Unit 1 – Spatial Relationships and Geometry  
Section B – Estimating Area and Volume  
Topics: Area, surface area, volume.

You are provided with a formula sheet online.  
See “Sheet for computation of volumes” on the course website.

Area:
- Definition: The area of a two-dimensional figure is the number of square units it takes to fill the inside of the figure
- Formula: Area of Rectangle = ( length ) ( width )
- Reasoning the other formulas:
  Area of Parallelogram = ( base ) ( height )

![Diagram of a parallelogram]

Area of Triangle = ½ ( base ) ( height )

![Diagram of a triangle]

Area of Trapezoid = Triangle + rectangle = ½ ( b – a ) (height) + ( a ) ( height )

![Diagram of a trapezoid]

= ½ ( height )( b – a + 2a ) = ½ ( height )( b + a )

- A circle is a set of points on a plane that are all the same distance from a fixed point called the center. This fixed distance is the radius of the circle. The diameter connects any two points on the circle and goes through the center, it is twice the length of the radius.
• Pi again is the ratio of a circle’s circumference to its diameter. It is fixed no matter how big the circle is \( \pi = \frac{C}{d} \approx 3.14 \). It is always best to use your pi button on your calculator instead of 3.14. If your answers come out to be 1 or 2 places off, this might be why

• **Formulas for Circles:**
  - The perimeter of a circle (circumference) = \( 2 \pi r \)
  - Area of a circle = \( \pi r^2 \)

• A trick question, **units of measurement**:
  - **Example:** How many inches in 1 foot?
    - **Solution:** 12 in = 1 foot
  - **Example:** How many square inches are in 1 square foot? Is it 12? NO!
    - **Solution:** \((1 \text{ foot})^2 = (12 \text{ in})^2 = 144 \text{ in}^2\)

Be sure to always square (or cube or whatever) the number in front of the unit as well as the unit itself!

**Volume:**
- **Definition:** Volume refers to the amount of space (in cubic units) occupied by a solid object
- Volume of Rectangular solid = \( (\text{area of bottom })(\text{height}) = (\text{length})(\text{width})(\text{height}) \)
- Volume of a Right Circular Cylinder = \( (\text{area of bottom})(\text{height}) = \pi r^2 h \)
- Volume of a pyramid = \( \frac{1}{3} (\text{area of base})(\text{height}) \)
- Volume of a Cone = \( \frac{1}{3} \pi r^2 h \)
- Volume of a Sphere = \( \frac{4}{3} \pi r^3 \)

**Surface Area:**
- The area of the outer surface of a three dimensional object is call **surface area**.
- Surface area of Box = top area + bottom area + side areas = \( 2lw + 2lh + 2wh \)
- Surface area of Circular cylinder = top area + bottom area + side area = \( 2\pi r^2 + 2\pi rh \)

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