# Scalars and vectors

A.C. Norman
anorman@bishopheber.cheshire.sch.uk

1. Draw up a table headed 'scalars' and 'vectors' and put the following physical quantities in the appropriate column: area, temperature, weight, gravitational potential, elastic energy, acceleration, magnetic field strength, power, density, momentum, speed, displacement, force.

2. A particle moves around a circle shown in the direction ABCDA. The circle has a radius of $8.0\,\text{m}$ and the particle takes $5.0\,\text{s}$ to travel around it.
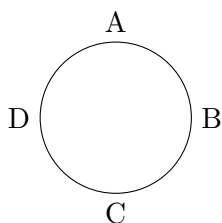
    Calculate

    (a) the average speed for one revolution,
    (b) the average speed for half of one revolution,
    (c) the average velocity for one revolution,
    (d) the average velocity for half of one revolution,
    (e) the change in velocity from A to C.

3. Boat A is travelling at $6.0\,\text{m}\,\text{s}^{-1}$ east along a river, in which there is no current.

    (a) Calculate the time taken for boat A to travel $300\,\text{m}$ relative to the bank.
        Boat B is travelling west at $12\,\text{m}\,\text{s}^{-1}$.
    (b) Calculate the velocity of boat B as seen from the front of boat A.
        The front of the boats are initially $3600\,\text{m}$ apart.
    (c) Calculate the time taken until the front of the boats pass.
        Boat A is $40\,\text{m}$ long, and boat B is $80\,\text{m}$ long.
    (d) Calculate the time taken between the front of the boats passing and the back of the boats passing.
        Some time later boat A is in a head on current of 2.0 m s-1.
    (e) Calculate the time it takes the full length of the boat A to pass a point on the bank.
        A man standing on the front of boat A is $100\,\text{m}$ from another man on the back of boat C, which is travelling at $3.0\,\text{m}\,\text{s}^{-1}$ away from boat A. He throws a cricket ball at $24\,\text{m}\,\text{s}^{-1}$ at boat C.
    (f) Calculate the time between the release of the ball and it being caught.