GEOMETRIC

CONSTRUCTIONS
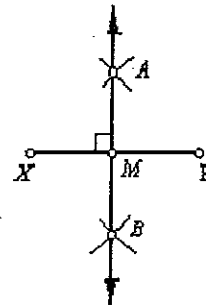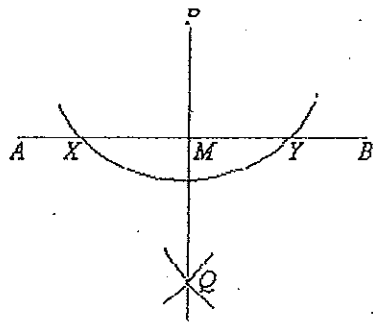
LESSON 1: Constructing Regular Polygons in a Circle

Task: Construct a regular pentagon inside a circle so all vertices are on the circle.
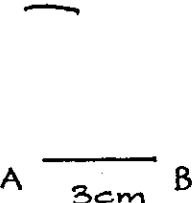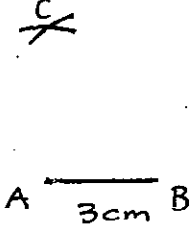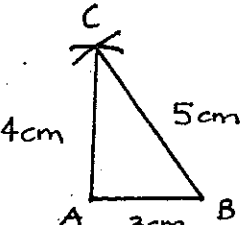
You will need: a sharp pointed lead pencil, a protractor & a ruler

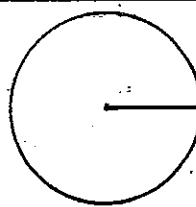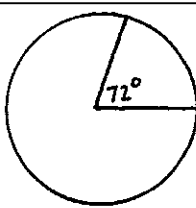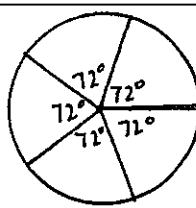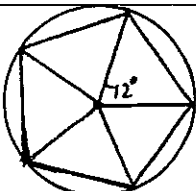|	
▪ Use your compass to <u>draw</u> a circle	
▪ A regular pentagon has 5 equal sides as well as 5 equal angles, So <u>each angle</u> at the centre must be $360° ÷ 5 = 72°$	
▪ From the center of the circle, use your ruler and pencil to draw a <u>radius</u> to the edge of the circle.	
▪ Using your <u>protractor</u>, measure 72° and draw the angle/arm to the edge of the circle.	
▪ <u>Repeat</u> step 4 until all 5 angles are drawn	
▪ Using your pencil <u>join</u> where the arms of each angle meet the circle	

LESSON 2:   Constructing a Triangle given Three Sides

Task: Construct a triangle with side lengths AB=3 cm, BC=4 cm and AC=5 cm.
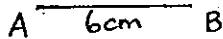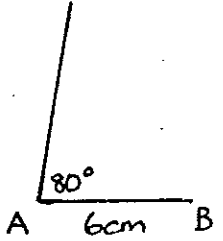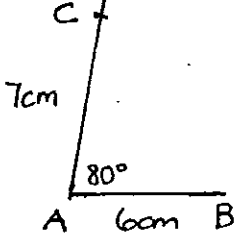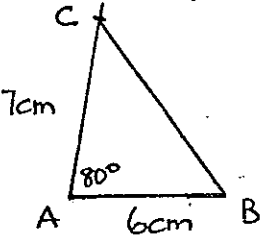
You will need: a sharp pointed lead pencil, a compass & a ruler

• Draw one side of the triangle using a ruler and pencil – let us draw 3 cm. • Label this interval AB – that is, one end of the line is A and the other end is B	A —3cm— B
• Open up your compass to 4cm • Put the compass point at A • Draw an arc above the line AB	A —3cm— B
• Open up your compass to 5cm • Put the compass point at B • Draw an arc above the line AB so that it crosses the arc drawn in the step above • Where the two arcs cross label this C.	C A —3cm— B
• Join the endpoint A to the point C • Join the endpoint B to the point C • Label the length of each side YOU HAVE JUST DRAWN THE TRIANGLE WITH SIDE LENGTHS 3cm, 4cm & 5cm. You can always check by measuring each side with your ruler!!!	C 4cm 5cm A 3cm B

Constructing a Triangle given Two Sides and an Angle

Task: Use a ruler & protractor to construct a triangle with
AB=6cm, ∠BAC=80° and BC= 7cm

You will need: a sharp pointed lead pencil, a protractor & a ruler
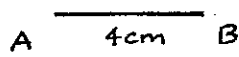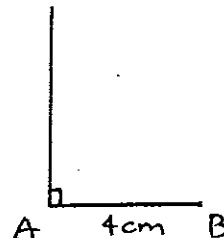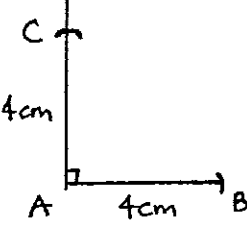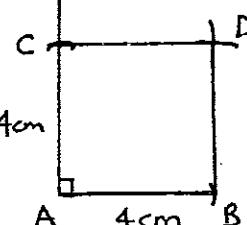
• __Draw__ one side of the triangle using a ruler and pencil – let us draw AB = 6 cm	A ⎯⎯ 6cm ⎯⎯ B
• Use your <u>protractor</u> to measure and draw an angle of 80°	80° A 6cm B
• Use your <u>ruler</u> to measure 7cm along the arm you have just drawn for your angle. • __Label__ this point C	C 7cm 80° A 6cm B
• __Join__ B to C. *** Make sure you label the vertices, side lengths and angle *** YOU HAVE JUST DRAWN THE TRIANGLE WITH SIDE LENGTH 6cm, 7cm & ANGLE 80°	C 7cm 80° A 6cm B

LESSON 3:   <u>Constructing Quadrilaterals</u>

<u>Task:</u>   Construct a square of side length 4cm

<u>You will need</u>: a sharp pointed lead pencil, a protractor, a compass & a ruler

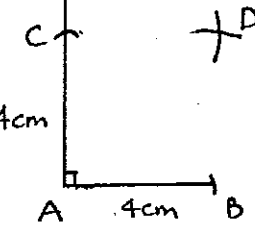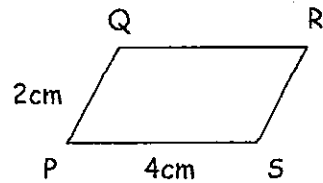|	
▪ <u>Draw</u> a line 4 cm long ▪ <u>Label</u> this line AB – that is, one end of the line is A the other end is B	A 4cm B
▪ Use your <u>protractor</u> to measure and <u>draw</u> a right angle (90°) at A.	A 4cm B
▪ Open up your <u>compass</u> to 4cm ▪ Put the compass point at A ▪ <u>Draw</u> an arc along the arm AB ▪ <u>Draw</u> an arc along the other arm ▪ <u>Label</u> where the arc crosses this arm C	C 4cm A 4cm B
▪ Keep your compass at 4cm ▪ Put the compass point at C ▪ <u>Draw</u> an arc above B ▪ Put the compass at B ▪ <u>Draw</u> an arc above B to cut the arc just drawn ▪ Call this point D	C D 4cm A 4cm B
▪ Join C to D and B to D to form a square **Make sure to label <u>each</u> vertex as well as <u>one</u> side ** YOU HAVE JUST DRAWN A SQUARE WITH SIDE LENGTH 4cm – check with a ruler to make sure	C D 4cm A 4cm B

Task: Construct this parallelogram:

You will need: a sharp pencil, a protractor & a ruler
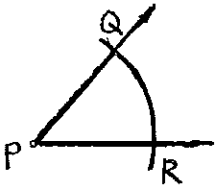
Q   R

2cm

P   4cm   S
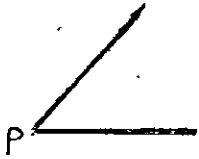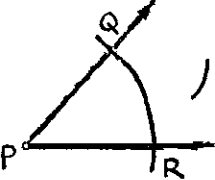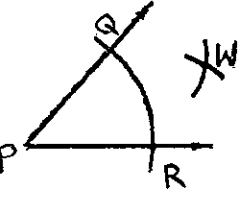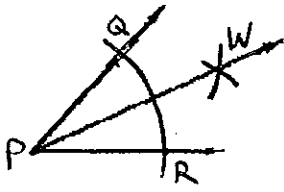
■ Draw a line 4 cm long ■ <u>Label</u> this line PS – that is, one end of the line is P the other end is S	P 4cm S
■ Use your protractor to measure and <u>draw</u> a 70° angle at P.	70° P 4cm S
■ Use your ruler to measure 2cm along the new arm ■ Label this point Q	Q 2cm 70° P 4cm S
■ Draw a line through Q, parallel to PS (slide your ruler up 2cm)	Q 2cm 70° P 4cm S
■ Draw a line through S, parallel to PQ (slide your ruler to the right 4 cm) ■ Where the two new lines cross, label this point R	Q R 2cm 70° P 4cm S
■ PQRS is a parallelogram *** Make sure you label your parallelogram! ***	Q R 2cm 70° P 4 cm S

LESSON 4:   Bisecting Angles

Bisecting something simply means cutting it into two equal halves.

You will need: a sharp pointed lead pencil, a compass, a ruler & a protractor

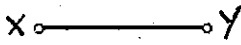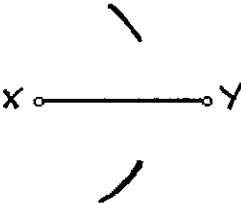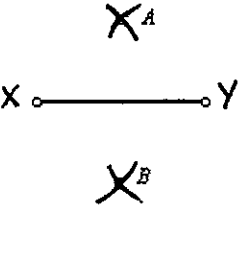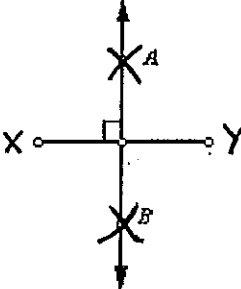|	
• Look at the angle P	
• Firmly place the point of your <u>compass</u> at point P • Open your compass so that it is about <u>half</u> the length of one arm • Draw a semi-circle so that it crosses through <u>each</u> arm of the angle. • Label the points of intersection Q, R respectively	
• Leaving the compass open at <u>exactly the same width</u>, place the point firmly at the Q • Draw another arc between the two arms of the angle <u>away</u> from the vertex	
• Leaving the compass open at <u>exactly the same width</u>, place the point firmly at the R • Draw another arc between the two arms of the angle <u>away</u> from the vertex so that it crosses the arc just drawn • Label the point of intersection W	
• With a ruler and pencil, <u>join</u> the vertex P to the point W YOU HAVE JUST <u>BISECTED</u> THE ∠P *** To check that you have bisected ∠P, <u>measure</u> each angle with a <u>protractor</u> ***	

Bisecting an Interval

<u>You will need</u>: a sharp pointed lead pencil, a compass, a ruler & a protractor

▪ Look at the interval XY	X o————o Y
▪ Firmly place the point of your <u>compass</u> at X ▪ Open your compass so that it is <u>more than half</u> the length of the interval ▪ Draw <u>two</u> arcs, one directly <u>above</u>, the other directly <u>below</u> the centre of the interval	\\ X o————o Y /
▪ Leaving the compass open at <u>exactly the same width</u>, place the point firmly at Y ▪ Draw <u>two</u> arcs, one directly <u>above</u>, the other directly <u>below</u> the centre of the interval so that they cross the two other arcs you have already drawn ▪ Label the points of intersection A, B respectively	X^A X o————o Y X^B
▪ With a pencil and ruler, draw a straight line <u>joining</u> point A to point B YOU HAVE JUST <u>BISECTED</u> THE INTERVAL X Y *** To check you have bisected AB, <u>measure</u> each half of the interval with a ruler ***	X^A X o——□——o Y X^B

The new line is called the <u>PERPENDICULAR BISECTOR</u> of the interval AB, meaning that it cuts the interval into 2 equal parts <u>AND</u> makes an angle of 90° (right angle) with the interval.
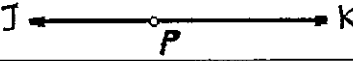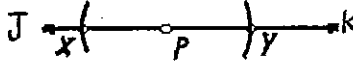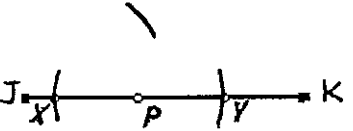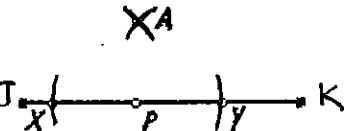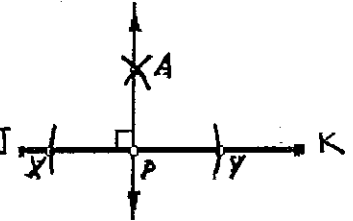
*** Check this by <u>measuring the angle</u> between the two lines ***

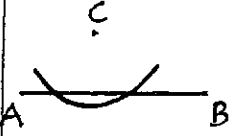LESSON 5:   <u>Constructing Perpendicular Lines</u>
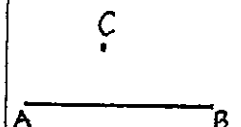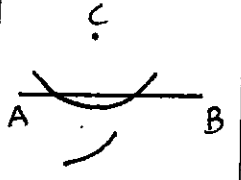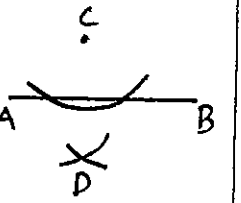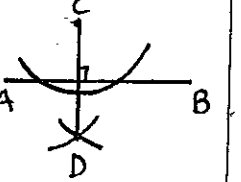
<u>Task</u>:   Draw a line from P, perpendicular to the interval JK

<u>You will need</u>: a sharp pointed lead pencil, a compass, a ruler & a protractor

▪ Look at the interval JK	J ←————o————→ K P
▪ Firmly place the point of your <u>compass</u> at P ▪ Open your compass so that it is <u>shorter than the intervals JP and PK</u> . ▪ Draw <u>two</u> arcs, one on either side of the point P through the intervals JP and PK ▪ Label the points of intersection X and Y	J ←(o)→ K X P Y
▪ Place your compass point at X ▪ Open out the compass so that it reaches past the point P ▪ Draw an arc that reaches above the point P	J ←(o)→ K X P Y
▪ Leaving the compass open at <u>exactly the same width</u>, place your compass point at Y ▪ Draw an arc that reaches above the point P which crosses the arc just drawn ▪ Label the point of intersection A	X A J ←(o)→ K X P Y
▪ With a pencil and ruler, join the point P to the point A YOU HAVE JUST DRAWN A RIGHT ANGLE AT P ** Use your protractor to check that you have drawn a right angle at B ** **Don't forget to label the right angle with a small square at the angle B**	X A J ←(o)→ K X P Y

<u>Task</u>: Draw a line through C, perpendicular to AB

<u>You will need</u>: a sharp pointed lead pencil, a compass, a ruler & a protractor

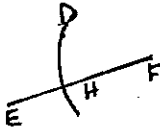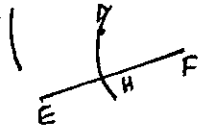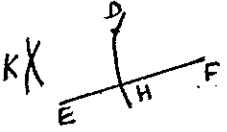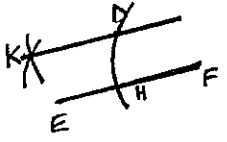|	
▪ Look at the interval AB and the point C (not on AB)	C A ————— B
▪ Firmly place the point of your <u>compass</u> at C ▪ Open your compass so that it reaches over the interval AB ▪ Draw a semi circle through the interval AB (cuts the interval AB twice)	C
▪ Leaving the compass open at <u>exactly the same width</u>, place your compass point at one of the points where the semi-circle crosses the interval AB ▪ Draw an arc below the interval AB, below the point C	C
▪ Leaving the compass open at <u>exactly the same width</u>, place your compass point at the other point where the semi-circle crosses the interval AB ▪ Draw an arc below the interval AB, below the point C, which crosses the last arc just drawn ▪ Where the last two arcs cross, label this point D	C A ———— B D
▪ With a pencil and ruler, join point C to point D YOU HAVE JUST DRAWN A PERPENDICULAR (RIGHT ANGLE) FROM C TO AB ** Use your protractor to check that you have drawn a right angle at B ** **Don't forget to label the right angle with a small square at the angle **	C A ———— B D

LESSON 6:   Constructing Parallel Lines

Task: Draw a line passing through D, and parallel to EF

**You will need**: a sharp pointed lead pencil, a compass & a ruler

▪ Look at the interval EF and the point D (not on EF)	
▪ Firmly place the point of your <u>compass</u> at F ▪ Open your compass so that it reaches the point D exactly ▪ Draw an arc passing through D and crossing EF ▪ Where this arc crosses EF, label this point H	
▪ Leaving the compass open at <u>exactly the same width</u>, place your compass point at D ▪ Draw an arc to the left of D	
▪ Leaving the compass open at <u>exactly the same width</u>, place your compass point at H ▪ Draw an arc to the left of D so that it crosses the arc just drawn ▪ Where these arcs cross, label this point K	
▪ With a pencil and ruler, join point K to point D YOU HAVE JUST DRAWN A LINE WHICH IS PARALLEL TO EF, THROUGH THE POINT D (NOT ON EF) *** i.e. DK ‖ EF ***	

1. Need to able to perform the following geometrical constructions:
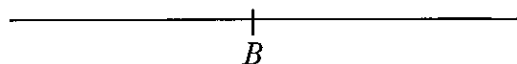
a. Construct a line segment of 6 cm long.

b. Bisect a line segment of 8 cm long.
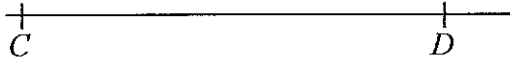
c. Construct an angle of 60^0 at A.

$$A$$
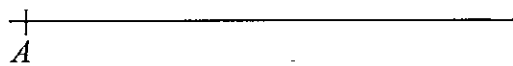
d. Bisect the angle in part (c) into two 30^0 angles.

e. Construct a right angle at B.

$$B$$

f. Construct a line parallel to the line *CD*.

C   D

Drawing geometrical figures:
Students may be asked to construct or draw geometrical figures showing their properties, e.g.

(1) Construct an equilateral triangle with side 6 cm.

(2) Construct an isosceles triangle with base of length 4 cm and base angles of 30^0.

(3) Construct a rhombus $ABCD$ with side $AB = 5$ cm and $\angle ABC = 50^0$.

(4) Draw a figure that has the following information: an equilateral triangle PQR has QR produced to S and S joined to P. The point T is the midpoint of PS and is joined to R.