

# Assessing pupils' progress in mathematics at Key Stage 3

Year 9 assessment package  
Shape, space and measures  
Examples of pupils' work



# Year 9

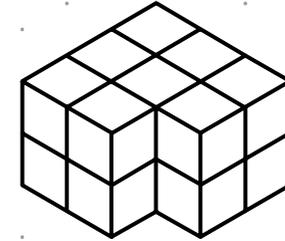
## Shape, space and measures

### LESSON 1: *Wrap around*

#### Pernickety prisms sheet 1 Level 3

Here is a drawing of a 16 cube prism.

Note that this pupil had access to linking cubes for support.

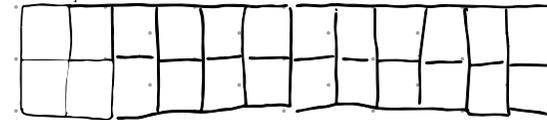


On squared paper, draw a **net** of this 16 cube prism.

What is the **surface area** of the 16 cube prism?

24

Now draw a 16 cube **cuboid**.

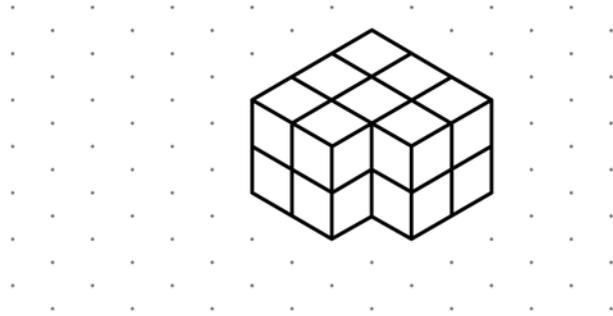


What is the **surface area** of the 16 cube cuboid?

24

Pernickety prisms sheet 1  
Level 4

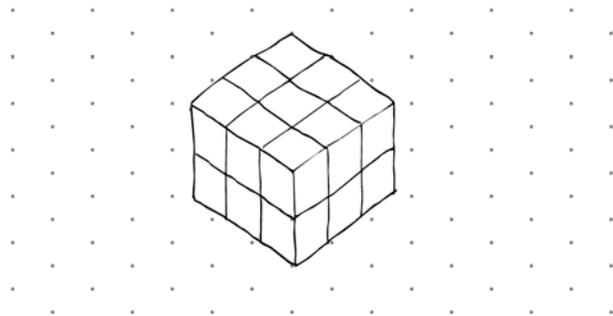
Here is a drawing of a 16 cube prism.



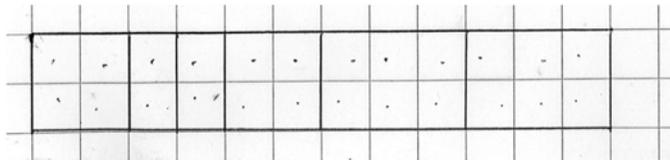
On squared paper, draw a **net** of this 16 cube prism.

What is the **surface area** of the 16 cube prism? 24<sup>2</sup>

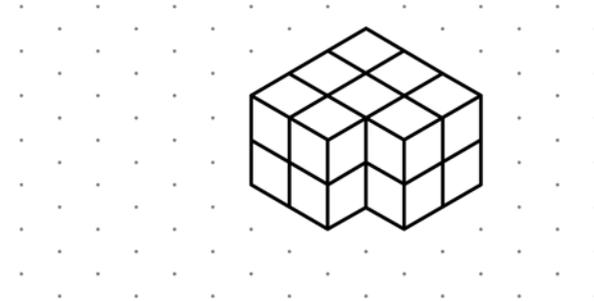
Now draw a 16 cube **cuboid**.



What is the **surface area** of the 16 cube cuboid? 26<sup>2</sup>



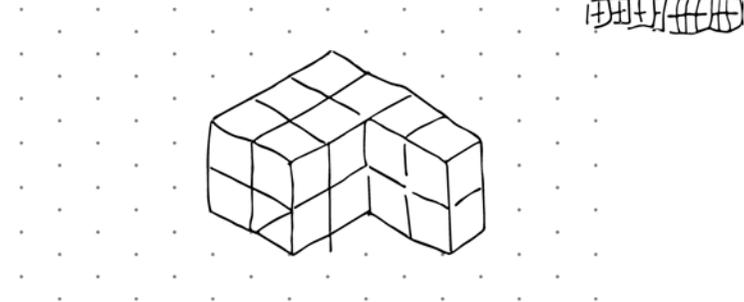
Here is a drawing of a 16 cube prism.



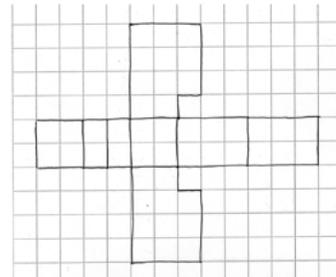
On squared paper, draw a **net** of this 16 cube prism.

What is the **surface area** of the 16 cube prism? 46

Now draw a 16 cube **cuboid**.

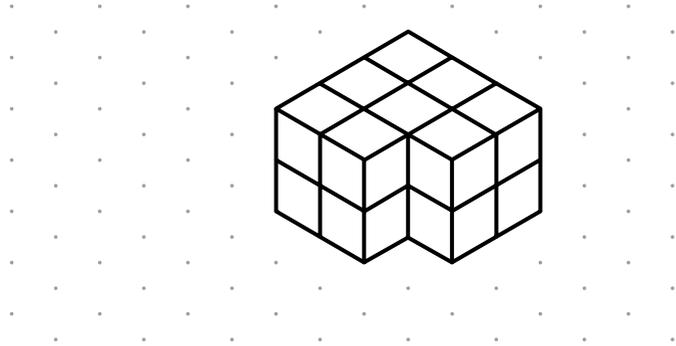


What is the **surface area** of the 16 cube cuboid? 44



Pernickety prisms sheet 1  
Level 5

Here is a drawing of a 16 cube prism.

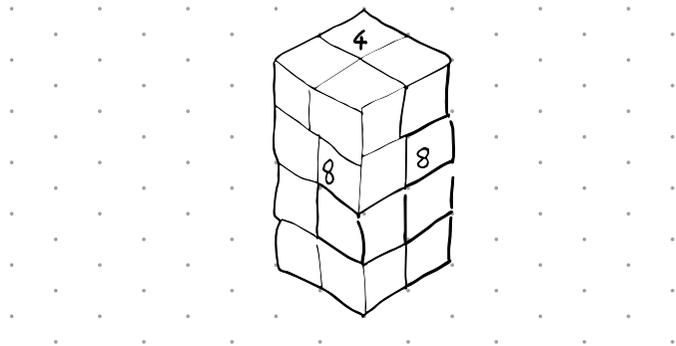


$$\begin{array}{r} 6 \\ 6 \\ 4 \\ 4 \\ 2 \\ 2 \\ 2 \\ 2 \\ \hline 8 \\ 8 \\ 8 \\ 8 \\ \hline 40 \end{array}$$

On squared paper, draw a **net** of this 16 cube prism.

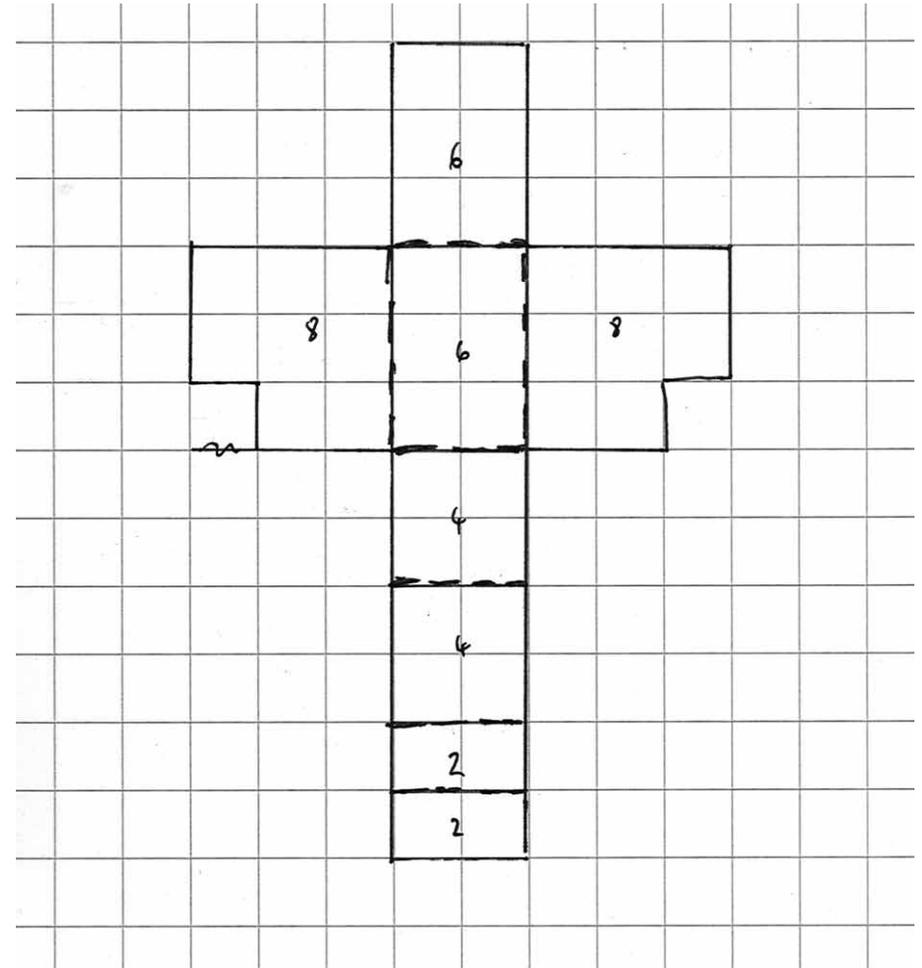
What is the **surface area** of the 16 cube prism? 40

Now draw a 16 cube **cuboid**.



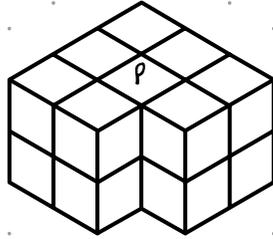
$$\begin{array}{r} 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ 3 \\ \hline 8 \\ 8 \\ 8 \\ 8 \\ 8 \\ 8 \\ 8 \\ 8 \\ \hline 40 \end{array}$$

What is the **surface area** of the 16 cube cuboid? 40



Pernickety prisms sheet 1  
Level 5

Here is a drawing of a 16 cube prism.



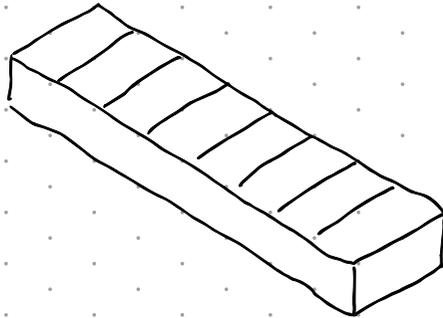
$$\begin{array}{r}
 2 \times 6 = 12 \\
 2 \times 4 = 8 \\
 2 \times 2 = 4 \quad + \\
 \hline
 34 \\
 2 \times 8 = 16 \quad + \\
 \hline
 40
 \end{array}$$

On squared paper, draw a **net** of this 16 cube prism.

What is the **surface area** of the 16 cube prism?

40 cm<sup>2</sup>

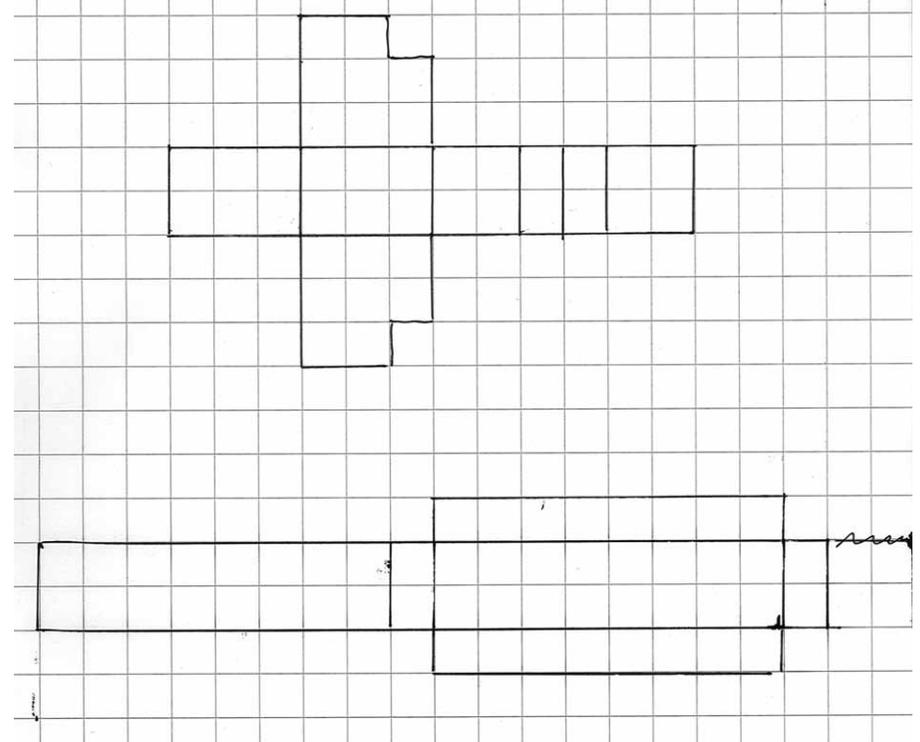
Now draw a 16 cube **cuboid**.



$$\begin{array}{r}
 2 \times 16 = 32 \\
 2 \times 8 = 16 \\
 2 \times 2 = 4 \\
 \hline
 52
 \end{array}$$

What is the **surface area** of the 16 cube cuboid?

52 cm<sup>2</sup>

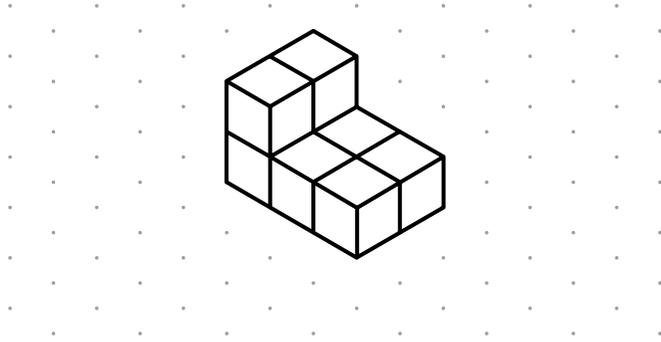


Pernickety prisms sheet 2

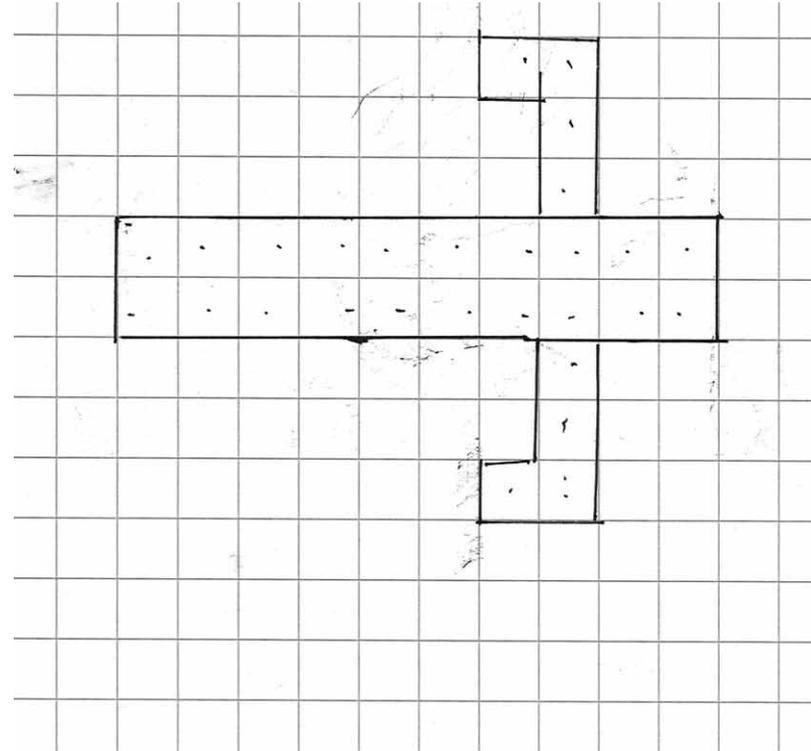
Level 4

You will need squared paper and isometric paper for your answers.

Here is a drawing of an 8 cube prism.



On squared paper, draw a **net** of this 8 cube prism.



What is the **surface area** of the 8 cube prism?

26

On isometric paper, draw the 8 cube prism with the **greatest possible** surface area.

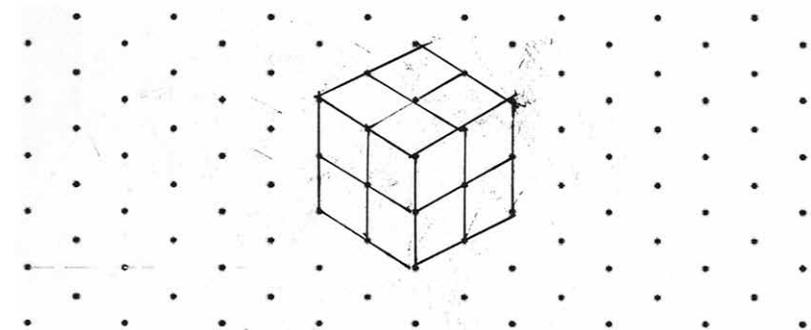
What is the **surface area** of this 8 cube prism?

24

Explain how you know that no other 8 cube prism has a greater surface area.

What would the 8 cube prism that has the **least possible** surface area look like, and what would its surface area be?

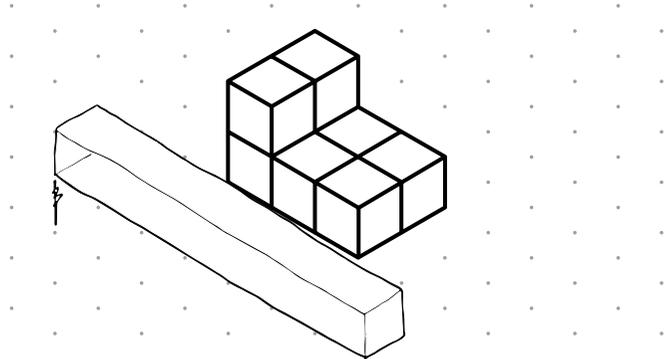
What about a 16 cube prism? Investigate.



Pernickety prisms sheet 2  
Level 5

You will need squared paper and isometric paper for your answers.

Here is a drawing of an 8 cube prism.



On squared paper, draw a **net** of this 8 cube prism.

What is the **surface area** of the 8 cube prism?

$$20 + 8 = 28$$

$$\begin{array}{r} 6 \\ 6 \\ 6 \\ \hline 20 \end{array} \quad \begin{array}{r} 4 \\ 4 \\ \hline 8 \end{array}$$

On isometric paper, draw the 8 cube prism with the **greatest possible** surface area.

What is the **surface area** of this 8 cube prism?

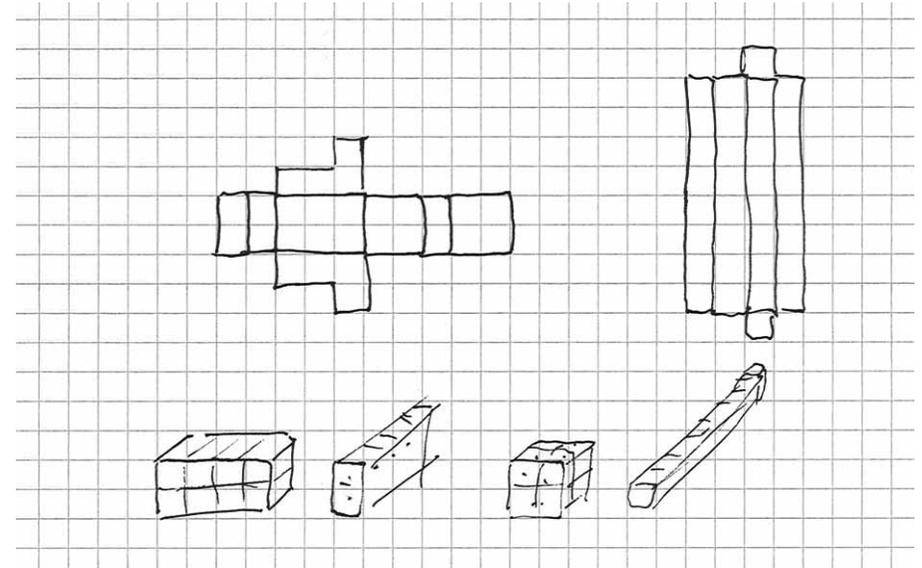
$$8 \times 4 = 36$$

$$36 + 2 = 38$$

Explain how you know that no other 8 cube prism has a greater surface area.

What would the 8 cube prism that has the **least possible** surface area look like, and what would its surface area be?

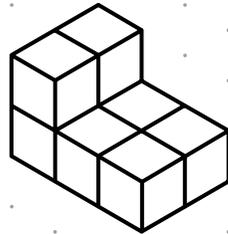
What about a 16 cube prism? Investigate.



Pernickety prisms sheet 2  
Level 5

You will need squared paper and isometric paper for your answers.

Here is a drawing of an 8 cube prism.



On squared paper, draw a **net** of this 8 cube prism.

What is the **surface area** of the 8 cube prism?

$$10 \times 2 = 20 \quad 20 + 8 = 28 \text{ cm}^2$$

On isometric paper, draw the 8 cube prism with the **greatest possible** surface area.

What is the **surface area** of this 8 cube prism?

$$34$$

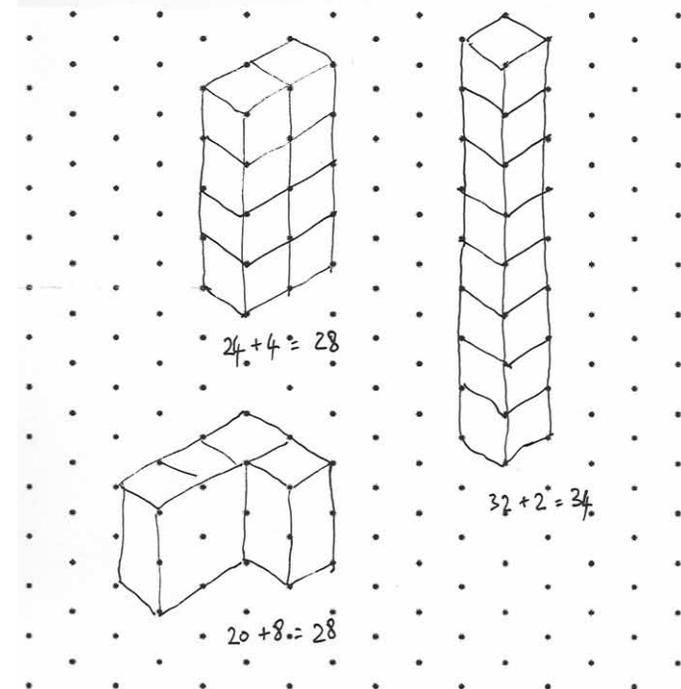
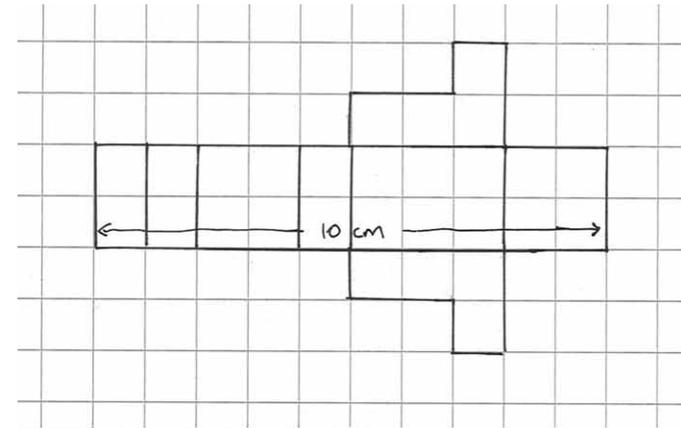
Explain how you know that no other 8 cube prism has a greater surface area.

*I tried different ones (see sheet).*

What would the 8 cube prism that has the **least possible** surface area look like, and what would its surface area be?

$$28$$

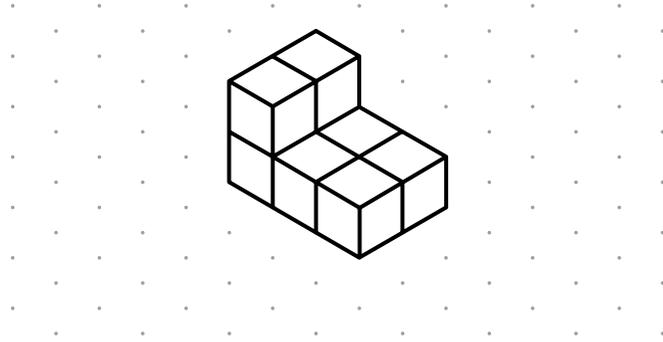
What about a 16 cube prism? Investigate.



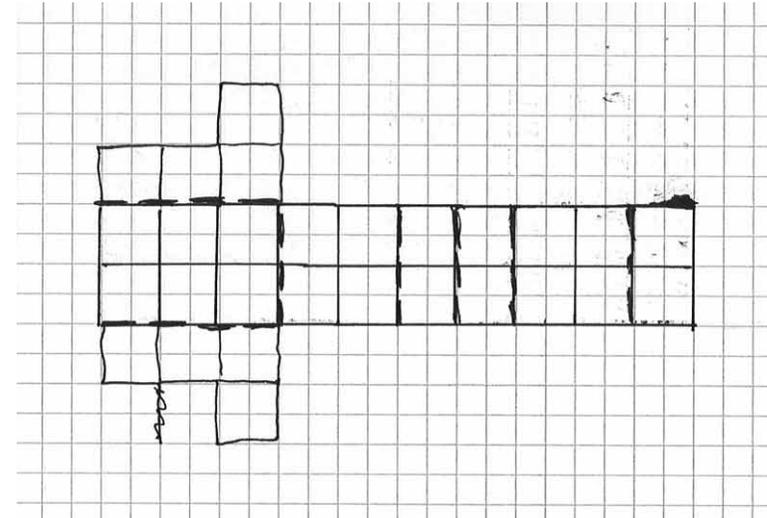
Pernickety prisms sheet 2  
Level 6

You will need squared paper and isometric paper for your answers.

Here is a drawing of an 8 cube prism.



On squared paper, draw a **net** of this 8 cube prism.



What is the **surface area** of the 8 cube prism?

$$28 \text{ cm}^2$$

On isometric paper, draw the 8 cube prism with the **greatest possible** surface area.

What is the **surface area** of this 8 cube prism?

$$34 \text{ cm}^2$$

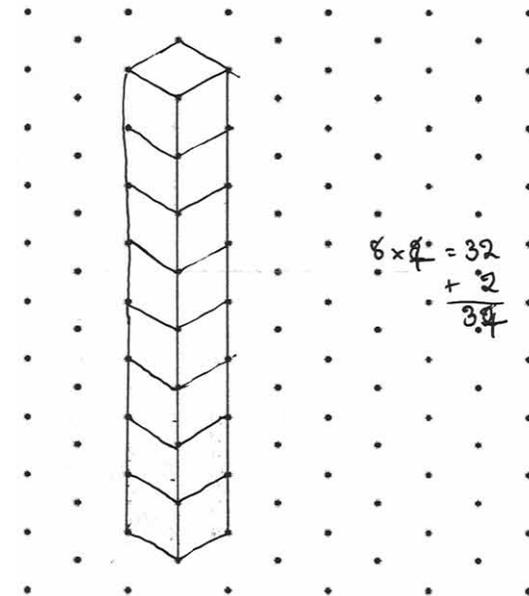
Explain how you know that no other 8 cube prism has a greater surface area.

*Its stretched out, not squashed in.*

What would the 8 cube prism that has the **least possible** surface area look like, and what would its surface area be?

*It would be shorter and wider*   $= 4 \times 6 = 24 \text{ cm}^2$

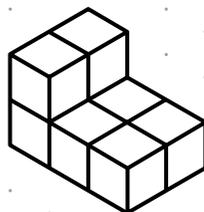
What about a 16 cube prism? Investigate.



Pernickety prisms sheet 2  
Above level 6

You will need squared paper and isometric paper for your answers.

Here is a drawing of an 8 cube prism.



On squared paper, draw a **net** of this 8 cube prism.

What is the **surface area** of the 8 cube prism?

$$2 \times 10 + 2 \times 4 = 28 \text{ cm}^2$$

On isometric paper, draw the 8 cube prism with the **greatest possible** surface area.

What is the **surface area** of this 8 cube prism?

$$4 \times 8 + 2 = 34 \text{ cm}^2$$

Explain how you know that no other 8 cube prism has a greater surface area.

*The cubes are spread out so less faces are touching. If you group them closer together, some will have more faces touching of 2 or 3 instead of one.*

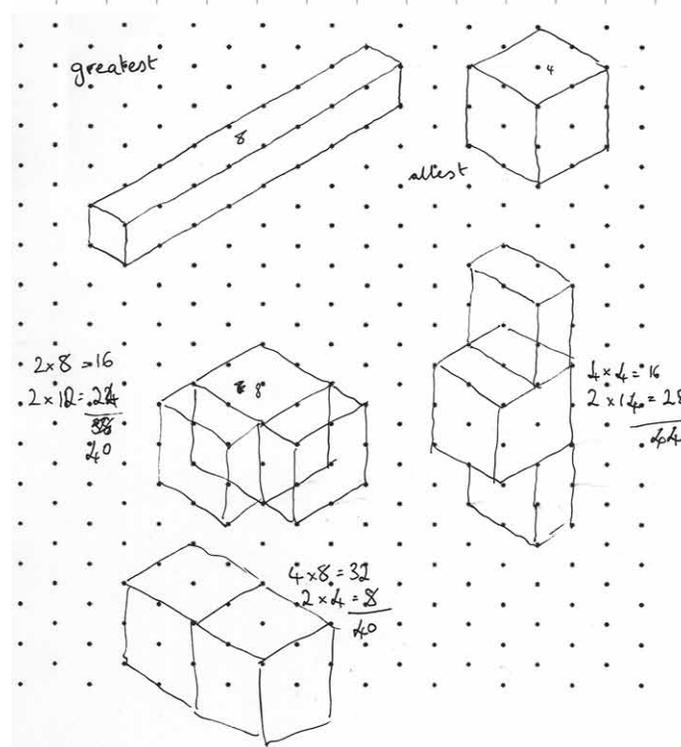
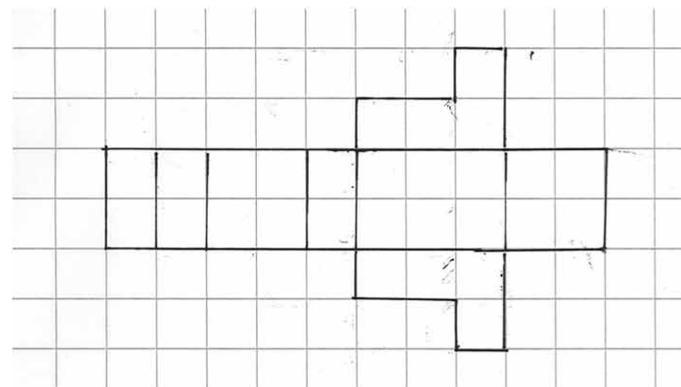
What would the 8 cube prism that has the **least possible** surface area look like, and what would its surface area be?

*It's a 2cm by 2cm cube like I have drawn. All cubes have 3 faces touching. The surface area =  $6 \times 4 = 24 \text{ cm}^2$*

What about a 16 cube prism? Investigate.

*You can't have a cube because 3cm by 3cm gives  $27 \text{ cm}^3$ .*

*I found two quite close to a cube. They both have an area of  $40 \text{ cm}^2$  and I think that is the smallest you can get.*



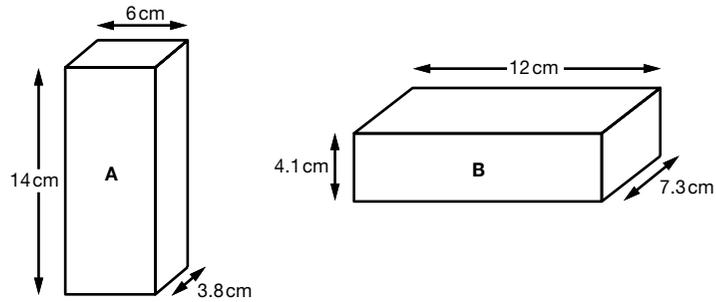
# Year 9

## Shape, space and measures

### LESSON 2: *Prismatic*

Big, bigger, biggest sheet 1  
Level 4

Here are two cuboids, A and B.

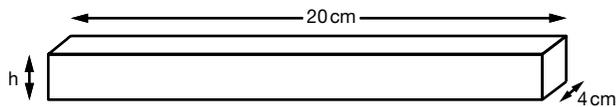


Which cuboid has the **bigger volume**? Show working to explain your answer.

$$6 \times 14 \times 3.8 = 319.2$$

$$12 \times 4.1 \times 7.3 = 354.24$$

The cuboid below has a **volume of 240cm<sup>3</sup>**



What is the height, h, of the cuboid?

$$20 \times 4 \times 4 = 320$$

$$20 \times 5 \times 5 = 500$$

$$20 \times 3 \times 3 = 180$$

$$20 \times 3 \times 4 = 240$$

What other cuboids have a volume of 240cm<sup>3</sup>?

On another sheet of paper, write the lengths, widths and heights of some of them.

$$4 \times 3 \times 20 = 240$$

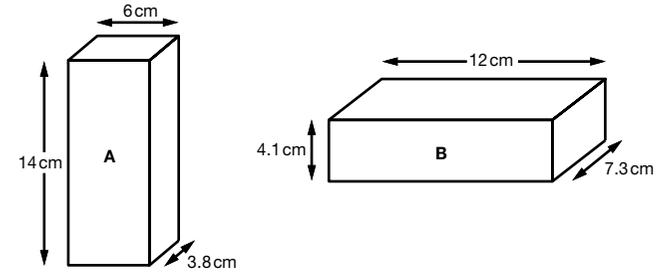
$$3 \times 4 \times 20 = 240$$

$$20 \times 4 \times 3 = 240$$

$$2 \times 120 \times 1 = 240$$

$$3 \times 8 \times 10 = 240$$

Here are two cuboids, A and B.



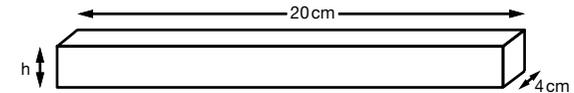
Which cuboid has the **bigger volume**? Show working to explain your answer.

$$A - 319.2$$

$$B - 359.16$$

B

The cuboid below has a **volume of 240cm<sup>3</sup>**



What is the height, h, of the cuboid?

$$20 \times 2 \times 4 = 160$$

$$20 \times 3 \times 4 = 240$$

3

What other cuboids have a volume of 240cm<sup>3</sup>?

On another sheet of paper, write the lengths, widths and heights of some of them.

$$20 \times 3 \times 4 = 240$$

$$10 \times 3 \times 8 = 240$$

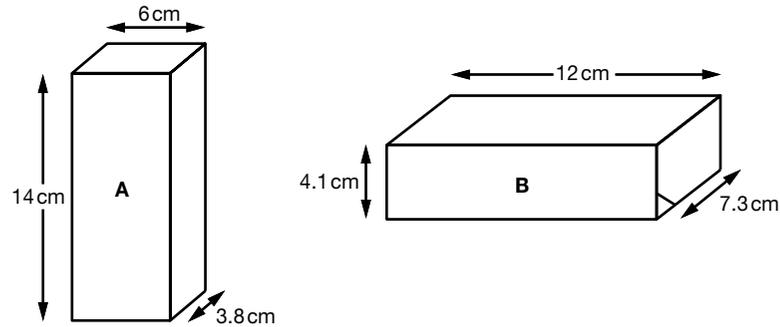
$$10 \times 6 \times 4 = 240$$

$$1 \times 24 \times 10 = 240$$

$$2 \times 2 \times 60 = 240$$

Big, bigger, biggest sheet 1  
Level 5

Here are two cuboids, A and B.

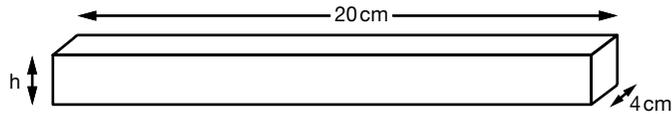


Which cuboid has the **bigger volume**? Show working to explain your answer.

$$6 \times 14 \times 3.8 = 319.2 \text{ cm}^3$$

$$12 \times 4.1 \times 7.3 = 359. \leftarrow \text{B is bigger}$$

The cuboid below has a **volume of 240cm<sup>3</sup>**



What is the height, h, of the cuboid?

$$20 \times 4 \times ? = 240 \quad 240 \div 80 = 3$$

$$20 \times 4 = 80 \quad h = 3$$

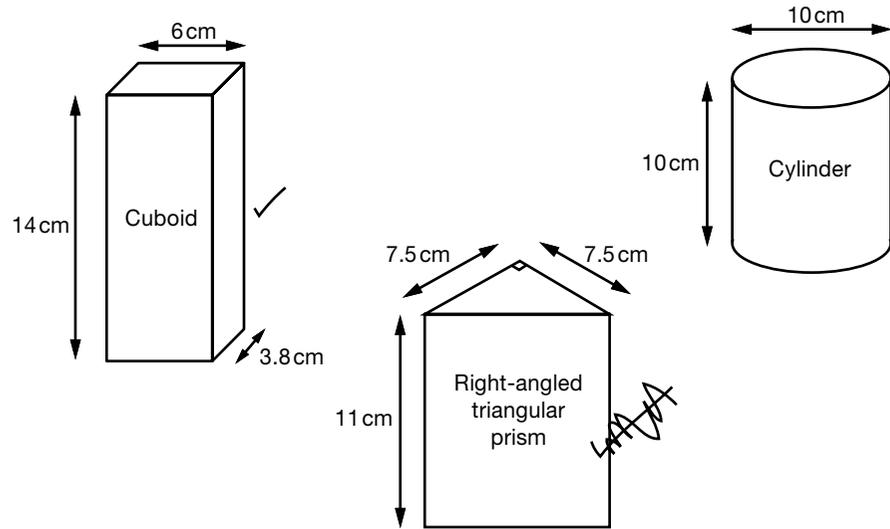
What other cuboids have a volume of 240cm<sup>3</sup>?

On another sheet of paper, write the lengths, widths and heights of some of them.

- 1 × 1 × 240
- 2 × 2 × 60
- 4 × 4 × 15
- 2 × 3 × 40
- 1 × 6 × 40
- 1 × 16 × 15
- 2 × 8 × 15
- 1 × 4 × 60
- 1 × 2 × 120
- 1 × 3 × 80
- 1 × 12 × 20
- 2 × 6 × 20
- 3 × 4 × 20
- 1 × 24 × 10
- 2 × 12 × 10
- 3 × 8 × 10
- 4 × 6 × 10

Big, bigger, biggest sheet 2  
Level 5

Here are three shapes.



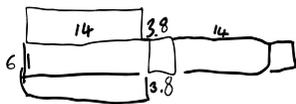
Which shape has the **biggest volume**? Show working to explain your answer.

$$14 \times 6 \times 3.8 = 319.2$$

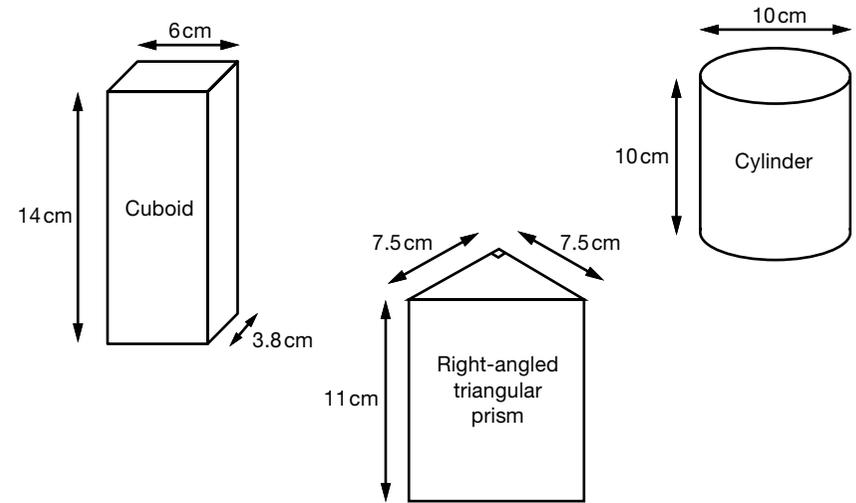
$$\frac{1}{2} 7.5 \times 7.5 = 28.125$$

$$28.125 \times 11 = 309.375$$

Which shape has the **biggest surface area**? Show working to explain your answer.



Here are three shapes.



Which shape has the **biggest volume**? Show working to explain your answer.

$$6 \times 14 \times 3.8 = 319.2$$

$$7.5 \times 7.5 \div 2 = 28.125$$

$$28.125 \times 11 = 309.375$$

$10 \times 10 = 100$   
— so the <sup>cuboid</sup> ~~triangular prism~~ shape is biggest

Which shape has the **biggest surface area**? Show working to explain your answer.

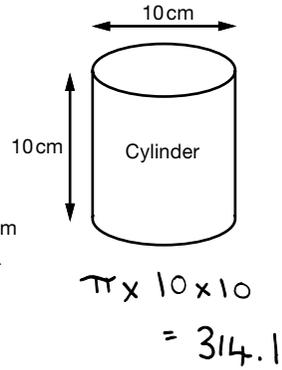
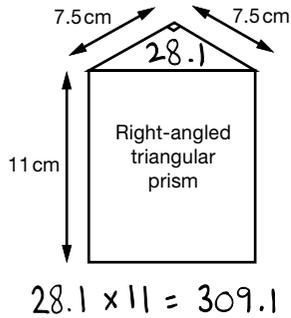
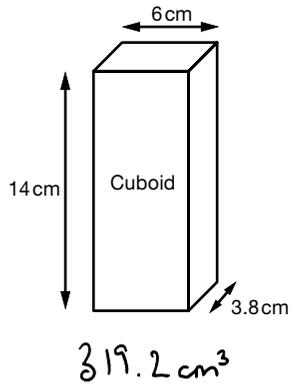
$$14 \times 6 = 84$$

$$6 \times 3.8 = 22.8$$

$$336 + 45.6 = 381.6$$

Big, bigger, biggest sheet 2  
Level 5

Here are three shapes.



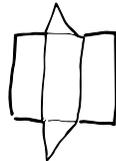
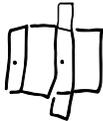
Which shape has the **biggest volume**? Show working to explain your answer.

The cuboid

Which shape has the **biggest surface area**? Show working to explain your answer.

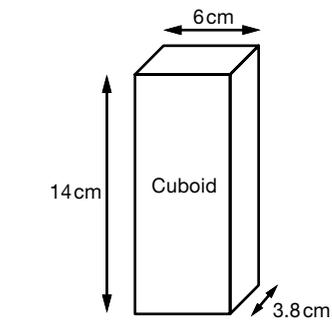
$$2 \times 84 + 2 \times 53.2 + 2 \times 22.8 = 320$$

$$3 \times 82.5 + 2 \times 28.1 = 303.7$$

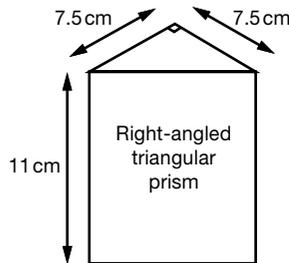


Big, bigger, biggest sheet 2  
Level 6

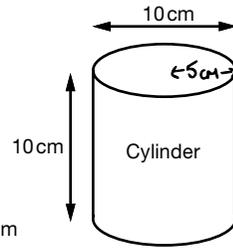
Here are three shapes.



$$6 \times 14 \times 3.8 = 319.2 \text{ cm}^3$$

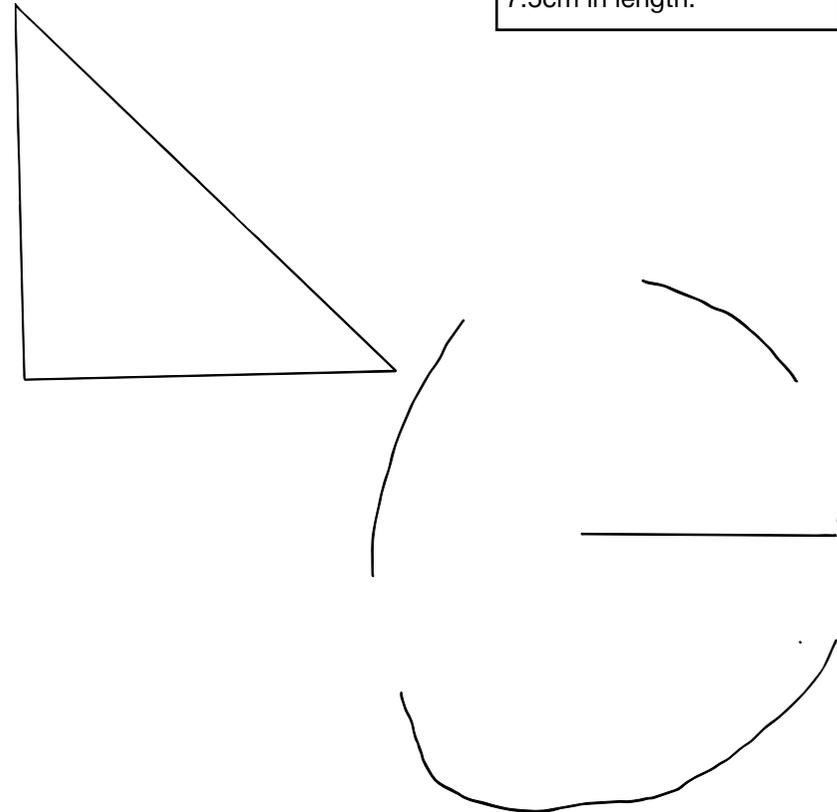


$$\frac{1}{2} \times 7.5 \times 7.5 \times 11 = 309.375 \text{ cm}^3$$



$$\pi r^2 \times 10 = \pi \times 25 \times 10 = 785.4 \text{ cm}^3$$

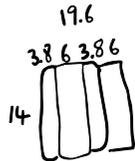
Note that this triangle has perpendicular sides of 7.5cm in length.



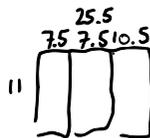
Which shape has the **biggest volume**? Show working to explain your answer.

Cylinder

Which shape has the **biggest surface area**? Show working to explain your answer.



$$14 \times 19.6 + 2 \times 3.8 \times 6 = 320 \text{ cm}^2$$

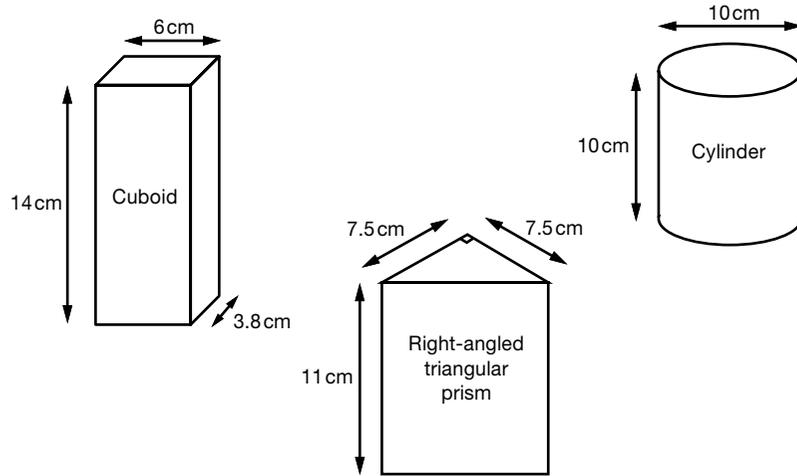


$$11 \times 25.5 + 2 \times 28.125 = 336.75 \text{ cm}^2$$



Big, bigger, biggest sheet 2  
Level 6

Here are three shapes.



Which shape has the **biggest volume**? Show working to explain your answer.

$$14 \times 6 \times 3.8 = 319.2 \text{ cm}^3$$

$$\frac{1}{2} \times 7.5 \times 7.5 \times 11 = 309.375 \text{ cm}^3$$

$$\pi \times 5^2 \times 10 = 785.398 \text{ cm}^3$$

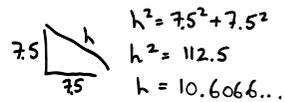
So the cylinder is much bigger.

Which shape has the **biggest surface area**? Show working to explain your answer.

~~Surface area =~~  
 $168 + 106.4 + 45.6 = 320 \text{ cm}^2$

$$2 \times 56.25 + 165 + 116.67 \dots = 337.9 \dots \text{ cm}^2$$

$$31.4159 \dots \times 10 + \pi \times 5^2 \times 2 = 471.2388 \dots$$



$$\pi \times 10 = 31.4 \dots$$

Again, the cylinder