Grade 7

ANGLES, LINES AND TRIANGLES

NAME ………………………………..

CLASS ………….

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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°

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

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:**

- 1800° __________
- 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°
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):
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°_________________

-5-
3. **LINES**

Two straight lines that intersect (cut) at right angles are **perpendicular** to each other. We write $AB \perp CD$.

3.1 Give some examples of perpendicular lines:

_________________________________________________
_________________________________________________
_________________________________________________
_________________________________________________
_________________________________________________

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

1. $\overline{XY} \perp \overline{ZW}$
2. $\overline{AD} \perp \overline{DF}$
3. $\overline{AC} \perp \overline{BC}$
4. $\overline{AB} \perp \overline{CD}$
5. $\overline{AC} \perp \overline{BD}$
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 \( AB \parallel CD \) 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:

Lines which are parallel to the horizon are called horizontal.

3.6  Give some examples of horizontal 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 $0^\circ \rightarrow 180^\circ$ clockwise and an inner scale going from $180^\circ \rightarrow 0^\circ$ 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:
Platinum Maths Gr 7  Ex 4.3  page 39
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:

- $125^\circ$
- $283^\circ$
- $162^\circ$
- $14^\circ$
- $330^\circ$
- $200^\circ$
- $74^\circ$
- $114^\circ$
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:

- $\angle AOB$ or $\angle BAO$ or $x$
- $\angle BOC$ or $\angle COB$ or $y$
- $\angle AOC$ or $\angle COA$ 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:

- $\angle CAD$ __________
- $\angle BCA$ __________
- $\angle ADB$ __________
- $\angle BCD$ __________
5.3 Using the diagram below:

5.3.1 Name, using capital letters:  

<table>
<thead>
<tr>
<th>Letter</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td></td>
</tr>
<tr>
<td>f</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td></td>
</tr>
<tr>
<td>h</td>
<td></td>
</tr>
<tr>
<td>i</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Letter</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td></td>
</tr>
<tr>
<td>f</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td></td>
</tr>
<tr>
<td>h</td>
<td></td>
</tr>
<tr>
<td>i</td>
<td></td>
</tr>
</tbody>
</table>

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.

- 120°  
- 30°  
- 15°  
- 120°  
- 100°  
- 45°  
- 40°  
- 100°
5.5 Construct the following angles. Label each angle using three point notation.

\[ \widehat{ABC} = 132^\circ \quad \text{and} \quad \widehat{PNA} = 243^\circ \]

\[ \widehat{CED} = 326^\circ \quad \text{and} \quad \widehat{XYZ} = 29^\circ \]

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

\[ \widehat{MOP} = 56^\circ \quad \text{and} \quad \widehat{TSR} = 284^\circ \]

\[ \widehat{BDA} = 105^\circ \quad \text{and} \quad \widehat{XYZ} = 302^\circ \]
5.7 Complete the table below the following sketch:

<table>
<thead>
<tr>
<th>Angle</th>
<th>Classification</th>
<th>Estimate in degrees</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \angle \text{CBD} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \angle \text{DBE} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \angle \text{ABD} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \angle \text{CBE} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>reflex ( \angle \text{ABE} )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.8 Complete the table below the following sketch:

<table>
<thead>
<tr>
<th>Angle</th>
<th>Classification</th>
<th>Estimate in degrees</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \angle \text{ABC} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \angle \text{DAC} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \angle \text{BCD} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \angle \text{ACD} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>reflex ( \angle \text{DAB} )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.9 Complete the table below the following sketch:

<table>
<thead>
<tr>
<th>Name Lower case</th>
<th>Name 3 capitals</th>
<th>Classification</th>
<th>Estimate in degrees</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>w + t</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DBC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AĈB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AĎC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

\[ \therefore a + b + c = \text{______}^\circ \]

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.
How many lines of symmetry does a scalene triangle have? _____________

How many lines of symmetry does an isosceles triangle have? _____________

How many lines of symmetry does an equilateral triangle have? _____________

To name a triangle we write $\Delta ABC$

Equal sides are marked.
7.6 Name and classify the following triangles:

A

B

C

W

X

Y

M

N

O

P

Q

R

X

Y

Z

A

B

C
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)
   $\triangle FED$
   $\triangle CFD$

1.3 Measure: (2)
   reflex $\angle ABD$
   line $CE$
Question 2

2.1 Name, using capital letters: (2)
   \[b\]
   \[h + i\]

2.2 Name, using small letters: (2)
   \[\text{DBE}\]
   \[\text{D\(\hat{\text{E}}\)C}\]

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
   \[\triangle ABC\] (2)
   \[\triangle FEC\] (2)

2.5 Measure
   \[\text{AF\(\hat{E}\)}\] (1)
   reflex \(\text{F\(\hat{C}\)E}\) (1)
3.1 Use capital letters to name: 
   a
   e + d

3.2 Use small letters to name: 
   \( \hat{EAD} \)
   \( \hat{ADC} \)

3.3 Complete by naming a line: 
   BC =
   AE \parallel
   AB \perp

3.4 Classify: 
   \( \triangle ABD \)

3.5 Using the letter \( m \), indicate reflex \( \hat{ABD} \) on the diagram.
Question 4

4.1 Complete by naming a line:  
PW ⊥  
QT ||  
RT =  

4.2 Using small letters name:  
QRT  
ŜTQ  

4.3 Name using capital letters:  
h  
e + g  

4.4 Classify:  
ΔRQT  

4.5 Measure:  
ŜRT  
reflex ŜPW
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)
   BÈD
   FÀB
5.4 Name, using capital letters: (2)
   p
   r + t
5.5 What kind of angle is: (2)
   BAF
   AEF
5.6 Classify \triangle AFE (2)
5.7 Measure the size of: (4)
   BCD
   AFE
   reflex FAB
   line AB