1. Draw the Archimedean tilings. [15 marks]

a. \((3^3.4^2)\)

b. \((3^2.4.3.4)\)

c. \((4.8^2)\)

d. \((3.12^2)\)

e. \((3.4.6.4)\)

f. \((4.6.12)\)

g. \((3.6.3.6)\)

h. \((3^4.6)\) in both left and right versions.
2. Complete the table for the Platonic and Archimedean solids. [44 marks]

<table>
<thead>
<tr>
<th>Solid</th>
<th>Vertices</th>
<th>Edges</th>
<th>Faces</th>
<th>Shape of face</th>
<th>Degree of vertex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrahedron</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Cube</td>
<td>8</td>
<td>12</td>
<td>6</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Octahedron</td>
<td>6</td>
<td>12</td>
<td>8</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Dodecahedron</td>
<td>20</td>
<td>30</td>
<td>12</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Icosahedron</td>
<td>12</td>
<td>30</td>
<td>20</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Truncated tetrahedron</td>
<td>12</td>
<td>18</td>
<td>4</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Truncated cube</td>
<td>24</td>
<td>36</td>
<td>6</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Truncated octahedron</td>
<td>24</td>
<td>36</td>
<td>8</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Truncated dodecahedron</td>
<td>60</td>
<td>90</td>
<td>12</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Truncated icosahedron</td>
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<td>90</td>
<td>20</td>
<td>6</td>
<td>3</td>
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<tr>
<td>Cuboctahedron</td>
<td>12</td>
<td>24</td>
<td>6</td>
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<td>4</td>
</tr>
<tr>
<td>Great rhombicuboctahedron</td>
<td>48</td>
<td>72</td>
<td>6</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Rhombicuboctahedron</td>
<td>24</td>
<td>48</td>
<td>8</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Icosidodecahedron</td>
<td>30</td>
<td>60</td>
<td>12</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Great rhombicosidodecahedron</td>
<td>120</td>
<td>180</td>
<td>12</td>
<td>10</td>
<td>3</td>
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<tr>
<td>Rhombicosidodecahedron</td>
<td>60</td>
<td>120</td>
<td>12</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Snub cube</td>
<td>24</td>
<td>60</td>
<td>6</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Snub dodecahedron</td>
<td>60</td>
<td>150</td>
<td>12</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
3. Use the chart in Attachment 1 to determine the symmetry type of the frieze patterns below. [7 marks]

a: pm11, b: pmm2, c: p111, d: pma2, e: p1a1, f: p112, g: p1m1
4. Use the chart in Attachment 2 to determine the symmetry type of the wallpaper patterns below. [34 marks]

a. p1
b. cmm
c. p4
d. pg
e. cm
f. pgg
g. p2
h. pmm
i. pmg
j. pm
k. p3
l. p31m
m. p4g
n. p4m
o. p6
p. p3m1
q. p6m
Attachment 1: Flow chart for frieze patterns.

1. **Is there a vertical reflection?**
   - yes
   - no

2. **Is there a horizontal reflection?**
   - yes
   - no

   - pmm2
   - Is there a rotation of 180°?
     - yes
     - no

     - pma2
     - pm11

   - no

3. **Is there a horizontal reflection or glide reflection?**
   - yes
   - no

   - p1m1
   - p1a1

   - Is there a rotation of 180°?
     - yes
     - no

     - p112
     - p111
Attachment 2: Flow chart for wallpaper patterns.

Diagram:

- **None**
  - Is there a reflection? no -> p1
  - Is there a glide reflection? yes -> cm
    - Are there reflections in lines that intersect at 45°? no -> p4
      - What is the smallest rotation? 90°
        - Is there a reflection? yes -> p4m
          - Are all rotation centres on reflection axis? no -> p4g
        - p4
      - p4
    - Are all rotation centres on reflection axis? yes -> pmm
      - cm
  - pm

- **180°**
  - Is there a reflection? yes -> cm
    - Are there reflections in lines that intersect at 45°? no -> pgg
      - Are there glide reflections in an axis that is not a reflection axis? no -> p2
        - pmg
    - Are there glide reflections in an axis that is not a reflection axis? yes -> cmm
      - pgg
    - Are there glide reflections in an axis that is not a reflection axis? no -> pg
      - p1
  - p1

- **60°**
  - Is there a reflection? yes -> p6m
    - What is the smallest rotation? 60°
      - p6
  - p6