Grade 9 Mathematics Worksheet

Geometry of straight-line, circles, and triangles

Questions:

1.   Read the entire question and the answers before you select the <u>most correct</u> answer.

   Concentric circles:
   A   Share the same radius
   B   Share the same midpoint
   C   Share the same midpoint but not the same radius
   D   Share the same midpoint and the same circumference

   In equilateral triangles
   A   All the angles are equal
   B   Two sides are equal
   C   There are two lines of symmetry
   D   One angle is obtuse

   In scalene triangles
   A   All the angles are equal
   B   Two sides are equal
   C   There are two lines of symmetry
   D   No sides or angles are equal

   In isosceles triangles
   A   All the angles are equal
   B   Two sides are equal
   C   There are two lines of symmetry
   D   One angle is obtuse

   In **any triangle** the smallest angle is always opposite the
   A   Smallest side
   B   Biggest side
   C   Middle side
   D   Smallest or middle side

   In **any triangle** on a flat surface or plane
   A   The sum of two angles are not bigger than 45^0
   B   The sum of two angles are bigger than 90^0
   C   The sum of three angles are not bigger than 90^0
   D   The sum of three angles are not bigger than 180^0

When two lines are **not** parallel

A   The alternate angles are equal

B   The corresponding angles are equal

C   The co-interior angles are equal

D   The alternate angles are not equal

When two lines are parallel

A   The alternate angles are equal

B   The corresponding angles are not equal

C   The co-interior angles are not equal

D   The alternate angles are not equal

Any two straight lines on an infinite plane

A   Will always intersect

B   Will never intersect

C   Will always be parallel

D   Will never be equal

Any angle on a plane

A   Consists of two rays of the same length

B   Consists of two rays of the same length that intersect at a vertex

C   Consists of two rays of different lengths that intersect at a vertex

D   Consists of two rays of different lengths that do not intersect at a vertex

A transversal is a

A   Line that cuts parallel lines only

B   Line that cuts any number of straight lines

C   Line that never cuts parallel lines

D   Line that cuts only two parallel lines

A plane consists of

A   Length and breadth and height

B   Three dimensions

C   Two dimensions

D   Zero dimensions

An arc

A   Is a straight line

B   Has no length

C   Consists of two dimensions

D   Has length

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A chord of a circle
A   Can be the diameter
B   An never be the diameter
C   Consists of zero dimensions
D   Can also be called a tangent of that circle

A radius of a circle
A   Can be the diameter
B   Can never be a chord of the circle
C   Can be twice the diameter
D   Can also be called a tangent of that circle

Two interlocking circles
A   Can only cut in one point
B   Can only cut in two points
C   Can cut in an infinite number of points
D   Will never cut

Two interlocking circles with the same radius
A   Can only cut in one point
B   Can only cut in two points
C   Can cut in an infinite number of points
D   Will never cut

A tangent to a circle
A   Can only touch the circle in one point
B   Can touch the circle in two points
C   Can touch the circle in an infinite number of points
D   Will never touch the circle

2.   Given: $\triangle ABC$ and points D and E. Point D is on the extension of the straight line AC. Point E is any point. Join C and D with a straight line.
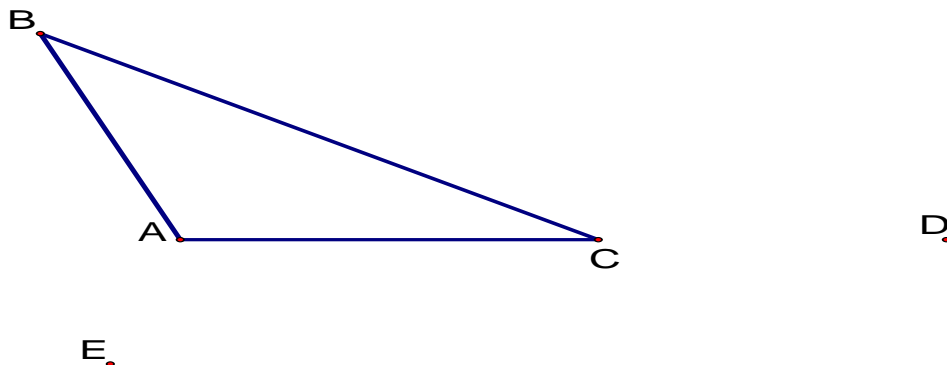
i)   Why can you say that angle ACB and DCB are supplementary?
ii)   What kind of angle pair is called supplementary?
iii)   Can we say that DCB is an exterior angle of a triangle? Why?
iv)   Give a definition of an exterior angle
v)   What elements (sides and vertices) does the exterior angle of a triangle have in common with the triangle itself?
vi)   Describe the position of the side of the exterior angle, which does not belong to the triangle

3.   Join points A and E with a straight line.
i)   Does BAE have elements in common with $\triangle ABC$?
ii)   Can BAE and BAC be called supplementary angles? Explain

4.   Construct an exterior angle to $\triangle ABC$ at vertex A, so that AB is the common side to the exterior angle and the triangle.
        Construct another exterior angle of $\triangle ABC$, at vertex A.
i)   What side does this second angle have in common with $\triangle ABC$?
ii)   What does the construction of these two exterior angles consist of, if you use a ruler for it?

5.   i)   The intersecting lines in the figure below forms a triangle
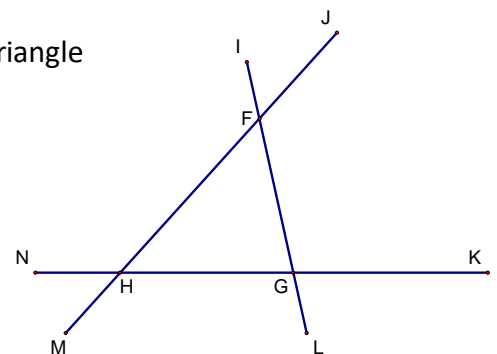
ii)   Copy this figure
    iii)   Label all the exterior angles of the triangle and write it down
    iv)   Define in words what kind of angle is called an exterior angle of a triangle
    v)   How many exterior angles can be obtained at each vertex of a triangle?
    vi)   Why can angle $I\hat{F}J, N\hat{H}M \text{ and } K\hat{G}L$, not be called exterior angles of the triangle?
    vii)   What are angles $I\hat{F}J, N\hat{H}M \text{ and } K\hat{G}L$, called relative to the interior angles of the triangle with which they share a vertex?

6.   i)   Mark the exterior angles of $\triangle OKL$. Write them down
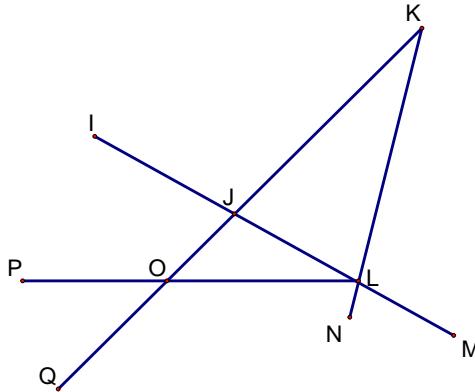
    ii)   Why can KJI not be called an exterior angle of this triangle
    iii)   Can KLM be called an exterior angle of this triangle? Why?
    iv)   Write a definition of the exterior angle of a triangle

7.   Draw two interlocking circles with a radius PQ of 5 cm. Your figure should look like this now. Connect the following points to get the following line segment. AB, AP, AQ, AD, CB, CP, CQ, CD.

    i)   Make a list of the shapes that you notice in this diagram and write the reason for classifying the shape in the table below
    ii)   Make a list of the other interesting relationships that you notice in the diagram and give reasons for these relationships
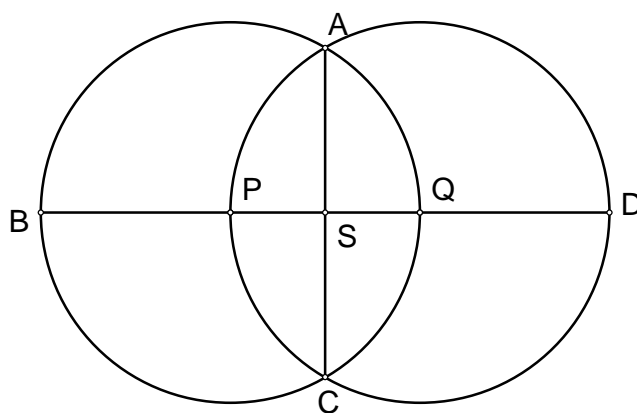
I	Triangles	Square	Rhombus	Convex Kite	Concave Kite	Trapezium
Name and reason for identifying shape						

Solution

Question	Answer
Concentric circles	C
In equilateral triangles	A
In scalene triangles	D
In isosceles triangles	B
In any triangle the smallest angle is always opposite the	A
In any triangle on a flat surface or plane	D
When two lines are not parallel	D
When two lines are parallel	A
Any two straight lines on an infinite plane	A
Any angle on a plane	C
A transversal is a	B
A plane consists of	C
An arc	D
A chord of a circle	A
A radius of a circle	C
Two interlocking circles	B
Two interlocking circles with the same radius	B
A tangent to a circle	A

1.

2. i)   Both lie in the straight line AD
    ii)   Two angles with a sum of 180°
    iii) It is supplementary and adjacent to one of the interior angles of a triangle
    iv)   It is supplementary and adjacent to one of the interior angles of a triangle
    v)   Common vertex and one of the sides of the triangle is also one of the rays of the exterior angle
    vi)   The side which is extended and forms a supplementary angle pair, of which the exterior angle forms one of the angles of the pair

3. i)   Yes. Vertex A and side BA
    ii)   No. They do not form a straight line when added together

4. i)   AB
    ii)   Two vertically opposite angles

5. iii) NHF, MHG and HFJ, JFG and FGK, HGL
    iv)   Angles adjacent to the interior angle of the triangle that forms a supplementary angle and sharing a common side
    v)   Two

      vi)   Not one of these angles form supplementary angles with the corresponding interior angle of the triangle

      vii)   Vertically opposite angles to the corresponding angles of the triangle

6.   i)   POK, NLO

      ii)   It does not share a side of the triangle

      iii)   No, because it does not share a side of the triangle

      iv)   Not one of these angles form supplementary angles with the corresponding interior angle of the triangle and forms a pair of vertically opposite angles around each vertex

7.   i)

    ii)

I	Triangles	Square	Rhombus	Convex Kite	Concave Kite	Trapezium
Name and reason for identifying shape	APB, BPC, APC, AQC, DQC, DQA (isosceles) APS, AQS, CQS, CSP, ASD, ASB,, CSB, CSD(right scalene) APQ, CQP, ABC, ACD (equilateral)	None, but can be drawn in by connecting T the midpoint of AD and J the midpoint of BC (AJCT is now a rectangle) Connect the midpoints of AJ and	ABCD and APCQ	AQCB and APCD	APCB and AQCD	PATC and AKLD

		TC to get two squares.				
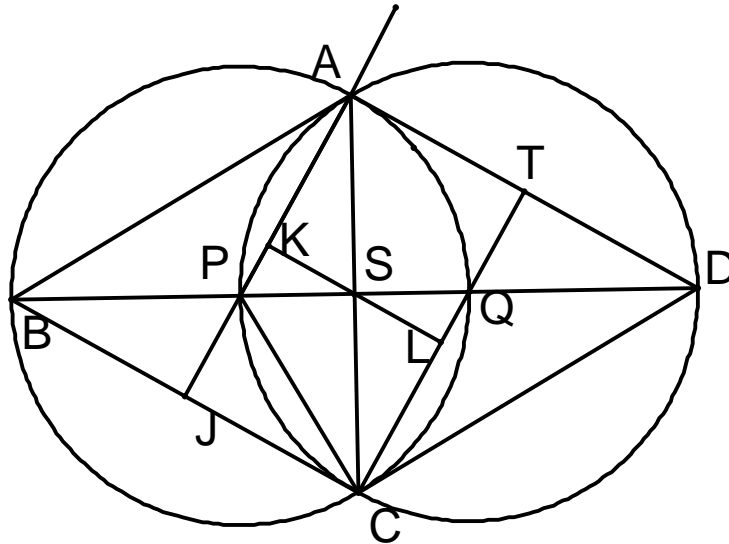
The pre-knowledge that is required is knowledge of properties of shapes as well as the effect of translating a given figure (Shape properties/size stay the same while orientation and position can change). In the case of the rigid transformations e.g. translation, reflection and rotation.

Shape properties/proportion changes while orientation and position can change). In the case of the non- rigid transformations e.g. dilations, shrinks, stretches.

The combined pre- knowledge should be used to identify the different shapes in the figure.

An extension activity could be to look at dilations and inflations of the various shapes on the grid.

The representation and introduction of terms related to solid objects should be carefully negotiated. Many of the concepts related to solid objects poses a conflict when represented on paper (e.g. skew lines looks as if they actually intersect on paper).