

# How Does The Shape of A Sail Affect The Speed of A Sailboat

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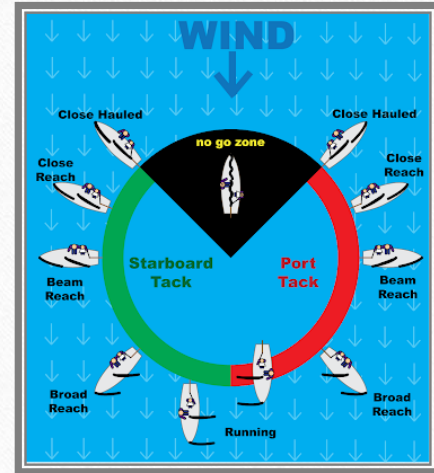
# Hypothesis

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If the shape of a sail is more curved when sailing downwind, then the boat will go faster because fuller sails gain more power than flatter sails but when sailing upwind you need flatter sails to reduce drag and also help you point closer to the wind. In this experiment the boat will be sailing downwind.

# Research Notes

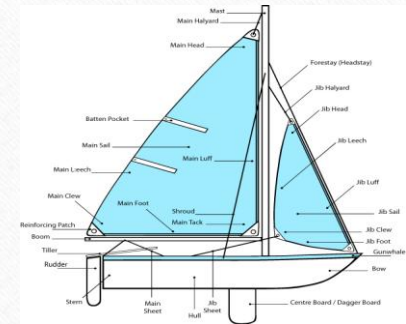
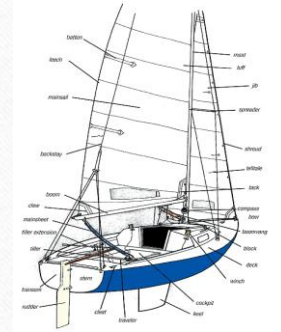
- Sailing wind
  - Sailing downwind means the wind is blowing behind you
  - Sailing upwind means you are sailing more towards the wind
- Structure
  - Luff -A sail's forward edge. The luff of the mainsail is usually hoisted up and attached to the mast. The luff of the jib is attached to the forestay.
  - Leech – The sail's back edge.
  - Foot – The bottom edge of the sail



# Research Notes Cont.

- Structure

- Tack – Between the luff and the foot is the tack. The tack is attached to the boat or a spar.
- Head – The corner at the top of the sail between the luff and the leech.
- Clew – The third triangle of a sail between the leech and the foot.
- Batten – Solid slats or rods to help maintain the desired airfoil shape.
- The Mainsail: It has its forward edge attached to the mast
- The Headsail: This is a generic term that refers to any sail that sits forward of the mast. The most common is the jib. When a jib is so large that it overlaps the mast, it is called a genoa.



# Materials

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Bathtub

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Water

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Cloth

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Hair drier

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Bottles, Playdough

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Sticks

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Cotton strings

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Timer

# Variables

Independent Variables	Shape of sails <b>How it's measured:</b> N/A
Dependent Variables	Speed of the boat <b>How it's measured:</b> A timer



# Controls

## Controlled Variables

Wind speed: use the same hair dryer for each boat

Direction: blow each boat from the same direction

Material of the boats: all boats are made of same materials

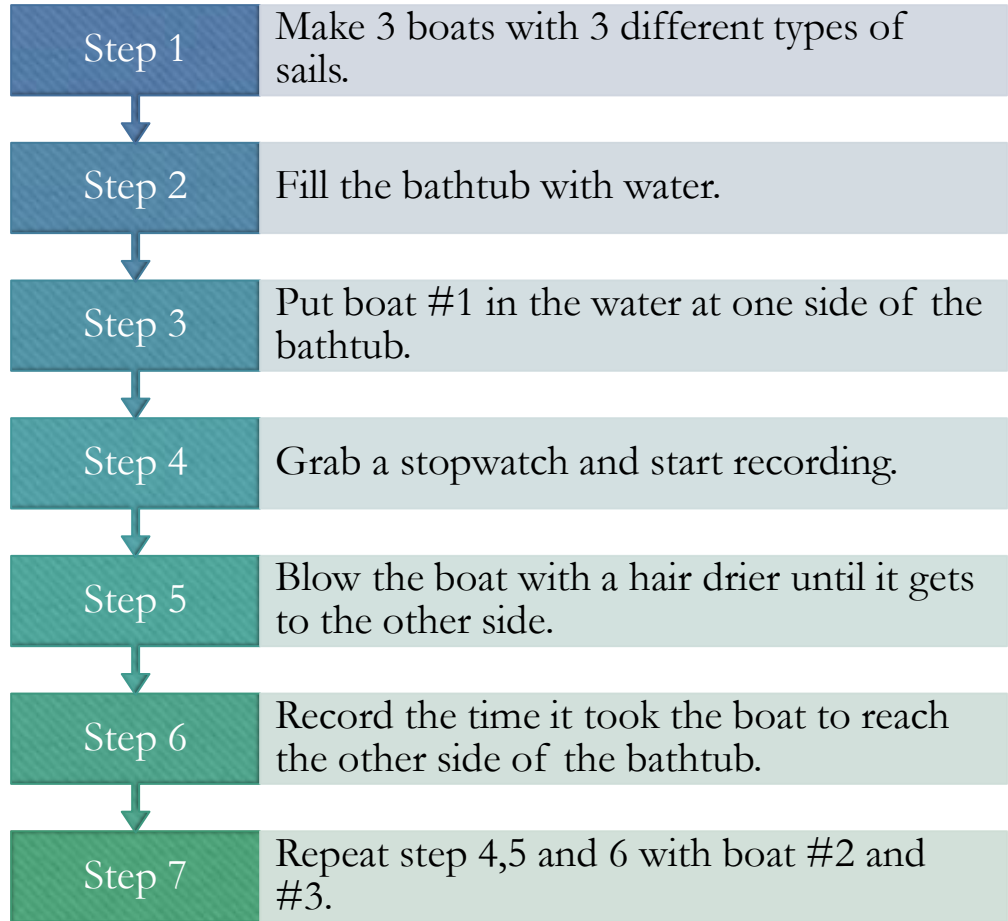
Sailing area: all boats sail in the same bathtub.

The water movement: the water movement in the bathtub is always the same

Sailing distances: each boat sail from one end to the other which is about 130cm long



# Step By Step Outline



# Results

Samples	Type of Sail	Time It Took For Boat To Reach
Boat #1	Flat Triangle	8.54 seconds
Boat #2	Slightly Curved Triangle	8.36 seconds
Boat #3	Curved Triangle	8.07 seconds

# Analysis

Based on the research on the shape of sails, I assumed that curved sails go fastest compared to flat and slightly curved sails in the water.

The flat sail is more fit for sailing upwind where there is overpowering conditions because it reduces power and drag. Therefore, the flat sail was much slower than the other sails. The slightly curved sail could take in more speed than the flat sail so it could go a little faster.

The curved sail is the most fit for sailing downwind where there is underpowered conditions because it can take in much more wind than the other sails. That is why the curved sail was faster than the other sails.

## Conclusion

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In conclusion, the boat with the fuller sail went the fastest which is in accordance with my hypothesis that fuller shapes move with more speed when sailing downwind.

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Nevertheless, there might be a deficiency of this experiment which is the wind. The wind in real life sailing situations probably would not be blowing exactly downwind like in this experiment.

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I think the results can be applied into real life, for example, boat sailing contestants could use more curved sails depending on the wind type and go faster in competitions

# References

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