WORKSHEET 1

PLANE FIGURES (Level 1)

OBJECTIVES: You should be able to:

(1) Describe properties of plane figures

(2) Define a polygon

(3) Compare polygons

(4) Find the sum of the angles of various polygons

ACTIVITIES

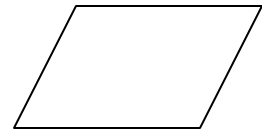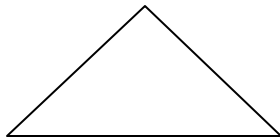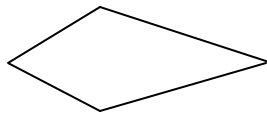1. Describe the properties of the following shapes (in your own words).

Fig. 3.1
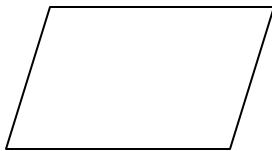
Fig

Fig. 3.3
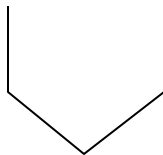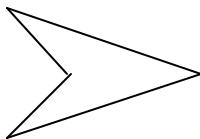
Fig.3.5

Fig. 3.6

Fig. 3.7

Fig.
3.8

1 A
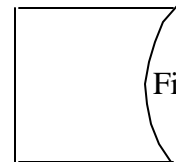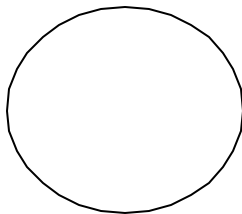
Fig. 3.9

Fig. 3.10

Fig. 3   Planar shapes
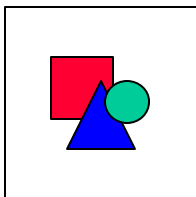
Fig. 3.11

2.   How are the FOUR triangles you have been given different from one another?
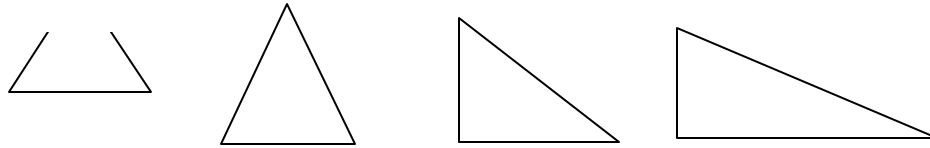
3.   Compare

3.1   A rectangle and a square

3.2   A parallelogram and a rhombus

3.3   A parallelogram and a trapezuim

4.   How does Fig. 3.10 compare with Fig 3.2, 3.5, 3.7?

3 A

5.   How are figures 3.10 and 3.11 different from all other figures?

6.   Figures 3.1 - 3.9 are polygons. Define a polygon.

7.   The sum of the angles of a triangle is $180°$. Find the sum of the angles of:

7.1   A quadrilateral

7.2   A pentagon

7.3   A hexagon

7.4   A heptagon

7.5   If a polygon has n sides, write an expression for calculating the sum of its angles.

WORKSHEET 2

3-D SHAPES

OBJECTIVES: Your should be able to

1. Use standard language to label 3-D shapes
2. Put different solids together that you think belong together and give reasons for your specific groups.
3. Classify solids as to whether they are prisms, pyramids, spheres, hemispheres, cylinders or cones.

ACTIVITIES

1. Put all different packaging materials that you have brought from home together that you think belong to a group and explain why you have chosen your specific group.

Table 1

Specific Group	Reason for Choosing Group

1.	Sort your packaging materials on page 3-6 by making use of the SOLIDS PAGE on pages 19-20 (van Niekerk 2000). Fill in Table 2 below.

Table 2

Solid Type	Number of packaging material that belongs to this solid type
Prisms	
Pyramids	
Cylinders	
Cones	
Spheres	
Hemispheres	

3-d SHAPES

OBJECTIVES: You should be able to:

1. Use your own language to define 3-D shapes
2. Define a face, edge and vertex of a polyhedron
3. Derive Euler's theorem

ACTIONS:

1. Write your own definition for the following words. Discuss it with a friend to make sure that it is clear,

1.1 Pyramid

1.2 Prism

1.3 Cylinder

1.4 Cone

2.   The diagram in 3 hereunder shows the vertices, edges and faces of six solids.

2.1   Write your own definition of:

2.1.1   Face

2.1.2   Edge

2.1.3   Vertex

3.   If F is the number of faces, V the number of vertices and E the number of edges, complete the following table.

Figure	F	V	E
A			
B			
C			
D			

E			
F			

2.   Find out whether there is a relationship between F, V, and E.

3.   Prisms and pyramids are examples of polyhedra. Define a polydedron.

WORKSHEET 4

2-D AND 3-D SHAPES

OBJECTIVES :   You should be able to:

        1.   Define a net of a cube

        2.   Find the eleven nets of a cube (Level 3)

ACTIVITIES

1.   The diagram alongside shows a dice
A dice is a cube with dots numbering
each of its faces. The dots on three of
the faces are shown in the diagram.
How many dots appear on the face
opposite the face with:
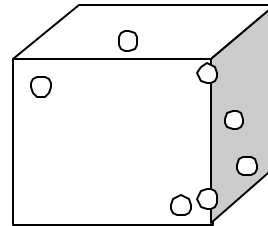
1.1   5 dots?

1.2   4 dots?

2.   The dice in question 1 was made out of cardboard. It was cut out along certain edges and flattened to give the 'pattern' shown. From the dice, fill in the correct number of dots in each side. If you have problems, use the cube provided.

3.   The above pattern is referred to as a net (of a cube). How can you define the net of a cube?

4.   Find the other 10 nets of a cube.

WORKSHEET 5

2-D AND 3-D SHAPES

OBJECTIVES.   You should be able to work concretely to:

     1.   Draw the nets of various prisms

     2.   Draw the nets of various pyramids

ACTIVITIES

1.   From the packaging materials presented to you, make a drawing of the nets of a square prism.

2.   Make a drawing of the nets of the triangular prism.

3.   Make a drawing of the nets of a square pyramid.

4.   Make a drawing of nets of the hexagonal pyramid.

5.   Make a drawing of the nets of a triangular pyramid.

WORKSHEET 6

PENTOMINOES AND HEXOMINOES

OBJECTIVES   You should be able to:

1.   Define pentominoes and hexominoes

2.   Find all the pentominoes and hexominoes

ACTIVITIES

These   are

pentominoes

(a)   (b)   (c)

1.

These are not
pentominoes

(d)   (e)   (f)

2.   Which of   these are

pentominoes?

(g)   (h)   (i)

3.   How can you define a pentomino?

4.   Draw the other 10 pentominoes

5.   What do you understand by the term hexominoes?

6.   Attempt to find the 35 hexominoes.

WORKSHEET7

TESSELLATIONS AND QUADRILATERALS

OBJECTIVES   You should be able to:

1.   Transform and tessellate various simple shapes and identify them in everyday life, cultural artifacts and nature.

2.   Use pentominoes to form tessellations

3.   Describe the properties of polygons

4. Define a tessellation.

ACTIVITIES

Fig. 4 Pattern for tessellations

1.   By transforming (flips) ▵ABF where necessary, a 'pattern' is formed in Fig. 4. Do you see the pattern?

1.1   Name all the angles in the figure equal to ABF.

1.2   Compare the straight lines AE and JF. How are they related?

1.3   How do the areas of ▵ABF and ▵UFI compare?

1.4 How do the lengths of the sides of △ABF and △UFI compare?

1.5 Mention at least FOUR shapes in the figure of which the pattern in the figure could be considered to be made of.

Fig. 5 Pattern of equilateral triangles/rhombuses

2. The figure represents part of a 'pattern' of equilateral triangles, all identical to triangle 5.

2.1 What kind of polygon is formed by triangles
1 + 2 + 3 + 4 + 5 + 6?

2.2 The quadrilateral formed by △1 + △2 is also a parallelogram.

2.2.1 How does this parallelogram differ from parallelogram ABGF in question 1?

2.2.2 What is the name of this kind of parallelogram?

16 A

2.2.3   Describe the polygon formed by $\triangle 1 + \triangle 2 + \triangle 3$.

3.   The 'patterns' in Fig. 1 and Fig. 2 are referred to as tessellations. Can you define a tessellation?

4.

Fig. 6 Pattern of a pentamino

Continue the pattern and complete the tessellation.

WORKSHEET 8

TESSELLATIONS AND QUADRILATERALS
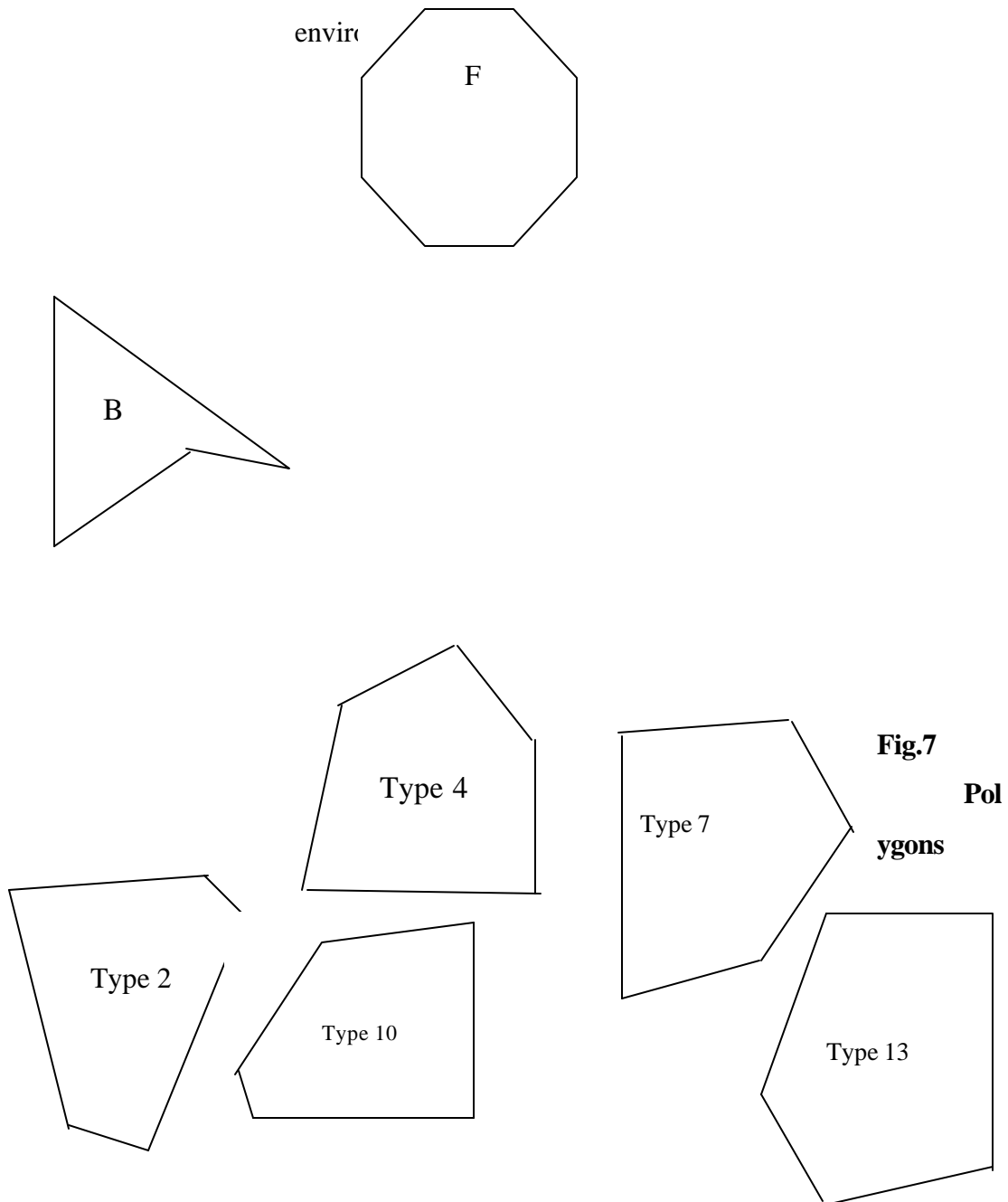
OBJECTIVES   You should be able to:

1.   Make designs using various polygons

2.   Conclude whether all polygons tessellate

3.   Use mathematical language to explain and describe patterns of shapes (using the language of tessellations and transformation viz. translate, rotate and reflect).

ACTIVITIES

1.   Fit together the eight polygons of the same kind onto cardboard such that there are no gaps and overlapping in between them (shapes from Fig. 7).

2.   Does your polygon tessellate?

3.   Using the same procedure as outlined in 1, fit together your eight pentagons of the same kind (pentagons from Fig. 8).

4.   Do you think that **all** quadrilaterals will tessellate?

5.   Test your answer in 4 with quadrilaterals A and B in Fig. 7.

6. From your tessellation and other groups' tessellations, do all polygons tessellate?

7. What can you deduce about the sum of the interior angles of any quadrilateral? (Look carefully at your tessellations of the quadrilaterals).

8. Where else (or in what form) have you seen tessellations in your enviro

F

B

Type 4

Type 7

Fig.7

Pol

ygons

Type 2

Type 10

Type 13

19 A

Fig. 8 Pentagons

WORKSHEET 9

TANGRAMS
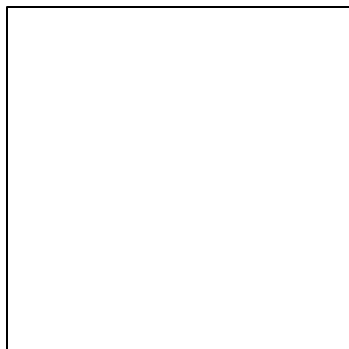

OBJECTIVES   You should be able to:

1.   Create designs from tangrams (ancient 7-piece Chinese
          puzzle)

2.   Observe various geometric shapes in your designs

3.   Communicate about your designs.

ACTIVITIES

1.   From the   following tangram, create any
      design you can   think of. Cut out and use all
      the 7-pieces in   your design.

Fig. 9 The tangram

Type 11

2.   What shapes did you use in your   design?
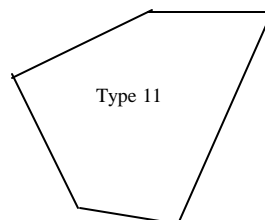
3.   Inform the rest of the class what your design is.

WORKSHEET 10 / APPENDIX 10

THREE-DIMENSIONAL PUZZLES

OBJECTIVES   You should be able to:
1.   Construct the seven puzzle pieces (Fig. 1)
2.   Use the seven puzzle pieces to construct more
         complicated structures (Fig 2 and 3).

ACTIVITIES

1.   Use cubes to build the following structures

Fig. 10

2.   Use your seven puzzle pieces to construct structures A-G in Fig 2 and Fig 11.

Fig. 11 Solids to be built using some of the puzzle pieces.

22 A
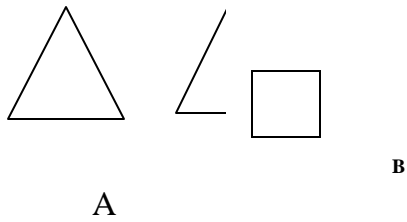
QUESTIONNAIRE A

1. Define a polygon

2. Define a polyhedron

3. What is a tetrahedron?

4. Give FOUR examples of quadrilaterals

5. Draw the quadrilaterals mentioned in 4

6. Define an edge of a polyhedron

7. Define a vertex of a polyhedron

8. Define a face of a polyhedron

9. Write Euler's formula

10. What can be said about the angles of a parallelogram?

11.   What can be said about the sides of a rhombus?

12.   Define a net

13.

A

B

A is a net of ....
B is a net of ....
C is a net of ....

14.   Draw FIVE nets of a cube

QUESTIONNAIRE 2

1.   What are the similarities between a rectangle and a square?

2.   What are the differences between a rectangle and a square?

3.   What are the similarities between a parallelogram and a rhombus?

4.   Define a rhombus in terms of a parallelogram

5.   Give TWO examples (from your environment) of the following:

a)   a prism

    a)   a cylinder

6.   Mention the polygons making the faces of the solids A, B. and C.

                                          B

       A

7.   Define a pentomino

8.   Which of the following are pentominoes?

                          A   B

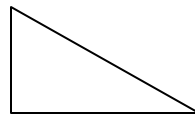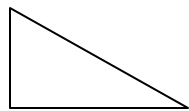   C   D

9.   Define a tessellation

10.   Do all polygons tessellate? Yes/No

11.   In a tessellation, what can you conclude about the sum of the angles where the
       polygons meet?
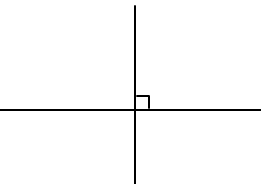
12.

       A
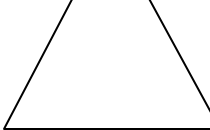
       In the language of tessellations, what have we done to triangle A to get triangle
       B?
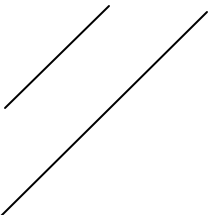
13.   Define a tangram

TESTS/APPENDIX C

PRE TEST

1.   What ⊢ are angles called that are formed like this?

2.

These appear to be what kind of triangles?

3.

Suppose these two lines will never meet no matter how far we draw them

What word describes this?   (1)

4.   Draw a rectangle   (1)

5.   Draw a right-angled triangle   (1)

27 A

6. Draw a parallelogram (1)

7. (a) Draw a square (1)

(b) What must be true about the sides? (1)

(c) What must be true about the angles? (1)

8. Does a right angled triangle always have a longest side?

Yes/No. If so, which one? (2)

9. Does a right angled triangle always have a largest angle?

Yes/No. If so, which one? (2)

10. What can you tell me about the sides of an isosceles triangle? (1)

11. What can you tell me about the angles of an isosceles triangle? (1)

12. How do you recognize parallel lines? (1)

13. (a) Name some ways in which squares and rectangles are alike (the same) (3)

(b) Are all squares also rectangles? Yes/No Why? (5)

14. Are the following statements true?

(a) All isosceles triangles are right angled triangles. Yes/No Why?(2)

(b) Some right angled triangles are isosceles triangles. Yes/No Why?(2)

Test items are taken from Van der Sandt (2000:212-216).

SOLUTIONS TO THE PRE TEST

1.   Right angles   (1)

2.   Isosceles triangles   (1)

3.   Parallel lines   (1)

4.

5.
      (1)
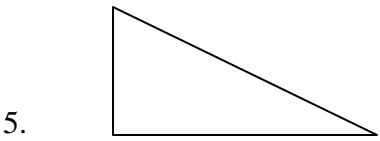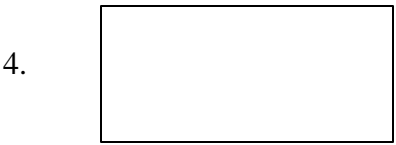
6.
      (1)

7.
(a)   (1)

(b)   They are equal   (1)

(c)   All angles are equal $90°$ (1)

8.   Yes, the hypotenuse   (2)

9.   Yes, 90° / the right angle   (2)

10. Two sides are equal   (1)

11. Two angles are equal   (1)

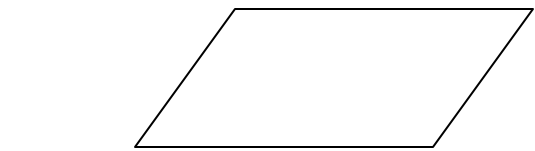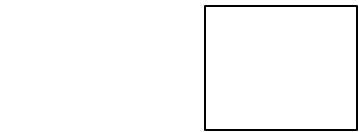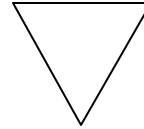12. Lines that will never meet   (1)

13. (a)   Two pairs of parallel lines   (3)
           Four sides
           Four angles

     (b)   Yes
           Four sides - opposite sides are equal and parallel
           Four angles   (5)

14. (a)   No
           Isosceles triangles need not be right angled
           e.g.

                               is acute angled

                                                                             (2)

     (b)   Yes
                          e.g.

                                                                             (2)

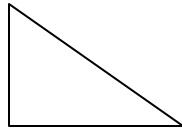   **Total: 28**

31 A

POST TEST 1

1. Mention the names of the following triangles

(c)

(d)

(4)

    1.1 Mention the properties of each of the triangles above (7)

    1.2 Will a right angled triangle always have a longest side? Which one? (2)

    1.3 Will a right angled triangle always have a largest angle? If so, which one? (2)

    2. Draw a rectangle and a square (2)

2.1 What are the similarities between a rectangle and a square? (3)

2.2 What are the differences between a rectangle and a square? (2)

    3. Draw a rhombus and a parallelogram (2)

3.1 Define a rhombus in terms of a parellelogram (2)

    4. Define:

4.1 An edge of a solid (1)

4.2 A vertex of a solid (1)

4.3 A face of a solid (1)

    5. Write down Euler's formula (1)

32 A

5.1   If a solid has 8 face and 12 vertices, how many edges will it have?   (1)

5.2   If a solid has 7 face and 12 edges, how many vertices will it have?   (1)

6.   Define a tessellation   (2)

MEMORANDUM POST TEST 1

Marks [34]

1.   (a)   isosceles △

        (b) equilateral △

        (c) scalene / obtuse < △   (4)

        (d) right angled △

1.1   isceles △ - two equal sides, base angles are equal

        equilateral △ - all sides equal, all sides equal 60°

        scalene △ - all sides unequal

        right < △ - one angle 90°, has longest side - hypotemuse   (7)

1.2   otemuse   (2)

1.3   Yes - the right angle (90°)   (2)
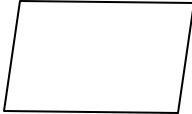
2.

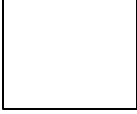   rectangle   square   (2)

2.1   Similarities

S   both have four sides (quadrilaterals)   (3)

S   all angles 90°

S   opposite sides are parallel

2.2   Diffe

                 S rectangle opposite sides equal, square all sides equal   (2)

3.   (2)

parm   rhombus

3.1   A rhombus is a parm with equal sides   (2)

4.1   Where the faces meet in a solid   (1)

4.2   Where the edges meet in a solid   (1)

4.3   A polygon on a solid   (1)

5. $F + V = E + 2$ (1)

5.1 $8 + 12 = E + 2$

$E = 18$

5.2 $7 + v = 12 + 2$

$V = 7$

6.   Putting together of planar shapes such that there are no spaces
between them and no overlapping.

Marks [40]

1.   Explain each of the following by making use of a diagram
Show as many properties of each shape as possible in your diagram.

1.1   A square   (2)

1.2   A rectangle   (3)

1.3   A parallelogram   (5)

1.4   A rhombus   (5)

1.5   A hexagon   (3)

1.6   An isosceles triangle   (2)

1.7   A kite   (4)

2.   Match items on the left with corresponding items on the right.

        2.1   Stop sign

                (a)   rectangular prism

        2.2   A beehive

                (b)   square pyramid

    2.3   Tomb of Pharaohs   (c)

            hexagonal prism

    2.4   Box of breakfast cereal   (d)

            octagonal prism

        2.5   Ice cream container   (e)

                cone

        (f)   triangular pyramid

        (g)   pentagonal prism

        (h)   triangular prism   (5)

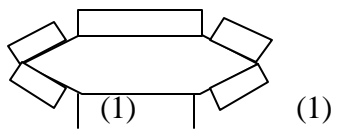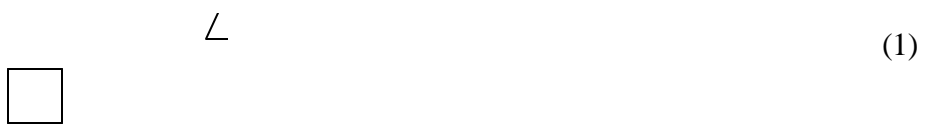3.   Draw FOUR nets of a cube   (4)

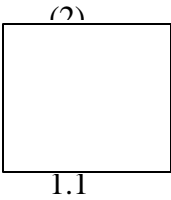4.   Mention solids that are represented by the following nets.
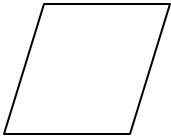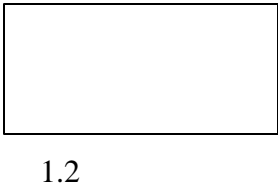
            4.1   4.2

                35 A

(1)   (1)

4.3

∠

□   (1)

4.4

(3)

36 A

Marks [40]

(2)

1.1 (3)

1.2

4

six sides

six angles/corners

sum of int $<_s = 720°$ (3)

1.6 (2)

1.7 (4)

2.

2.1   (d)

2.2   (c)

2.3   (b)

2.4   (a)

2.5   (e)   (5)

3.   Any four nets   (4)

4.

4.1   Triangular pyramid
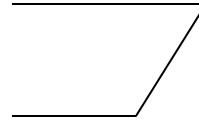
4.2   Rectangle prism
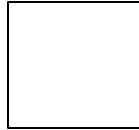
4.3   Hexagonal pyramid   (3)

4.4   open box, open portion is a base

                 of a square based pyramid   (3)
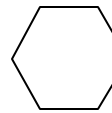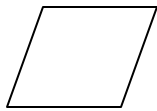
APPENDIX D

QUESTIONS FOR INTERVIEWS

1.   What do we call each of these shapes?

A

B

C

D

E

2.   What are the properties of each?

3.   What is the sum of the angles of a triangle?

4.   What is the sum of the angles of

      4.1   a parallelogram?

      4.2   a hexagon?

5.   (The learner is shown a triangular prism). What do we call this portion of this shape? (face)

6.   How many faces do we have in this object?

7.   How many edges?

8.   How many vertices?

9.   What is Euler's formula?

10.   Does this solid satisfy Euler's formula?

11. What is a net?

12. Can you give me examples of a tessellation you know of?

13. What did you enjoy most (in the work we did) and why?

14. What did you find difficult?

APPENDIX E

Learner portfolios have been displayed in various activities in 6.2.2.