

**EVALUATING
ACADEMIC READINESS
FOR APPRENTICE SHIP TRAINING**
Revised for
Access to Apprenticeship

**MATHEMATICS SKILLS
PROPERTIES OF ANGLES**

**AN ACADEMIC SKILLS MANUAL
for
The Hairstylist Trade**

*Workplace Support Services Branch
Ontario Ministry of Training, Colleges and Universities*

Revised 2011

In preparing these Academic Skills Manuals we have used passages, diagrams and questions similar to those an apprentice might find in a text, guide or trade manual.

This trade related material is not intended to instruct you in your trade. It is used only to demonstrate how understanding an academic skill will help you find and use the information you need.

MATHEMATICS SKILLS

PROPERTIES OF ANGLES

*An academic skill required for the study of the
Hairstylist Trade*

INTRODUCTION

In learning the different procedures for cutting and styling hair, you will come across instructions such as the following:

“When hair is held out at a 90° angle and cut to a given length, it is considered an all-over layered cut. If the hair is held at a 45° angle, the perimeter will be moderately layered.”

“Prepare a roller section by combing the strand firmly and smoothly at a 45° angle.”

“The amount of volume created by a roller depends on the angle of the strand of hair being curled. For medium volume, the angle is 90° . For more volume, the angle of the strand is less than 90° and for less volume, the angle is more than 90° .”

The statements above all use explanations involving angles to convey information. To follow the directions accurately, you need to know the approximate size of these angles. A basic understanding of angles is essential to completing these tasks successfully, so some knowledge of geometry becomes important. Geometry is the study of figures and the relationships that the different parts of the figures have to each other.

This skills manual on angles covers the following topics:

- ◆ Basic terms used to describe angles
- ◆ Definition of an angle
- ◆ Measuring angles
- ◆ Different types of angles

BASIC GEOMETRIC TERMS

Specific terms are used to describe the parts of an angle and the different types of angles. A **line** is described as a set of points. A **straight line** is the shortest distance between two points. When we talk about a line, we assume it is a straight line. Otherwise it is called a **curved line**. A highway consists of a series of connected straight and curved lines.

A closed, curved line that has all its points the same distance from the center forms a circle. The **diameter** of a circle is a line that goes from one edge of the circle to the other edge and passes through the centre, as you can see in Figure 1.

Some of the tools you use as a hairstylist are circular. For example, the ends of curlers are circular in shape. The size of a curler is indicated by both the diameter and the length. Perm rods vary in diameter from .3 centimeters (1/8 inch) to 1.8 centimeters (3/4 inch). They come in various lengths, usually called short, medium and long.

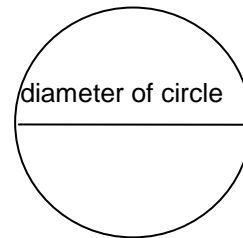


FIGURE 1: Diameter of a Circle

A line can extend indefinitely or it can be limited by one or two **endpoints**. Points on a line and endpoints are named by a letter such as point A or point X. A **ray** is a line that has one endpoint.

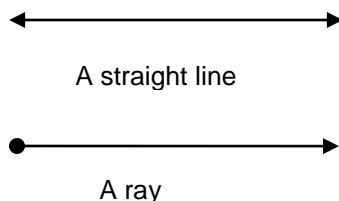


FIGURE 2: A Straight Line and a Ray

Parallel lines are lines that run side by side and never intersect or meet. When a truck is moving in a straight line, the front wheels are parallel to each other.

Intersecting lines are lines that cross each other.

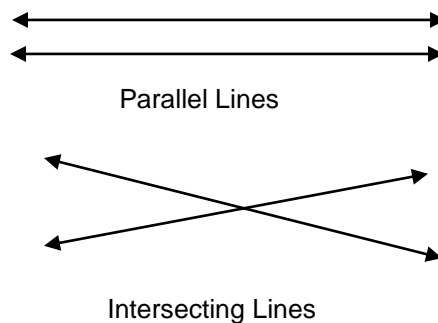


FIGURE 3: Parallel Lines and Intersecting Lines

DEFINITION OF AN ANGLE

An **angle** is formed by two rays having the same endpoint. The endpoint of an angle is also called the **vertex**. When we name an angle, we use the word “angle” or the symbol for angle, \angle .

Angles can be identified by one letter, usually a capital, written at the vertex. See Figure 3, Angle A.

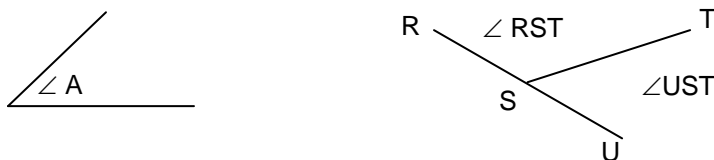


FIGURE 4: Two Ways Of Naming Angles

Angles can also be identified by three letters, one for a point on each ray and one for the vertex. Look at Figure 4 and $\angle RST$ and $\angle TSU$.

The vertex is always named second if three letters are used. If two angles share the same vertex, three letters must be used to name the angles so there is no confusion as to which angle is being referred to.

Angles are also labelled by the number of degrees they contain.

Measuring Angles

Angles are divided into units of measurement called **degrees** ($^{\circ}$). To get a picture of the size of a degree, think of the outside of a circle divided into 360 equal parts with each division marked.

- ◆ Lines drawn from the centre of the circle to each of the 360 dividing marks form 360 equal angles, each measuring 1 degree.
- ◆ To determine the size of any angle, say a 45° angle, you could draw a line from the centre of the circle to one of these degree marks and then counted 45 more marks. If you draw another line from the centre of the circle to this second mark, the two lines would be 45° apart.
- ◆ We use a circular compass that is divided into degree marks to draw an angle of a certain size.
- ◆ The angle is drawn with two rays that meet at a common endpoint. The length of the rays does not affect the size of the angle.

In Figure 5, a circle is divided into angles each measuring 15 degrees. One complete rotation around the circle measures 360 degrees. One quarter of a circle measures 90° . One half of a circle measures 180° . Three quarters of a circle measures 270° .

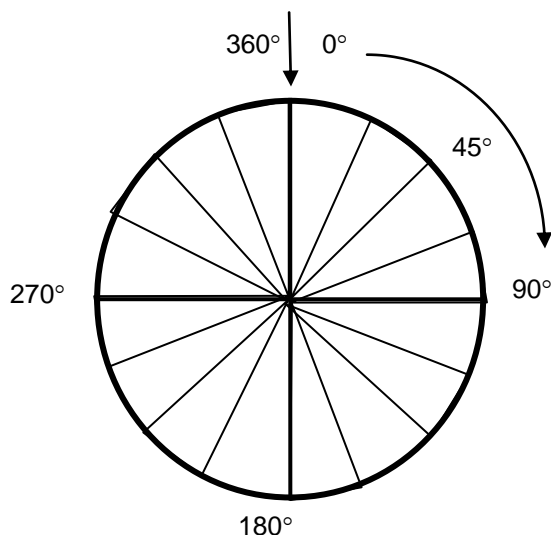


FIGURE 5: Degrees in a Circle

Some of the angles formed by dividing a circle into 360° .

Although the circle was originally used to determine the size of a degree, we do not show the outside of the circle when we draw an angle. We draw only the two rays and the endpoint, using a protractor to determine the correct size of the angle. The length of the rays does not affect the size of the angle.

Usually the size of an angle is written inside the angle near the vertex, as in Figure 5. Notice the small arc near the endpoint in Angle JKL. It is sometimes written to indicate an angle measurement. In the 90° angle shown in angle A, the angle measurement is indicated by two small, straight lines instead of an arc.

TYPES OF ANGLES

Right angle: A 90° angle is called a *right angle*. Angle A in Figure 6 is a right angle. The term 90° is often used to describe the position of an object.



Figure 6: Indicating The Number Of Degrees In An Angle.

Example: You may be instructed to hold a strand of hair at a 90° angle, or perpendicular to the scalp. You should have a clear picture of what a 90° angle looks like.

A line drawn through the centre of a 90° angle forms two 45° angles. A 45° angle, Angle JKL, is shown in Figure 6.

Straight angle: The 180° angle formed by one half of a complete rotation of a circle is called a *straight angle*. It is an important angle because it forms a straight line.

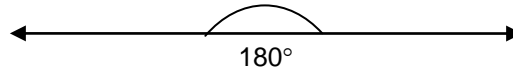


Figure 7: A Straight Angle

Other common angles you should be familiar with include the 30° angle and the 60° angle.



FIGURE 8: A 30° and a 60° Angle

Perpendicular lines: When one straight line extends out from another straight line in such a way that two right angles (90°) are formed, the two lines are *perpendicular*.

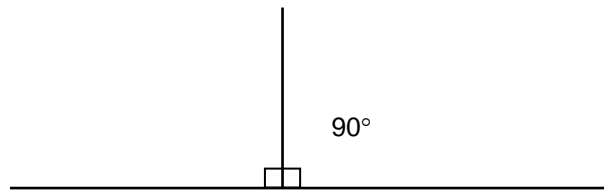


FIGURE 9: Perpendicular Lines

Some angles are named by their size relative to right and straight angles.

Acute angle: An acute angle is greater than 0° but less than 90° . See Figure 6, \angle JKL, and Figure 4, \angle A.

Obtuse angle: An obtuse angle is greater than 90° but less than 180° . See \angle XYZ in Figure 10 and \angle ABD in Figure 11.

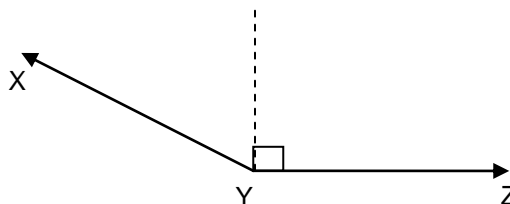


Figure 10: Obtuse Angle

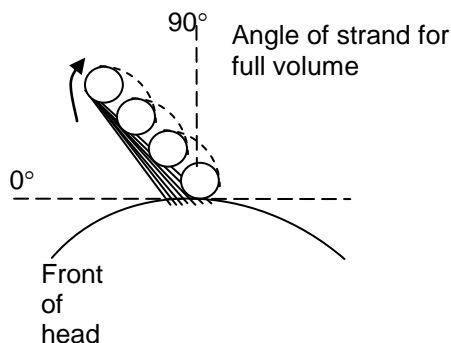


FIGURE 11: Full Volume

If you are instructed to create a style with more volume, you would hold the strand of hair at an acute angle to the front of the head before rolling it. See Figure 11. To create a style with less volume, you would hold the hair at an obtuse angle to the front of the head before rolling it.

Complementary Angles

If the sum of the measurements of two angles is 90° , the angles are called ***complementary angles***.

If there are two angles within a right angle and you know the measurement of one of them, you can find the measurement of the unknown angle. You do this by subtracting the value of the known angle from 90° .

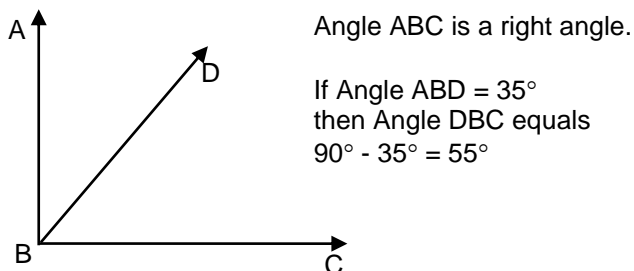


Figure 12: Finding An Unknown Complementary Angle When The Other One Is Known.

Example: If you have two complementary angles and one angle measures 40° , what is the measure of the other angle?

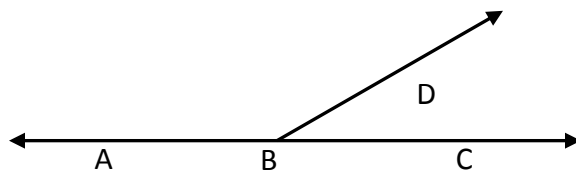
Complementary angles add up to 90° .

$$90^\circ - 40^\circ = 50^\circ$$

The other angle measures 50° .

Supplementary Angles

If the sum of the measurements of two angles adds up to 180° , they are **supplementary angles** (Figure 13). If you have two angles contained within a straight angle, you can find one angle if you know the other. Subtract the known angle from 180° .



Angle ABC is a straight angle equal to 180° .

If $\angle ABD = 130^\circ$ then
 $\angle CBD = 180^\circ - 130^\circ$
 $180^\circ - 130^\circ = 50^\circ$
 $\angle CBD = 50^\circ$

FIGURE 13: Finding An Unknown Supplementary Angle When The Other Angle Is Known

Example: $\angle RST$ and $\angle TSU$ are supplementary angles. If $\angle RST$ is 120° , what is $\angle TSU$?

Since supplementary angles add up to 180° , subtract the known $\angle RST$ from 180° to find $\angle TSU$.

$180^\circ - 120^\circ = 60^\circ$
 $\angle TSU$ is 60° .

ANGLES FOUND IN GEOMETRIC FIGURES

A closed geometric figure is made up of straight lines that are joined at distinct endpoints. Where two lines meet at an endpoint, angles are formed. For this reason, descriptions of common figures such as triangles and rectangles include information about the angles at the endpoints of the figures. (We actually use the word *angle* in the names of these figures.) We will look at the angles in rectangles and triangles.

Rectangles: A rectangle is a four-sided figure with equal opposite sides that are parallel. The sum of the angles of any four-sided figure is equal to 360° . If you draw a rectangle and measure the four angles in the corners, you will find that each angle in a rectangle is a right angle measuring 90° and the sum of the four angles equals 360° .

Triangles: A triangle is a closed, three-sided figure formed by three connected line segments. At each of the three endpoints (or vertices), an angle is formed by the lines of the adjacent (next each other) sides. See Figure 14.

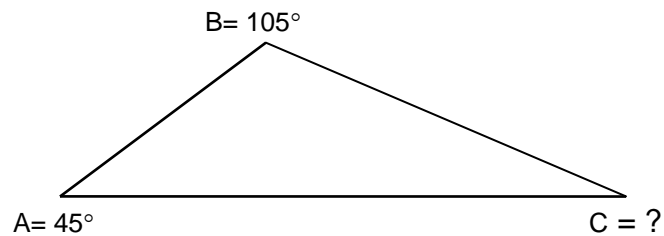


FIGURE 14: The Sum Of The Angles Of A Triangle Is 180°

If you draw any triangle and measure its three angles, the value of the three angles adds up to **180°** . Because of this relationship, if you know the value of two angles in a triangle, you can find the value of the third. If you add the values of the two, known angles and subtract the answer from 180° you will have the value of the third angle.

Example: If two of the angles in a triangle are 45° and 105° , what is the value of the third angle?

Find the sum of angles A + B.

$$45^\circ + 105^\circ = 150^\circ$$

Subtract that sum from 180° .

$$180^\circ - 150^\circ = 30^\circ$$

The third angle, C, is equal to 30° .

Answer these questions on angles and their relationships. Look back at the examples for guidance. **Answers are on the last page.**

1. The size of an angle is measured in units called _____ .
2. A complete rotation of the circumference of a circle is equal to _____ degrees.
3. The _____ is a line that goes through the center of a circle from one edge to the other side.
4. A right angle measures _____ degrees.
5. A straight angle measures _____ degrees.
6. If you divide a 90 degree angle in half, you get a _____ degree angle.
7. An angle that is greater than 0° but less than 90° is called an _____ angle.
8. An angle that is greater than 90° but less than 180° is called an _____ angle.
9. The sum of the three angles in a triangle adds up to _____ degrees.
10. The sum of the angles in a four-sided figure adds up to _____ degrees.
11. If two angles in a triangle are equal to 55° and 80° , what is the value of the third angle? _____
12. If a line extends at a right angle from another line, the two lines are _____ to each other.

ANSWER PAGE

1. degrees
2. 360°
3. diameter
4. 90°
5. 180°
6. 45°
7. acute
8. obtuse
9. 180°
10. 360°
11. 45°
12. perpendicular