Name: _____ Class: _____

SECOND TERM E-LEARNING NOTE

SUBJECT: BASIC TECHNOLOGY **CLASS: JSS 2**

SCHEME OF WORK

WEEK	TOPIC
1	REVISION/CIRCLES
2	QUADRILATERALS
3	POLYGONS
4&5	AREA OF PLANE FIGURES
6&7	WOODWORK MACHINES
8&9	METALWORK MACHINES
10	FRICTION
11	REVISION
12	EXAMINATION

REFERENCE MATERIALS

1. MELROSE, Basic Science and Technology, Book 2
2. NERDC, Basic Technology for JSS, Book 2

WEEK ONE **CLASS: _____**

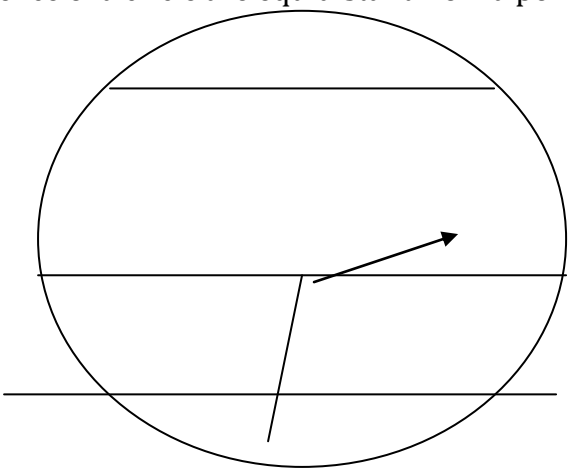
TOPIC: REVISION/CIRCLES

CONTENT

- DEFINITION OF CIRCLE

PARTS OF A CIRCLE

A circle is a plane figure bounded by a curved line called the circumference. All the points on the circumference of a circle are equidistant from a point called the centre.



parts of a circle

1. Diameter

The diameter is a straight line drawn through the centre of a circle and meeting the circumference at both ends.

2. Radius

The radius is a straight line drawn from the centre of a circle to any point on the circumference of the circle. The length of the radius is always used to draw the circle.

3. Segment

The segment is an area of the circle bounded by an arc and a straight line called the chord.

4. Chord

The chord is a straight line which joins any two given points on the circumference of a circle.

5. Sector

The sector is part of the circle bounded by two radii and an arc.

6. Quadrant

The quadrant is the part of the circle bounded by two radii which are at right angles to each other, bounded by an arc. The quadrant, as the name, is ¼ of the circle.

7. Tangent

The tangent is usually formed outside the circle. When a straight line touched is formed. However, that line must be right angle to a radius.

EVALUATION

1. Draw a circle 30mm and show the different parts.
2. Explain each part of a circle

How to draw a circle given the radius

Procedure

- Draw the centre lines horizontal and the other vertical, to intersect each other at E at 90^0.
- The point of intersection is the centre. With the compass at centre E, pick the given radius into the compasses.
- The point of intersection E, is the centre of the circle. Place the pinpoint of the compasses on the centre and swing the pencil round such that the pencil makes 360^0 to give the circle.

How to construct a circle through a three points which are not on a straight line.

Procedure

- Join the given points ABC with straight lines AB and BC.
- Draw the perpendicular bisector of the two lines AB and BC to intersect at point D.
- The point of intersection D is the centre of the circle. With point D as centre, set the pencil point of the compasses to any of the three given point A, B or C
- Swing your compass through the three points to produce the circle.

How to construct a series of circles touching one another on the two converging lines

Procedure

- Copy the given converging lines AB and AC.
- Bisect the angle between the converging lines BA and CA.
- Draw a line from A to pass through D.
- AE is the bisector, and the centre of the circles is located on the bisector.
- Draw the largest circle by placing the point of the compasses somewhere on the bisector and adjust the pencil point, until the required radius is obtained.
- Draw a tangent FG to the circle at point of intersection between the circumference of the circle and the bisector .
- Bisect the angle IJA
- Draw a line through point K to intersect main bisector AE at L.
- Note that point L is the centre for smaller circle.
- With centre L draw the smaller circle to touch the bigger circle tangentially.

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How to find centre of a circle
Procedure

1. Draw the given circle.
2. Draw any two chords AB and AC.
3. Bisect lines AB and AC. The bisecting lines will intersect at O.
4. O is the centre of the circle.

EVALUATION

1. Draw a circle of diameter 80 mm and determine its centre.
2. Draw three circles of diameter 40mm touching each other

READING ASSIGNMENT

Read about QUADRILATERALS

REFRENCE BOOK

- MELROSE, Basic Science and Technology, book 2 page 81-83.
- NERDC, Basic technology for JSS book 2, page 52-56.

WEEKEND ASSIGNMENT

1. The part of the circle that is bounded by an arc and a chord is A. segment B. sector C. diameter D. tangent.
2. A straight line drawn through the centre, meeting the circumference at both ends is called A. sector B. radius C. diameter D. tangent
3. A plane figure bounded by a curved line called circumference is called------- A. triangle B. circle C. quadrilaterals D. curved line
4. Any straight line drawn across the circle, meeting the circumference at both ends is called A. chord B. tangent C. radius) D. diameter
5. Which of the following can be used to draw a circle? A. protractor B. French curve C. compass D. template

THEORY

1. Draw a circle of radius 35mm and divide it into 12 equal sizes.
2. Draw a circle and with shaded portion show (i) quadrant (ii) sector (iii) segment inside the circle

WEEK TWO **DATE: _____**

TOPIC: QUADRILATERALS

CONTENT

- Types of Quadrilaterals
- Construction of a rectangle given its diagonal and one side
- Construction of a rhombus given its side and a diagonal

1. Construction of a rhomboid given its diagonal and one side.

QUADRILATERALS

Quadrilaterals are plane figures bounded by four straight lines. The sum of angles in a quadrilateral is 360^0.

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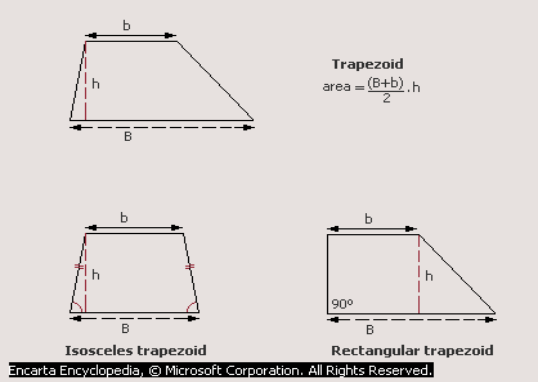
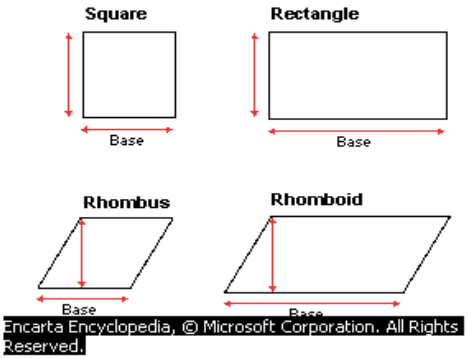
A straight line called the diagonal may join any two opposite angular points.
Types of quadrilateral





1. Parallelogram: This is a quadrilateral with it's opposite sides equal and parallel.
2. Square: A square is a parallelogram, which has its entire sides equal and each angle a right angle.
3. Rhombus: A rhombus is a parallelogram, which has its sides equal but no angle is a right angle.
4. Rectangle: A rectangle is a parallelogram, which has each angle a right angle.
5. Rhomboid: A rhomboid is a parallelogram, but no angle is right angled.

EVALUATION

1. What is a quadrilateral?
3. State the types of quadrilateral

CONSTRUCTION OF QUADRILATERALS

Construction of Squares

A. To construct a square upon a given side.

Procedure

(i) Draw a line and mark off AB equal to the side of the square.
(ii) At A, erect a perpendicular AC marking AC equal to AB.
(iii) With center C and a radius equal to AB, strike an arc with center B and the same radius; strike another arc to intersect the previous one at D.
(iv) Joint CD and BD to obtain the required square ABCD

B. TO CONSTRUCT A SQUARE GIVEN THE LENGTH OF ITS DIAGONAL.

Procedure

(i) Draw a horizontal line and a vertical line, which intersect at O.
(ii) With center O and a radius equal to half the length of the given diagonal, cut the horizontal line at A and B, and the vertical line at C and D.
(iii) Join AD, DB, BC and CA to obtain the required square ADBC.

Construction of Rectangles

A. To construct a rectangle given its length and breadth

Procedure

(i) Draw a line and mark off AB equal to the length of the rectangle.
(ii) At A, erect a perpendicular AC making AC equal to the breadth of the rectangle.
(iii) With center C and a radius equal to AB, strike an arc. With center B and a radius equal to AC, strike another arc to intersect the previous one at D.
(iv) Join CD and BD to obtain the required rectangle ABDC

B. To construct a rectangle given its diagonal and one side.

Procedure

(i) Draw a line and mark off AB equal to the given diagonal.
(ii) Bisect AB at C, and with center C draw a circle with AB as diameter.
(iii) With center A and a radius equal to the given side of the rectangle, cut the circle on any side of AB at D. with center B and the same radius, cut the circle on the other side of AB at E.
(iv) Join AE, EB, BD and DA to obtain the required rectangle AEBD.

Construction of a Parallelogram

To construct a parallelogram given the length of the two sides and one angle

(i) Draw one side AB, say 10cm
(ii) Construct the given angle AB1, i.e 120^o
(iii) With center B and radius BC, i.e., 4cm, draw an arc to cut B1 at C
(iv) With center A and radius BC, draw an arc
(v) With center C and radius AB, draw an arc to cut the previous arc at D.
(vi) Join AD and DC

Construction of a Trapezium

To construct a trapezium given the parallel, the perpendicular distance between them and one angle

(i) Draw one of the parallels AB=8cm
(ii) Construct the given angle BA1=50^o
(iii) Draw the parallel CD, i.e., 4.5cm
(iv) Join D to B to complete the trapezium

Construction of Rhombus

A. To construct a rhombus given its side and a diagonal.

Procedure

(i) Draw a line and mark off AB equal to the given diagonal.
(ii) With center A and a radius equal to the side, strike arcs above and below AB.
(iii) With center B and the same radius, cut the previous arcs at C and D.
(iv) Join AD, DB, BC and CA to obtain the required rhombus ADBC.

B. To construct a rhomboid given a diagonal and two sides.

Procedure

(i) Draw AB equal to the given diagonal.
(ii) With centers A and B and a radius equal to one of the sides, strike arcs above and below AB respectively.
(iii) With center B and a radius equal to the other side, strike arcs to intersect the previous ones at C and D respectively.
(v) Join AD, DB, BC and CA to obtain the required rhomboid ADBC.

EVALUATION

1. Construct a parallelogram in which length of two sides equal 10cm and one of the angle is 120^o
2. Construct a square given the length of its diagonal to be 5cm

READING ASSIGNMENT

Read about POLYGONS

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REFERENCE MATERIALS

- MELROSE BASIC SCIENCE AND TECHNOLOGY BOOK 2, page 83-85
- NERDC- BASIC TECHNOLOGY BOOK 2, page 57-61

WEEKEND ASSIGNMENT

1. A plane figure bounded by four equal sides is called _____ A. square B. rectangle C. trapezium D. kite
2. Opposite sides of a parallelogram are _____ A. diagonal B. parallel C. vertex D. straight
3. The diagonals in a rhombus bisect each other at A. 90^0 B. 60^0 C. 45^0 D. 70^0
4. A quadrilateral with only two parallel sides is called ___ A. square B. rectangle C. trapezium D. kite
5. The diagonals in a trapezium bisect each other to give A. 90^0 B. equal opposite angles C. parallel opposite angles D. 45^0

THEORY

1. Construct (i) a square and (ii) rectangle with diagonal of 120mm
2. (i) Define Quadrilateral (ii) Construct a rectangle ABCD, AB=40mm BC=70mm

WEEK THREE **DATE: _____**

TOPIC: POLYGONS

CONTENT

- Definition
- Types of polygon
- Construction of different polygons

What is a polygon?

A polygon is a plane figure with five or more straight sides. A polygon can either be regular or irregular A polygon is said to be regular it all its sides are equal and its angles are equal. An irregular polygon has unequal sides.

Types of polygons

1. Pentagon: A pentagon is a polygon with five sides.
2. Hexagon: A hexagon is a polygon with six sides
3. Heptagon: A heptagon is a polygon with seven sides.

4. Octagon: An octagon is a polygon with eight sides.
5. Nonagon: A nonagon is a polygon with nine sides.
6. Decagon: A decagon is a polygon with ten sides.

EVALUATION

1. What is a polygon?
2. Explain different types of polygon.

CONSTRUCTION OF POLYGONS

Construction of a regular Hexagon given its side.

A. Using 60^o set - square

Procedure

(i) Draw a horizontal line and mark off AB equal to the side of the hexagon.
(ii) Through A, draw a line at 60^o and mark off AC equal to AB
(iii) Through B, draw a line at 60^o and mark off BD equal to AB.
(iv) Through C, draw a line at 60^o parallel to BD and mark off CE equal to AB.
(v) Through D, draw a line at 60^o parallel to AC and mark off DF equal to AB.
(vi) Join EF to complete the hexagon.

B. Using compasses: - This method is called constant radius rule.

Procedure

(i) Draw a circle whose radius is equal to the side of the hexagon. Draw the horizontal diameter AB.
(ii) With center A and the same radius, cut the circle above AB at C and below AB at D
(iii) With center B and the same radius, cut the circle above AB at E and below AB at F.
(iv) Join AD, DF, FB, BE, EC and CA to obtain the hexagon.

Constructing a regular hexagon given the distance across flats.

Procedure

(i) Draw a circle whose diameter is equal to the distance across flats. Draw the vertical diameter AB.
(ii) Draw diameter CD and EF at 30^o.
(iii) Through A and B, draw horizontal tangents.
(iv) Through C, D, E, F, in turn, draw tangents at 60^o. The figure that is formed by the intersection of the tangents is the required hexagon.

This is the procedure when describing a regular hexagon about a given circle.

To construct a regular Octagon given its sides

Procedure

(i) Draw a horizontal line mark off AB equal to the given side.
(ii) Through A and B, draw lines at 45^o and mark off AC and BD equal to AB.
(iii) Through C and D, draw vertical lines and mark off CE and DF equal to AB.
(iv) Through E and F, draw lines at 45^o and mark off EG and FH equal to AB.
(v) Join GH to complete the octagon.

To construct a rectangular octagon given the distance across flats.

Procedure

(i) Draw a circle whose diameter is equal to the distance across flats. Draw a horizontal diameter AB and a vertical diameter CD.

(ii) Draw diameters EF and GH at 45^o

(iii) Draw vertical tangents through A and B and horizontal tangents through C and D.

(iv) Through E, F, G, H, in turn draw tangents at 45^o. the figure formed by the intersection of the tangents is the required octagon.

This is the procedure when describing a regular octagon about a given circle.

General methods for constructing a regular polygon on a given base.

A. The External Rule – $\frac{360^o}{N}$

Procedure

(i) Obtain the external angle of the required polygon by dividing 360^o by the number of side (N) of the polygon, i.e. external angle = $^{360o}/_{N}$

(ii) Draw a horizontal line and mark off AB equal to the given base.

(iii) Through A, draw a line at $360^o/N$ and mark off a length equal to AB. Also at B, draw a line at $360^o/N$ and mark off a length equal to AB.

(iv) Continue the process until you have obtained the polygon of N sides where N = 5, 6, 7, 8, 9, 10…… Suppose that at N = 5, then external angle = $360º/5= 72^o$

B. THE TWO–TRIANGLE RULE.

Procedure

(i) Draw a horizontal line and mark off AB equal to the given base.

(ii) Bisect AB and produce its bisector as long as it is convenient.

(iii) On AB as base, draw an isosceles triangle with base angle 45^o and an equilateral triangle so that the apexes of the two triangles lie on the bisector of AB. Denote the apex of the isosceles triangle as F.

(iv) Bisect FD to obtain point e.

(v) Along the bisector of AB, from point f, step off length de (or if) to obtain points G, H, L, J, e.t.c. The points D, E, F, G, H, L, J, are the centers of the circumscribing circles for a square, regular pentagon, hexagon and decagon respectively.

(vi) Suppose you want to draw a polygon of 8 sides (octagon).

With center h and radius HA (or HB) draw a circle. Take length AB and step it off on the circle to obtain the points C, D, E, F, G, H, I. Join the points to obtain the required regular nonagon. Note that D = 4; E = 5;F = 6;G = 7;H = 8;L = 9;J = 10.

Conclusion

A polygon may be regular or irregular. When it is regular, all its sides are equal, and its angles are also equal. Polygons include pentagons, hexagons, heptagons, octagons, nonagons, and decagons, which have five, six, seven, eight, nine, and ten sides respectively.

Evaluation

1. Construct a hexagon using the 60^0 by 30^0 set-square
2. State the formula for generally constructing a polygon

READING ASSIGNMENT

Read about AREAS OF PLANE FIGURES

REFERENCE MATERIALS

- MELROSE BASIC SCIENCE AND TECHNOLOGY BOOK 2, page 86-89
- NERDC- BASIC TECHNOLOGY BOOK 2, page 61-66

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WEEKEND ASSIGNMENT

1. Which of the following is not a polygon? A. Circle B. Triangle C. Decagon D. Heptagon.
2. Two angular points are joined by a _____ A. diagonal B. vertex C. horizon D. pinnacle
3. A polygon is a plane figure with _____or more straight sides. A. Five B. three C. four D. two
4. A regular polygon has _____ of its sides and angles equal A. five B. all C. three D. four
5. An Octagon is a polygon with _____ sides A. 5 B. 6 C. 7 D. 8

THEORY

1. A. Define polygon
   B. What are regular polygons?
2. Construct (i) a square of side 60mm (ii) a regular hexagon of side 80mm.

WEEK FOUR AND FIVE **DATE: _____**

TOPIC: **AREA OF PLANE FIGURE**

INTTRODUCTION

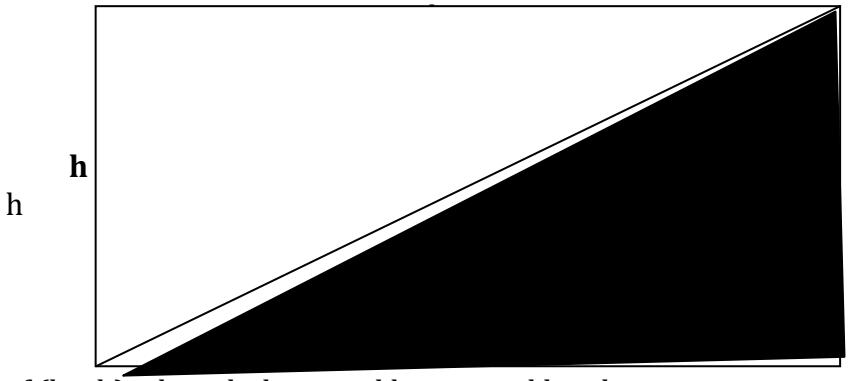
Plane figures are flat two-dimensional shapes. The can be made of straight lines, curved lines or both straight and curved lines. Examples of plane figures are: triangle, square, parallelogram, circle, rectangle etc.

AREA OF PLANE FIGURES

When a plane figure is drawn, it occupies a certain amount of space. At times, it is important to know the amount of space of a figure occupies, when it is drawn. This way, it will be possible to draw a different shape that has the same amount of space with it.

Therefore, area of a plane figure can be defined as the space it occupies.

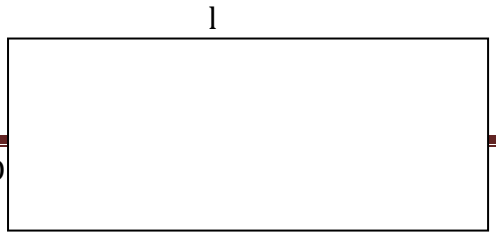
Area of a triangle



Area = ½ of (b x h) where b=base and h= vertical height

Note: The area of any plane figure (polygon) can be reduced to a combination of areas of rectangles (Or squares) and triangles each of which can be computed and the total area together.

Area of a rectangle



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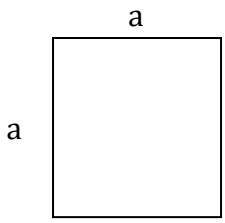
b

Area= l x b where l= length and b= breadth

Area of a square

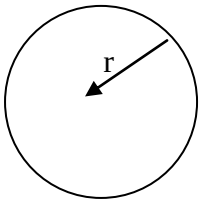


Area= a x a= a^2 where a= length of side

Area of a parallelogram

Area= b x h where b= base and h= vertical height

Area of a circle



Area= πr^2 where r= radius

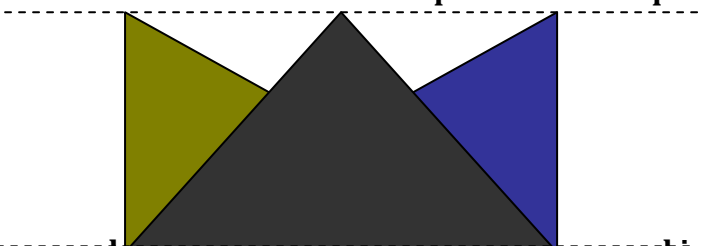
Evaluation

1. Define the area of plane shape.
2. State the area of (i) triangle (ii) rectangle

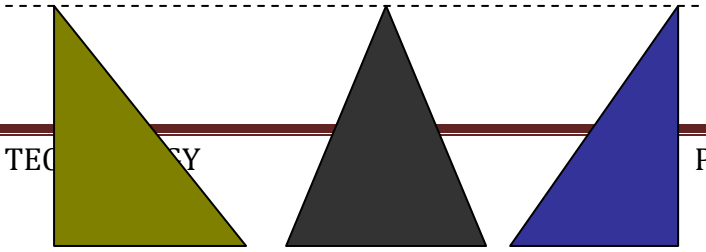
THEOREMS

In construction regular plane figure of equal areas, some geometrical laws, generally called theorems, are applied. For instance, the following are will be relevant to this topic:

1. **Triangles on the same base and between the same parallels are equal in area.**



2. **Triangles on equal bases and between the same parallels are equal in area.**



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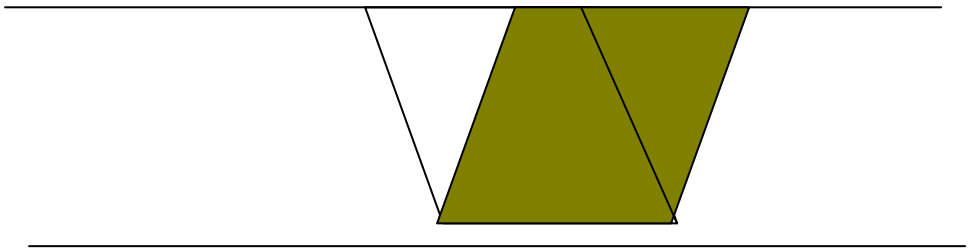
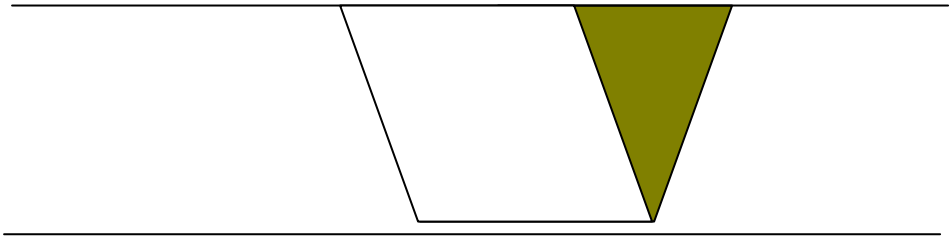
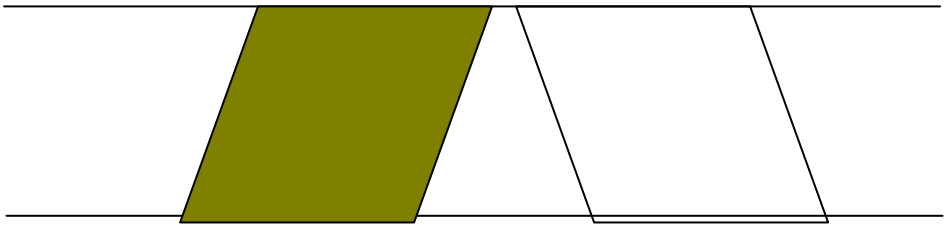
3. **Parallelograms on the same base and between the same parallels are equal in area.**



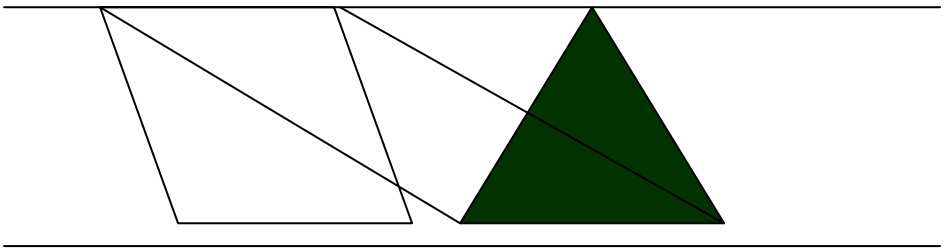
4. **Parallelograms on equal base and between the same parallel are equal in area.**



5. **A triangle on the same parallels with a parallelogram is half the area of the parallelogram.**



6. **if a triangle and a parallelogram are on equal bases and between the same parallels, the triangle is half the area of the parallelogram**



Evaluation

1. State 6 theorems of area of plane shape
2. Sketch diagrams that demonstrate the theorems of plane shape.

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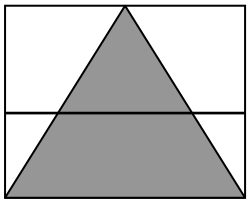
CONSTRUCTION OF SIMILAR AREA OF PLANE SHAPES

Constructing a triangle equal in area to a given rectangle

Procedure

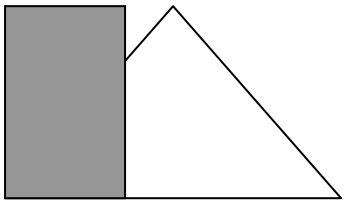
1. Draw the rectangle ABCD
2. Project line CD and mark off DE, using the distance equal to CD.
3. Draw a horizontal line from point F to line BA parallel to BC.
4. Locate point G anywhere on line EF.
5. Join point G to B and C respectively, to obtain the triangle equal in area to rectangle ABCD. Triangle BCG is equal to the given rectangle.



Constructing a rectangle equal in area to a given triangle

Procedure

1. Draw the given triangle ABC.
2. Draw a line through A, parallel to BC.
3. Bisect line BC perpendicular at D and to meet the line through at D and to meet the line through A at E.
4. Draw a perpendicular to BC at B meet the line through A at F.
5. FBDE is the rectangle required



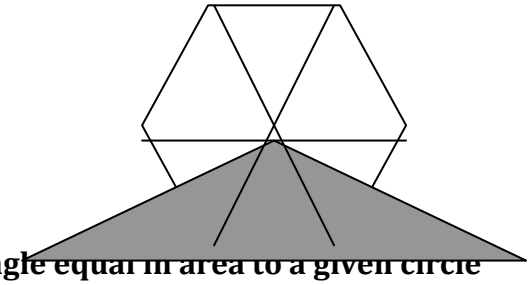
Evaluation

1. Construct a triangle equal in area to a rectangle AB=50mm, BC=60mm.
2. Construct a rectangle equal in area to a triangle ABC, AB= 40mm, AC=70mm and BC=60mm

Constructing a triangle equal in area to any regular polygon

Procedure

1. Draw the regular polygon (hexagon) ABCDEFG
2. Draw the diagonals to intersect at the centre of the polygon O.
3. Draw HI equal in length to the length of side x number of sides. In this exercise, GH is equal to six times, the length of the side of the hexagon. (HI= 6 x y mm)
4. Join O to G and H, GOH is required triangle

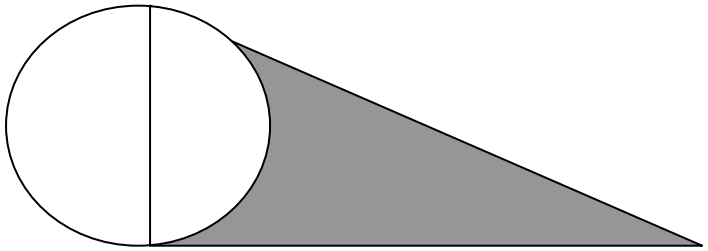


Constructing a triangle equal in area to a given circle

Procedure

1. Draw the given circle of diameter AB and centre O.
2. Divide the radius OA into 7 equal parts

3. Draw a perpendicular line at A equal in length to 3 1/7
4. Join C to B.ACB is the required triangle



Reducing an irregular quadrilateral to half its original area
Procedure

1. Draw the given irregular quadrilateral ABCD
2. Draw a diagonal BD
3. Bisect AB perpendicular at E
4. With centre E and radius EA, draw an arc to meet the bisector at F.
5. With centre B and radius BF, draw an arc, which meets the bisector at F.
6. From G and GH parallel to AD, also draw HI parallel to DC.
7. GBIH is required reduced irregular quadrilateral.

Evaluation

1. Construct a triangle equal in area to any regular hexagon 50mm.
2. Draw a triangle equal in area to a given circle of radius 40mm.

READING ASSIGNMENT
Read more about AREA OF PLANE FIGURES

REFERENCE MATERIALS

- MELROSE BASIC SCIENCEBASIC TECHNOLOGY BOOK 2, page 86-92
- NERDC- BASIC TECHNOLOGY BOOK 2, page 61-63

WEEKEND ASSIGNMENT

1. The space which a plane shape occupies is known as _____ A. triangle B. rectangle C. parallelogram D. area
2. The units of area are as follows except A. mm^2 B. cm^2 C. kg^2 D. m^2
3. Triangles on the same base and between the same parallels are equal in area A. True B. False C. None of the above D. All of the above
4. A triangle on the same base and between the same parallels with a parallelogram. A. True B. False C. None of the above D. All of the above
5. The area of a triangle is ___A. ½ B x H B. B x H C. B^2 x H D. B x H^2

THEORY

1. State 6 theorems of area of plane shape
2. Construct a right-angled triangle, which has the same area with an equilateral triangle of side 60mm.

WEEK SIX AND SEVEN **DATE: _____**
TOPIC: WOODWORK MACHINES
CONTENT

- Introduction

Name: _____ Class: _____

- Woodwork Machines
- Circular Sawing Machine
- Surface Planing
- Thicknessing Machine
- Drill Press Machine
- Wood Lathe
- Band Saw

INTRODUCTION

Wood work machine are machines used for processing wood and making the wood ready for use. These machines are used for heavy woodwork operation and also for mass production.

In the past, nearly all-sawing operations were carried out by hand: a lot of energy was put into it and it was more time consuming. In modern days, various machines through improved technology are now available.

Evaluation

1. State the reasons for using wood working machines.
2. Mention two manual wood working tools

WOODWORK MACHINES

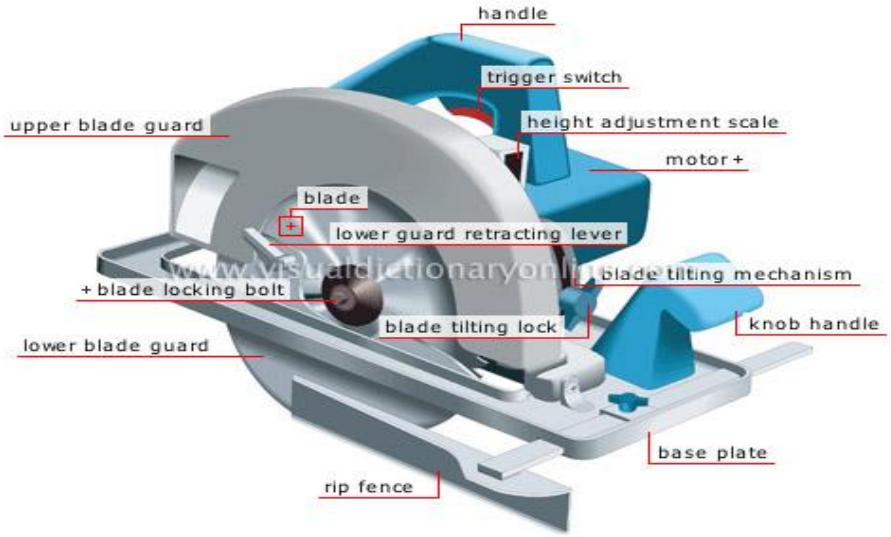
Woodwork machines include the following:

1. Circular sawing machine
2. Surface planing
3. Thicknessing machine
4. Drill Press machine
5. Wood lathe
6. Band saw

Circular Sawing Machine: This is a woodworking machine used to re-saw or prepares timber into suitable sizes for articles of joinery, furniture e.t.c. Circular saws include the ripsaw and cross cut saw. Other special purpose saw and are fitted onto the machine as their uses arises include upper saw, hollow ground saw, ground-off saw, wobble saw or drunken saw, novelty saw, planer saw.

There are other sawing machines that can do the same job as circular sawing machine does a hand feed bench type with tilting arbor, and rise and fall attachment would be most suitable.

Name: _____ Class: _____



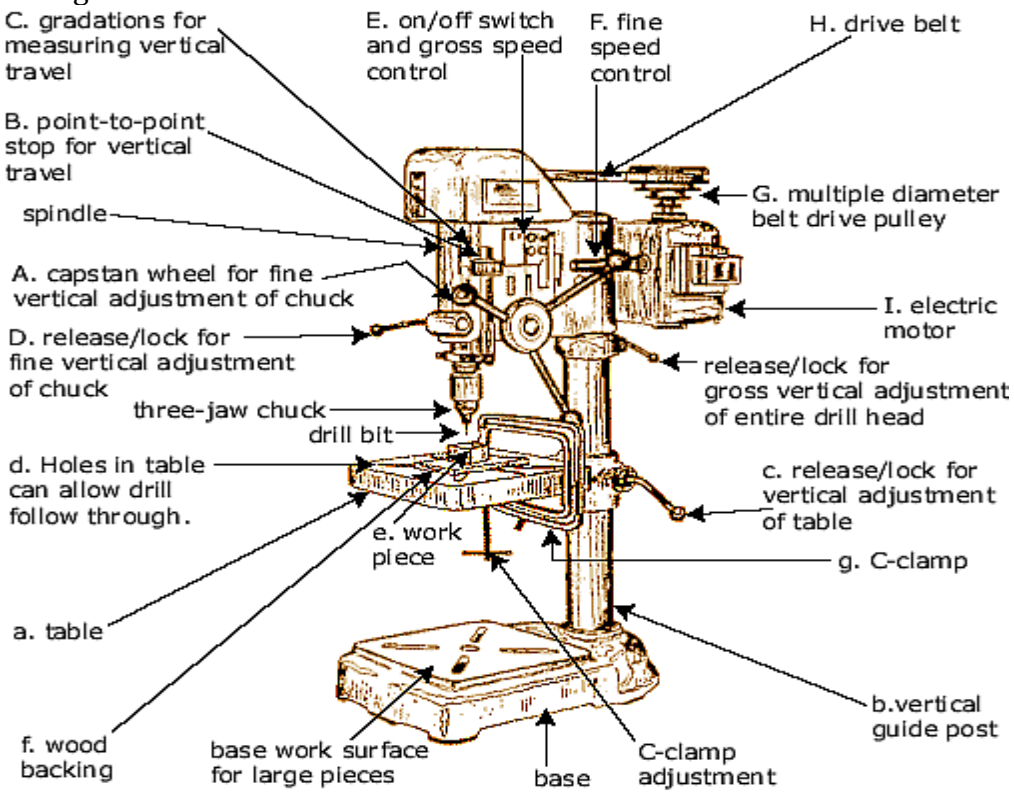
2. **Band Sawing machine:** This is a wood working machine having a compensating arrangement of a band saw that allows the upper pulley to move up and down and adjust to the changes in the saw and keep the tension of the blade constant.

3. Surface Planing Machine: This is a woodworking machine that enables the sawn timber to be planed to remove marks thus ensuring a flat surface.Planing is the most laborious operations in woodworking. The introduction of the planing machines enables construction of pieces to be planed to the required thickness joining edge to edge.
Surface planing machine is used for truing up the edges, removing the marks and for removing the "wind or twist" on the face of the wood. It can also handle chamfering, beveling, tapering and tenoning.

Name: _____ Class: _____

3. **Thicknessing Machine:** This is a woodworking machine that is used exclusively for planing wood to a specific thickness after surface planing operation.
In order to achieve a perfect operation, the front table is pulled backwards from the cutter block to allow the wood chips fly out.

4. ***The Drill Press:*** This another wood working machine, which can also be used as machine tools, used for performing various operations such as boring, sanding and mortising.



5. ***Wood Lathe Machine:*** This is a wood working machine, which can be used for metal working operations, employed where a number of turning will be made.
Generally, turning can be made on the lathe in two ways i.e. between centres and the faceplate- both inside and outside. The lathe bed must be sturdy. The headstock runs on double bearing which may be directly driven with about four speeds

Name: _____ Class: _____

Evaluation

1. State six woodwork machine
2. Differentiate between surface planing machine and Thicknessing machine
3. Draw and label the drill press.

Reading Assignment

Read more about WOODWORK MACHINES

Reference Materials

- MELROSE BASIC SCIENCEBASIC TECHNOLOGY BOOK 2, page 93-98
- NERDC- BASIC TECHNOLOGY BOOK 3, page 61-66

WEEKEND ASSIGNMENT

1. Which of the following is not a wood working machine A. Circular sawing machine B. Surface planing machine C. Milling machine D. Thicknessing
2. A machine that is used to resaw or prepare timber into suitable sizes for articles of joinery and furniture is known as A. Circular sawing machine B. Surface planing machine C. Milling machine D. Thicknessing
3. A machine that is used exclusively for planing wood to a specific thickness after surface planing operation is called __ A. Circular sawing machine B. Surface planing machine C. Milling machine D. Thicknessing
4. A wood working machine, which can also be used as machine tools, used for performing various operations such as boring, sanding and mortising is known as A. Drill press B. Surface planing machine C. Milling machine D. Thicknessing
5. The largest wood working machine is ___ A. Drill press B. Wood lathe machine C. Milling machine D. Thicknessing

THEORY

1. Explain the functions of six woodwork machines
2. Draw and label drill press.

WEEK EIGHT AND NINE **DATE: _____**

TOPIC: METALWORK MACHINES

CONTENT

- Definition
- Shaping machine
- Planing machine
- Milling machine
- Grinding machine
- The drill press
- The lathe machine

Definition

Metalwork machines are machines used for metal work operations. The various types of metalwork machines include the following:

1. Shaping machine
2. Planing machine
3. Milling machine
4. Grinding machine
5. The drill press

Name: _____ Class: _____

6. The lathe machine

Evaluation

1. Define machine tools
2. State 6 machine tools

1. The milling machine

A milling machine is a machine tool used to machine solid materials. Milling machines are often classed in two basic forms, horizontal and vertical, which refers to the orientation of the main spindle. Both types range in size from small, bench-mounted devices to room-sized machines. Unlike a drill press, which holds the workpiece stationary as the drill moves axially to penetrate the material, milling machines also move the workpiece radially against the rotating milling cutter, which cuts on its sides as well as its tip. Workpiece and cutter movement are precisely controlled to less than 0.001 in (0.025 mm), usually by means of precision ground slides and leadscrews or analogous technology. Milling machines may be manually operated, mechanically automated, or digitally automated via computer numerical control (CNC).

Milling machines can perform a vast number of operations, from simple (e.g., slot and keyway cutting, planing, drilling) to complex (e.g., contouring, diesinking). Cutting fluid is often pumped to the cutting site to cool and lubricate the cut and to wash away the resulting swarf.

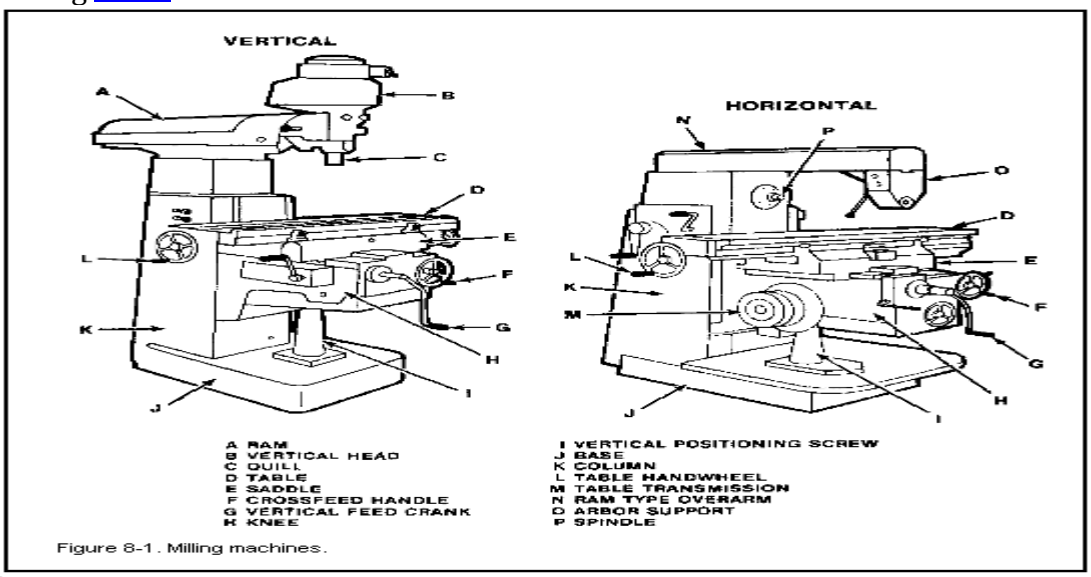
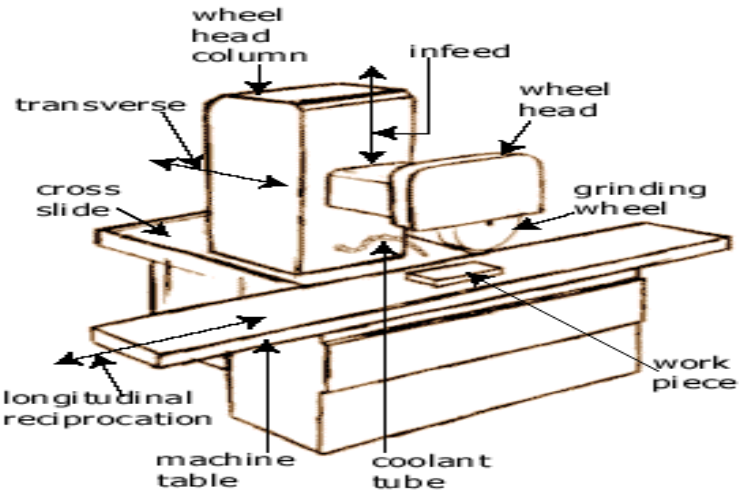


Figure 8-1. Milling machines.

2. Planing machine (Planer)

Metal-cutting machine tool in which the work piece is firmly attached to a horizontal table that moves back and forth under a single-point cutting tool. The tool-holding device is mounted on a cross rail so that the tool can be moved across the table in small sideward movements. Since the cutting tool can be moved at almost any angle, a wide variety of grooves and surfaces can be generated. Mechanical planers, or surfacers, are also used to smooth wood to an even thickness. Planers perform the same operations as shapers but can machine work pieces up to 50 ft (15 m) long.

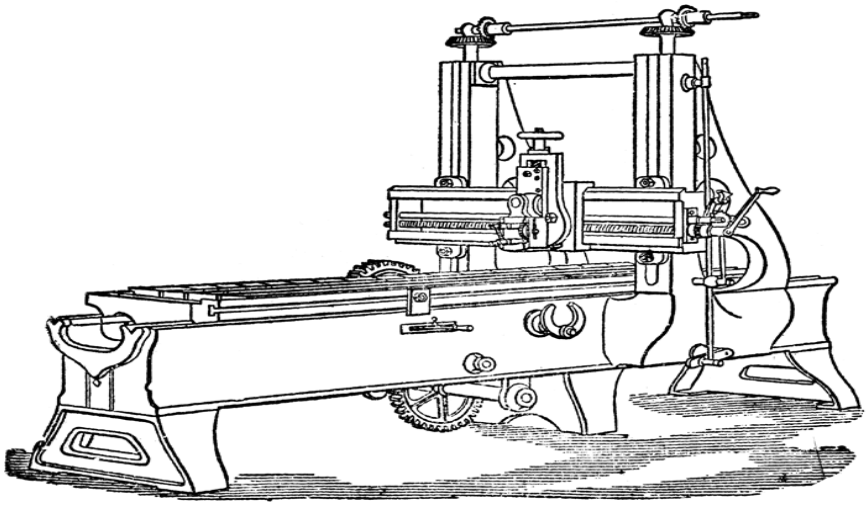
A machine for the shaping of long, flat, or flat contoured surfaces by reciprocating the work piece under a stationary single-point tool or tools.



3. Milling machine

This is a machine tool that rotates a circular tool with numerous cutting edges arranged symmetrically about its axis, called a milling cutter. The metal work piece is usually held in a vise clamped to a table that can move in three perpendicular directions. Cutters of many shapes and sizes are available for a wide variety of milling operations. Milling machines cut flat surfaces, grooves, shoulders, inclined surfaces, dovetails, and T-slots. Various form-tooth cutters are used for cutting concave forms and convex grooves, for rounding corners, and for cutting gear teeth.

A machine for the removal of metal by feeding a work piece through the periphery of a rotating circular cutter. It is known as miller.



4. The drill press

This is m machine tool for producing holes in hard substances. The drill is held in a rotating spindle and is fed into the work piece, which is usually clamped in a vise supported on a table. The drill may be gripped in a chuck with three jaws that move radially in unison, or it may have a tapered shank that fits into a tapered hole in the spindle. Means are provided for varying the spindle speed and (on some machines) for automatically feeding the drill into the work piece. *See also* boring machine. A drilling machine, in which a vertical drill, moves into the work, which is stationary.

5. The lathe machine

Lathe (lā*th*), machine tool for holding and turning metal, wood, plastic, or other material against a cutting tool to form a cylindrical product or part. It also drills, bores, polishes, grinds, makes threads, and performs other operations. Its principal parts are the headstock (attached to the bed or base of the machine), which holds one end of the

material in a rotating spur; the tailstock, which holds the other end, moves along the bed, and can be clamped in position at any point; the cutting tool; and the power feed, comprising the drive and its motive parts.
Machine tool that performs turning operations in which unwanted material is removed from a work piece rotated against a cutting tool. Lathes are among the oldest and most important machine tools, used in France from 1569 and important in the Industrial Revolution in England, when they were adapted for metal cutting. Lathes (usually called engine lathes) today has a power-driven, variable-speed horizontal spindle to which the work holding device is attached. Operations include turning straight or tapered cylindrical shapes, grooves, shoulders, and screw threads and facing flat surfaces on the ends of cylindrical parts. Internal cylindrical operations include most of the common hole-machining operations, such as drilling, boring, reaming, counter boring, countersinking, and threading with a single-point tool or tap. *See also* boring machine.
Lathe: A machine for shaping, boring, facing, or cutting a screw thread in metal, wood, etc., in which the work piece is turned about a horizontal axis against a fixed tool
The lathe machine is regarded as the father of all machine tools because apart from being used for turning cylindrical surface (external and internal) it can perform other operations which are peculiar to other machines.
Thus, it is possible to carry out the following operations on the lathe machine:

- Turning (production of cylindrical of flat such as plumb bulb, centre punch)
- Facing (production of flat surfaces)
- Screw cutting (external and internal)
- Grinding (external and internal)
- Slotting
- Taper turning (production of conical surface)

Parts of the lathe machine

1. Bed: This provides a plane surface for mounting and moving accessories at a constant level.
2. Head stock: This holds the main spindle and houses the arrangement for driving and speed variation
3. Main spindle: This rotates the work and transmits movement to saddle.
4. Tailstock: It is used to support work being turned between centres.
5. Saddle and cross slide: These are used for mounting the tool for cylindrical work.
6. Lead screw: Moves the saddle at rates relative to the rotation of the work.
7. Compound slide: This permit movement of the tools at angles other than a right angle (e.g. for conical work)
8. Centres: These support work drilled at end centres
9. Steadies: These support work to prevent bending. They can be either of fixed type bolted to the end of the bed, or of the traveling type bolted to the saddle which prevents vibration during machining of long and slender shafts.

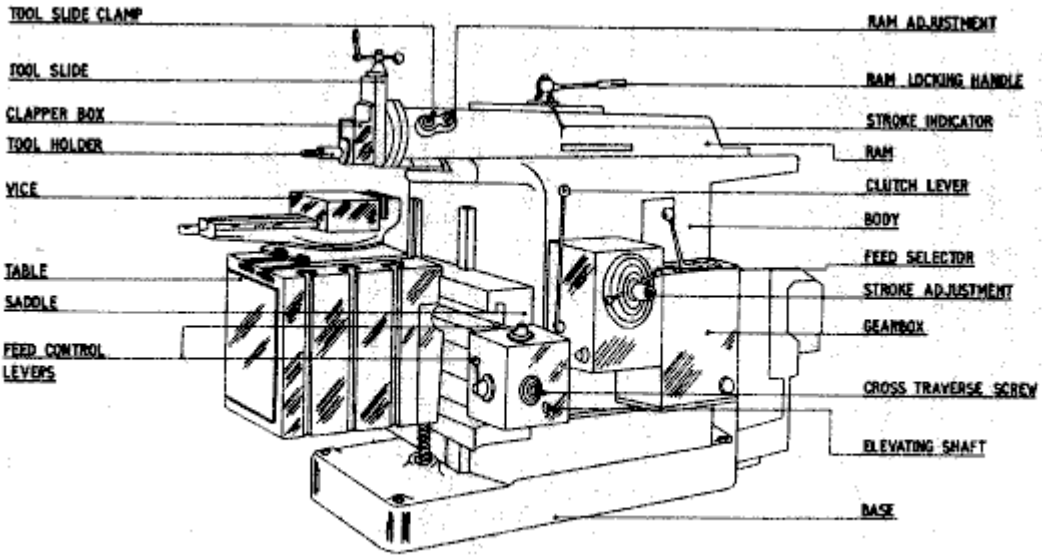
Wood holding methods

Work holding methods on a lathe machine include:

- Catch and center: This method is used when matching ordinary work between centres. Matching between centres is used when chuck matching is impossible.
- Face plate: The pace plate has slots for clamping or holding jobs with T-bolts Chuck: A chuck holds cylindrical work which is to be done in setting. It may be of the three-jaw, self-centering, chuck which grips irregular jobs more efficiently than three-jaw chuck.

Name: _____ Class: _____

6. SHAPER



SHAPER

A shaper is analogous to a planer, but smaller, and with the cutter riding a ram that moves above a stationary workpiece, rather than the entire workpiece moving beneath the cutter. The ram is moved back and forth typically by a crank inside the column; hydraulically actuated shapers also exist.

Operation

Shaper linkage. Note the drive arm revolves less for the return stroke than for the cutting stroke, resulting in a quicker return stroke and more powerful cutting stroke.

A shaper operates by moving a hardened cutting tool backwards and forwards across the workpiece. On the return stroke of the ram the tool is lifted clear of the workpiece, reducing the cutting action to one direction only.

The workpiece mounts on a rigid, box-shaped table in front of the machine. The height of the table can be adjusted to suit this workpiece, and the table can traverse sideways underneath the reciprocating tool, which is mounted on the ram. Table motion may be controlled manually, but is usually advanced by an automatic feed mechanism acting on the feedscrew. The ram slides back and forth above the work. At the front end of the ram is a vertical tool slide that may be adjusted to either side of the vertical plane along the stroke axis. This tool-slide holds the *clapper box* and toolpost, from which the tool can be positioned to cut a straight, flat surface on the top of the workpiece. The tool-slide permits feeding the tool downwards to deepen a cut. This adjustability, coupled with the use of specialized cutters and toolholders, enable the operator to cut internal and external gear tooth profiles, splines, dovetails, and keyways.

The ram is adjustable for stroke and, due to the geometry of the linkage, it moves faster on the return (non-cutting) stroke than on the forward, cutting stroke. This action is via a *slotted link* or *whitworth* link.

USES

The most common use is to machine straight, flat surfaces, but with ingenuity and some accessories a wide range of work can be done. Other examples of its use are:

Evaluation

1. State the function of the following:
    - Shaping machine
    - Planing machine

- Milling machine

2. State the function of the following:
    - Grinding machine
    - The drill press
    - The lathe machine

Reading Assignment
Read more about METALWORK MACHINES

Reference Materials
1. MELROSE BASIC SCIENCEBASIC TECHNOLOGY BOOK 2, page 106-113
2. NERDC, Introductory Technology for JSS, book 3, pages 84 - 112

WEEKEND ASSIGNMENT
1. Which of the following is a machine tool A. Circular sawing machine B. Surface planing machine C. Milling machine D. Thicknessing machine
2. Which of the following is used to rotates the work and transmits movement to saddle of a lathe A. the bed B. the headstock C. the saddle cross slide D. main spindle
3. Which of the following provides a plane surface for mounting and moving accessories at a constant level on a lathe machine A. the bed B. the headstock C. the saddle cross slide D. main spindle
4. Which of the following permits movement of tool at angle other than right angle (e.g. for conical work) A. the compound slide B. the head stock C. the slide cross slide D. main spindle
5. The following are work holding methods except A. catch and carrier B. face plate C. saddle D. chuck

Theory
1. State the function of the following:
    - Shaping machine
    - Planing machine
    - Milling machine
2. State the function of the following:
    - Grinding machine
    - The drill press
    - The lathe machine

WEEK TEN **DATE: _____**
TOPIC: FRICTION
CONTENT
- **Meaning of Friction**
- **Advantages and Disadvantages of Friction**
- **How to Reduce Friction**

MEANING OF FRICTION
When a body slides over the surface of another body, there is opposing force acting opposite to the direction of motion. This opposing force is called **FRICTION**. Friction is therefore the force that opposes the relative motion between two surfaces that are in

contact. Friction is required in most of the things we do. For instance, to be able to run, friction is required between the shoe and the ground. Also, a car must maintain friction between its tyres and the road to be able to move forward. It is also important to note the following:

i. The rougher the surfaces rubbing against each other, the more the friction
ii. The smoother the surfaces rubbing against each other, the less the friction

ADVANTAGES OF FRICTION

1. With the help of friction it is possible to walk freely.
2. Without friction the brake of a motor car cannot work.
3. Buildup of friction between the bolts and nuts help them to stay tightened.
4. A ladder positioned against a vertical wall will not slide due to friction between the ladder and the wall

DISADVANTAGES OF FRICTION

1. It reduces the efficiency of machines
2. It causes wear and tear in machines
3. It reduces motion
4. It causes the heating of engines

EVALUATION

1. What is friction?
2. State two advantages and two disadvantages of friction.

APPLICATIONS OF FRICTION

1. Friction between the matchbox and the matchstick creates light
2. In sharpening a knife with a file, friction is also employed
3. In sharpening a pencil, friction is required between the sharpener blade and the pencil for sharpening to take place.
4. Materials used for making floors in homes and offices must be of high friction to provide a firm grip for the feet.

HOW TO REDUCE FRICTION

1. Lubricating: This involves the use of oily substance such as oil, grease and other material, that makes surfaces smooth and slippery, thereby reducing heat, wear, friction and vibration caused when two or more surfaces rub together.
2. Polishing: Friction between two surfaces in contact can be reduced by polishing them
3. Streamlining: It helps to reduce friction due to the shape of an object
4. Use of belt drives and pulley

EVALUATION

1. State four methods of reducing friction
2. List four applications of friction

READING ASSIGNMENT

Read more about METALWORK MACHINES

REFERENCE MATERIALS;

- MELROSE BASIC SCIENCEBASIC TECHNOLOGY BOOK 1, page 77-79
- NERDC, Introductory Technology for JSS, book 3, pages 146 – 148

Name: _____ Class: _____

WEEKEND ASSIGNMENT

1. Lubricant oil and grease in engines are used to reduce……. A. Tension B. Friction C. Gravity D. Magnetic
2. A force that can slow moving objects is called ……... A. Gravity B. Magnetic force C. Contact force D. Friction
3. ……. helps to reduce friction due to the shape of an object A. Polishing B. Streamlining C. Lubricating D. driving
4. Materials used for making floors in homes and offices must be of A. Low friction B. equal friction C. unequal friction D. high friction
5. Which of the following is not a method of reducing friction A. Heating B. Lubricating C. Streamlining D. Polishing.

THEORY

1. List four applications of friction
2. State two advantages and two disadvantages of friction