4.17 Plans and Elevations: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

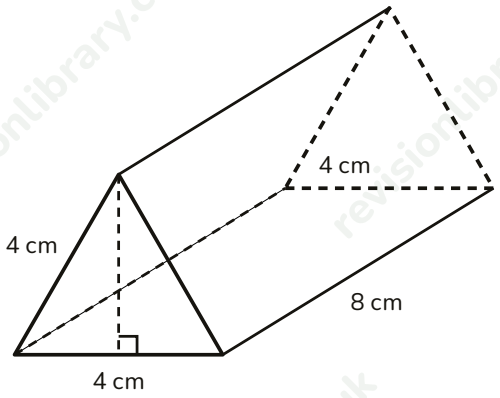
1 A wooden box measures length 12 cm, width 5 cm and height 3 cm. State the two measurements that are shown on the plan (top view).

(Total for Question 1 is 1 mark)

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2 A solid is a triangular prism. The triangular face is an equilateral triangle with side 4 cm and the prism length is 8 cm.
What is the shape of the front elevation (the view looking at the triangular face)?

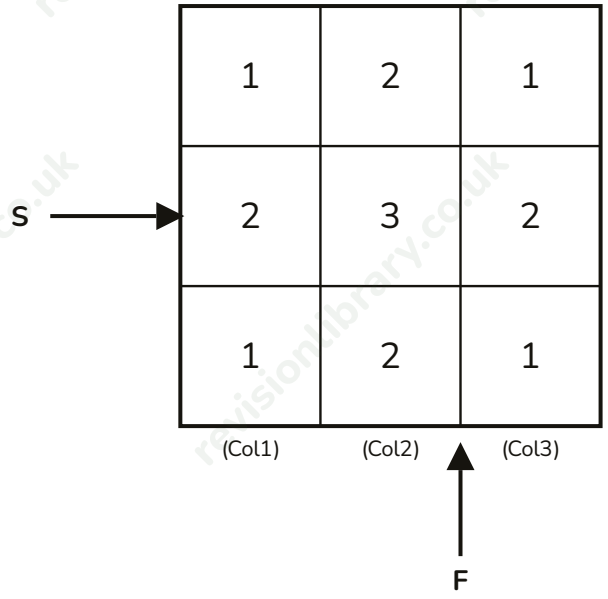
Diagram NOT accurately drawn



(Total for Question 2 is 1 mark)

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3 The diagram shows a solid built from 1 cm cubes standing on a 3 by 3 grid. The numbers show how many cubes are stacked at each position.



(a) Draw the front elevation of the solid. **(2)**

(b) Draw the side elevation of the solid. **(2)**

(Total for Question 3 is 4 marks)

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4 A solid is built from 1 cm cubes. It is 4 cubes long and 2 cubes deep. In every column of cubes, the height is the same in the back row as it is in the front row. Four diagrams show possible front elevations, each 4 squares wide. The numbers show the height, in unit squares, of each column, left to right.

A) 1, 1, 2, 2

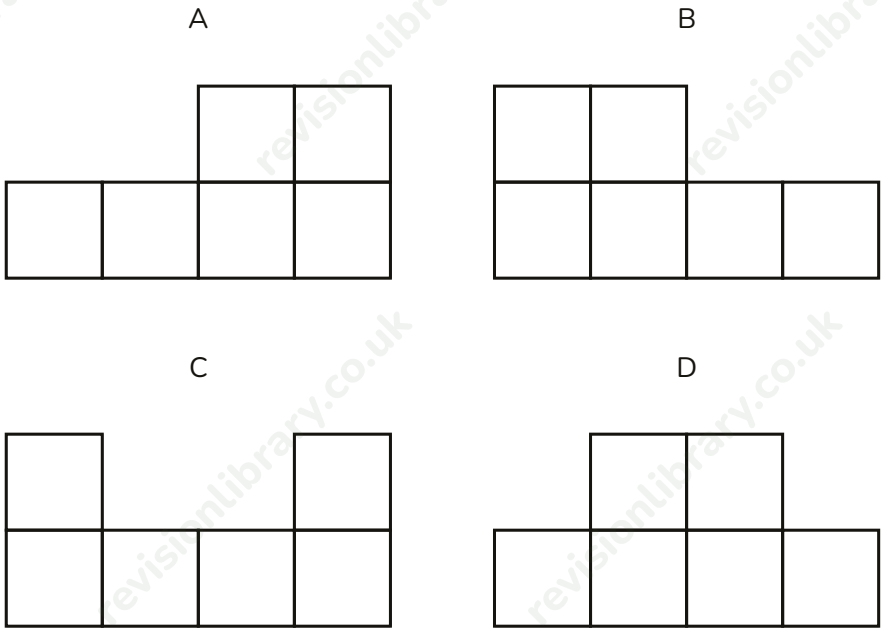
B) 2, 2, 1, 1

C) 2, 1, 1, 2

D) 1, 2, 2, 1

The solid's two tallest columns (height 2) are on the left, and its two shortest columns (height 1) are on the right.

Diagram NOT accurately drawn



(a) Which diagram, A, B, C or D, is the correct front elevation of the solid? **(1)**

- ☐ A) 1, 1, 2, 2
- ☐ B) 2, 2, 1, 1
- ☐ C) 2, 1, 1, 2
- ☐ D) 1, 2, 2, 1

(b) How many unit cubes make up the whole solid? **(1)**

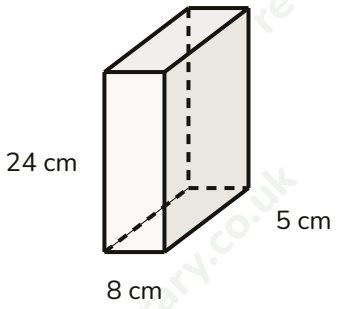
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(Total for Question 4 is 2 marks)

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5 A cereal box is a cuboid. Standing upright in its usual position, the front elevation measures 8 cm by 24 cm, and the plan measures 8 cm by 5 cm. The box is then laid down so that the face which used to be the front elevation (8 cm by 24 cm) becomes the new plan view.

Diagram NOT accurately drawn



(a) Write down the dimensions of the new plan view. **(1)**

.....

(b) Work out the height of the box in this new position. **(1)**

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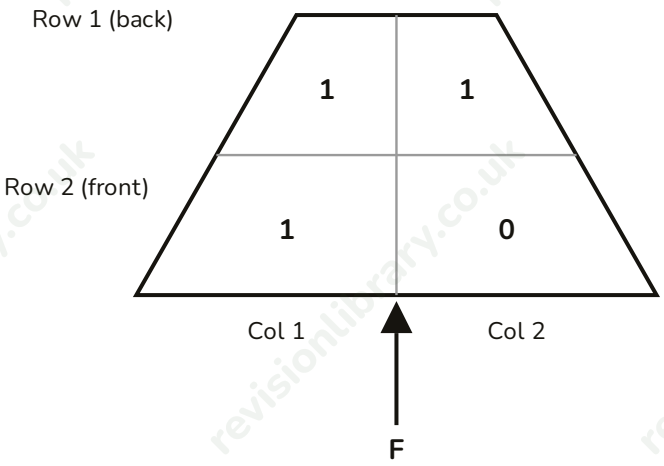
(c) Write down the dimensions of the two new elevations (the front and side elevations), giving each one's dimensions. **(2)**

.....

(Total for Question 5 is 4 marks)

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6 The diagram shows a flat solid made from three 1 cm cubes on a 2 by 2 grid (one grid position is empty).



Numbers show height (in 1 cm cubes) at each position.
0 = no cube. Arrow F shows the front-view direction.

(a) Which of these is the correct plan of the solid? **(1)**

- ☐ A) a 2 by 2 square
- ☐ B) an L-shape made of 3 unit squares (the Row 2, Column 2 square is missing)
- ☐ C) a 1 by 3 rectangle
- ☐ D) a T-shape made of 4 unit squares

(b) Even though the plan is an L-shape, the front elevation of this solid is a plain 2 cm by 1 cm rectangle, with no gap visible. Give a reason why. **(1)**

(Total for Question 6 is 2 marks)

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7 A solid is made from 8 identical unit cubes arranged as a 2 by 2 by 2 cube. Sketch or describe the top plan, front elevation and side elevation. Give the number of visible unit-square faces in each view.

(a) State how many unit-square faces are visible in the top plan. **(1)**

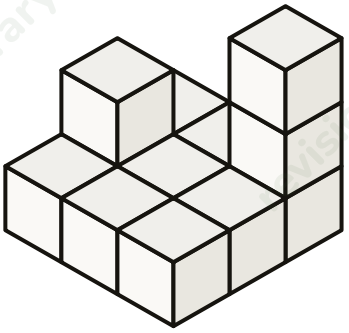
(b) State how many unit-square faces are visible in a front elevation (one face of the cube facing the viewer). **(1)**

(Total for Question 7 is 2 marks)

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8 A solid is made from 1 cm cubes on a 3 by 3 base. The numbers show how many cubes are in each stack, with the columns listed from left to right.
Front row: 1, 1, 1
Middle row: 2, 1, 1
Back row: 1, 1, 3
The front elevation is the view from the front. How many squares are in the front elevation?

Diagram NOT accurately drawn



(Total for Question 8 is 2 marks)

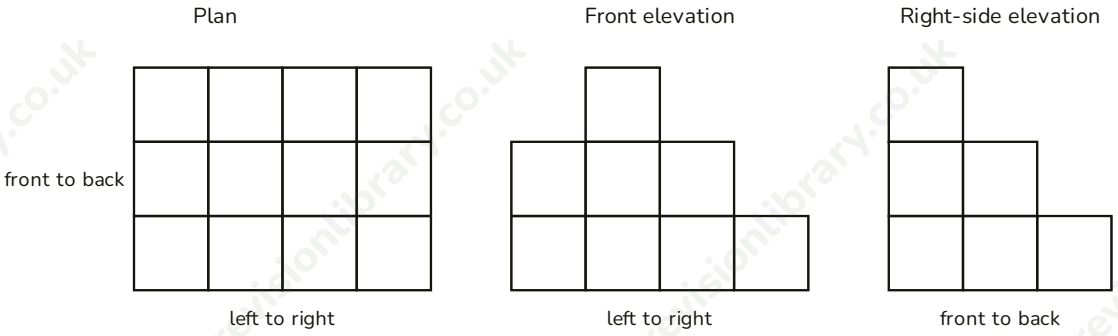
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9 A model is built on a grid of 3 columns (left to right) and 2 rows (front to back). There is a cube in every cell of the plan. The front elevation (looking along the rows) shows heights left to right 2, 3, 2. The side elevation (looking along the columns from the right) shows heights front to back 3, 2. Give one possible set of heights (in unit cubes) for the six cells, writing them row by row (front row left to right, then back row left to right).

(Total for Question 9 is 3 marks)

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10 A solid has plan shown as a 3 by 4 grid (3 rows front to back, 4 columns left to right). The front elevation (viewed from the front, across the 3-row depth) shows heights (left to right) 2, 3, 2, 1. The right-side elevation (viewed from the right, across the 4-column width) shows three columns of heights (front to back) 3, 2, 1. The solid uses as many cubes as possible. Show your working.



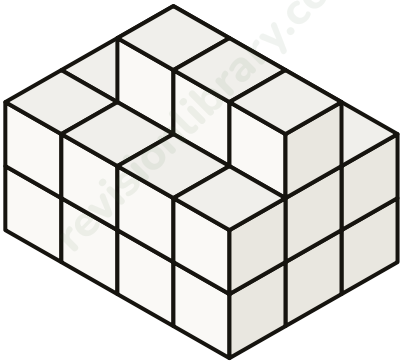
(a) Determine the height of each of the 12 plan cells and give the total number of unit cubes used. **(3)**

(b) Calculate the total external surface area of the solid, including the base, in cm^2. Show working. **(3)**

(Total for Question 10 is 6 marks)

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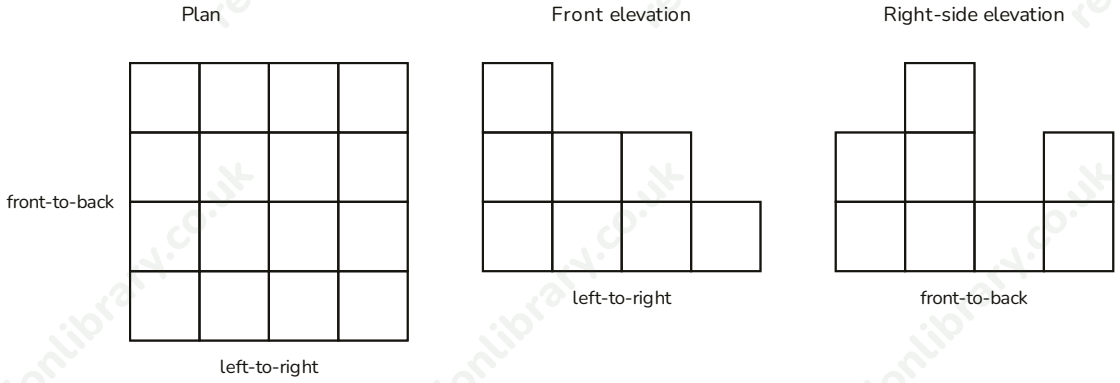
11 A 3D object is built from unit cubes with side 1 cm, on a base 4 squares wide (left to right) by 3 squares deep (front to back). The height of each of the 12 base squares is:
Row 1 (front): 2, 2, 2, 2
Row 2 (middle): 2, 3, 3, 3
Row 3 (back): 2, 2, 2, 2
(columns given left to right within each row). Show that the total number of cubes used is 27, and show that these heights are consistent with a front elevation that is a 4 by 3 rectangle with a 1 by 1 square missing from its top-left corner, and a right-side elevation showing three heights of 2, 3 and 2 (front to back).



(Total for Question 11 is 6 marks)

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12 Three elevations of a model on a 4 by 4 plan are given. The front elevation (viewing across the depth) shows left-to-right heights 3, 2, 2, 1. The right-side elevation (viewing across the width) shows front-to-back heights 2, 3, 1, 2. The plan shows that every of the 16 cells is present. Full justification is required.



(a) Find the minimum and maximum possible number of unit cubes consistent with the three elevations. Give the numbers. **(4)**

(b) Give one possible 4 by 4 matrix of heights that achieves the minimum and calculate its total number of cubes. **(4)**

(c) Give a justification and calculation for the maximum possible number of cubes and state one matrix achieving it. **(3)**

(Total for Question 12 is 11 marks)

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Mark scheme · 4.17 Plans and Elevations: Test Pack

Question 1

12 cm by 5 cm cao **B1**

Answer: 12 cm by 5 cm (length and width). 12 cm, 5 cm are shown on the plan.

Question 2

triangle/equilateral triangle cao **B1**

Answer: Triangle (equilateral, side 4 cm).

Question 3

(a) correct heights per column: 2, 3, 2 (left to right) **B1**

(a) correct symmetrical shape, 3 squares wide with a single central peak of height 3 **B1**

(a) Answer: A symmetrical profile 3 squares wide with heights (left to right) 2, 3, 2 unit squares.

(b) correct heights per row (depth): 2, 3, 2 (back to front) **B1**

(b) correct symmetrical shape identical to the front elevation **B1**

(b) Answer: A symmetrical profile 3 squares wide with heights (back to front) 2, 3, 2 unit squares (identical in shape to the front elevation).

Question 4

(a) B cao **B1**

(a) Answer: B

(b) 12 cao **B1**

(b) Answer: 12

Question 5

(a) 8 cm by 24 cm oe **B1**

(a) Answer: 8 cm x 24 cm

(b) 5 cm cao **B1**

(b) Answer: 5 cm

(c) 8 cm by 5 cm oe **B1**

(c) 24 cm by 5 cm oe **B1**

(c) Answer: 8 cm x 5 cm and 24 cm x 5 cm

Question 6

(a) B cao **B1**

(a) Answer: B

(b) correct reason, e.g. Column 2 still has a cube in Row 1, so that column still shows height 1 from the front; the missing cube in Row 2 is hidden behind it, oe **B1**

(b) Answer: The empty grid position is hidden behind a cube in the other row of the same column, so the front elevation still shows full height across both columns.

Question 7

(a) 4 cao **B1**

(a) Answer: 4

(b) 4 cao **B1**

(b) Answer: 4

Question 8

tallest stack in each column: 2, 1, 3 **M1**

6 **A1**

Answer: 6

Question 9

set up maxima: column maxima = front elevation, row maxima = side elevation oe **M1**

find a consistent arrangement satisfying those maxima oe **M1**

one possible set: front row 2, 3, 2; back row 2, 1, 2 cao **A1**

Answer: One possible set (front row then back row): 2, 3, 2; 2, 1, 2. (Checks: column maxima 2,3,2 and row maxima 3,2.)

Question 10

(a) use front elevation to give row maxima per column: columns heights left to right 2,3,2,1 **M1**

(a) use right-side elevation to give column maxima per row: rows front to back 3,2,1 and combine with front info to deduce per-cell heights **M1**

(a) total cubes 19 cao **A1**

(a) Answer: 19

(b) calculate top area and base area: top equals number of cells with height > 0 (12) and base = 12 **M1**

(b) calculate vertical face area by summing differences between adjacent cells across the grid and perimeter faces **M1**

(b) total surface area 52 cm² cao **A1**

(b) Answer: 52 cm^2

Question 11

recognise the right-side elevation heights 2, 3, 2 match the maximum height in each row: row 1 max 2, row 2 max 3, row 3 max 2 **M1**

recognise the front elevation is 4 by 3 with column 1 only reaching height 2 in every row (never 3), so its overall column maximum is 2, giving the 1 by 1 notch at the top-left of the 4 by 3 envelope, while columns 2-4 reach height 3 in row 2 **M1**

read off the height of each of the 12 cells from the table: row 1 [2,2,2,2], row 2 [2,3,3,3], row 3 [2,2,2,2] **M1**

sum the heights over the 12 cells: (2+2+2+2) + (2+3+3+3) + (2+2+2+2) = 8 + 11 + 8 **M1**

27 cubes cao **A1**

clear explanation linking the front, plan (table) and side data to the column heights, with correct arithmetic **C1**

Answer: 27

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Question 12

(a) identify that each cell height must be at most its column max (from front) and row max (from side) and at least the maximum of constraints leading to minima **M1**

(a) for minimum take each cell = minimum of its row and column maxima **M1**

(a) for maximum take each cell = maximum value allowed without violating any elevation, i.e. each cell = minimum of its row and column maxima actually gives both bounds; recognise method **M1**

(a) minimum 20 and maximum 26 cao **A1**

(a) Answer: Minimum 20, Maximum 26

(b) produce a matrix where each entry = min(column max, row max) **M1**

(b) show the per-cell numbers summed **M1**

(b) obtain total 34 **M1**

(b) 20 cao **A1**

(b) Answer:Example matrix (rows front to back):
[1,2,1,1]
[3,1,1,1]
[1,1,1,1]
[1,1,2,1]
Total 20

(c) justify that to maximise, use as many cells as possible equal to the larger of the two maxima where not violating the other; allocate full row maxima in those rows where side allows **M1**

(c) provide a matrix consistent and sum entries **M1**

(c) 26 cao **A1**

(c) Answer:One maximum matrix (rows front to back):
[2,2,2,1]
[3,2,2,1]
[1,1,1,1]
[2,2,2,1]
Total 26

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