---

10 **(a)** y is directly proportional to x^2.
It is known that $y = 10$ for a particular value of x.
Find the value of y when this value of x is halved.

(b) Seven men can paint a bridge in 15 days.

(i) How long would it take 3 men?

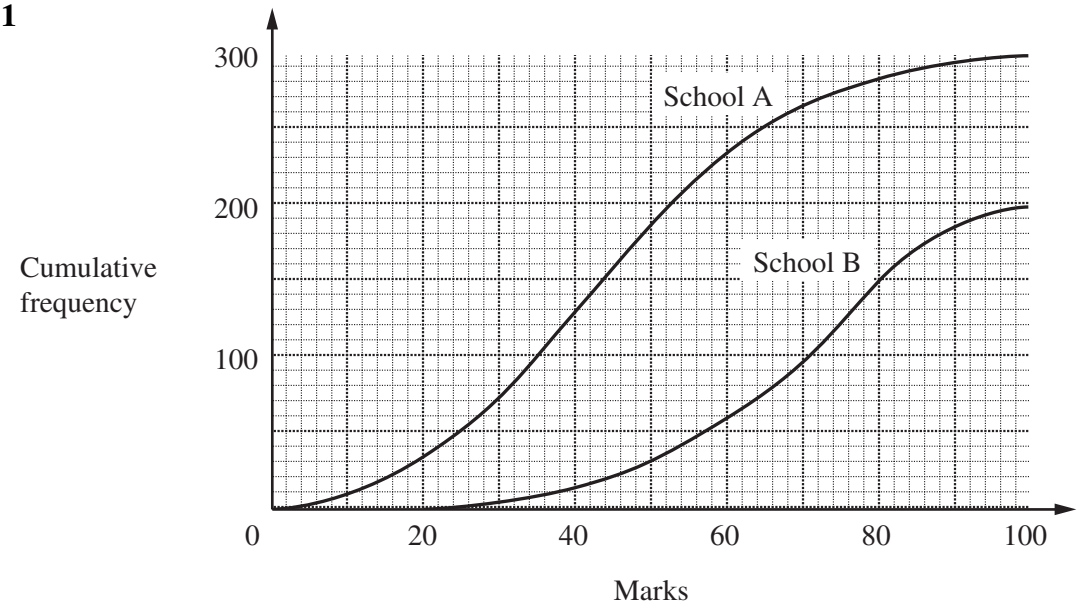
(ii) The bridge was painted in t days.
Write down an expression, in terms of t, for the number of men needed to paint the bridge.

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

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

(ii) ..... [1]

11



All the students from two schools, *A* and *B*, take the same examination paper. The cumulative frequency curves show the results for the two schools.

(a) Estimate the median mark of the students from school *A*.

(b) Estimate the percentage of the students from school *B* who gained more than 80 marks.

(c) State, with a reason, which school achieved the better results.

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

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

Answer (c) School ..... because .....

..... [1]

---

12 Find *a*, *b* and *c* when

(a) $3^a \div 3^5 = 27$,

(b) $125^b = 5$,

(c) $10^c = 0.001$.

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

(*b*) $b =$ ..... [1]

(*c*) $c =$ ..... [1]

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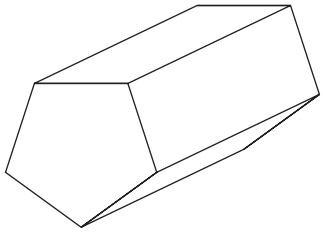
13 **(a)** How many planes of symmetry has a prism with a regular pentagon as its cross-section?



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

(b) The sides of a rectangular plot of land are measured correct to the nearest metre.

The measurements are given as 20 m by 3 m.

(i) Write down the upper bound of the length of the plot of land.

(ii) Find the least possible perimeter of the plot.

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

(ii)..... m [1]

---

14 It is given that $\mathrm{f}(x) = \dfrac{3}{2x-5}$.

Find

(a) $\mathrm{f}(2)$,

(b) $\mathrm{f}^{-1}(\frac{1}{2})$.

Answer (*a*) $\mathrm{f}(2)$ = ... [1]

(*b*) $\mathrm{f}^{-1}(\frac{1}{2})$ = ... [2]

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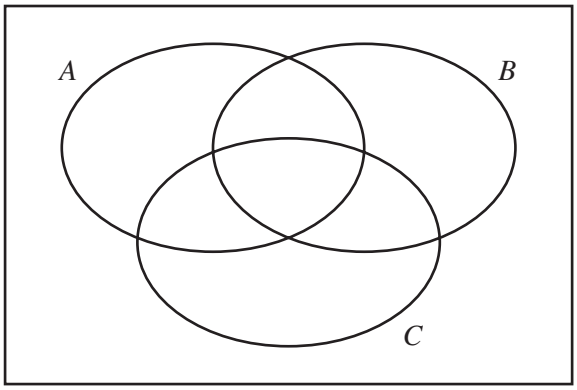
15 **(a)** On the Venn Diagram in the answer space, shade the set $(A' \cup B') \cap C$.

Answer (*a*)



[1]

(b) $\mathscr{E} = \{x : x \text{ is an integer and } 4 \leqslant x \leqslant 16\}$
$P = \{x : x \text{ is a prime number}\}$
$S = \{x : x \text{ is an odd number}\}$
$T = \{x : x \text{ is a multiple of } 3\}$

(i) List the members of the set $S \cap T$.

(ii) Describe, **in words**, the set S'.

(iii) Find $\text{n}(P \cup T)$.

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

(ii) ..... [1]

(iii) $\text{n}(P \cup T)$ = ... [1]

---

16 $\mathbf{A} = \begin{pmatrix} 2 & 3 \\ -1 & 0 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 3 & 1 \\ -4 & -3 \end{pmatrix}$, $\mathbf{C} = (1 \quad 2 \quad 3)$, $\mathbf{D} = \begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}$

Find

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

(b) $\mathbf{A}^2$,

(c) $\mathbf{A}\mathbf{A}^{-1}\begin{pmatrix} 7 \\ 8 \end{pmatrix}$,

(d) $\mathbf{CD}$.

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

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

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

(*d*) ..... [1]

---

17 The temperatures, at noon, on five days were

$$-2\,°C, \quad -1\,°C, \quad 1\,°C, \quad -2\,°C, \quad 5\,°C.$$

(a) Find the median temperature.

(b) Calculate the mean temperature.

(c) The temperature, at noon, on another day was x °C.
The mean temperature for the six days was 1.5 °C.
Find the value of x.

Answer (*a*) .....°C [1]

(*b*) .....°C [1]

(*c*) x = ... [2]

18 Look at this pattern

$$1^2 - 0^2 = 1$$
$$2^2 - 1^2 = 3$$
$$3^2 - 2^2 = 5$$
$$4^2 - 3^2 = 7$$
$$\vdots \quad \vdots \quad \vdots$$

(a) Write down

(i) the 8th line of the pattern,

(ii) the nth line of the pattern.

(b) Use the pattern to find

(i) $340^2 - 339^2$,

(ii) the integers x and y such that $x^2 - y^2 = 701$.

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

(ii) ..... [1]

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

(ii) x = ... y = ... [1]

---

19 **(a)** **(i)** Factorise $ax - bx$.

(ii) Hence evaluate $1426 \times 0.6789 - 426 \times 0.6789$.

(b) Solve the equation

$$3(x - 5) - 2 = 7 - (1 - x).$$

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

(ii) ..... [1]

(*b*) x = ... [2]

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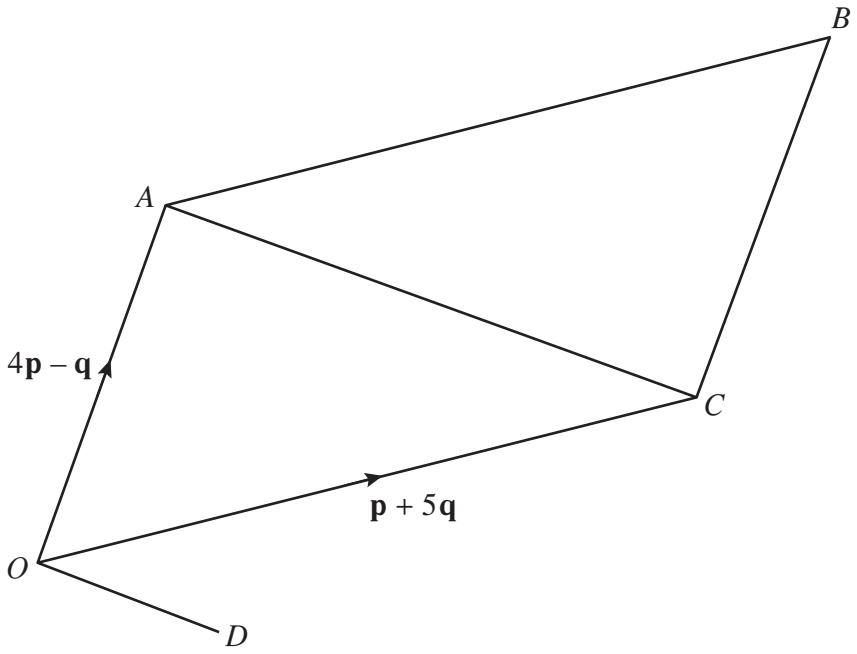
20 In the diagram, $OABC$ is a parallelogram, $\overrightarrow{OA} = 4\mathbf{p} - \mathbf{q}$ and $\overrightarrow{OC} = \mathbf{p} + 5\mathbf{q}$.



(a) Express, as simply as possible, in terms of **p** and **q**,

(i) $\overrightarrow{BC}$,

(ii) $\overrightarrow{AC}$.

(b) D is the point such that $\overrightarrow{OD} = -\mathbf{p} + 2\mathbf{q}$.

(i) Explain why $\overrightarrow{AC}$ is parallel to $\overrightarrow{OD}$.

(ii) Given that the area of triangle OAC is 18 square units, find the area of triangle OCD.

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

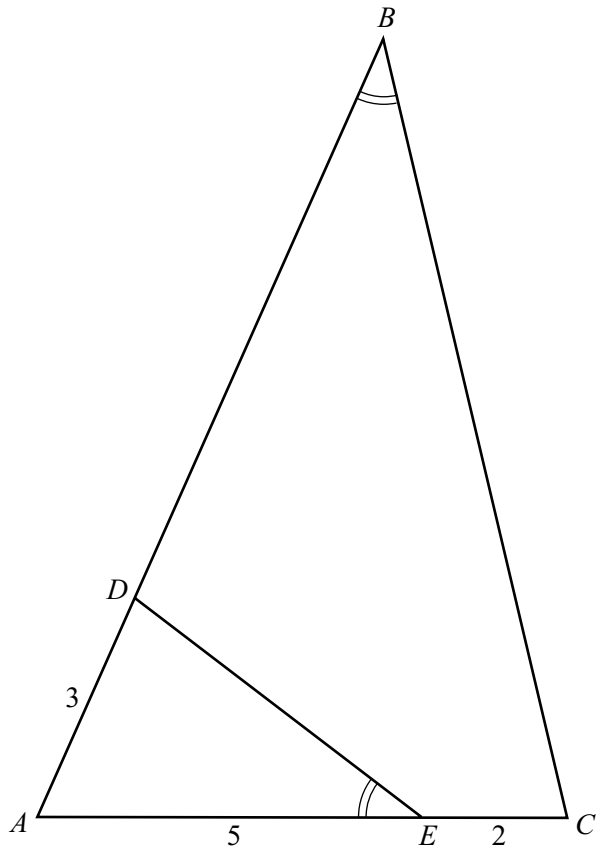
(ii) $\overrightarrow{AC}$ = ... [1]

Answer (*b*)(i) .....

..... [1]

(ii) ..... units^2 [1]

21



In the diagram, $A\hat{B}C = A\hat{E}D$.

(a) Explain why triangles ABC and AED are similar.

Answer (*a*) .....

..... [1]

(b) Given also that $AD = 3$ cm, $AE = 5$ cm and $EC = 2$ cm, calculate

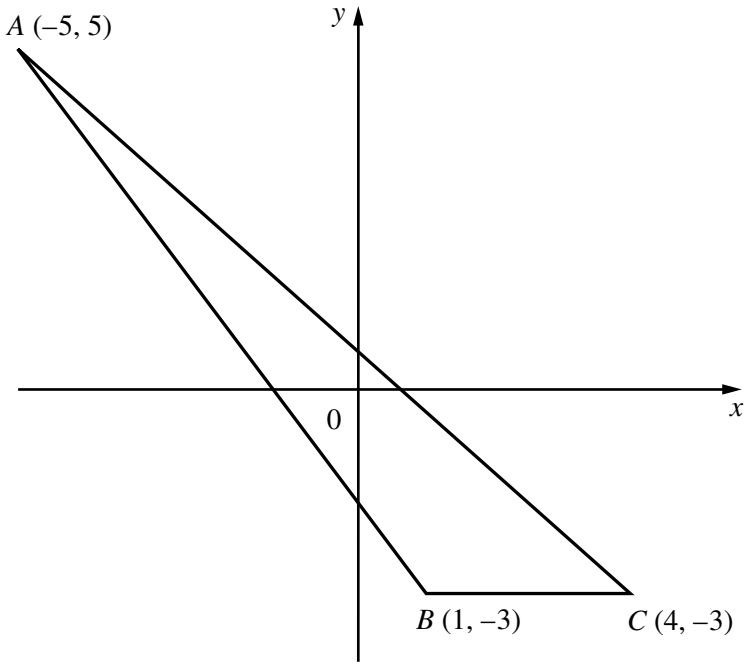
(i) BD,

(ii) $\dfrac{\text{Area of triangle } AED}{\text{Area of triangle } ABC}$.

Answer (*b*)(i) BD = ... cm [3]

(ii) ..... [1]

22 The points $A(-5, 5)$, $B(1, -3)$ and $C(4, -3)$ are shown in the diagram.



Find

(a) the coordinates of the midpoint of AC,

(b) the gradient of the line AB,

(c) the equation of the line which passes through $(0, 3)$ and is parallel to AB,

(d) the length of AB,

(e) the value of cosine $A\hat{B}C$.

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

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

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

(*d*) ..... units [1]

(*e*) ..... [1]

23 Three lines, l_1, l_2 and l_3, are drawn on the diagram in the answer space.
The equation of the line l_1 is $y = x + 5$.
The equation of the line l_2 is $3y + x = -3$.

(a) Use the diagram to solve the simultaneous equations

$$y = x + 5 \text{ and } 3y + x = -3 .$$

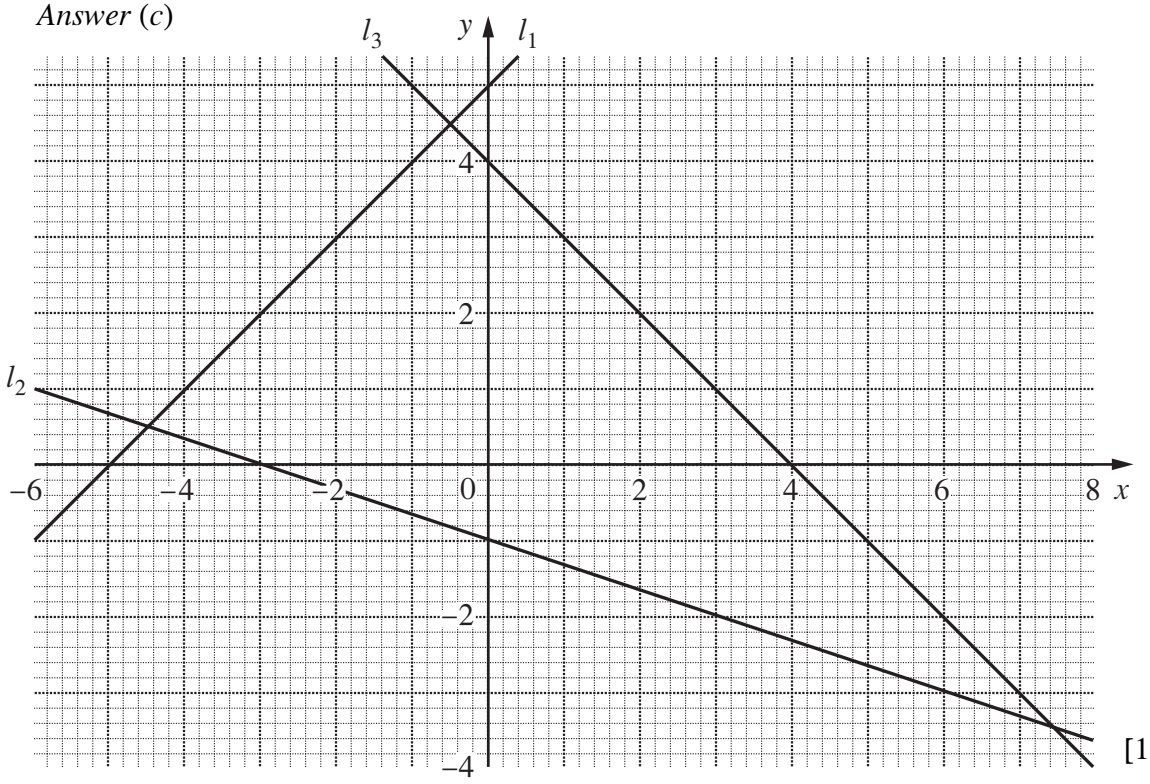
Answer (*a*) $x =$ ....., $y =$ ..... [2]

(b) Write down the equation of the line l_3.

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

(c) The equation of another line, l_4, is $y = -1$.
Draw this line on the diagram in the answer space.

Answer (*c*)



[1]

(d) The region enclosed by these four lines is defined by four inequalities.
One of these is $3y + x \geqslant -3$.
Write down the other three inequalities.

Answer (*d*) .....

.....

..... [2]

24 Triangle *ABC* is drawn below.

(a) Measure angle *ABC*.

Answer (*a*) $A\hat{B}C$ = ... [1]

(b) The point *D* is below *AC* where *AD* is 12 cm and *CD* is 9 cm.
Using ruler and compasses only, complete the construction of triangle *ADC* on the diagram in the answer space.

(c) The region, *S*, lies within the quadrilateral *ABCD*.
Points in *S* are

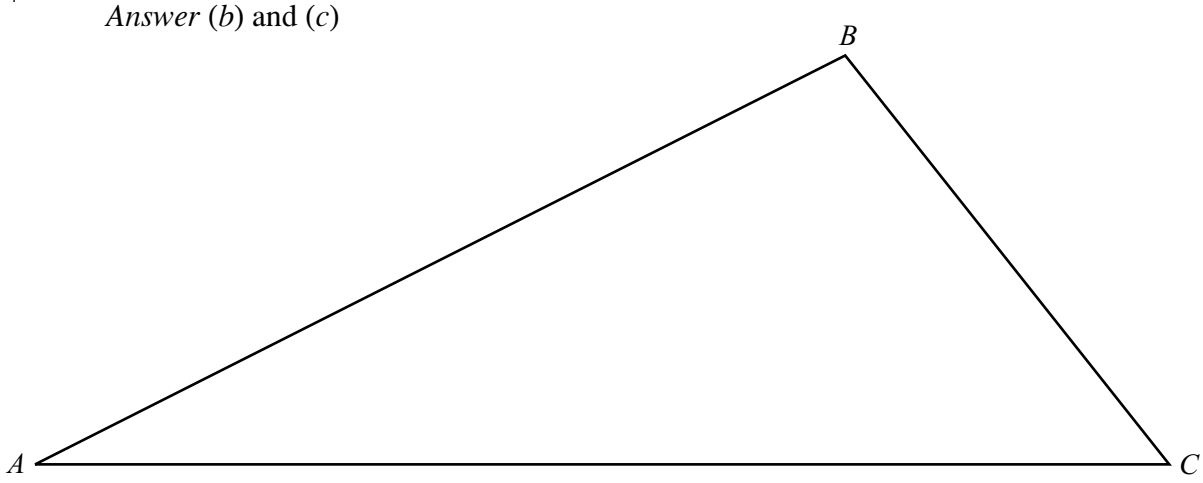
I nearer to *C* than *A*,

II more than 8 cm from *B*,

III nearer to *BA* than *BC*.

Use conditions **I**, **II** and **III** to construct appropriate loci.
Hence shade the region *S*.

Answer (*b*) and (*c*)



[5]

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