Surface area

Mana Maths

Te reo Māori terms

horahanga mata
surface area
Open in Te Aka

rohe
area
Open in Te Aka

kupenga
net
Open in Te Aka

tairite
congruent
Open in Te Aka

Surface area

Key idea

Surface area is the total area of all the outside faces of a 3D shape. Imagine wrapping the shape in paper — the amount of paper needed is the surface area. A good method is to find the area of each face, then add them all together.

Step-by-step method

1. Identify every face on the outside of the shape.
2. Find the area of each face using the correct formula.
3. Multiply when faces are the same (congruent pairs).
4. Add all the areas together.
5. Write the final answer with square units (cm^2, m^2, etc.).

Common mistake

Forgetting a face. A cube and a cuboid each have **6 faces**. A closed cylinder has **2 circles** plus the curved surface — that's 3 parts, not 2!

Cube

A cube has side length 4 cm. All faces are identical squares.

Area of one face: $4 \times 4 = 16$ cm^2
6 identical faces: $6 \times 16 = 96$ cm^2

Surface area = 96 cm^2

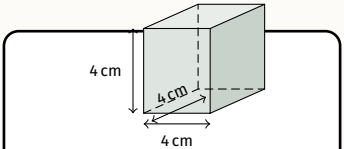
Cuboid

A box is 8 cm by 3 cm by 2 cm. Opposite faces are the same size.

Top & bottom: $2 \times (8 \times 3) = 48$
Front & back: $2 \times (8 \times 2) = 32$
Left & right: $2 \times (3 \times 2) = 12$
Total: $48 + 32 + 12 = 92$

Surface area = 92 cm^2

Start Tasks



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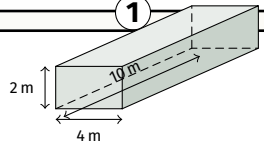

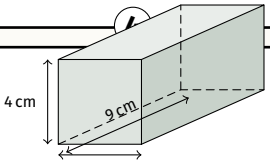

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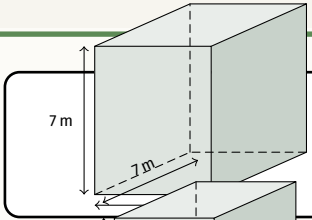

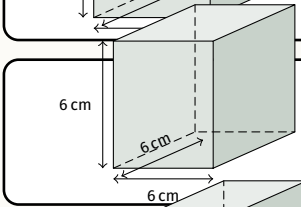

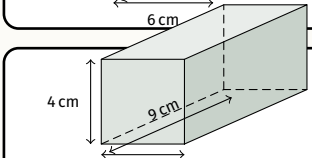

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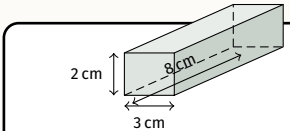

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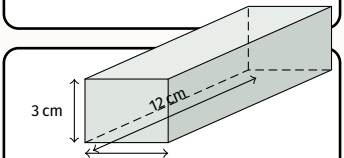
6. One face 25 cm^2, 6 faces



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Start Tasks - Answers

1. Cube side 4 cm
SA = $6(4^2) = 6(16) = 96$ cm^2

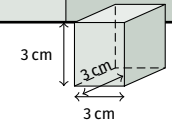
2. Cube side 7 m
SA = $6(7^2) = 6(49) = 294$ m^2

3. Cuboid $8 \times 3 \times 2$ cm
SA = $2(8 \cdot 3 + 8 \cdot 2 + 3 \cdot 2) = 2(46) = 92$ cm^2

4. Cuboid $10 \times 4 \times 2$ m
SA = $2(10 \cdot 4 + 10 \cdot 2 + 4 \cdot 2) = 2(68) = 136$ m^2

Sta

30 cm



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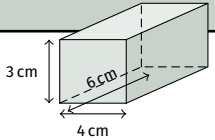

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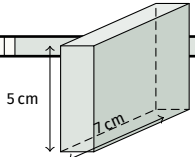
13. Top+bottom 96, base 8×6?

14. Why square units?



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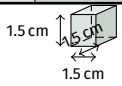
10

25 cm

40 cm



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Start Tasks - Answers

7. Top+bottom of $9\times5\times4$
$2(9\times5) = 2(45) = 90\ \text{cm}^2$

8. Four side faces
$2(9\times4)+2(5\times4) = 72+40 = 112\ \text{cm}^2$

9. Gift box $12\times5\times3$ cm
$SA = 2(60+36+15) = 2(111) = 222\ \text{cm}^2$

10. Fish tank (no lid)
Base+sides: $1000+3900 = 4900\ \text{cm}^2$

Start Tasks - Answers

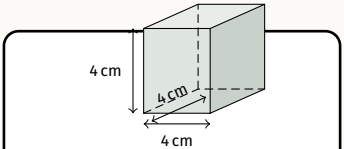
13. Top/bottom total 96 cm^2
$2(8 \times 6) = 96$, consistent

14. Why square units?
SA is 2D area, so cm^2 not cm^3

15. Cube 0.5 m
SA = $6(0.5^2) = 6(0.25) = 1.5\ m^2$

16. Cuboid $7 \times 2 \times 5$
SA = $2(14+35+10) = 2(59) = 118\ cm^2$

Start Tasks



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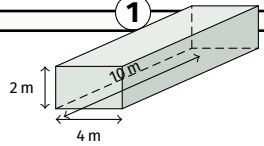

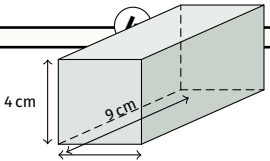

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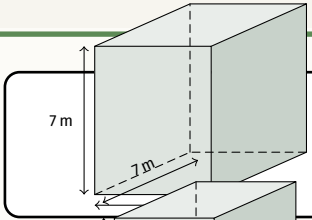

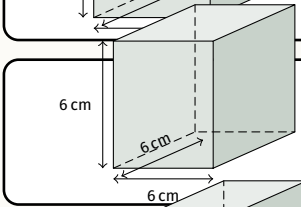

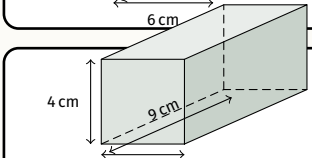

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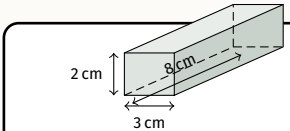

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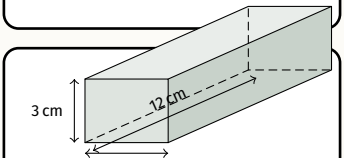

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Build Tasks - Answers

1. Cuboid $12 \times 8 \times 5$ cm
SA = $2(96+60+40) = 392$ cm^2

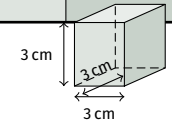
2. Box $1.2 \times 0.7 \times 0.5$ m
SA = $2(0.84+0.6+0.35) = 3.58$ m^2

3. Cube SA = 384
$6s^2=384 \rightarrow s^2=64 \rightarrow s=8$ cm

4. Cuboid $15 \times 9 \times 4$ cm
SA = $2(135+60+36) = 462$ cm^2

Sta

30 cm



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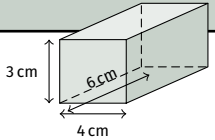

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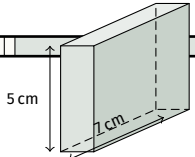

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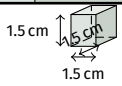
10

25 cm

40 cm



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Build Tasks - Answers

7. Cylinder r=3, h=10
$2\pi(3)(10)+2\pi(9) \approx 244.92$ cm^2

8. Cylinder d=8, h=12
r=4: $2\pi(4)(12)+2\pi(16) \approx 401.92$ m^2

9. Cylinder SA=471, r=5
$31.4h+157=471 \rightarrow$ h=10 cm

10. Pencil $20\times12\times8$ mm
SA = 2(240+160+96) = 992 mm^2

Build Tasks - Answers

13. Cube 2.5 cm
SA = 6(6.25) = 37.5 cm^2

14. Paint can label
$\pi dh \approx 3.14 \times 10 \times 14 = 439.6$ cm^2

15. Cylinder r=6, h=15
SA $\approx$ 565.2+226.08 = 791.28 cm^2

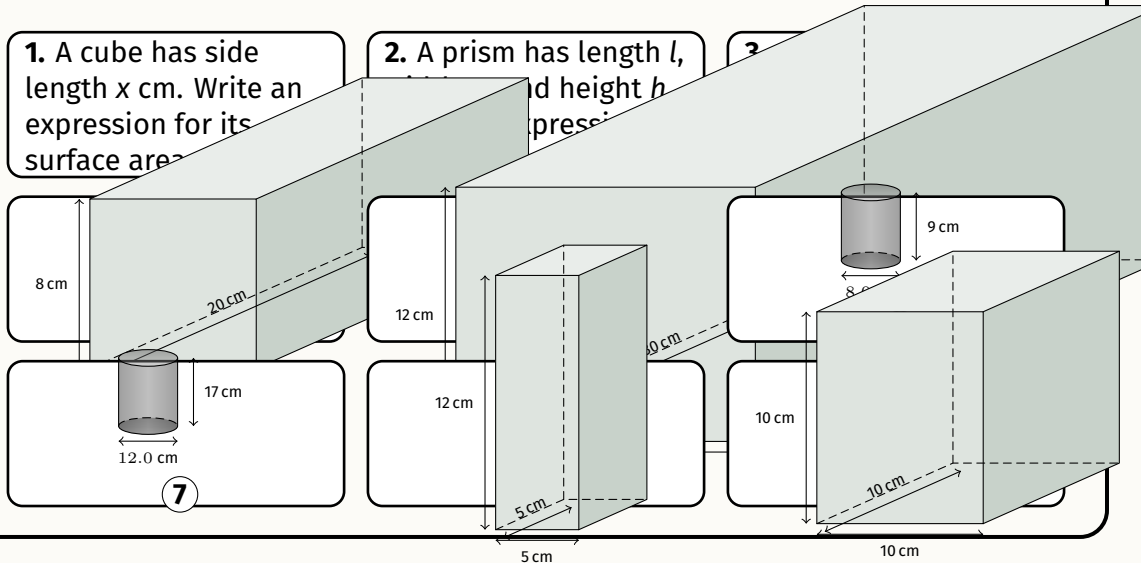
16. Room $6 \times 4.5 \times 2.8$
85.8-8 = 77.8 m^2

Push Tasks

1. A cube has side length x cm. Write an expression for its surface area.

2. A prism has length l, [illegible] and height h [illegible]

3



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Push Tasks - Answers

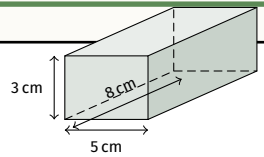
1. Cube side x
SA = $6x^2$

2. Prism l, w, h
SA = 2(lw+lh+wh)

3. Cube s=6, prism $9 \times 4 \times h$
$216 = 2(36+13h) \rightarrow h = 72/13 \approx 5.54$ cm

4. Cuboid $20 \times 10 \times 8$
SA = 2(200+160+80) = 880 cm^2

Push Tasks



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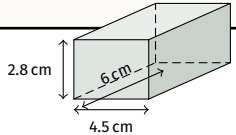

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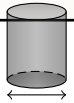

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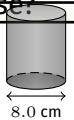
13. A cuboid has a square base of side 7 cm and total SA = 238 cm^2. Find its height.

14. If every edge of a cube doubles, by what factor does its surface area increase?

15. If the radius and height of a cylinder both triple, by what factor does the SA increase?

16. A cuboid has dimensions in the ratio $3:2:1$ and SA = 352. Find the dimensions.

17. A cylinder (r=3, h=5) has a hemisphere (r=3) on top. Find total SA (exclude the join area).



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Push Tasks - Answers

7. Cylinder SA=276π, r=6
$12\pi h+72\pi=276\pi \rightarrow$ h=17 cm

8. Square prism s=5, h=12
SA = 2(25)+4(60) = 290 cm^2

9. Cube SA=600, find side
$6s^2=600 \rightarrow s^2=100 \rightarrow$ s=10 cm

10. Compare cuboids
158 vs 164; second greater by 6 cm^2

Push Tasks - Answers

13. Square base 7, SA=238
$98+28h=238 \rightarrow h=5$ cm

14. Cube edges double
Factor $2^2 = 4$

15. Cylinder r,h triple
Factor $3^2 = 9$

16. Cuboid 3:2:1, SA=352
$22x^2=352 \rightarrow x=4 \rightarrow 12,8,4$