**GRADE 8**

**INVESTIGATION**

**GEOMETRY OF 3D OBJECTS**

**MARK ALLOCATION: 40**

**INSTRUCTIONS:**

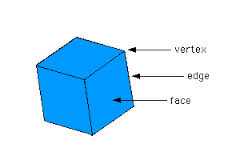
1. This investigation consists of **THREE** activities.
2. Answer **ALL** activities.
3. Answer questions as detailed and extensive as possible.
4. Addendum A is examples of different prisms, use this to answer Activity 1.1
5. Write neatly and legibly.

# EULER’S LAW / THEOREM



**Euler's Theorem**, was discovered by the mathematician Leonhard Euler (pronounced "Oil-er"). You already know that a polyhedron has faces (*F*), vertices (*V*), and edges (*E*). But Euler's Theorem says that there is a relationship among *F*, *V*, and *E* that is true for *every polyhedron*.

In this investigation you will have to find the relationship between the faces, vertices and edges of given prisms. Like Euler you will write an equation to determine the number of faces, vertices and edges of any given prism with only the number of sides of the base of the prism given.

**[](http://www.google.co.za/imgres?imgurl=http://mathforum.org/sum95/math_and/poly/labelcube.gif&imgrefurl=http://mathforum.org/sum95/math_and/poly/polyhedra.html&h=200&w=300&tbnid=2ljuZIVVgowy5M:&zoom=1&docid=vl2IX7x42S5SVM&ei=vOydU9CNKYW47Abo_YG4Ag&tbm=isch&ved=0CDwQMygZMBk&iact=rc&uact=3&dur=1633&page=3&start=22&ndsp=12)REMEMBER:**

**ACTIVITY 1**

1.1 Use the given nets of prisms in ADDENDUM A, build the prism and complete the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SOLID** | **SHAPE OF THE BASE** | **VER**  **TICES (V)** | **EDGES**  **(E)** | **FACES (F)** | **RELATIONSHIP** |
| Triangular prism |  |  |  |  |  |
| Rectangular prism |  |  |  |  |  |
| Pentagonal prism |  |  |  |  |  |
| Hexagonal prism |  |  |  |  |  |
| Octagonal prism |  |  |  |  |  |

(5 x 2 =10)

1.2 Make use of the information in the table to determine a relationship between the number of faces, vertices and edges. Use the last column of the table to record your findings. (2)

***HINT: Try different operations with the number of faces, vertices and edges to find the relationship, must be the same for all given prism for it to become a rule.***

1.3 Write the relationship found in 1.2 in words and then in the form of an equation.

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1.4 Test your relationship found in 1.2 on the following polyhedra.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PLATONIC SOLIDS** | **V(vertices)** | **E(edges)** | **F(faces)** | **Relationship** |
| CUBE |  |  |  |  |
| OCTAHEDRON |  |  |  |  |

(2 x 2 = 4 marks)

**[20]**

**ACTIVITY 2**

2.1 It will not always be that the solid will be provided in diagrammatic form. Explain how you will determine the number of faces, vertices and edges of a prism with a 100 – sided base.

**HINT: Make use of the two tables completed in activity 1 to assist you with**

**specific reference to vertices, edges and faces.**

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(8)

2.2 Write a relationship to determine the faces, vertices and edges of a prism with *n* – sided polygons in its base.

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(3)

2.3 Use your rule in 2.2 to determine the number of faces, vertices and edges of the following prisms. Check whether your relationship found in 1.2 still work.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Solid** | **V** | **E** | **F** | **Euler’s formula (theorem)** |
| 1. 50 – sided polygon in base |  |  |  |  |
| 1. 70 – sided polygon in base |  |  |  |  |
| 1. 115 – sided polygon in base |  |  |  |  |

(4)

**[15]**

**ACTIVITY 3**

**Is Euler’s theorem only applicable to prisms or will it work for pyramids as well. Prove.**

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**[5]**