Nets

Mana Maths

Notes – Nets of 3D shapes

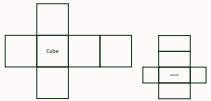
Key idea

A net is a flat 2D plan that folds along edges to make a 3D shape. The same 3D shape can have many different nets. All faces must be present and connected.

Steps to identify a net

1. Count the faces. Does the net have the right number? (Cube = 6, cuboid = 6, pyramid = 5, tetrahedron = 4)
2. Check shapes match. Are the faces the correct polygons?
3. Visualise folding. Imagine bending each face along the edge.
4. Check overlaps. No faces should overlap when folded.
5. Check gaps. There should be no gaps between faces.

Common nets



A cube has 11 distinct nets. A cuboid also has a net of 6 rectangles (3 pairs of equal size).

Common mistake

Thinking any 6 connected squares form a cube net. In fact, if a cross arm is more than 2 squares long, it won't fold correctly.

Notes – Nets and surface area

Example 1: Cube net

A cube of side 3 cm has net area = $6 \times (3 \times 3) = 54$ cm^2. The net is the surface area of the cube.

Example 2: Cuboid box

A $5 \times 3 \times 2$ cm box: SA = $2(5 \cdot 3 + 5 \cdot 2 + 3 \cdot 2) = 62$ cm^2.

Example 3: Opposite faces

In a cube cross net, the two squares at the ends of the cross are opposite each other when folded.

Example 4: Open box

An open box net has 5 faces (no top). Its surface area excludes the missing top face.

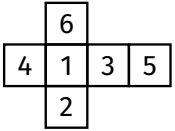
Try these

1. Draw a cube net of side 2 cm.
2. Find surface area of a 4 cm cube.
3. Identify opposite faces in a cross net.

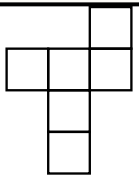
Common mistake

Forgetting that opposite faces never share an edge in a net. In the cross net, the top and bottom squares are opposite.

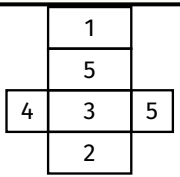
Start Tasks - Nets



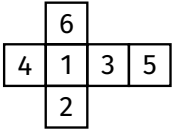
1. How many faces does this cube net have?



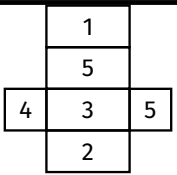
3. Does this T-shape form a cube when folded?



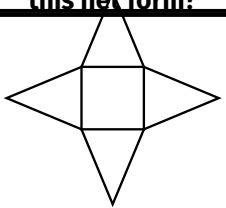
5. What 3D shape does this net form?



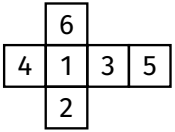
2. When folded, which face is opposite face 2?



4. How many faces does a

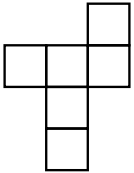


Start Tasks - Nets



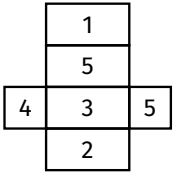
1. Faces in this net?

6



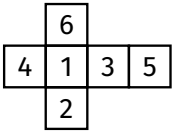
3. Does T form a cube?

Yes



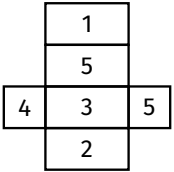
5. What 3D shape?

Cuboid

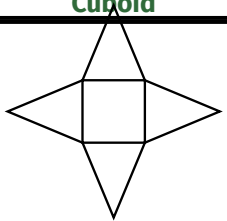


2. Opposite face 2?

Face 5

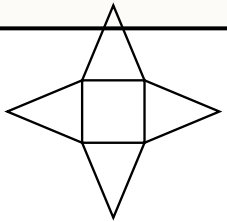


4. Faces of a cuboid?

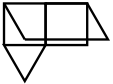


6. Pyramid faces?

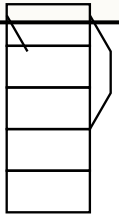
Start Tasks - Nets



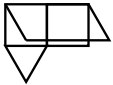
7. What shape do the



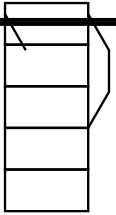
9. How many rectangular faces?

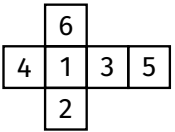


11. How many rectangular



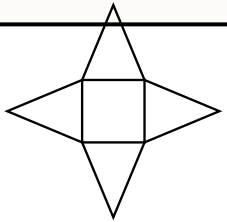
8. How many faces on a triangular prism?



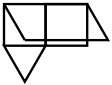


12. How many different cube nets are possible?

Start Tasks - Nets

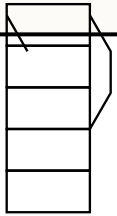


7. Triangles meet at?

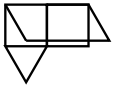


9. Rectangular faces?

3

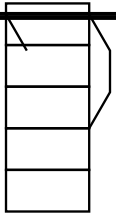


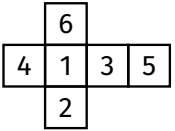
11. Rectangular faces in net?



8. Triangular prism faces?

5

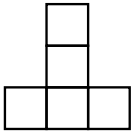




12. Distinct cube nets?

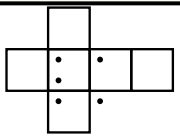
11

Start Tasks - Nets

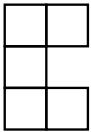


13. Can this pentomino fold into an open box?

15. How many faces on a tetrahedron?

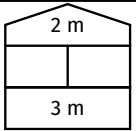


17. On a standard die, what do opposite faces sum to?



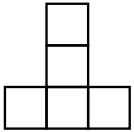
14. Can this pentomino form an open box?

16. What shape are the faces?



18. How many triangular faces does this tent net

Start Tasks - Nets

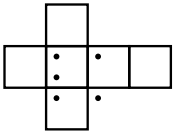


13. Open box from A?

Check by folding

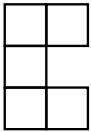
15. Tetrahedron faces?

4



17. Opposite faces sum?

7

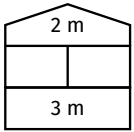


14. Open box from B?

Check by folding

16. Face shape?

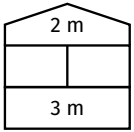
Triangle



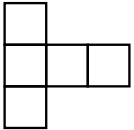
18. Triangular faces?

2

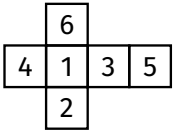
Start Tasks - Nets



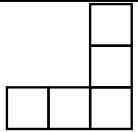
19. How many faces total on this tent net?



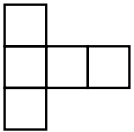
21. This net has 5 faces. What is missing?



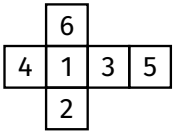
23. Name the 3D shape this net forms.



20. Will this 5-square L-shape form an open

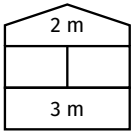


22. How many faces will this open box have?



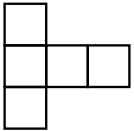
24. What shape is each face of a cube?

Start Tasks - Nets



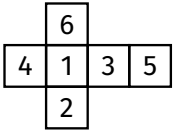
19. Total faces?

5



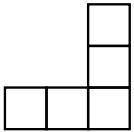
21. Missing what?

The lid / top face



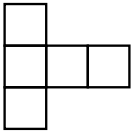
23. 3D shape name?

Cube



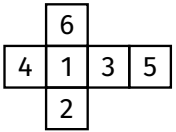
20. Open box from L?

Check by folding



22. Faces when folded?

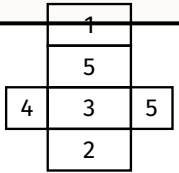
5



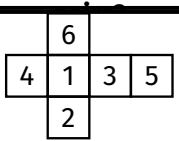
24. Shape of each face?

Square

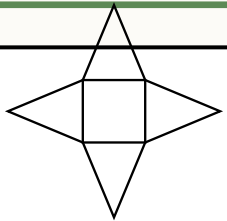
Start Tasks - Nets



25. A cuboid has 6 faces. How many different-sized

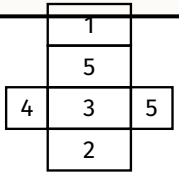


26. Sketch this net on paper. Label the face that



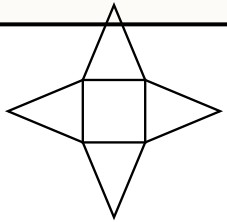
27. Sketch a different valid net for a square pyramid.

Start Tasks - Nets



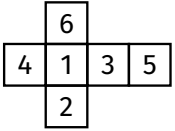
25. Different-sized face pairs?

3 pairs



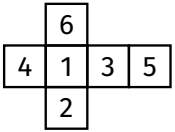
27. Different pyramid net?

e.g. 4 triangles in a row

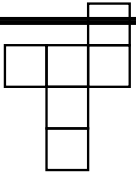


26. Sketch and label opposite face 1.

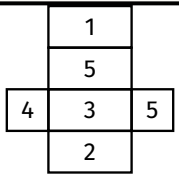
Build Tasks - Nets and SA



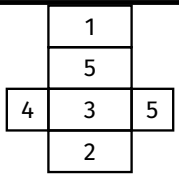
1. Which face is opposite face 3 in this cube net?



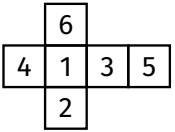
2. In the T-net, which face is opposite the top



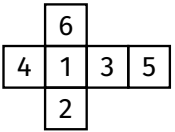
3. Cuboid 5 cm x 3 cm x 2 cm. Volume?



4. Surface area of the

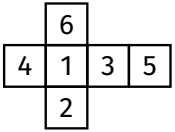


5. Cube side 4 cm. Volume?



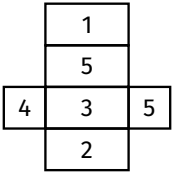
6. Surface area of a 4 cm

Build Tasks - Nets and SA



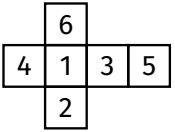
1. Opposite face 3?

Face 4



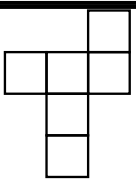
3. Volume 5x3x2?

30 cm^3

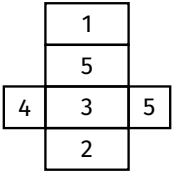


5. Cube side 4, volume?

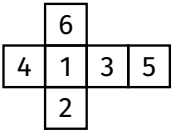
64 cm^3



2. Opposite top square?



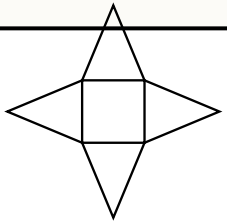
4. Surface area?



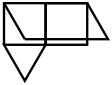
6. Surface area 4 cm?

96 cm^2

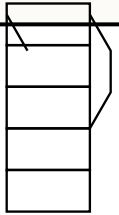
Build Tasks - Nets and SA



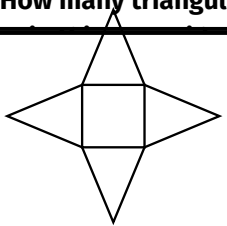
7. How many triangular

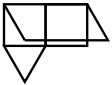


9. Equilateral triangle sides 2 cm, length 4 cm. Volume?

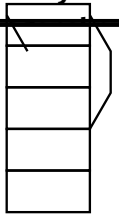


11. How many vertices on

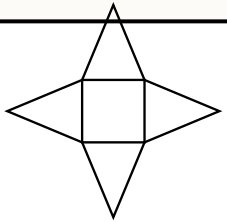




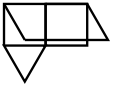
10. Surface area of the prism?



Build Tasks - Nets and SA

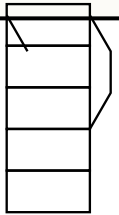


7. Triangles in pyramid?

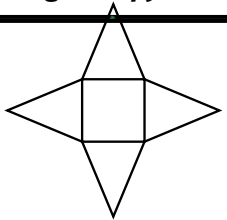


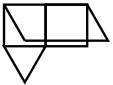
9. Volume 2 cm tri + 4 cm?

6.92 cm^3



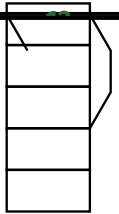
11. Hex prism vertices?





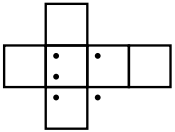
10. Surface area?

27.46 cm^2

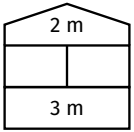


12. Hex prism edges?

Build Tasks - Nets and SA

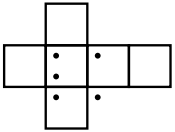


13. If 1 faces up, what is on the bottom?

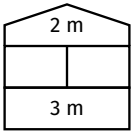


15. Tent floor 3 m by 4 m. Floor area?

17. How many vertices on a tetrahedron?



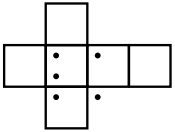
14. If 3 faces you, which face is opposite?



16. Which faces form the tent floor?

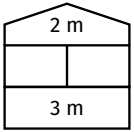
18. How many edges on each face?

Build Tasks - Nets and SA



13. 1 up = bottom?

6

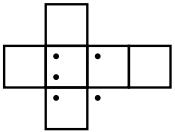


15. Floor area 3x4?

12 m^2

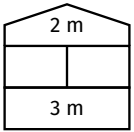
17. Tetrahedron vertices?

4



14. 3 facing = opposite?

4



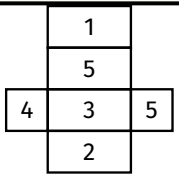
16. Floor faces?

Large rectangle

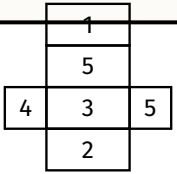
18. Edges per face?

3

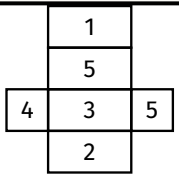
Build Tasks - Nets and SA



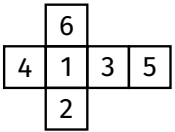
19. How many 1x1x1 cubes fit in a 5x3x2 box?



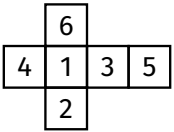
21. Gift box 12x5x3 cm. Cardboard needed



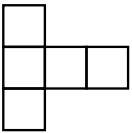
23. Rectangular prism 10x4x2 m. Surface area?



20. A cube has surface area 54 cm². Side length?

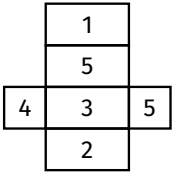


22. Cube face area 25 cm². Total SA?



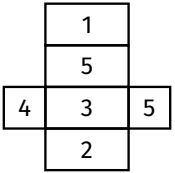
24. Open box has 5 faces. If cube of side 3, SA?

Build Tasks - Nets and SA



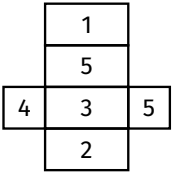
19. Cubes in 5x3x2?

30



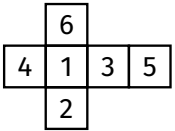
21. 12x5x3 cardboard?

222 cm^2



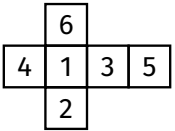
23. 10x4x2 prism SA?

136 m^2



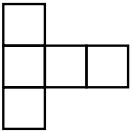
20. SA 54, side?

3 cm



22. Face 25 cm^2, total SA?

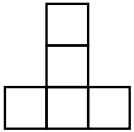
150 cm^2



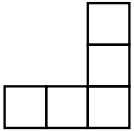
24. Cube side 3, open SA?

45 cm^2

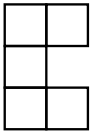
Build Tasks - Nets and SA



25. Pentomino A: valid cube net?

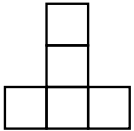


27. L pentomino: can it fold to an open box?



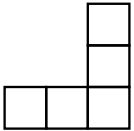
26. Pentomino B: valid

Build Tasks - Nets and SA



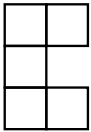
25. Valid cube net?

Check by folding



27. Open box from L?

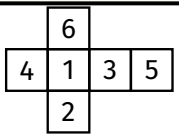
Check by folding



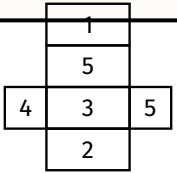
26. Valid cube net?

Check by folding

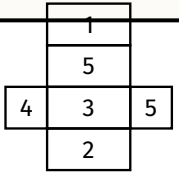
Push Tasks - Nets and SA



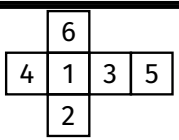
1. Name 3 arrangements of 6 squares that do NOT fold to a cube.



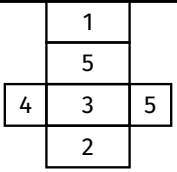
3. A 5x3x2 cuboid has 3 pairs of opposite faces.



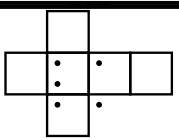
5. Which dimensions give maximum SA for volume



2. Explain why some cross shapes of 6 squares

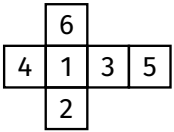


4. Minimise SA for volume



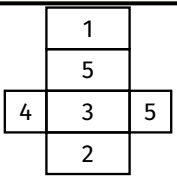
6. Prove that opposite faces of a standard die

Push Tasks - Nets and SA



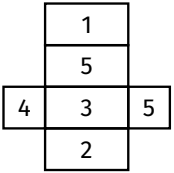
1. Invalid arrangements?

e.g. 4 in a row with 2 on same side



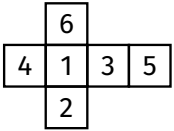
3. 3 pairs face areas?

15, 10, 6 each x 2



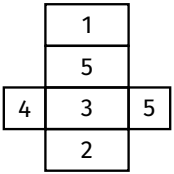
5. Max SA for V=96?

1x1x96 = 386 cm^2

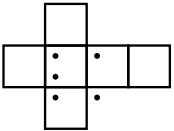


2. Why some fail?

Overlap when folded



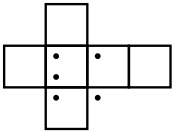
4. Min SA for V=96?



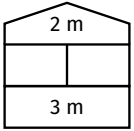
6. Opposite sums to 7?

Standard: 1-6, 2-5, 3-4

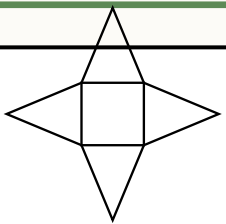
Push Tasks - Nets and SA



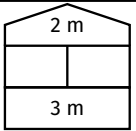
7. Design a different die net with 1 opposite 6.



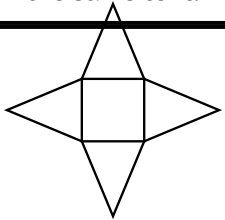
9. Draw a different net for the same tent.



11. Pyramid base area 25 cm^2, each triangle area 15

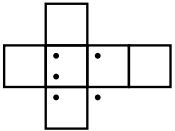


8. Explain why tent triangular faces are



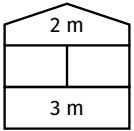
12. Draw the net of a right-triangle prism.

Push Tasks - Nets and SA



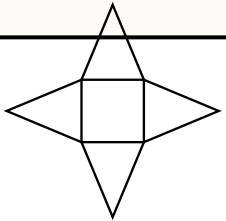
7. Different die net?

Any valid cube net

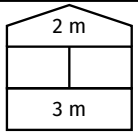


9. Different net?

Swap triangle positions

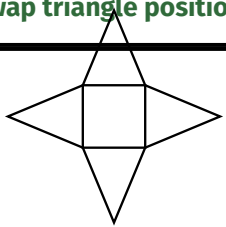


11. Pyramid SA: base 25, tri 15 each?

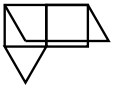


8. Triangles isosceles?

Two equal sides by



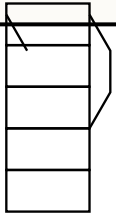
10. Triangles congruent?



12. Right triangle prism net?

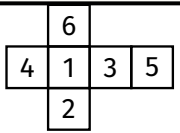
Rectangles + 2 triangles

Push Tasks - Nets and SA



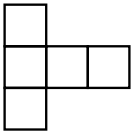
13. Find SA of hex prism:

15. Why must a tetrahedron net use 4 triangles?

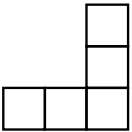


17. Cube side 3 cm. Shortest surface path A to opposite corner?

14. How many distinct nets for a tetrahedron?

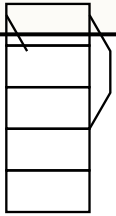


16. Open box volume 12 cm^3. SA (no top)?



18. L pentomino can form a cube net if... explain

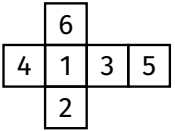
Push Tasks - Nets and SA



13. Hex prism SA side 2, len 5?

15. Why 4 triangles?

4 triangular faces

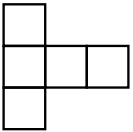


17. Shortest surface path?

Unfold net, draw line

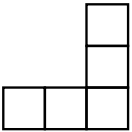
14. Tetrahedron nets?

2 distinct nets



16. V=12 no top SA?

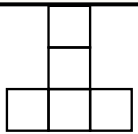
Depends on dimensions



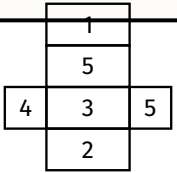
18. L as cube net?

Only with 6th square

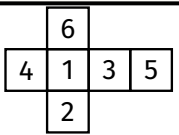
Push Tasks - Nets and SA



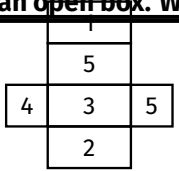
19. Only 2 of 12 pentominoes cannot form an open box. Which?



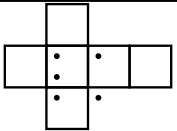
21. 4x6x4 cuboid uses least paper for V=96.



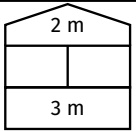
23. Shortest path: unfold the net, draw straight line.



20. 1x1x96 cuboid uses most wrapping paper.

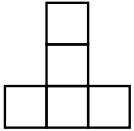


22. Minimum colours to paint a cube so adjacent



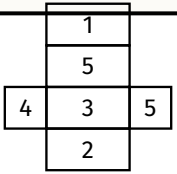
24. Ribbon on tent box: 4 m total, knot 20 cm.

Push Tasks - Nets and SA



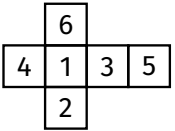
19. 2 non-box pentominoes?

I and X pentominoes



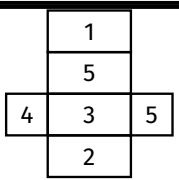
21. 4x6x4 min paper proof?

Closest to cube

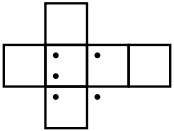


23. Shortest path?

Draw net, straight line

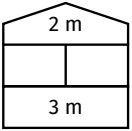


20. 1x1x96 max paper?



22. Min colours?

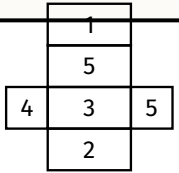
3 (opposite faces same)



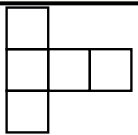
24. Ribbon on faces?

3,8 m on faces

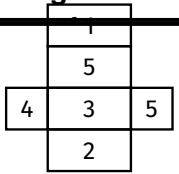
Push Tasks - Nets and SA



25. Cube SA = 150 cm^2. Side length? Then find

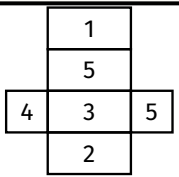


27. Open-top box from 6x4 cm card. Max volume?



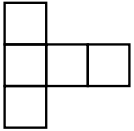
26. Cuboid 8x3x2 cm. Find

Push Tasks - Nets and SA



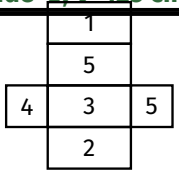
25. SA=150, side then V?

Side=5, V=125 cm^3



27. Open-top max volume?

Depends on card size



26. 8x3x2 wrap cost $0.05/$cm^2$?