The Shape of Things to Come_

New Basics referents

Life pathways and social futures

- Developing initiative and enterprise
- Multiliteracies and communications media
- Mastering literacy and numeracy
- **Environments and technologies**
- Developing a scientific understanding of the world
- Working with design and engineering technologies

Targeted repertoires of practice

- · Adapting something to meet a new purpose or situation or an additional condition
- Analysing physico-mathematical and mathematical relationships in different ways
- Comparing and contrasting ideas/information
- Estimating, measuring and calculating
- Identifying and dealing with shapes, their properties, and their constructions
- Identifying, creating, analysing and extending patterns
- Mensuration
- Predicting on the basis of a mathematical model
- Presenting complex ideas simply (e.g. via diagrams, storyboards and comic strips)
- Sequencing the steps that lead to a mathematical solution
- Substituting in formulae
- Translating information from one form to another to make it comprehensible
- Understanding general principles from mathematics and physics and applying them to specific situations
- Understanding how mathematics is used to describe and explain
- Using algebra to effect
- Using technology as appropriate in the representation of mathematics

Students will use concepts and skills in mathematical sciences — especially in measurement, patterning, space, statics and dynamics — to investigate the structure of something from nature and changes in the shapes and properties of one mechanical and one non-mechanical man-made object. For each of the man-made objects, they will propose a likely next stage which meets an identified new purpose or situation or an additional condition, and explain the mathematics relevant to the proposal.

Investigate a variety of areas of mathematics, taking special note of how different aspects of mathematics manifest themselves in the structure and workings of man-made objects and natural phenomena.

Select two man-made objects that have progressively and significantly changed shape as a result of refinement or modification for different purposes.

Ensure the selected objects rely on different underlying concepts in the mathematical sciences and are suitable for in-depth investigation.

Relate key concepts in the mathematical sciences to important attributes of the objects at critical stages of their evolution.

Using a form of sequential presentation, outline the history of development of the object thus far, citing the advantage(s) of progressive stages and highlighting the relationship between important attributes and relevant concepts in the mathematical sciences.

Foreground the purpose of each proposed development and the mathematics involved.

For each object, present the details of your proposed next stage of development, ensuring that you outline the relationship between important attributes and key concepts in the mathematical sciences.

The aim is to display your highest level of mathematical knowledge and understanding.

For each man-made object, consider

a likely next stage of development

to meet a new purpose or situation

or an additional condition.

Explain, with the aid of diagrams, the mathematical complexities that underpin a natural phenomenon.

 Investigations might draw on mensuration (length, breadth, height, perimeter/circumference, surface area, volume), mechanics (distribution of mass, centre of gravity, equilibrium, moments and stability, levers, gears, friction, elasticity and tension, mass and power), pattern and sequence, ratio, geometry, trigonometry, statistics (such as average and range), algebra, harmonics, as appropriate.

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Make sure

you consider and

comment on how the

changes in the important

attributes are likely to

affect the success of

each proposed

development.

Ideas, hints and comments

• A proposed next stage of development may reflect aesthetic, functional or social needs.

• Natural phenomena include botanical and zoological patterns and structures linked to Fibonnaci numbers and/or the golden mean, wave motion, and shape and structure of crystals.

• The choice of the two man-made objects should require students to be exposed to and develop a variety of concepts in the mathematical sciences.

• Man-made objects include amusement rides, bottles or cartons, buildings (ancient or modern), computers, concave mirrors, crockery or glassware, corkscrews, food containers, footwear, furniture, laundry equipment, mechanical clocks, musical instruments, puzzles, radios, robots, sewing machines, sinks, skateboards, surfboards, swimming pools, telescopes, tools or vehicles (land, water and air).

Task parameters

• Task intensity: medium-high

- Students may work individually or in groups.
- Available grades: 4