

# MATHS TREATS

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## HITTING THE WAVES AT BELLS BEACH

Waves are caused by a disturbance that transfers energy. Mechanical waves travel through a medium, e.g., seismic waves through the earth. Surfers seek the best waves from the ocean. This column was inspired by Passy's World of Mathematics.

### SURFABLE WATER WAVES



Wind blowing over water transfers energy to the surface which creates waves. The size depends on wind speed, fetch (the distance the wind travels over open water), wind duration, and depth. Waves are described in terms of height, length (between crests), period, and propagation direction. Their speed depends on gravity, wave length and depth. Wind can cause capillary waves (ripples). Sustained wind can form large, often irregular swells, groups of waves with the same direction and wave length. How a wave breaks on the shore depends on the sea floor topography (bathymetry) and wind direction.

#### ACTIVITY

How might the surface area of flat water versus waves influence the energy transmitted by the wind? How does the size of the wave vary with wind speed, fetch, or wind duration? How does the shape of the shoreline affect the how waves 'break' in shallower water? How is wave modelling useful?

### GEOMETRY OF SURFBOARDS



Surfboards have several parts: nose (front) and tail (back), deck (top) and bottom, rails (sides), stringer, and fins. The specific design will vary in shape, varying length, width, thickness, and the curvature of sides and deck (rocker). The number, shape, and placement of fins is also important. The geometrical shape of a surfboard impacts its speed and acceleration, stability, hold/release of the water, and manoeuvrability including tracking, turning, and lift. Choosing the right type of surfboard will depend on a person's weight, wave type preference, and level of experience.

#### ACTIVITY

Research the web to decide which type of surfboard most suits you. What functionality do you want and how is that related to the design? How would you calculate the volume of the surfboard? Would this provide sufficient foam for flotation of your weight?

## REFERENCES AND FURTHER READING

#### IMAGES

Leadbeater possum - Steve Kuiter. Other images - Pixabay

#### WIND WAVE MATHEMATICS

Search Wikipedia for wave and wind wave.

Mathematics of Ocean Waves and Surfing <http://passyworldofmathematics.com/mathematics-of-ocean-waves-and-surfing/>

Oceanography: how waves work [www.seafriends.org.nz/oceano/waves.htm](http://www.seafriends.org.nz/oceano/waves.htm)

Water wave mechanics (The US Army Corps of Engineers Coastal Engineering Manual) [www.marine.tmd.go.th/Part-II-Chap1.pdf](http://www.marine.tmd.go.th/Part-II-Chap1.pdf)

#### SURFBOARD DESIGN

Surfboard Geometry and Design <http://passyworldofmathematics.com/surfboard-geometry-and-design/>

Using maths to design 'uplifting' surfboard fins [www.insidescience.org/news/using-math-make-more-%E2%80%98uplifting%E2%80%99-surfboard-fins](http://www.insidescience.org/news/using-math-make-more-%E2%80%98uplifting%E2%80%99-surfboard-fins)

<http://surfapig.blogspot.com.au/2015/07/surfboard-calculus.html>

[www.boardcave.com/the-surfers-corner/selecting-the-perfect-surfboard/](http://www.boardcave.com/the-surfers-corner/selecting-the-perfect-surfboard/)

How to build your first surfboard [www.surfersteve.com/design.htm](http://www.surfersteve.com/design.htm)