

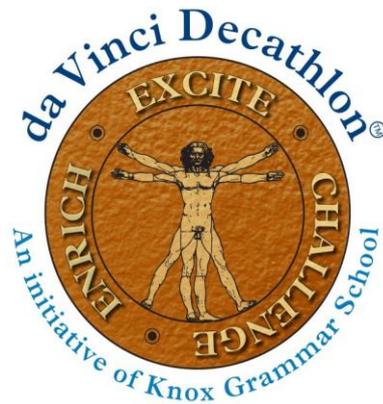


KNOX
GRAMMAR
SCHOOL

STATE

DA VINCI DECATHLON 2019

CELEBRATING THE ACADEMIC GIFTS OF STUDENTS
IN YEARS 5 & 6



ENGINEERING

TEAM NUMBER _____

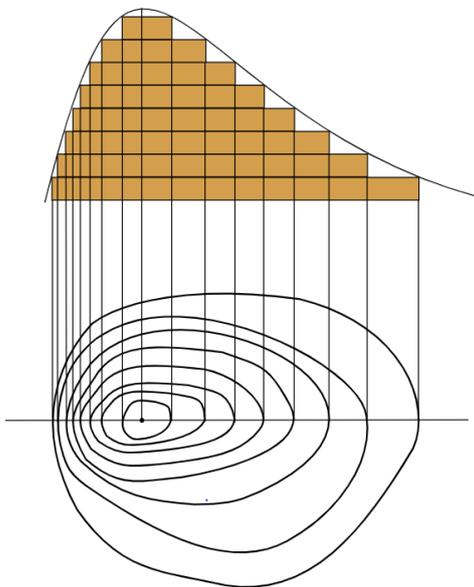
ENGINEERING LANDSCAPES

BACKGROUND

Civil engineers design, build, supervise, operate, construct, and maintain infrastructure projects and systems, including roads, buildings, airports, tunnels, dams, bridges, and systems for water supply and sewage treatment.

As a first step in the design of a new piece of landscape infrastructure a civil engineer may seek advice from experts such as geologists, geographers, hydraulic engineers, meteorologists and town planners, as well as utilising existing information and data to begin the design process. An important document to consult when building roads and bridges would be a geographical map of the area.

Geographical maps are two-dimensional representations of three-dimensional landscapes. They may be used to show the relative locations of places such as states, cities and towns within a country. There are also navigational maps which show the locations of road and rail networks. In addition to showing the positions of various landmarks geographical maps often contain information about rainfall, temperature, vegetation and elevation. A **topographical map** is one which shows elevation, or height. On a topographical map contour lines are used. A contour line joins points of equal elevation above a given level, such as sea level. Topographic maps are able therefore to show features such as valleys and hills, and the steepness or gentleness of slopes.



An example of contour lines on a topographical map



A bridge between two mountains

THE TASK

The township of Riverton sits at an altitude of 400 m above sea level on the north side of River Mountain. The township of Crest Hill sits 350 m above sea level on the north side of Crest Hill. They are separated by a steep valley and a river, which flows from the top of River Mountain down to The Green Sea. Currently the only way to get from Riverton to the Crest Hill township is via an old and precarious road which was built many years ago and takes the traveller on a long and winding 5 km journey clockwise around River Mountain to the south and all the way around the south of Crest Hill.

Your task as a Civil Engineer is to design and build a model of a road and bridge that traverse the steep valley and allow direct access between the two townships. This will cut the journey from around 30 minutes to less than 5 minutes.

The first part of your task is to build a three-dimensional model of the landscape shown in the map provided below. You need to include River Mountain, Crest Hill, both townships, the river valley and the Green Sea.

Once you have prepared your model of the landscape your second task is to build a bridge across the river valley and a road to connect the two townships via the shortest possible route.

DESIGN STATEMENT

Your landscape and bridge must be free-standing and be movable to the marking area. Your bridge must be in attached in place on the landscape that you have built on the second copy of the topographic map provided.

You will also be required to complete the design details on pages 5 & 6. These will not only be marked independently for the design details marking component, but also to assist with marking the first 7 criteria.

DESIGN PARAMETERS

You will have **sixty minutes** to design and construct your landscape model.

The model will be marked according to:

- The accuracy of the slope and height of each mountain and your interpretation of the contours from the topographic map
- The accuracy of your representation of the river and river valley flowing down to the sea
- The construction of the road and bridge
- The overall aesthetics of your 3D landscape
- The quality of design and efficient use of materials
- The design details (pages 5 & 6)

You will be provided with several materials. It will be up to the team to decide which materials to use to construct your 3D landscape. You can select from the following materials:

- 1 x A3 topographic map
- 8 pieces of A4 paper
- 10 straws
- sticky tape (your own)
- coloured pencils etc. (your own)

MARKING MATRIX

Criteria	Skilful	Effective	Sound	Limited
Slope and height of River Mountain (accurate use of topographic map)	3	2	1	0
Slope and height of Crest Hill (accurate use of topographic map)	3	2	1	0
Slope and accuracy of the river and river valley (accurate use of topographic map)	3	2	1	0
Placement of new road and bridge	3	2	1	0
Design of bridge	3	2	1	0
Overall aesthetics of 3D landscape	3	2	1	0
Quality of design and efficient use of materials	3	2	1	0
Design details	3	2	1	0

TOTAL

/24

DESIGN DETAILS (3 MARKS)

1. Explain how you determined the height of each mountain using the topographic map. (1 mark)

/1

2. Explain how you determined the position of the river and slope of the river valley using the topographic map. (1 mark)

/1

3. Explain your decision to position the road and bridge as you did. (1 mark)

/1

END OF PAPER