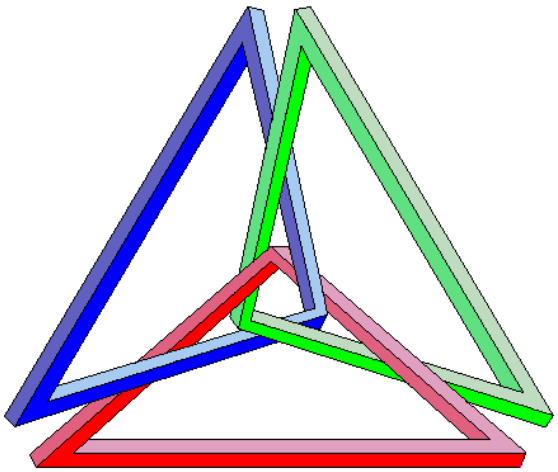
Grade 7

ANGLES, LINES AND TRIANGLES



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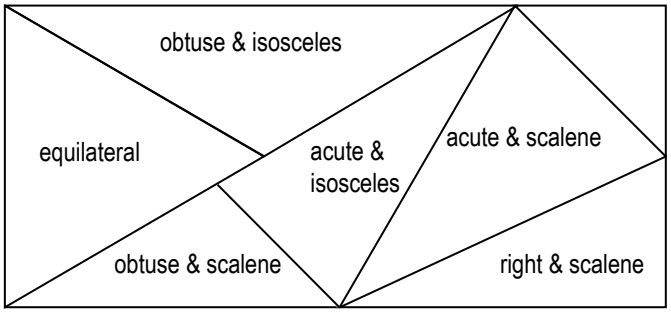

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1. ROTATIONS

We often turn things or parts of things. Today you may have:

Turned a doorknob
Turned a water tap on and off
Unscrewed the cap of a toothpaste tube
Turned your head to look at the person beside you

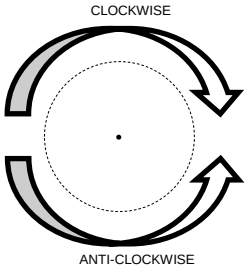
1.1 What other things turn, rotate, revolve or spin?

_____

_____

_____

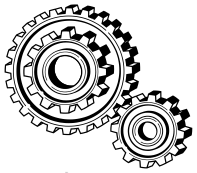
_____



A rotation is a mathematical term for a turn.

It has a centre (or point) of rotation, a direction of rotation (clockwise or anticlockwise) and a size of rotation measured in degrees.

A full rotation measures 360^o



1.2 What is the likely reason for the Babylonians (who lived 3000 to 2000 BCE and were great astronomers) choosing 360^o?

_____

_____

_____

_____

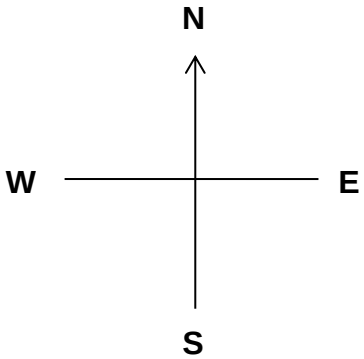
1.3 How many degrees is half of one rotation? _____

1.4. How many degrees is a quarter of one rotation? _____

1.5 Through how many degrees would you turn in going:

From facing **N**, turning clockwise to face **S**

_____



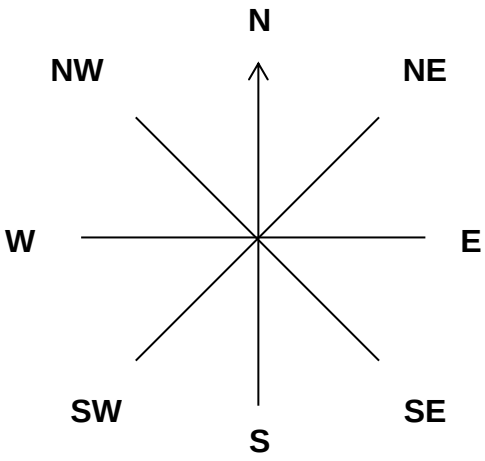
From facing **S**, turning anticlockwise to face **E**

_____

From facing **E**, turning anticlockwise to face **S**

_____

1.6 Through how many degrees would you turn in going:



From facing **N**, turning clockwise to face **NE** ____

From facing **NE**, turning clockwise to face **S** ____

From facing **S**, turning anticlockwise to face **SW** ____

From facing **SW**, turning clockwise to face **NW** ____

From facing **SW**, turning anticlockwise to face **NW** ____

1.7 In which direction would you be facing:

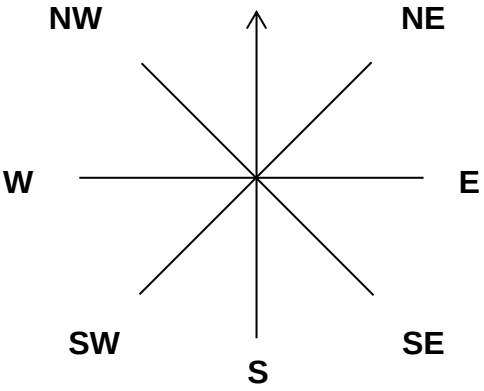
From facing N, turning anticlockwise 45°_____

From facing NE, turning clockwise 270° _____

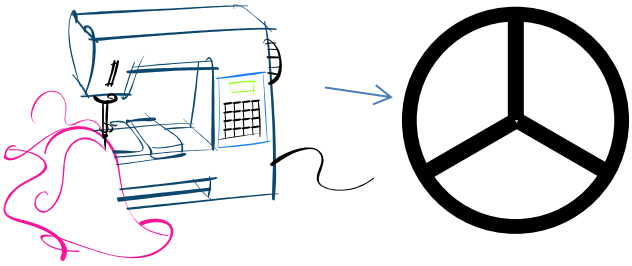
From facing S, turning clockwise 225°_____

From facing SE, turning anticlockwise 90°_____

From facing W, turning clockwise 135° _____



OPTIONAL



A sewing machine makes 3 stitches for every turn of the flywheel.

1.8 How many degrees does the flywheel turn when the machine makes:

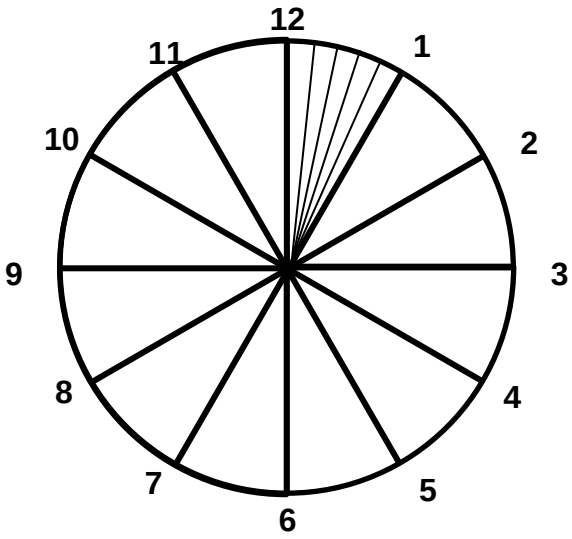
1 stitch _____ 2 stitches _____

6 stitches _____ 13 stitches _____

1.9 How many stitches does the machine make when it turns:

1 800° _____ 480° _____

960° _____ 60° _____



1.10 Through how many degrees does the minute hand of a clock turn in:

1 hour_____ 3 hours_____ 30 mins_____ 5 mins_____ 1 min_____

1.11 Through how many minutes does it take the minute hand of a clock turn:

60°_____ 270°_____ 720°_____ 54°_____ 3°_____

1.12 Through how many degrees does the hour hand of a clock turn in:

1 hour_____ 3 hours_____ 7 hours_____14 hours_____ 30 mins_____

1.13 Through how many hours does it take the hour hand of a clock turn:

120°_____ 180°_____ 720°_____ 330°_____ 45°_____

1.14 What is the angle between the hands of a clock at:

3,00am_____ 5,00pm_____6,00am _____12,30am_____ 3,30pm_____

15:00_____ 21:00_____ 05:30_____ 07:00_____ 12:00_____

1.15 What is the direction (clockwise or anticlockwise) and the estimated number of degrees of the rotation when you:

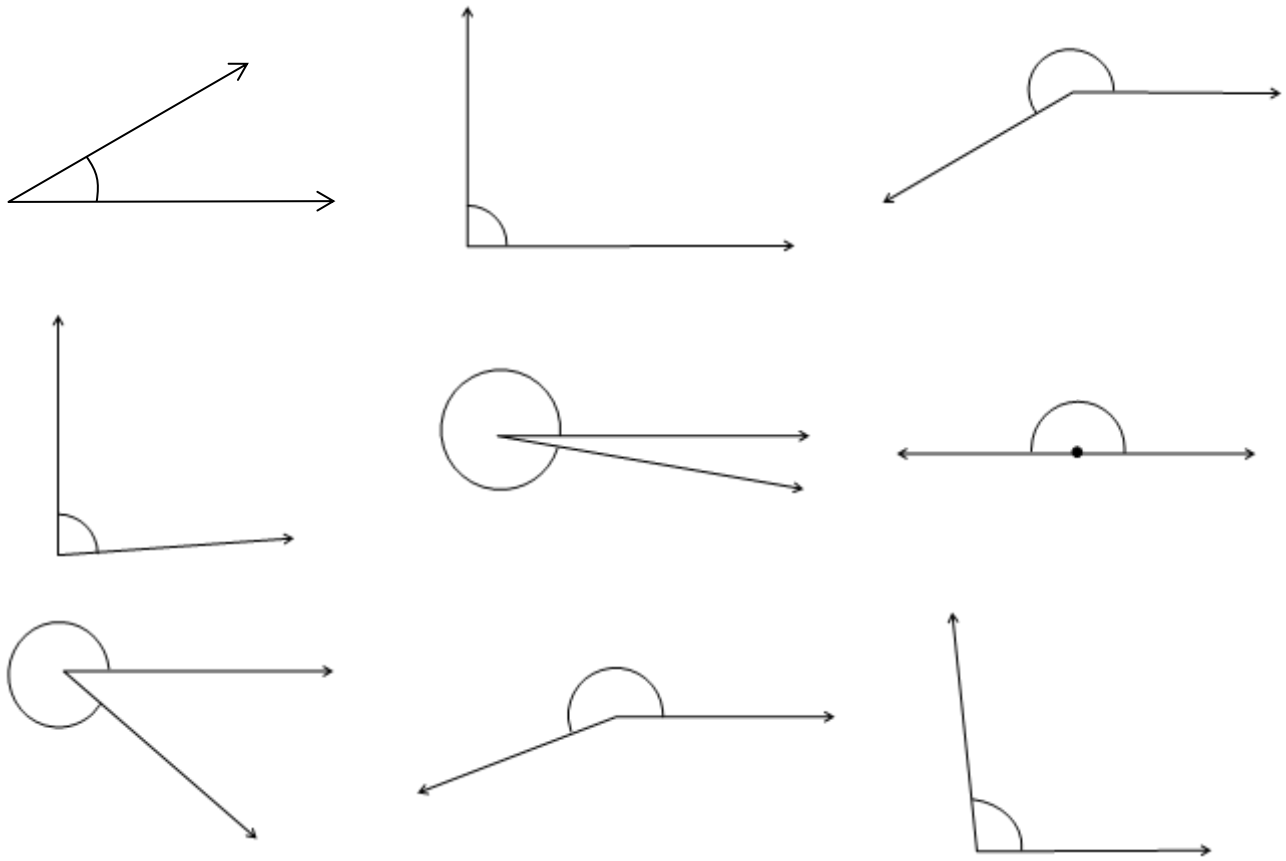
Turn right at a traffic light _____

Unlock your front door _____

unscrew the top off a bottle _____

Turn on the oven to 180^{o} _____

1.6 Estimate the sizes of the following rotations and write your answer in the rotation:



1.7 Use the line given to draw estimations of the following rotations (angles):

130°

270°

10°

170°

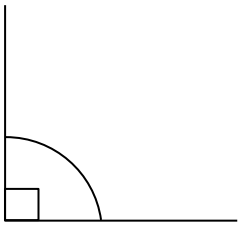
330°

200°

ANGLES

An object rotating about a point, rotates through an **angle**.

2. CLASSIFICATION (KIND) OF ANGLES



When a line is turned through a quarter of a whole rotation, the angle formed is called a right angle. Right angles are marked with a little square.

2.1 Give some examples of right angles:

_____

_____

_____

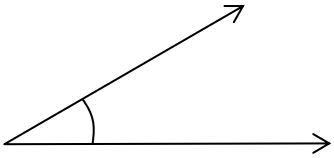
_____

An **acute angle** is less than 90°
A **right angle** is 90°
An **obtuse angle** is between 90° and 180°
A **straight angle** is 180°
A **reflex angle** is between 180° and 360°
A **revolution** is 360°

2.2 Classify the following angles:

48° _____ 3° _____ 359° _____

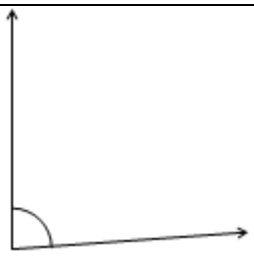
152° _____ 194° _____ 91° _____



_____

_____

_____



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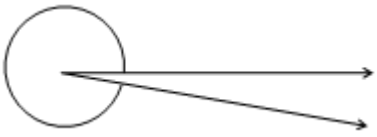

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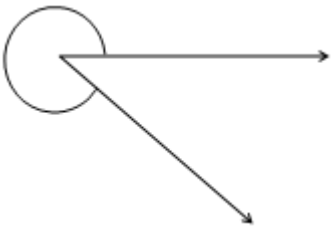

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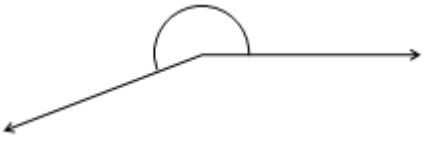

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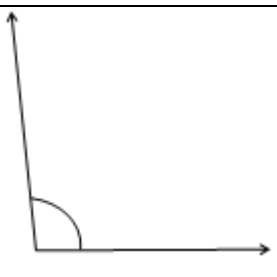

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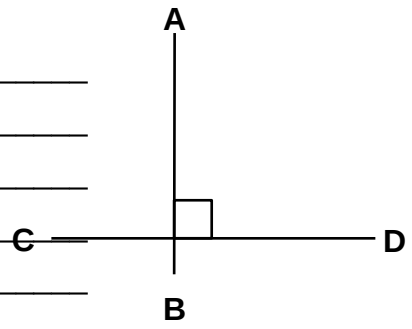
3. LINES

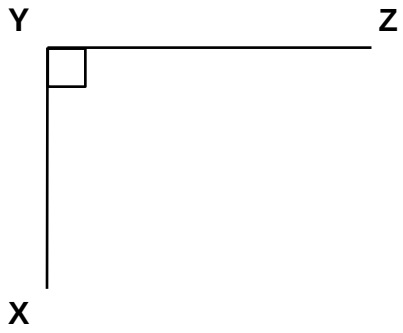
Two straight lines that intersect (cut) at right angles are **perpendicular** to each other

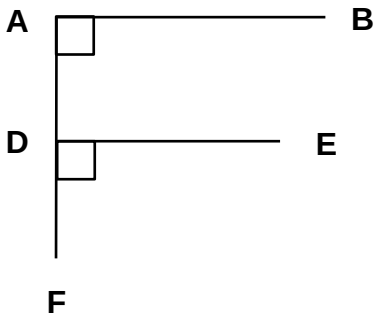
We write AB ⊥ CD.

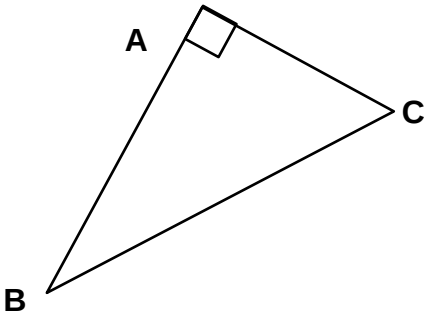
3.1 Give some examples of perpendicular lines:

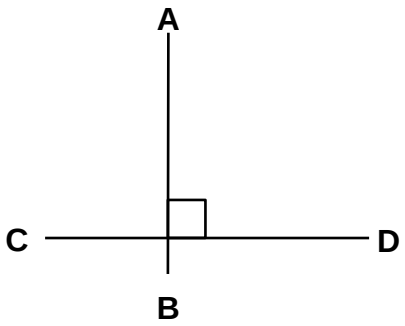


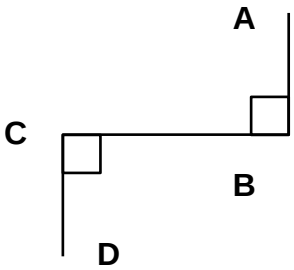
3.2 Name all the pairs of perpendicular lines in the following:

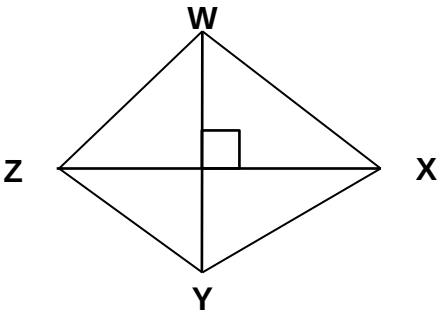




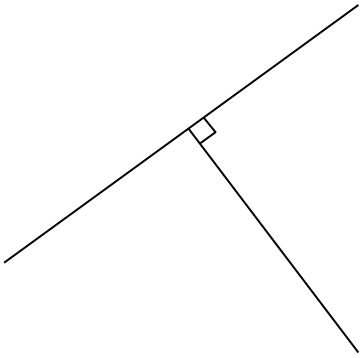


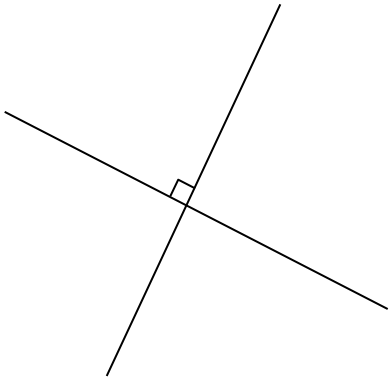


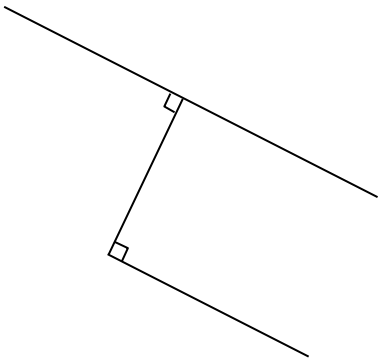


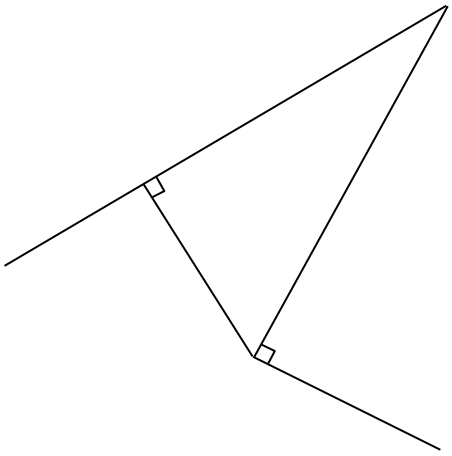


3.3 Use your set square and ruler to copy the following:









Lines which are the same distance apart and cannot meet are **parallel** to each other.

We write AB || CD and indicate that the lines are parallel with arrow heads.

3.4 Give some examples of parallel lines:

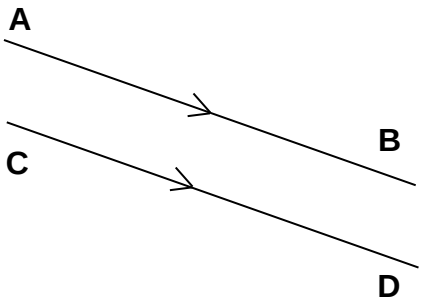
_____

_____

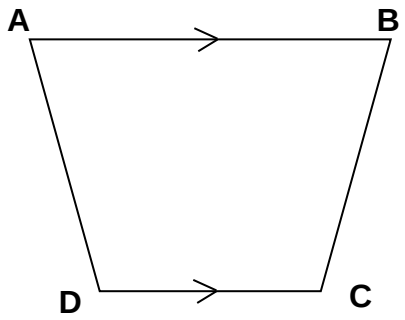
_____

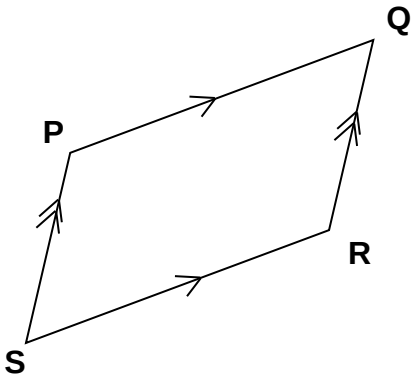
_____

_____



3.5 Name all the pairs of parallel lines in the following:





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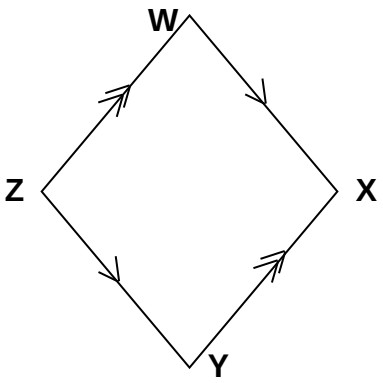
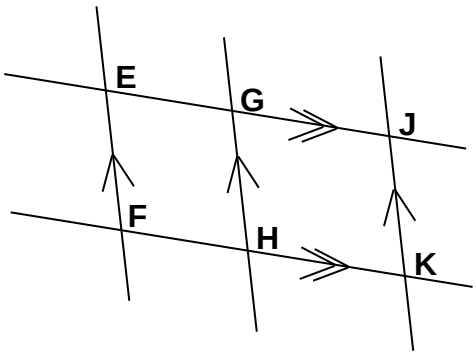




_____ _____

Lines which are parallel to the horizon are called **horizontal**.

3.6 Give some examples of parallel lines:

_____

_____

Lines which are perpendicular to the horizontal are called **vertical**.

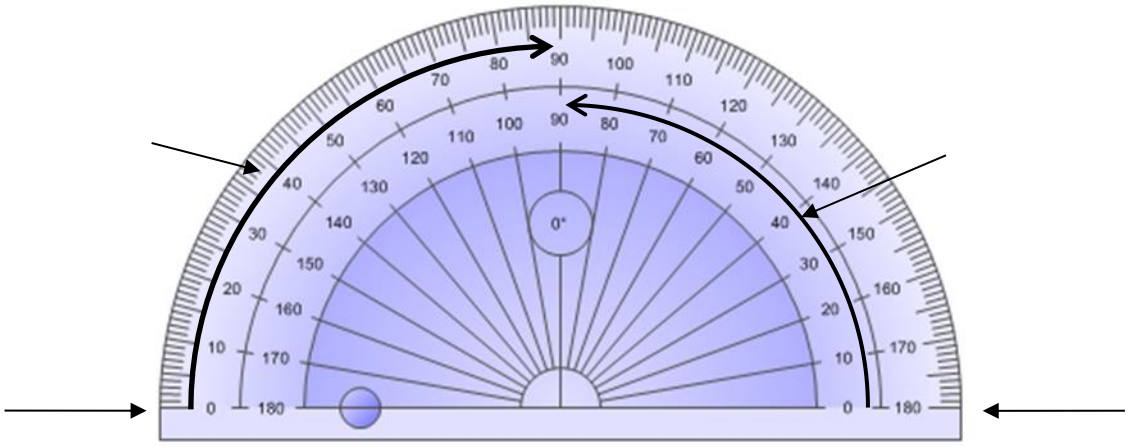
3.7 Give some examples of vertical lines:

_____

_____

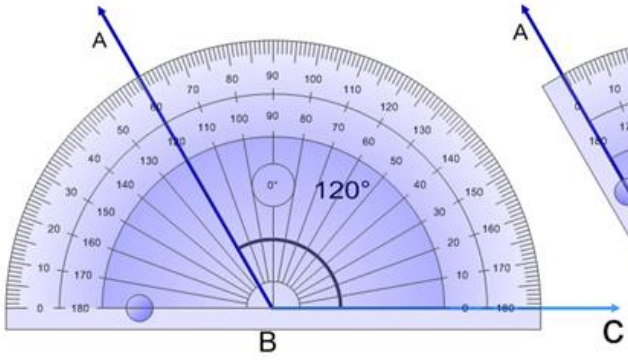
4. MEASURING AND CONSTRUCTING ANGLES

The protractor has two scales: an outer scale going from 0° → 180° clockwise and an inner scale going from 180° → 0° anticlockwise.

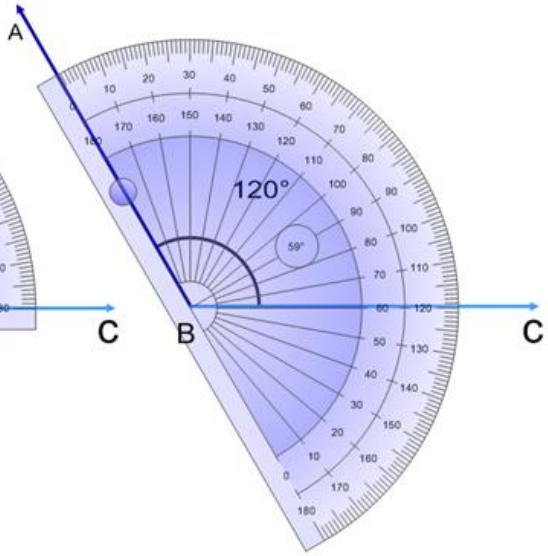


The centre of the protractor is placed at the centre of rotation with a zero line on one line. Every angle can be measured in 2 ways:

using the inner scale



using the outer scale



Textbook Exercise:
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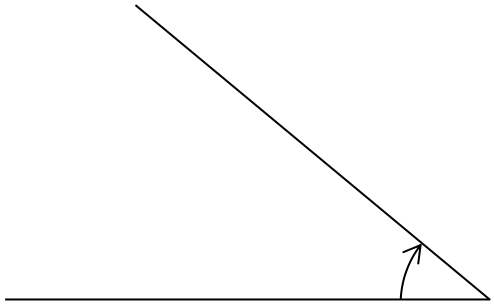
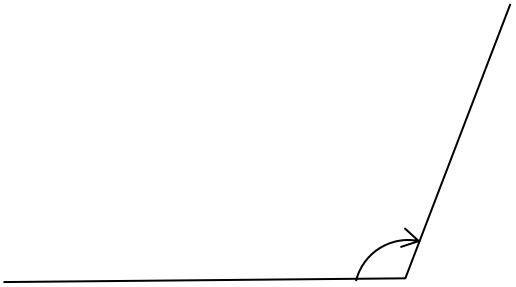
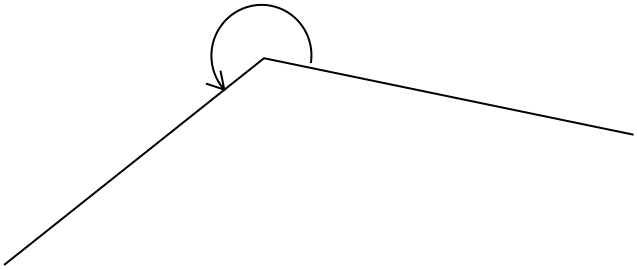
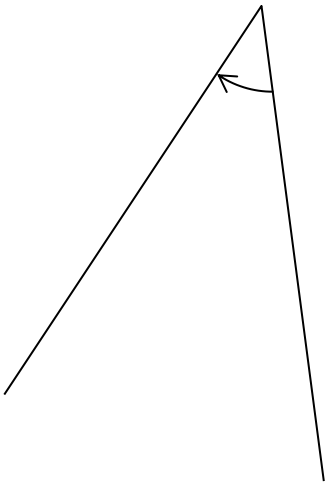
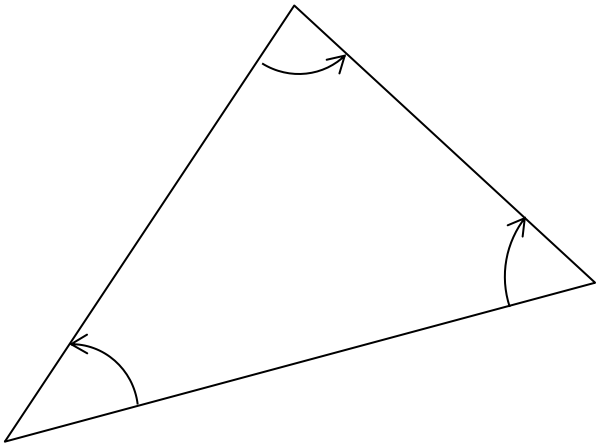
4.1 Measure the following angles accurately and record the sizes of the angles:

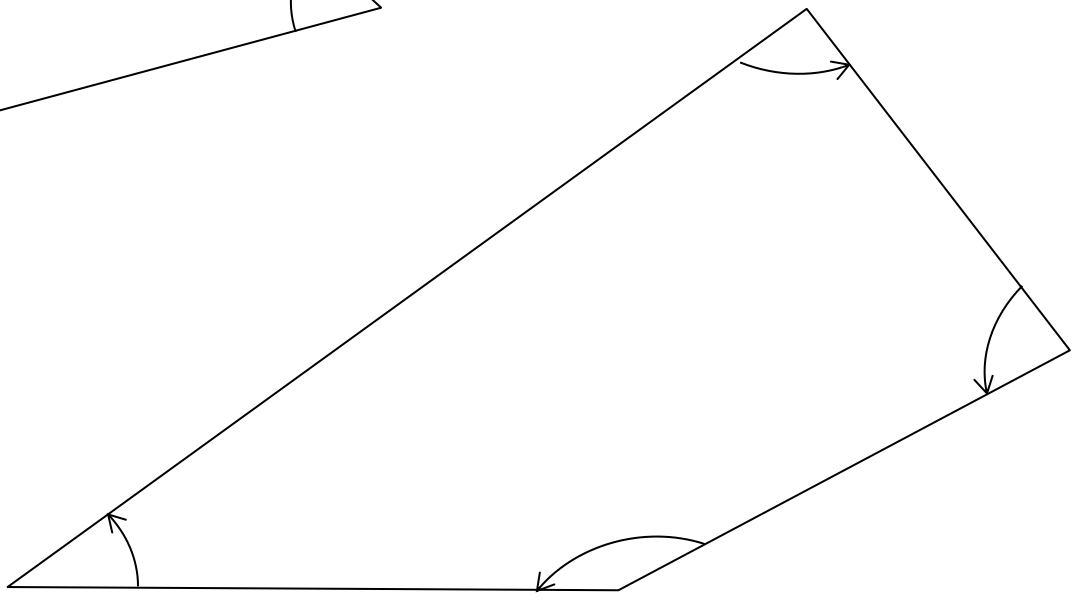




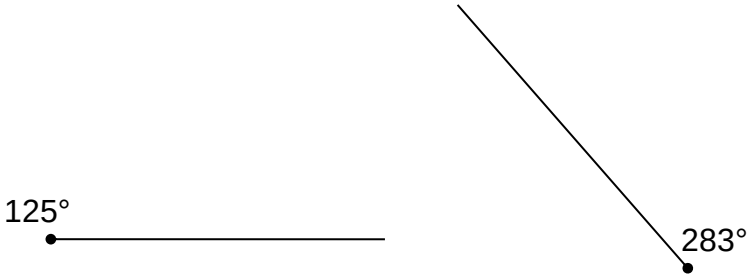


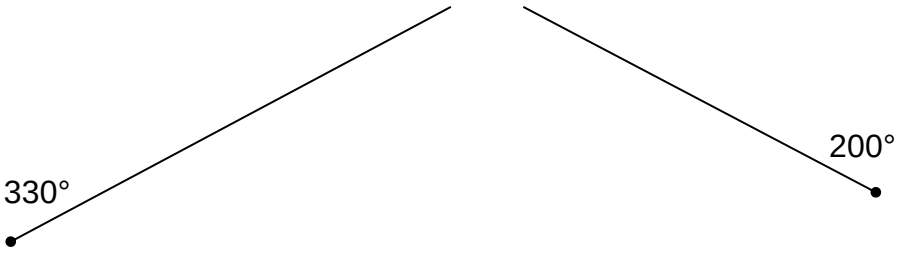


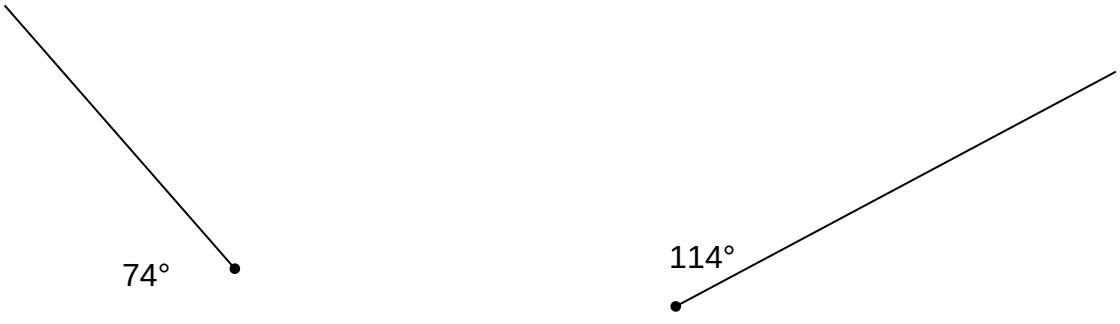




4.2 Use the line given to accurately draw the following angles:



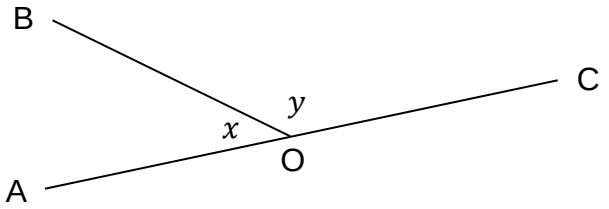




5. NAMING ANGLES

Any of lines OA, OB or OC can be rotated clockwise or anticlockwise about O onto any of the other lines. The rotations are the angles at O and point O is called the vertex of these angles.

To distinguish the various angles at O we write:

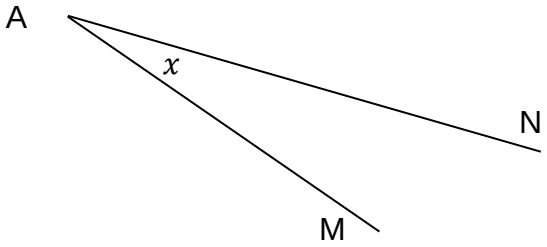


$A\hat{O}B$ or $B\hat{O}A$ or x

$B\hat{O}C$ or $C\hat{O}B$ or y

$A\hat{O}C$ or $C\hat{O}A$ or $x + y$

5.1 Consult the diagram alongside and complete the following:

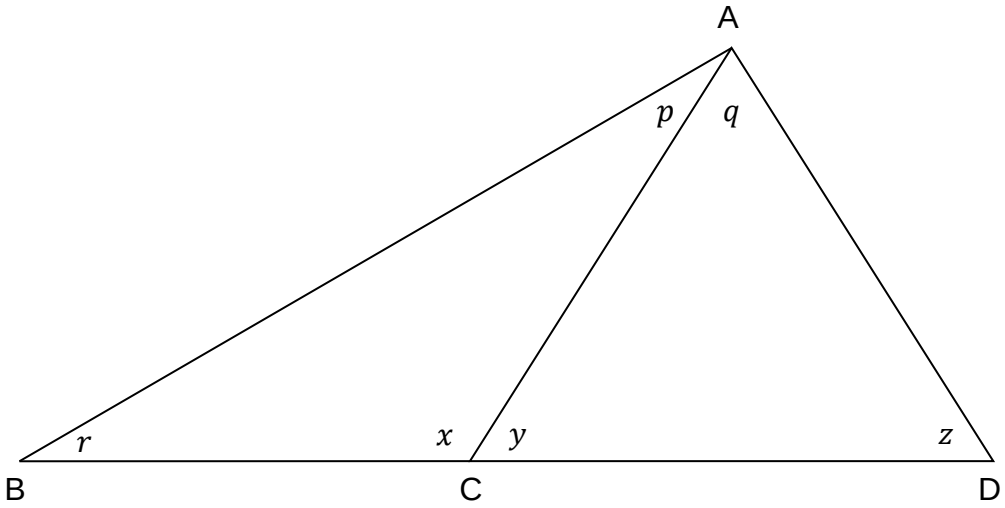


The vertex of the angle in this figure is _____

and it can be named _____

or _____

5.2 Using the diagram below:



5.2.1 Name, using capital letters:

p _____

r _____

y _____

$p + q$ _____

5.2.2 Name, using one lower case letter or the sum of lower case letters:

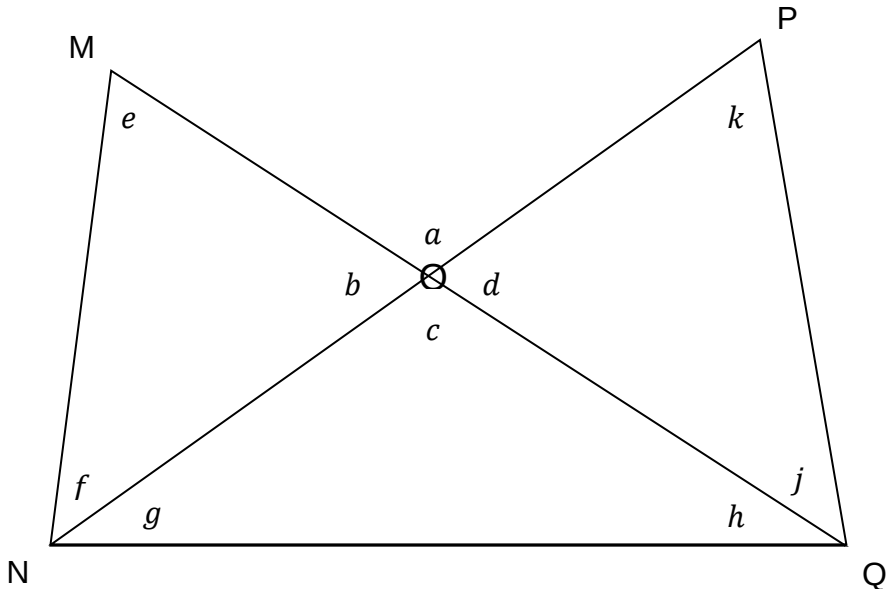
$C\hat{A}D$ _____

$B\hat{C}A$ _____

$A\hat{D}B$ _____

$B\hat{C}D$ _____

5.3 Using the diagram below:



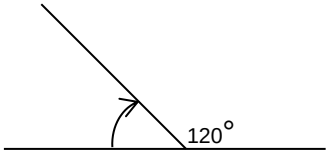
5.3.1 Name, using capital letters:

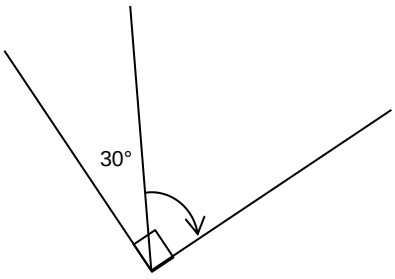
b	_____
e	_____
g	_____
h	_____
$h + j$	_____
$b + c$	_____

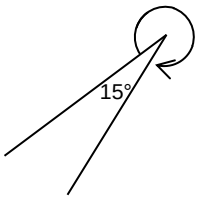
5.3.2 Name, using one lower case letter or the sum of lower case letters:

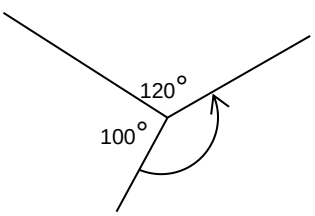
$M\hat{O}P$	_____
$\mathrm{M\hat{N}P}$	_____
$\mathrm{M\hat{Q}P}$	_____
$\mathrm{N\hat{P}Q}$	_____
$\mathrm{M\hat{N}Q}$	_____
$\mathrm{N\hat{O}P}$	_____

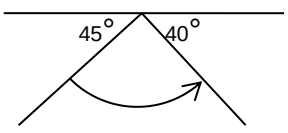
5.4 In the following figures, right angles and some other angles are marked.
Calculate the sizes of the marked angles and write the sizes in the angle.
Do not use a protractor.

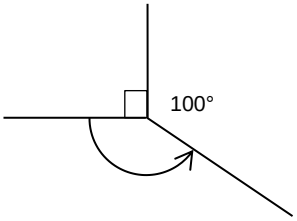












5.5 Construct the following angles. Label each angle using three point notation.

$A\hat{B}C = 132°$

$P\hat{N}A = 243°$

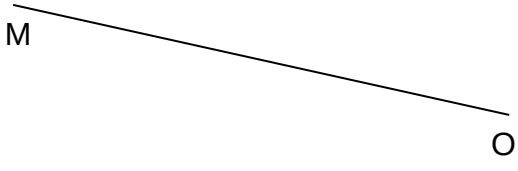
$C\hat{E}D = 326°$

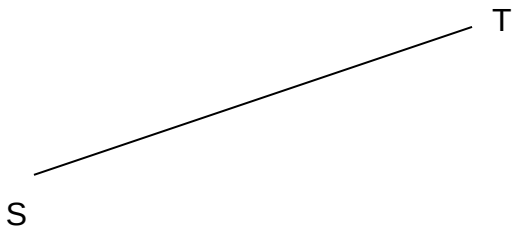
$X\hat{Y}Z = 29°$

5.6 Use the lines below to draw and label the given angles. Note the position of the vertex of each angle.

$M\hat{O}P = 56°$

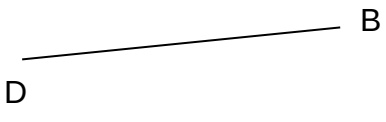
$T\hat{S}R = 284°$

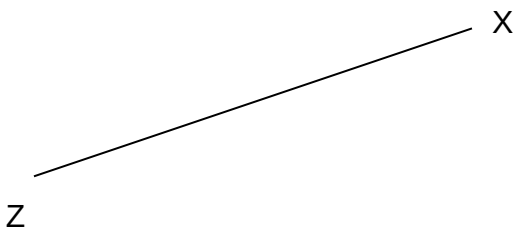




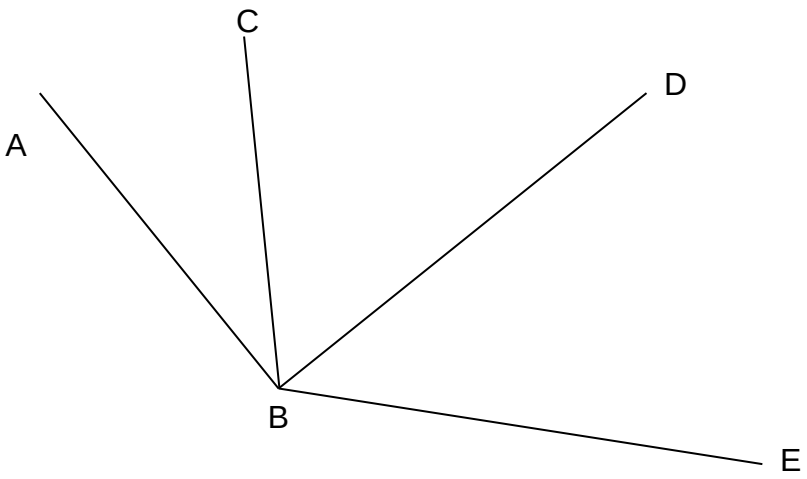
$B\hat{D}A = 105°$

$Y\hat{X}Z = 302°$



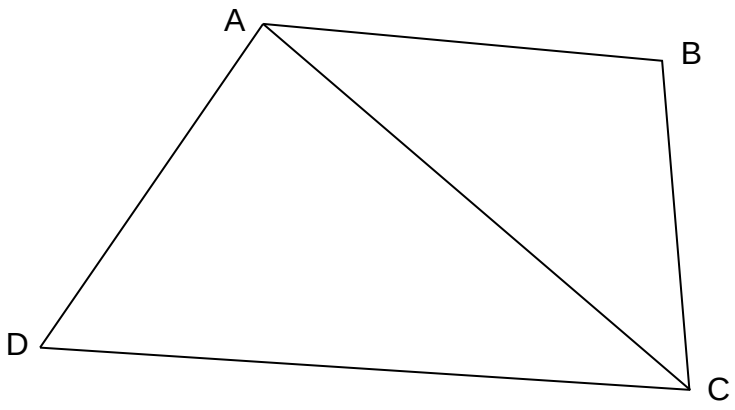


5.7 Complete the table below the following sketch:



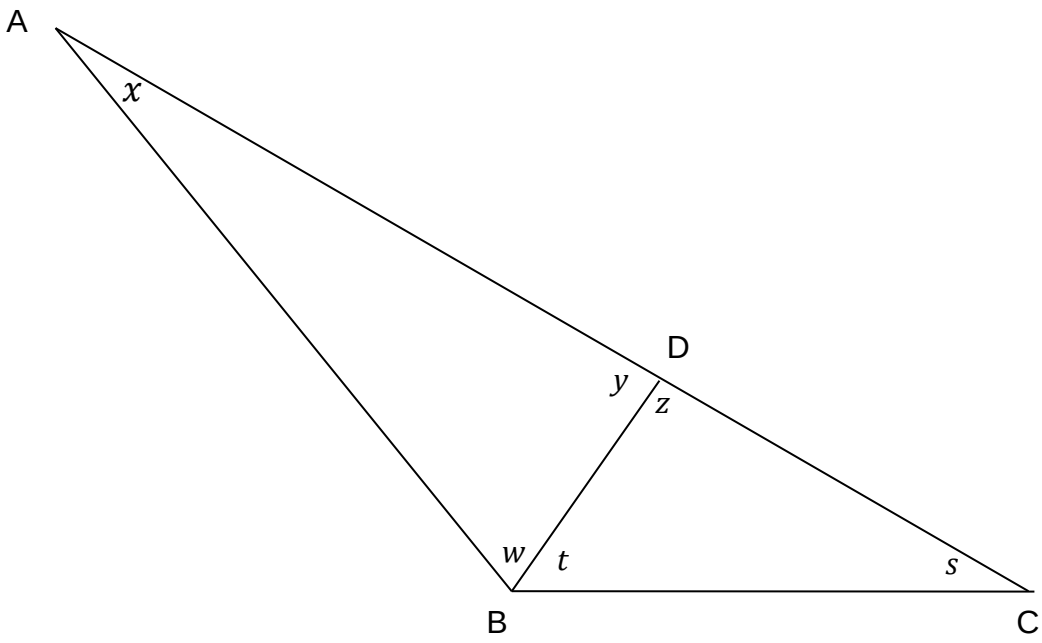
Angle	Classification	Estimate in degrees	Size
$C\hat{B}D$			
$D\hat{B}E$			
$A\hat{B}D$			
$C\hat{B}E$			
reflex $A\hat{B}E$			

5.8 Complete the table below the following sketch:



Angle	Classification	Estimate in degrees	Size
$A\hat{B}C$			
$D\hat{A}C$			
$B\hat{C}D$			
$A\hat{C}D$			
reflex $D\hat{A}B$			

5.9 Complete the table below the following sketch:

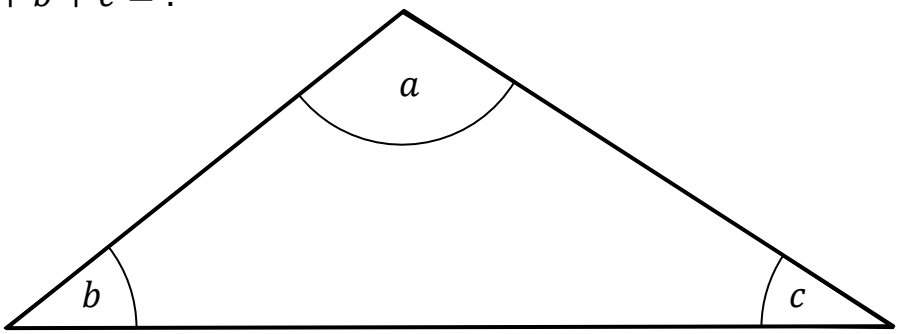


Name Lower case	Name 3 capitals	Classification	Estimate in degrees	Size
w				
x				
y				
$w + t$				
	$\mathrm{D\hat{B}C}$			
	$\mathrm{B\hat{D}C}$			
	$\mathrm{A\hat{C}B}$			
	$\mathrm{A\hat{D}C}$			

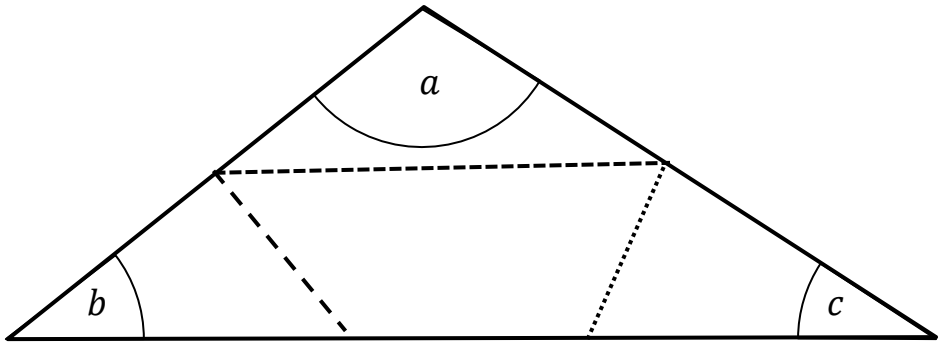
6. TRIANGLES

6.1 What is the sum of the angles of a triangle?

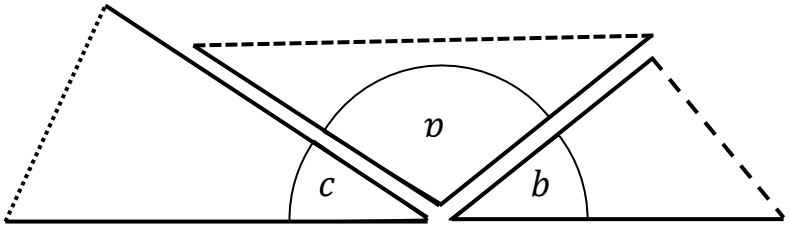
$a + b + c = ?$



If the angles of the triangle were to be cut along the broken lines as shown below:



And the vertices are then arranged as shown below:



The 3 angles would form a straight line.

$\therefore a + b + c =$ _____°

6.2 On a piece of coloured paper construct a triangle of your own and mark the angles in a similar manner.

Cut out each of the angles of the triangle and stick them around the point on the straight line below.

7. CLASSIFICATION OF TRIANGLES

7.1 Carefully cut out all the triangles on the pink coloured sheet provided at the end of the booklet. Sort them into groups and explain how you formed the groups.

_____

_____

_____

_____

_____

_____

_____

Triangles are classified according to their angles and their sides.

Triangles are:

acute angled if all its angles are acute.

right angled if one angle is a right angle.

obtuse angled if one angle is obtuse.

Triangles are:

scalene if none its sides are equal.

isosceles if two of its sides are equal.

equilateral if all of its sides are equal.

7.2 Now paste the triangles you cut out into the blocks below and classify each of them.

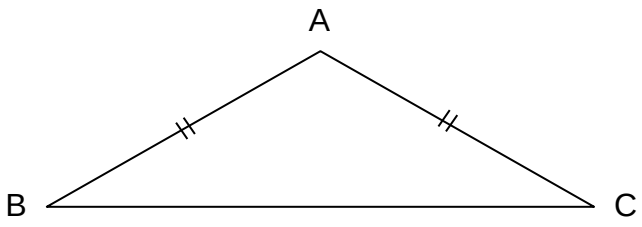
7.3 How many lines of symmetry does a scalene triangle have? _____

7.4 How many lines of symmetry does a isosceles triangle have?_____

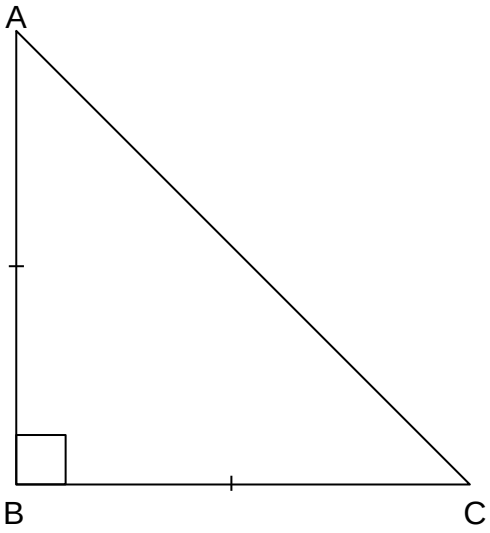
7.5 How many lines of symmetry does an equilateral triangle have?_____

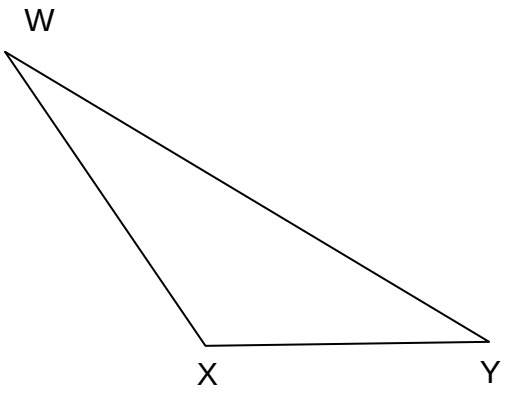
To name a triangle we write ΔABC

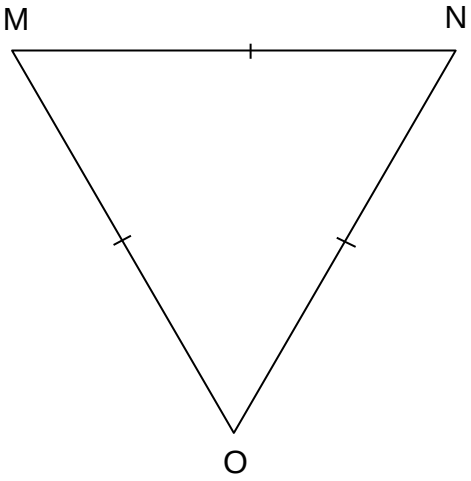
Equal sides are marked.

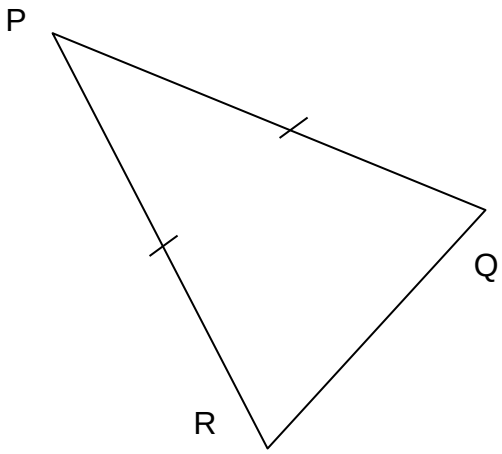


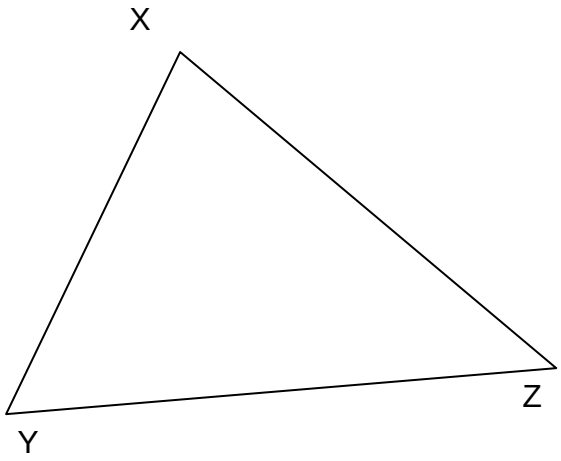
7.6 Name and classify the following triangles:

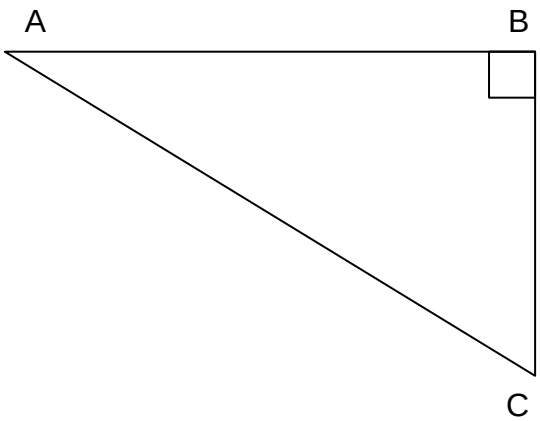












7.7 As accurately as possible draw:

an obtuse angled, scalene triangle

an acute angled, isosceles triangle

a right angled, isosceles triangle

an obtuse angled, equilateral triangle

an acute angled, scalene triangle

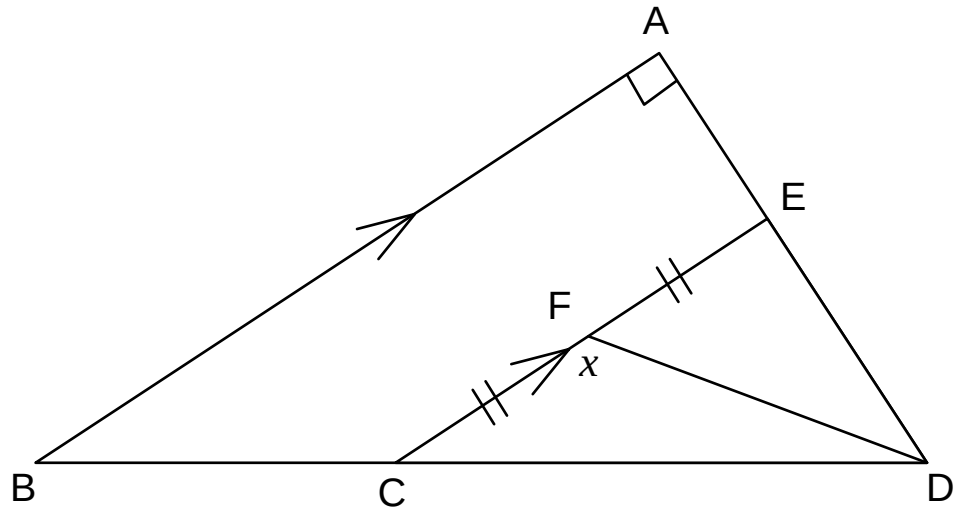
a right angled, scalene triangle

an obtuse angled, isosceles triangle

a right angled, equilateral triangle

MIXED EXAMPLES

Question 1



1.1 Name: (5)

the line parallel to AB

the line perpendicular to AB

the line equal to CF

the angle marked x

a right angled triangle

1.2 Classify: (3)

$F\hat{E}D$

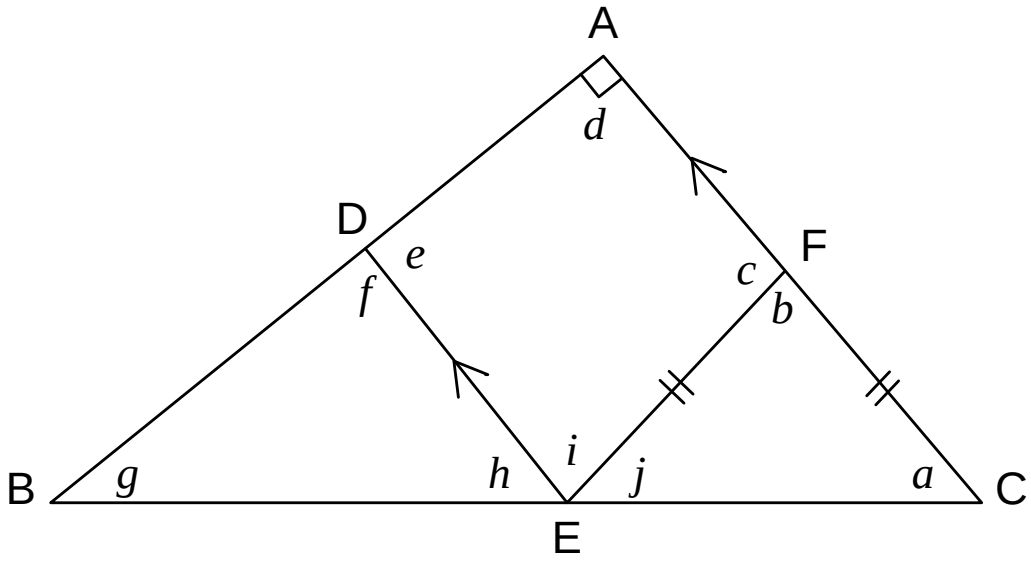
ΔCFD

1.3 Measure: (2)

reflex $A\hat{B}D$

line CE

Question 2



2.1 Name, using capital letters: (2)

b

$h + i$

2.2 Name, using small letters: (2)

$\hat{DBE}$

$\hat{DEC}$

2.3

2.3.1 Name one pair of parallel lines. (1)

2.3.2 Name one pair of perpendicular lines. (1)

2.4 Classify

ΔABC (2)

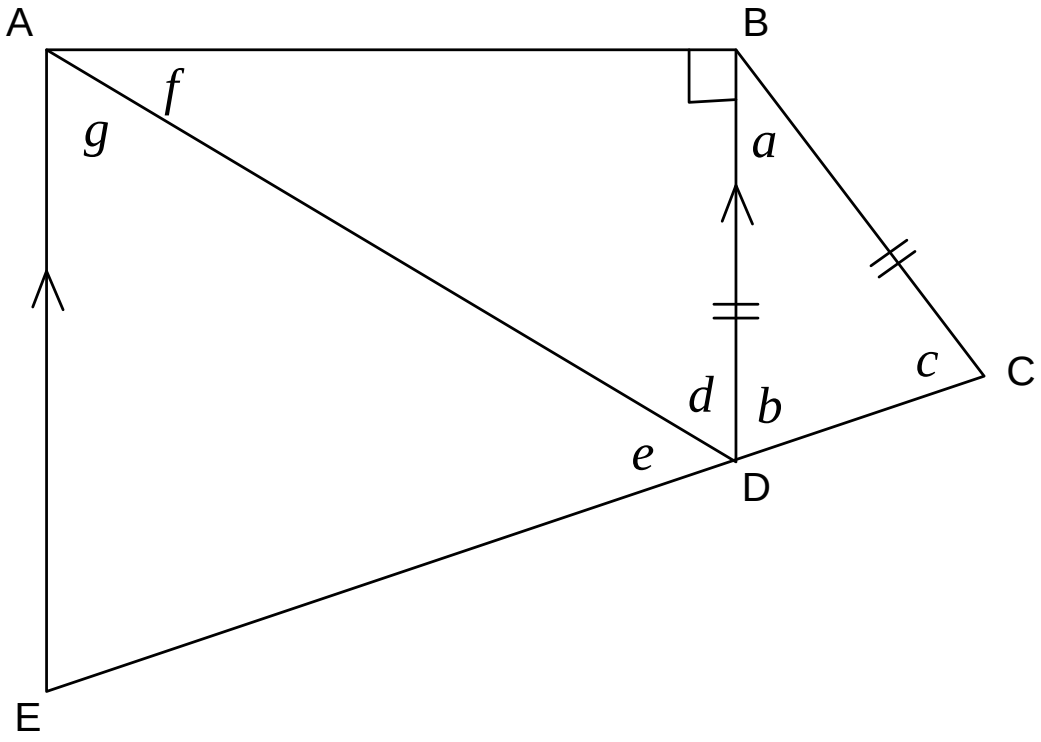
ΔFEC (2)

2.5 Measure

$\hat{AFE}$ (1)

reflex $\hat{FCE}$ (1)

Question 3



3.1 Use capital letters to name: (2)

a

$e + d$

3.2 Use small letters to name: (2)

$E\hat{A}D$

$A\hat{D}C$

3.3 Complete by naming a line: (3)

BC =

AE ||

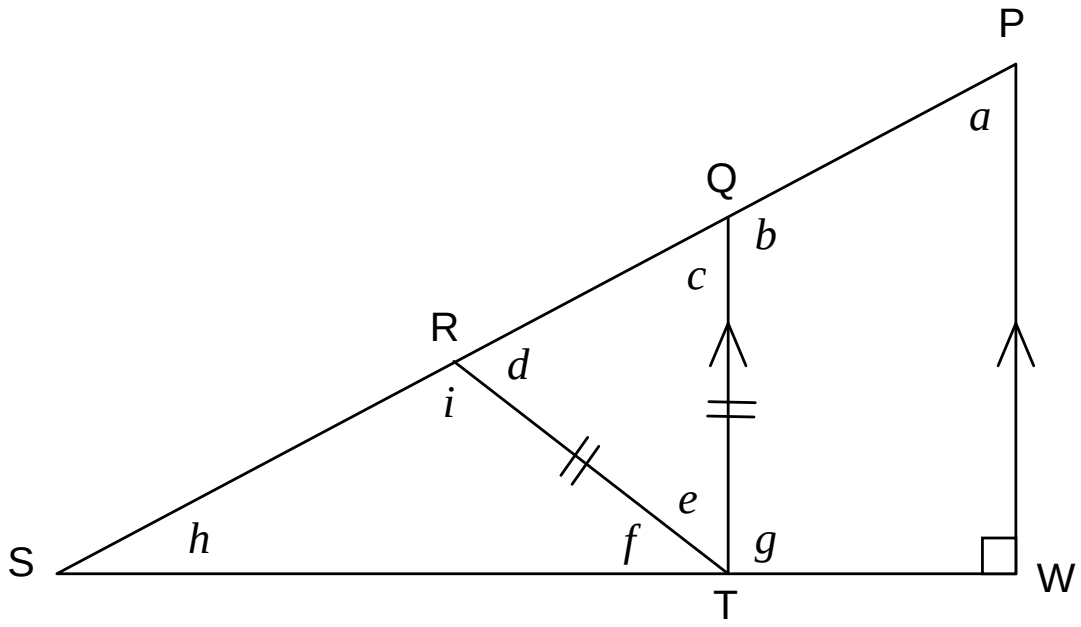
AB ⊥

3.4 Classify: (2)

ΔABD

3.5 Using the letter m, indicate reflex $A\hat{B}D$ on the diagram. (1)

Question 4



4.1 Complete by naming a line: (3)

PW $\perp$

QT $||$

RT =

4.2 Using small letters name: (2)

$Q\hat{R}T$

$S\hat{T}Q$

4.3 Name using capital letters: (2)

h

$e + g$

4.4 Classify: (2)

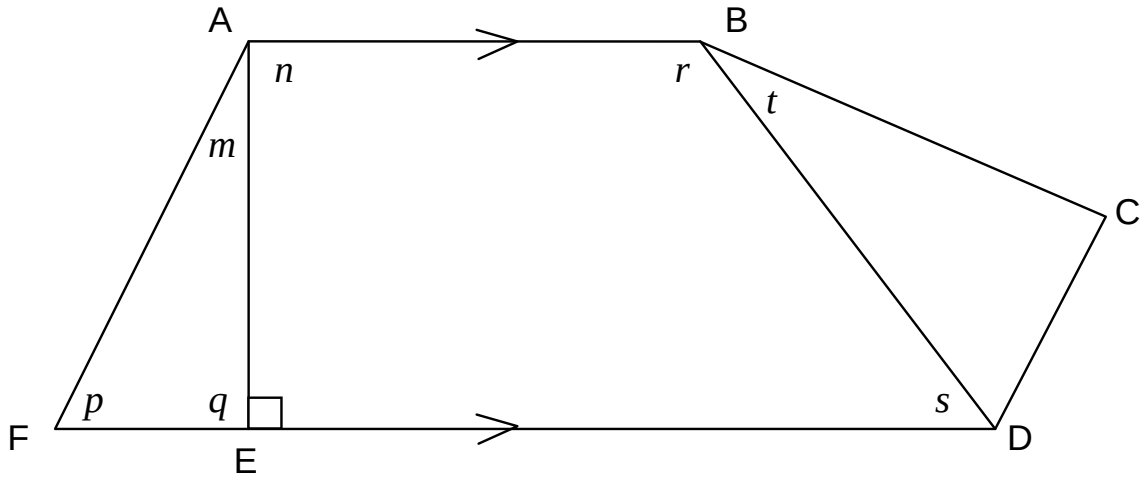
ΔRQT

4.5 Measure: (2)

$S\hat{R}T$

reflex $S\hat{P}W$

Question 5



5.1 Name a pair of perpendicular line segments. (1)

5.2 Name a pair of parallel line segments. (1)

5.3 Name, using small letter(s): (2)

$B\hat{D}E$

$F\hat{A}B$

5.4 Name, using capital letters: (2)

p

r + t

5.5 What kind of angle is: (2)

$B\hat{A}F$

$A\hat{E}F$

5.6 Classify △AFE (2)

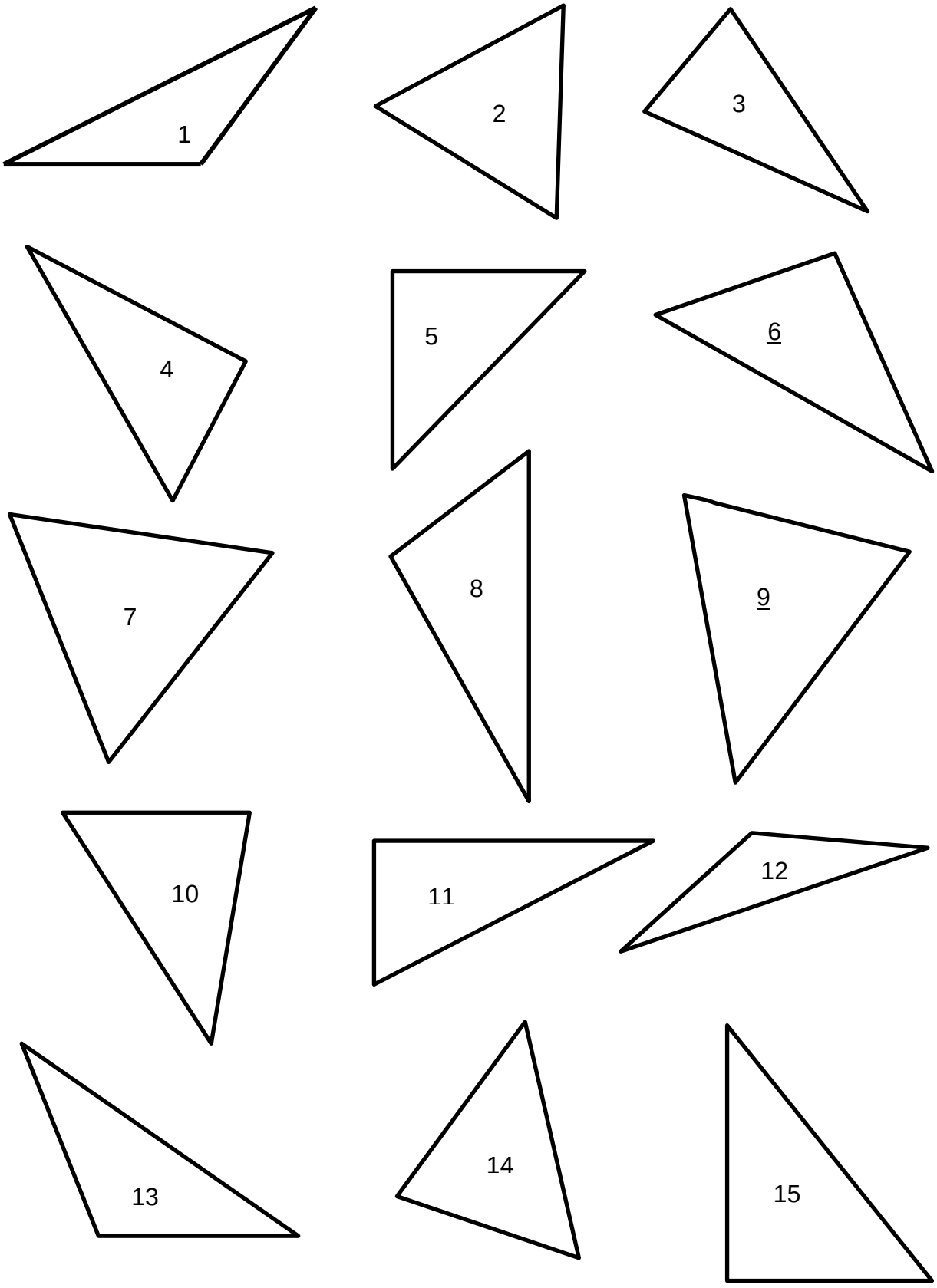
5.7 Measure the size of: (4)

$B\hat{C}D$

$A\hat{F}E$

reflex $F\hat{A}B$

line AB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