Chapter 1  More about Coordinates .......................................................... 2
  1.1  Areas of figures in a coordinate plane 2
  1.2  Distance and gradient 8
  1.3  Mid-point of a line segment 14
  1.4  Parallel and perpendicular lines 16
  1.5  Combined problems in a coordinate plane 24
  1.6  Equations of straight lines 30

Chapter 2  Laws of Indices ...................................................................... 39
  2.1  Basic index operations 39
  2.2  Negative exponents 43
  2.3  Indices and roots 46

Chapter 3  Polynomials .......................................................................... 51
  3.1  Addition and subtraction of polynomials 52
  3.2  Multiplication of polynomials 55
  3.3  Definition of algebraic fractions 57
  3.4  Multiplication and division of algebraic fractions 62

Chapter 4  Change of Subject ................................................................. 68
  4.1  Revision of equations 68
  4.2  Formulas and substituting values into formulas 71
  4.3  Change of subject 73
<table>
<thead>
<tr>
<th>Chapter 5</th>
<th>Factorization of Polynomials</th>
<th>79</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Factorization by finding common factors</td>
<td>79</td>
</tr>
<tr>
<td>5.2</td>
<td>Factorization of quadratics using the difference of two squares and perfect squares</td>
<td>82</td>
</tr>
<tr>
<td>5.3</td>
<td>Factorization of quadratics using the cross method</td>
<td>85</td>
</tr>
<tr>
<td>Chapter 6</td>
<td>Surds and Rationalization</td>
<td>90</td>
</tr>
<tr>
<td>6.1</td>
<td>Definition of surds</td>
<td>90</td>
</tr>
<tr>
<td>6.2</td>
<td>Operations on surds</td>
<td>91</td>
</tr>
<tr>
<td>6.3</td>
<td>Rationalization</td>
<td>96</td>
</tr>
<tr>
<td>Chapter 7</td>
<td>Angle Properties</td>
<td>101</td>
</tr>
<tr>
<td>7.1</td>
<td>Angle properties with intersecting lines</td>
<td>101</td>
</tr>
<tr>
<td>7.2</td>
<td>Angle properties with parallel lines</td>
<td>109</td>
</tr>
<tr>
<td>Chapter 8</td>
<td>Angles in Polygons</td>
<td>118</td>
</tr>
<tr>
<td>8.1</td>
<td>Interior angles in polygons</td>
<td>118</td>
</tr>
<tr>
<td>8.2</td>
<td>Exterior angles in polygons</td>
<td>125</td>
</tr>
<tr>
<td>Chapter 9</td>
<td>Congruent Triangles</td>
<td>131</td>
</tr>
<tr>
<td>9.1</td>
<td>Identifying congruent triangles</td>
<td>131</td>
</tr>
<tr>
<td>9.2</td>
<td>How to show two triangles are congruent</td>
<td>135</td>
</tr>
</tbody>
</table>
Chapter 1
More about Coordinates

1.1 Areas of figures in a coordinate plane

We can find the area of a polygon in a coordinate plane if we know the coordinates of each vertex. The following examples illustrate different methods of finding the area.

Example

Find the area of $\triangle ABC$ in the figure below:

\[ y \]
\[ 6 \quad C \]
\[ O \quad A \quad 2 \quad B \quad x \]

Solution:

We need to find the base and height of $\triangle ABC$:

Length of base $= AB = 4 - 2 = 2$
Length of height $= OC = 6 - 0 = 6$

Therefore, the area of $\triangle ABC$

\[ = \frac{1}{2}(AB)(OC) \]
\[ = \frac{1}{2} \times 2 \times 6 \]
\[ = 6 \text{ sq. units} \]

Fun Fact

The coordinate plane has uses far outside the classroom. It is used to give locations on maps, to chart data in statistics and to create designs for buildings and clothing, among others.
Sometimes it is necessary to break down or divide the figure into separate parts:

**Example**

Find the area of the quadrilateral $ABCD$ in the figure below:

![Diagram of quadrilateral ABCD]

**Solution:**

We can divide the quadrilateral into the two triangles $ABC$ and $ADC$ by joining $AC$. $AC$ is the common base of both triangles. $BH$ is the height of $\triangle ABC$ where the coordinates of $H$ are $(3, 3)$. $DK$ is the height of $\triangle ACD$ where the coordinates of $K$ are $(3, 0)$.

Area of quadrilateral $ABCD$

$= \text{area of } \triangle ABC + \text{area of } \triangle ACD$

$= \frac{1}{2} \times AC \times BH + \frac{1}{2} \times AC \times DK$

$= \frac{1}{2} \times 5 \times 4 + \frac{1}{2} \times 5 \times 3$

$= 10 + 7.5$

$= 17.5$ sq. units
Sometimes, instead of breaking a shape up, we surround it by a simpler shape, as in this example.

**Example**

Find the area of the triangle $OYZ$ in the figure below:

![Diagram of triangle OYZ with points O, Y, and Z and coordinates (2,5) for Y and (6,3) for Z.]

**Solution:**

First, surround the triangle $OYZ$ by the rectangle $OABC$:

![Diagram of rectangle OABC with points O, A, B, and C and coordinates (2,5) for Y and (6,3) for Z.]

Referring to the above figure, we can divide rectangle $OABC$ into four triangles: $\triangle OAY$, $\triangle YBZ$, $\triangle OCZ$ and $\triangle OYZ$.

Area of rectangle $OABC$

\[
= OA \times OC \\
= 5 \times 6 \\
= 30
\]

Area of $\triangle OAY$

\[
= \frac{1}{2} \times OA \times AY \\
= \frac{1}{2} \times 5 \times 2 \\
= 5
\]
Area of $\triangle YBZ$
\[= \frac{1}{2} \times YB \times BZ \]
\[= \frac{1}{2} \times 4 \times 2 \]
\[= 4 \]

Area of $\triangle OCZ$
\[= \frac{1}{2} \times OC \times CZ \]
\[= \frac{1}{2} \times 6 \times 3 \]
\[= 9 \]

Therefore, the area of $\triangle OYZ$
\[= \text{area of } OABC - \text{area of } \triangle OAY - \text{area of } \triangle YBZ - \text{area of } \triangle OCZ \]
\[= 30 - 5 - 4 - 9 \]
\[= 12 \text{ sq. units} \]

**Exercise 1.1**

**Section A**

For questions 1 – 10, find the area of the given figures.

1. [Diagram of a rectangle with vertices at (0,1), (0,2), (3,1), (3,2)]
2. [Diagram of a triangle with vertices at (1,1), (3,1), (1,3)]
Section B

For questions 1 – 10, find the area of the given figures.

1. 

2. 

3. 

4. 

5. 

6. 

7. 

8.