WaterSafe
AUCKLAND INC.
ORA
Building a water safety culture

Teacher Notes
The maths of speed and distance on the water

The speed that boats and ships travel on water is measured in knots and the distance they travel is measured in nautical miles (nm). Knowledge of these is important as the rules of the sea can affect the speed at which craft travel and this is an important water safety consideration for all users. For example all craft must travel at 5 knots or less if within 200 metres of the shore and within 50 metres of any other boat, swimmer, or diver's flag.

The nautical mile as a measure of sea travel started when people realised the earth was round and not flat. It is based on the circumference of the earth at the equator. As the earth is round at the equator, (it flattens out a bit at the poles) there are 360 degrees around the earth and each degree is broken down into 60 minutes (measure of angle and not time!). A minute, of arc at the equator, is 1 nautical mile. So the earth's circumference at the equator is 360 degrees x 60 minutes = 21,600 nautical miles. Before 1970 a nautical mile was approximately 6,080 feet in the imperial system. However, the international measure is now 1,852 meters (1.852km) and is used on marine charts for sea travel by all nations. To travel around the earth's circumference at the equator you would have to travel 21,600 nautical miles or 40,003km. (21,600 x 1.852 = 40.003km).

Nautical miles = Arc

Statute miles = straight line

45°

Stand and turn 90°, 180°, 270° and 360° - you have turned in a circle – now draw it and mark your stopping points.

Imagine you cut the world in half at the equator. The equator would be the circle's circumference. Now mark 45°. How many nautical miles would there be in between 0° and 45°? 45 x 60 = 2,700 nm
How many statue miles from 0° - 45°? 2,700 x 0.87 = 2,349 m

Distance equivalents (approx.)		
Unit	Feet	Metres
Nautical mile	6,080	1852
Statute mile*	5,280	1,603

* Distances from Wikipedia
http://en.wikipedia.org/wiki/imperial_units

The standard measure of 'on land' distance in England and USA. A nautical mile is 1.1508 miles.

The distance from Cape Reina to Bluff is 2100.3 km along State Highway 1. How many nautical miles would that be if we sailed?

To convert distances

Statute miles x 1.15 = Nautical miles
Nautical miles x 0.87 = Statue miles
Nautical miles x 1.852 = Kilometres
Kilometres x 0.54 = Nautical miles
1 knot of wind is equal to 1.85km/hour

A knot is a measure of both speed on the water and wind speed. If you travel at 1 nautical mile per hour your speed is 1 knot, 5 knots is 5 nautical miles per hour. From this we can see that speed is distance divided by time.

How fast would we be travelling if we sailed 10 nautical miles in a) I hour b) in 2 hours and c) in 3 hours?

If we travel at 50 knots how many kilometres per hour would that be?