Core maths for designers

**Volume and density**

- **Volume of a cuboid** \( V = \text{length} \times \text{width} \times \text{height} = L \times W \times H \)
- **Volume of a cylinder** \( V = \text{area of circle} \times \text{length} = A \times L = \pi r^2 \times L \)
- **Density** \( \rho = \text{mass} / \text{volume} = m / V \)

**Dimensions of a triangle**

- **Pythagoras theorem** (for right angled triangles) \( A^2 + B^2 = C^2 \)
- Rearranging: \( A = \sqrt{(C^2 - B^2)} \), \( B = \sqrt{(C^2 - A^2)} \), \( C = \sqrt{(A^2 + B^2)} \)
- **Trigonometry**
  - \( \tan \theta = O/A \)
  - \( \sin \theta = O/H \)
  - \( \cos \theta = A/H \)

**Area**

- **Area of a rectangle** \( \text{length} \times \text{width} = L \times W \)
- **Area of a circle** \( \pi r^2 \)
- **Area of a triangle** \( \text{half (base} \times \text{height}) = \frac{1}{2} (B \times H) \)

For complicated shapes, calculate the area by breaking them down into simple shapes.

**Cost**

- **Cost of material in a part** = mass of material \( \times \) cost per unit mass
- (or cost of material = area of material \( \times \) cost per unit area)
- **Labour to make a product** = labour time \( \times \) charge rate
- **Total cost of parts in a product** = £ part1 + £ part2 + £ part3 etc.
- **Total cost to make a product** = cost of parts + cost of materials + labour cost
- **Profit** = sales price – total cost

**Graphs**

Graphs are used to communicate data and show relationships between data. Commonly used graphs include line graphs, bar graphs and pie charts.

Formula for a straight line graph: \( y = mx + c \)