Higher

TRIGONOMETRY

MEET ROBERT

Senior Naval Architect, BMT

SUBJECTS STUDIED AT SCHOOL

Highers in:

Maths • Physics • Chemistry • English • Tech studies

Advanced Highers in:

Maths • Physics • Chemistry

FURTHER EDUCATION: Masters degree in Naval Architecture at the University of Strathclyde

CAREER JOURNEY SO FAR

Graduate scheme

Two years as a design engineer at a major UK shipbuilder

Four years as a naval architect in a dockyard working on naval and commercial projects

Moved to BMT two years ago to work in engineering consultancy

FUTURE ASPIRATIONS

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The dream for me is to be the chief designer for a new ship! Right now I only work on parts of ships, and I think it would be really interesting to be responsible for the whole thing.

Q&A WITH ROBERT

What does your company/organisation do?

BMT helps other companies and government organisations to design ships and plan how to maintain and repair them. We also help them train their staff and work out how to work safely, efficiently and effectively.

What types of activities do you do in your job?

I’m currently working on the design of a ship, where I’m responsible for some of the equipment on board. I have to work out what the equipment needs to be able to do, and what rules it has to meet, and write specifications so that the company which will make it knows what they have to supply.

What does a typical day at work look like for you?

A typical day can involve performing design calculations, producing drawings, or writing specifications. It varies a lot depending on what I’m working on and what deadlines I have. I don’t usually have very many meetings, but I talk to my colleagues a lot about what we’re doing and help each other out.

What are your favourite things about your job?

Probably my favourite thing is seeing something you’ve worked on go from an idea in my head into a real thing that’s been built. It’s also cool every time I get to go on a ship!

What skills are important for your job and how do you use them?

Problem solving and time management are important skills for me. I often have lots of deadlines for different people, and have to know how to prioritise what I’m doing.

HOW ROBERT USES TRIGONOMETRY AT WORK

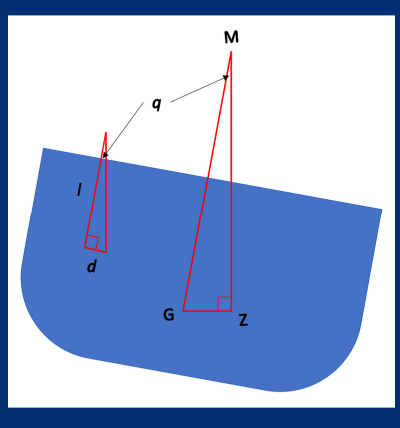
- Calculating forces when performing structural and mooring analyses.
- Determining how much a ship will heel (lean to one side) when weight or environmental loads change.
- Determining clearance between a ship and structures.

ACTIVITIES

Problem 1

A)

In an inclining experiment, the stability of a ship is measured by moving a known weight of ballast (usually concrete) a known distance on the ship, and measuring the deflection of a pendulum. When the weight is moved, a 4 metre long pendulum moves 150mm at the bottom. Calculate the angle the ship leans over (heel)



B)

When we carry out the experiment, we precisely measure how deep in the water the ship sits and use calculus to work out its weight. By using this, the weight of ballast used, and the distance it moved, we can calculate the ‘righting lever’, which we call GZ. For this ship, GZ = 0.0175 m.
Another quantity, called the metacentric height, is a good measure of stability when the ship is upright. This is abbreviated to GM. For small angles, GZ=GMsin q . Calculate GM for this ship.

Solutions

A)

$$\frac{d}{l} = \tan tan\ q$$

$$\frac{150}{4000} = \tan tan\ q$$

$$q = \left(\frac{150}{4000}\right) = 2.15\ degrees$$

B)

$$0.0175 = GM \sin sin\ q$$

$$0.0175 = GM \sin sin\ 2.15\ degrees$$

$$GM = \frac{0.0175}{\sin sin\ 2.15\ degrees} = 0.467m$$