Finding the surface area of a three dimensional object

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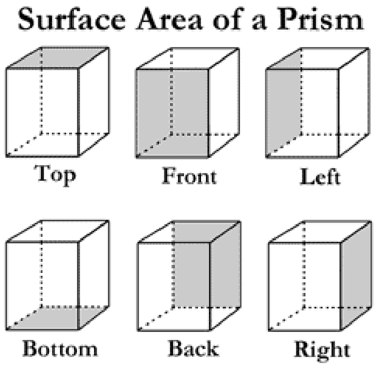
What is surface area?

- Surface area is the total area of all the surfaces of a three dimensional object
- Surface area can be found by using a net of the object which shows all the surfaces of an object and adding them together **OR** by applying the formula for that specific shape



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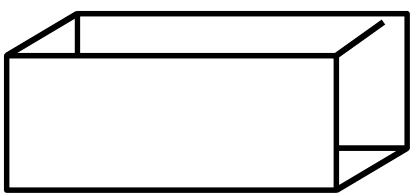
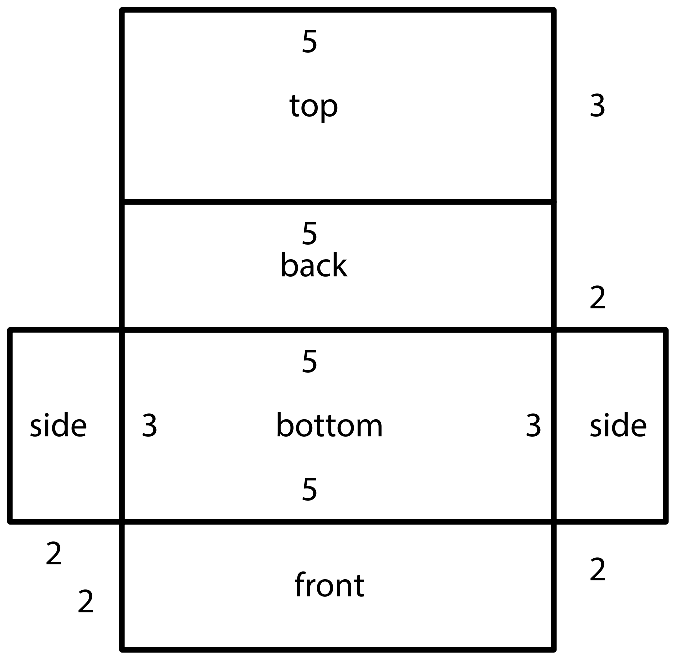
Surface area of rectangular prisms: An example

- In a rectangular prism, it is helpful to decompose (unfold) the object so students can see all the different faces
- For example,





This is called a net. A net is a two dimensional representation of all the faces

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Surface area of rectangular prisms: An example cont.

- Based on the net, you can see that the rectangular prism is made up of 2 sets of 3 different rectangles
  - Front and back- 2 by 5
  - Top and bottom- 3 by 5
  - 2 sides-2 by 3

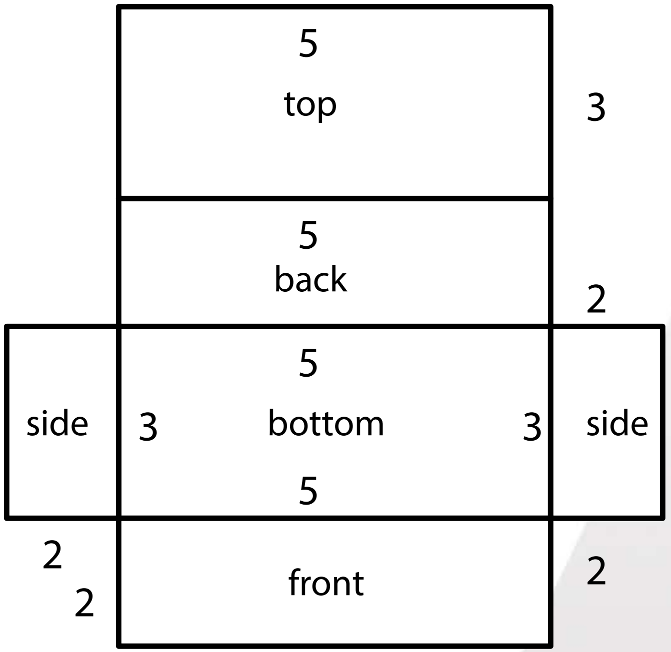
2 of each

SA= 2(2x5+3x5+2x3)

Front and back

Top and bottom

2 sides



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Surface area of rectangular prisms: An example cont.

- Step 1: SA= 2(2x5+3x5+2x3)
- Step 2: SA= 2(10+15+6)
- Step 3: SA = 62 cm^2

Don't forget the units

Helpful Hint:
Remember to review order of operations. Students must multiply before adding

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Surface area of cubes: An example

- For a cube, all faces have the same length and width, so for a cube with 4cm length, width, and height.

- Step 1: SA= 6 (l x w)

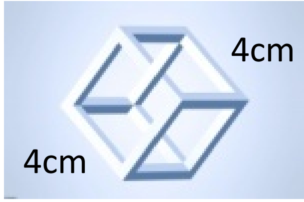
Formula for area of a square

Number of faces

- Step 2: SA= 6(4x4)

  = 6(16)

  = 96 cm^2



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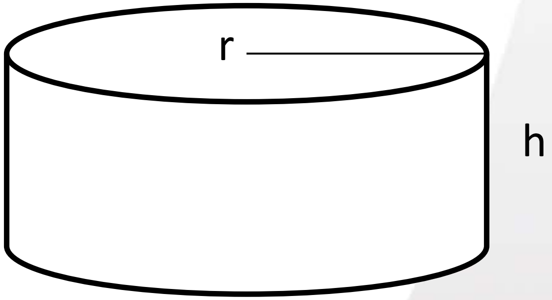
Surface area of cylinder: An example

- A cylinder is a solid with a circular base
- The height of a cylinder is the distance between its bases

radius ↓ height ↙

- $SA = 2\pi r^2 + 2\pi rh$



Helpful Hint:
Remember to the concept of π and that it is a constant and irrational number

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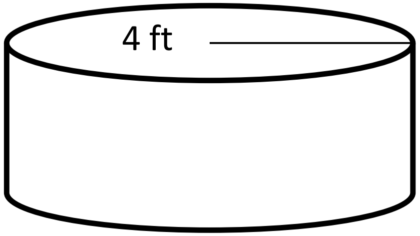
Surface area of cylinder: An example

- Step 1: $SA = 2\pi(3^2) + 2\pi(3)(4)$
- Step 2: $SA = 2\pi(9) + 2\pi(12)$
- Step 3: $SA = 18\pi + 24\pi$
- Step 4: $SA = 42\pi$
- Step 5: $SA \approx 131.95\ ft^2$



Note the change in symbol to communicate an approximation

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Surface area of a pyramid: An example

- A pyramid is a polyhedron where the base is a polygon and the faces are triangles with a common vertex

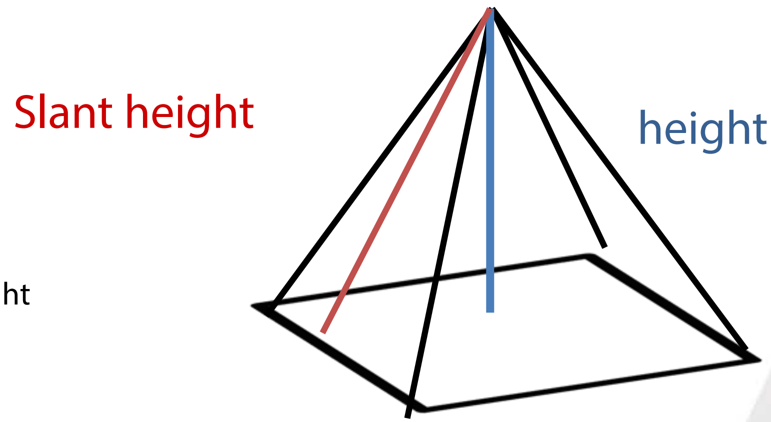
base ↘ Lateral area ↙

SA=B + L

or

SA=B + 1/2Pl ← Slant height

↑ base ↑ perimeter



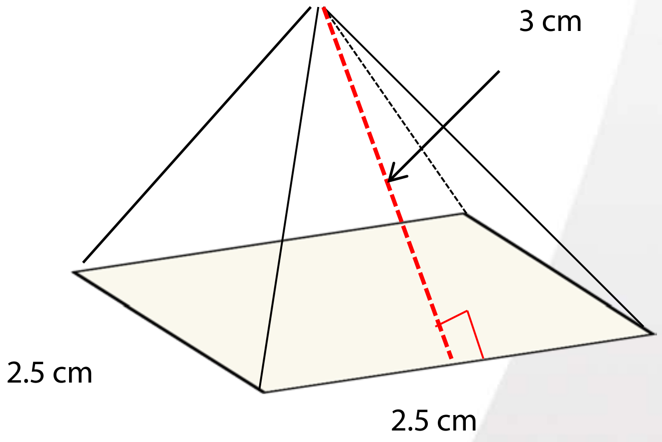
Regular pyramid: All faces, including the base, are congruent

Surface area of a pyramid: An example

- SA=B + 1/2Pℓ

Perimeter= 4(2.5)

- Step 1: SA=(2.5 x 2.5) + ½ (10)(3)
- Step 2: SA=6.25 + ½ (30)
- Step 3: SA= 6.25 + 15
- Step 4: SA = 21.25 in^2



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Surface area of a cone: An example

- A cone has a circular base and a vertex.

base ↘ Lateral area ↙

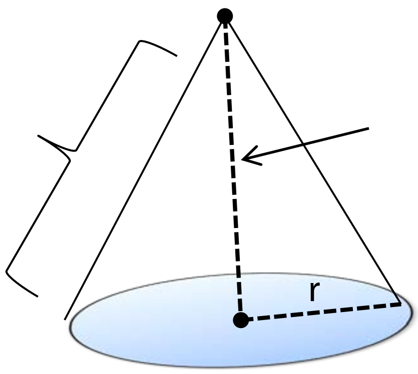
$$SA = B + L$$

or

$$SA = \pi r^2 + \pi r l$$

← Slant height

radius ↗ radius ↗



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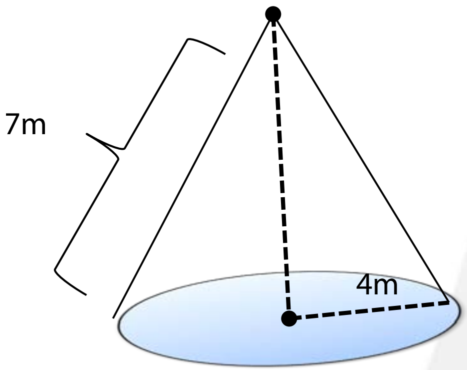
Surface area of a cone: An example

- SA= $\pi r^2 + \pi r\ell$

- Step 1: SA= $\pi(4)^2 + \pi(4)(7)$



- Step 2: SA= $16\pi + 28\pi$

- Step 3: SA $\approx 44\pi$

Note the change in symbol to communicate an approximation

- Step 4: SA $\approx 138.2\ m^2$

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Making Connections

- Finding the volume of three dimensional objects addresses the following 7th and 8th grade Core Content Connectors
  - 7-8.NO.3c1 Use the rules for mathematical operations to verify the results when more than one operation is required to solve a problem
  - 7.GM.1h2 Find the surface area of three-dimensional figures using nets of rectangles or triangles
  - 7.GM.1h3 Find the area of plane figures and surface area of solid figures
  - 8.GM.1g1 Recognize congruent and similar figures

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