

The 'Maths is ...' Jugglers

Knowledge

Skills

Understanding



ISBN-10: 1-874428-88-3

ISBN-13: 978-1-874428-88-6

Sample Resources

from the

Teachers' Resource and Assessment Pack

for Y10 Ruff (GCSE Tier E-B)

The topic **“Coordinates, Shapes and Transformations”**

can be downloaded from the website

www.mathsisjugglers.com

**You have permission to print
this topic for use with your students.**

This pack contains the **Teachers' Resources and Assessments**
for the topic **“Coordinates, Shapes and Transformations”**
in the Y10 Ruff Guide.

You have permission to print these for use with your students.

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A list of items at Grade B in the Ruff Guides
can be downloaded from the website.
Students using this text and following the new
Foundation syllabus should omit these items.

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Ruff

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of the Intermediate GCSE Course



ISBN-10: 1-874428-88-3
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SAMPLE

THE RUFF GUIDE Part 2 (Y11)



ISBN-10: 1-874428-89-1
ISBN-13: 978-1-874428-89-3

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SAMPLE

The emphasis here is on non-calculator skills, with a particular stress on mental agility. Many of the sections within the topics open with items that can be used as mental/oral starters and the techniques taught/reviewed here should be repeated regularly over the weeks following their introduction

The course should start with **Topic 1**. This contains the number techniques that will be assumed thereafter throughout the course.
The rest of the topics are independent and can be done in any order.
Any techniques required within a topic that are taught elsewhere, will be repeated at the point where they are required.



Order one **half price** copy of **Y10 Ruff** and **Y11 Ruff**
using the **Special Offer form**
which can be downloaded
from the website
www.mathsisjugglers.co.uk

Cross-Topic Information

The emphasis here is on non-calculator skills, with a particular stress on mental agility. Where applicable, sections within the topics open with items that can be used as mental/oral starters and the techniques taught/reviewed here should be repeated regularly over the weeks following their introduction.

Each lesson should start with a brief mental/oral starter. As well as developing mental arithmetic expertise, it provides a positive start to the lesson.

Suggestions for these are given on the topic pages that follow.

The aim is to develop a learning ethos where:

- mental techniques are a first resort
- pencil-and paper techniques are used routinely
- standard arithmetic techniques are used on a regular basis
- non-standard arithmetic techniques (jottings) are acceptable provided they are clearly shown
- calculators are used only when the calculations become complex
- calculator functions are understood and used effectively

Calculators to be used should have, as a minimum, the following functions:

+ - x ÷ x^2 \sqrt{x} memory brackets
 x^y or y^x $x^{1/y}$ or $x\sqrt{\quad}$ sin cos tan

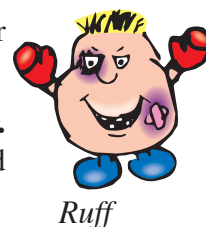
Students who will take the Intermediate Tier at GCSE will have a wide spread of abilities. It is not expected that every student should do every exercise.

The better students will not need to do the easier exercises. For these students, a brief resumé of a technique, done as an oral starter, is all that is required.

The less able students are not expected to do the extension exercises – but they should be allowed to tackle them, if they feel able to do so.

The course should start with Topic 1. This topic contains the number techniques that will be assumed thereafter throughout the course.

The rest of the topics are independent and can be done in any order. Any techniques required within a topic that are taught elsewhere will be repeated at the point where they are required.



The Y10 and Y11 Ruff Guides deliver both the National Curriculum and the linear GCSE syllabuses for AQA, Edexcel and OCR.

However, the topics have been ordered in such a way as to make the material accessible to teachers and students following one of the modular GCSE syllabuses. To facilitate this, two of the topics are in both the Y10 text and the Y11 text. The topic contents of the whole course is listed on the contents page of both texts.

Topic 6: Coordinates, Shapes and ...

Printing List

D3.1: Finding lines of symmetry

Page in text

191

Pack page

26

In this topic students will review/develop techniques for working with coordinates, some transformations, angles in polygons and properties of polygons.

By the end of the topic, each student should apply these techniques confidently to solve problems.

Suggested mental/oral topics

Lines with equations of the form $x = p$, $y = q$, $y = x$ and $y = -x$	(met in D6.2)
Angles at a point and on a straight line	(met in D8.1)
Angles in a triangle	(met in D8.2)
Angles in equilateral, isosceles and right-angled triangles	(met in D8.3)
Identifying quadrilaterals from their properties	(met in D11.2)
Names of the most common polygons	(met in E12.3)
Calculating exterior angles of regular polygons	(met in D13.3)
Calculating interior angles of regular polygons using both methods	(met in D13.3)
<i>as well as</i>	
The mental arithmetic techniques listed for Topic 5	
MULTIPLICATION TABLES	

Direct teaching points

Section 10: Students need to be able to understand (and, where possible, reproduce) the proofs in this section. You may wish to add other proofs to this group.

Section 11: D11.3: Quadrilateral calculations is an important exercise.

Students need to be taught to apply *all* the following properties when tackling these questions:

- symmetries of quadrilaterals
- angle properties associated with parallel lines
- properties of isosceles triangles

Students need to be taught to put all the given information onto the diagram. They need to mark parallel lines and equal length line segments, not just put in the given angle sizes. If they do not mark equal line segments, they will not be able to spot isosceles triangles.

When students are referred to their teacher for answers

E6.6: Rules for coordinate reflections ANSWERS

p202

Task 3: Students are asked to investigate what happens under reflection in the line $y = x$. They are expected to use the methods of Tasks 1 – 2.

Rule: $(x, y) \rightarrow (y, x)$

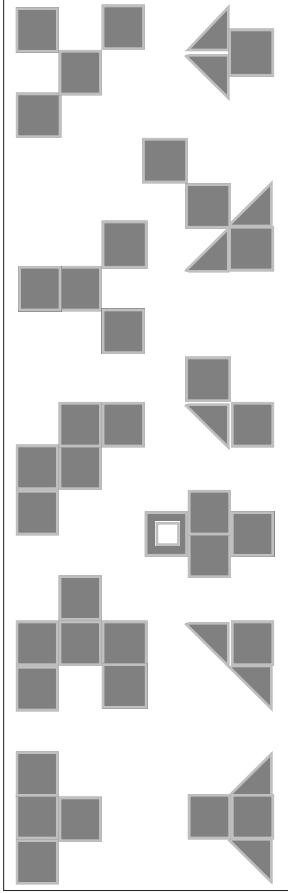
E6.7: Testing hypotheses ANSWERS

p203

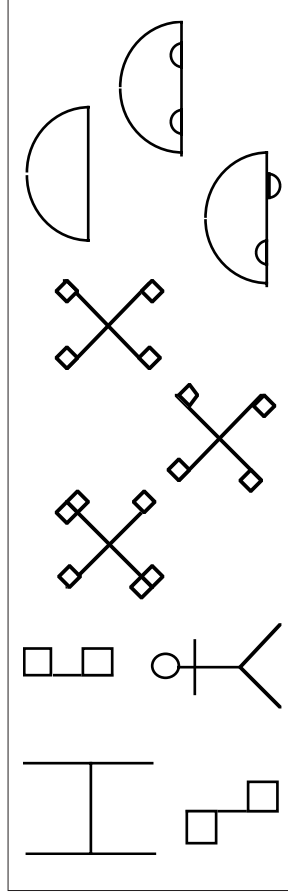
In **Task 5** students are asked to investigate four hypotheses, each involving the combination of two consecutive reflections. In **Task 6** they are asked to invent some hypotheses of their own involving reflections. The teacher needs to check each student's hypothesis individually.

D3.1: Finding lines of symmetry

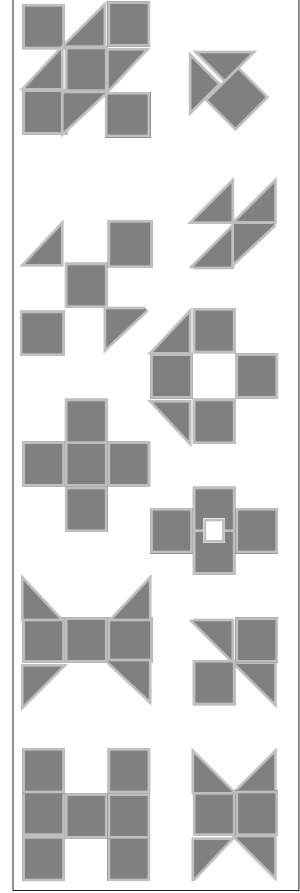
Task 1: Draw in one line of symmetry for each shape:



Task 2: Draw as many lines of symmetry as you can find:



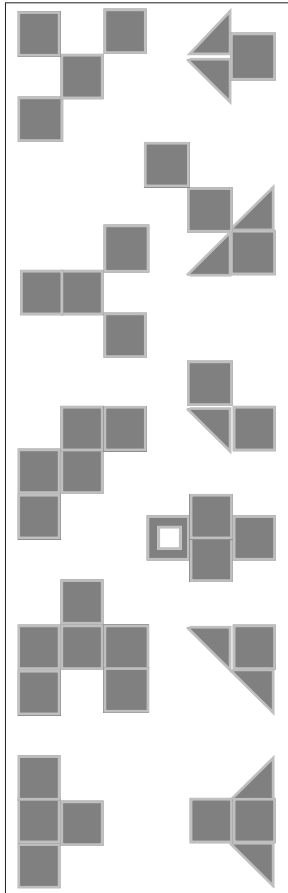
Task 3: Draw as many lines of symmetry as you can find:



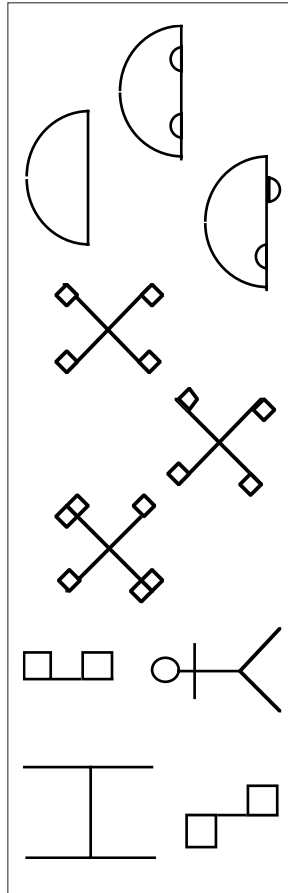
• Check your answers.

D3.1: Finding lines of symmetry

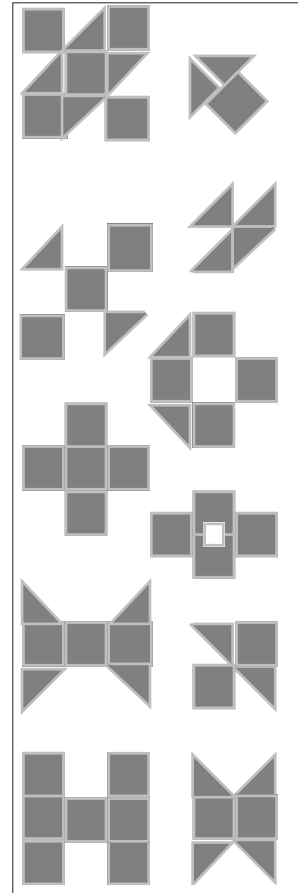
Task 1: Draw in one line of symmetry for each shape:



Task 2: Draw as many lines of symmetry as you can find:



Task 3: Draw as many lines of symmetry as you can find:



• Check your answers.

Coordinates, Shapes and ... REVISION

Name :

Do the answers to this revision sheet in your exercise book or on paper – NOT ON THIS SHEET. Check your answers using the answers on the reverse of this sheet.

KEEP THIS SHEET SOMEWHERE SAFE.
USE IT AGAIN TO REVISE FOR EXAMS.

1. ABCD is a parallelogram, where A is (-5,0), B is (-1,-2) and C is (3,1).

- Draw the parallelogram and draw in its diagonals.
- State the coordinates of (i) the point D
(ii) the centre of the parallelogram
(iii) the midpoint of AB



Section 2

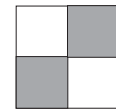
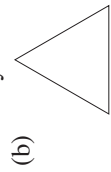
2. Copy the diagram. Reflect the shaded pieces in the two mirror lines to make a symmetric pattern.

Section 3

3. Copy the diagram. Draw in all the lines of symmetry.

Section 3

4. What is the order of rotational symmetry of each of these shapes ?



Section 4

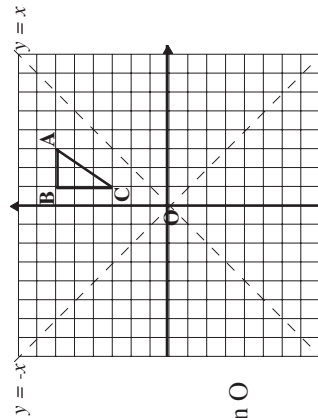
5. Copy the diagram.

On the same diagram draw images of triangle ABC under each of the following transformations.

Label each image with the number of the transformation.

- reflection in the y-axis
- rotation of -90° about the origin O
- reflection in the $y = -x$
- rotation of -90° about C
- rotation of $+90^\circ$ about A

Sections 6 & 7



6. Copy and complete each of these statements:

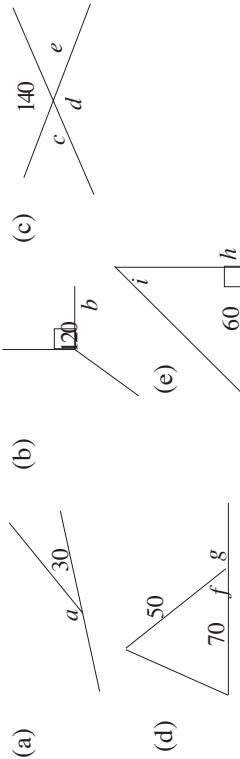
Angles on a straight line add up to $^\circ$

Angles at a point add up to $^\circ$

Angles in a triangle add up to $^\circ$

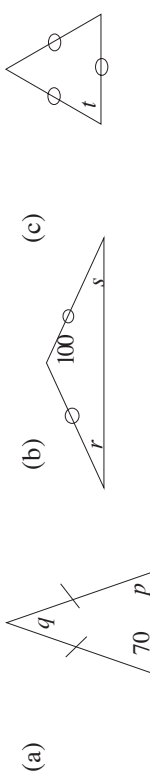
Section 8

7. Work out the size of each of the lettered angles:



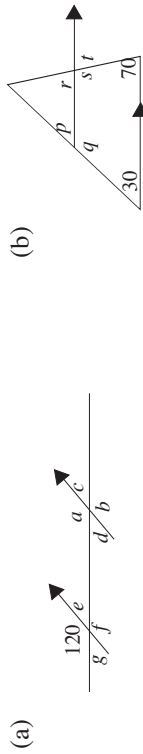
Section 8

8. Work out the size of each of the lettered angles:



Section 8

9. Copy each diagram. Replace each letter with the correct angle size.



Section 9

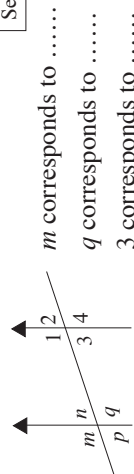
10. Copy and complete:

m is vertically opposite to

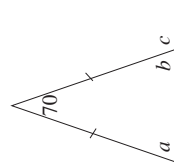
q is alternate to

3 is vertically opposite to

Section 9



11.



Sections 8 & 9

Work out the size of each of the lettered angles.

12. Copy and complete this table:

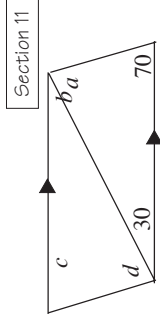
Shape	Name of shape	2 pairs of parallel sides ?	2 pairs of equal sides ?	Only 1 pair of parallel sides ?	Mirror symmetry ?
		Yes			

13. (a) Draw this parallelogram.

Replace each letter with the correct angle size.

(b) Are the two triangles isosceles ?

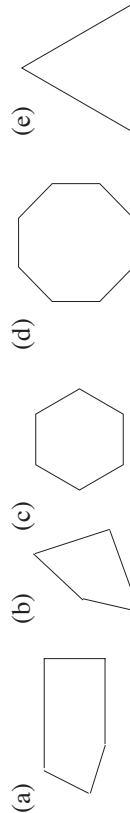
(c) What is the order of rotational symmetry of the parallelogram ?



14. What shape is described here :

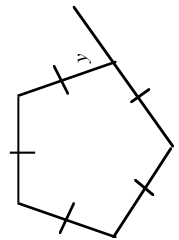
- it has 4 equal sides;
- it has 2 pairs of equal angles;
- it has 2 pairs of parallel sides;
- it has 2 lines of symmetry.

15. Name each of these polygons:



16. Which three shapes in Q15 are regular polygons ?

17. Calculate the size of the exterior angle of this regular pentagon, y .



Section 11

Section 11

Section 11

Section 12

Section 12

Section 13

ANSWERS

1. (b) (i) (ii) $(-1, 1/2)$ (iii) $(-3, -1)$

2. $y = x$ $y = -x$

3. $y = x$ $y = -x$

4. (a) 4 (b) 3 (c) 2

6. 180° ; 360° ; 180°

7. (a) $a = 150$ (b) $b = 150$ $e = 40$
 (c) $c = 40$ $d = 140$ $g = 120$
 (d) $f = 60$ $i = 30$
 (e) $h = 90$

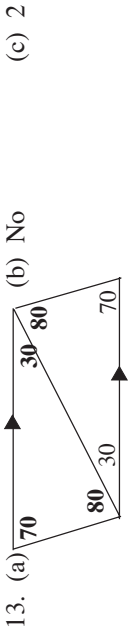
8. (a) $p = 70$ $q = 40$ (b) $r = s = 40$ (c) $t = 60$

9. (a) $120/60$ $60/120$ (b) 30 70 150 110 70

10. m is vertically opposite to q m corresponds to 1
 q is alternate to 1 q corresponds to 4
 3 is vertically opposite to 2 3 corresponds to p

11. $a = b = 55$ $c = 125$ $d = 80$ $e = 40$

square	Yes	Yes	No	Yes
rectangle	Yes	Yes	No	Yes
parallelogram	Yes	Yes	No	No
trapezium	No	No	Yes	No
kite	No	Yes	No	Yes



14. rhombus or diamond

15. (a) pentagon (b) quadrilateral (c) hexagon (d) octagon (e) triangle

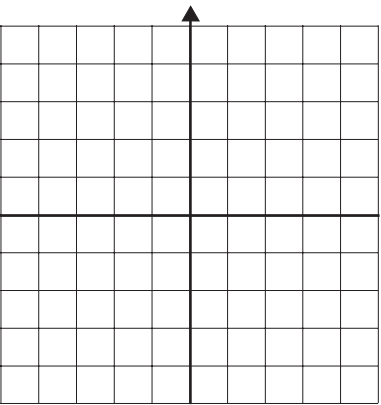
16. hexagon (c) octagon (d) triangle (e)

17. 72°

Coordinates, Shapes and ... ASSESSMENT

Name :

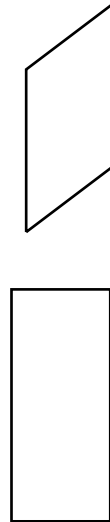
Write the answers on this sheet.



- PQRS is a rectangle, where P is (-3,-2), Q is (3,2) and R is (5,-1).
 (a) Plot the points P, Q and R.
 Complete the rectangle.
 Draw in its diagonals. (4 marks)

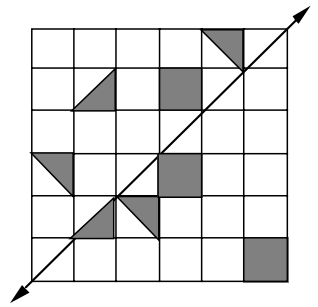
- State the coordinates of:
 - the point S
 - the centre of the rectangle
 - the midpoint of RS
 (6 marks)

- Draw all the lines of symmetry of each shape. (3 marks)



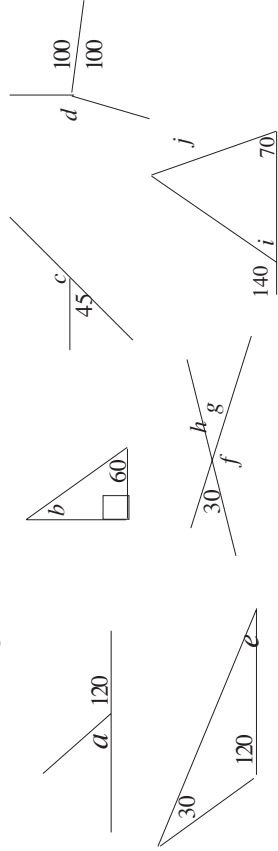
order of symmetry order of symmetry order of symmetry

- Fill in the order of symmetry for each shape. (3 marks)



- Reflect each shaded piece in the mirror line to make a symmetrical pattern. (8 marks)

- Write the correct angle size next to each letter: (10 marks)



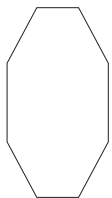
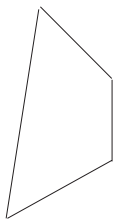
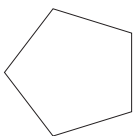
- $p = \dots\dots\dots^\circ$
 - $q = \dots\dots\dots^\circ$
 - $r = \dots\dots\dots^\circ$
 (6 marks)

- $i = \dots\dots\dots$
 - $j = \dots\dots\dots$
 - $k = \dots\dots\dots$
 (6 marks)

- d is alternate to
 - d is vertically opposite to
 - 5 corresponds to
 - a is alternate to
 (6 marks)

- $c = \dots\dots\dots$
 - $d = \dots\dots\dots$
 - $e = \dots\dots\dots$
 (8 marks)

9. (a) Name each of these polygons:



A..... B..... C.....

(b) Which of these polygons are regular ?

10. Say whether each statement is true (T) or false (F):

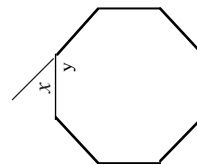
- A rectangle has two pairs of parallel sides
- A trapezium has two pairs of parallel sides
- A kite has a line of symmetry
- The opposite angles of a parallelogram are equal
- A parallelogram has mirror symmetry

11. • It has 4 sides all of different lengths.

- It has 1 pair of parallel sides.
- It has no lines of symmetry.

What is it ?

12. This is a regular octagon.



Exterior angle $x = \dots\dots\dots^\circ$

Interior angle $y = \dots\dots\dots^\circ$

13. Draw the image of each flag under the given transformation: (12 marks)

reflection in the dotted line

reflection in the dotted line

rotation of -90° about L

rotation of 180° about P

rotation of 45° about N

rotation of 90° about M

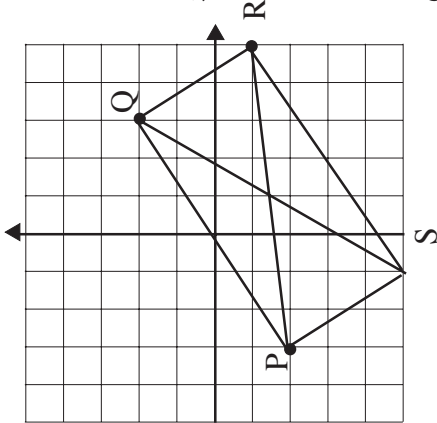
Coordinates, Shapes and ...

ASSESSMENT ANSWERS

Overall mark = %

1. PQRS is a rectangle, where P is (-3,-2), Q is (3,2) and R is (5,-1).

- (a) Plot the points P, Q and R. Complete the rectangle. Draw in its diagonals. (4 marks)

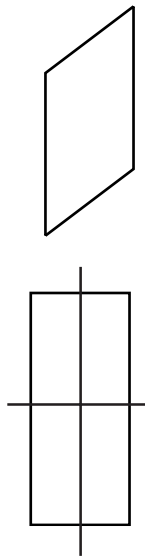


- (b) State the coordinates of:

- (i) the point S (-1,-5)
- (ii) the centre of the rectangle (1,-1.5)
- (iii) the midpoint of RS (2,-3)

(6 marks)

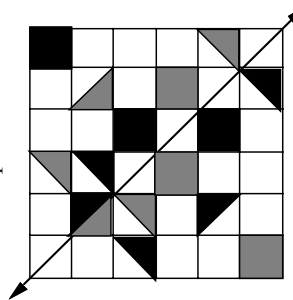
2. (a) Draw all the lines of symmetry of each shape.



(3 marks)

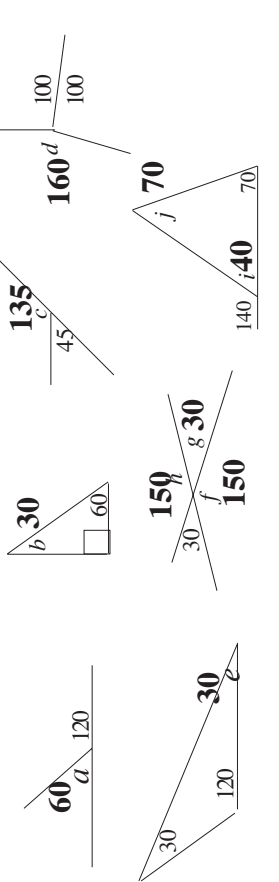
order of symmetry .2 order of symmetry .2 order of symmetry .2

- (b) Fill in the order of symmetry for each shape.

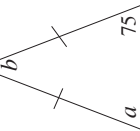
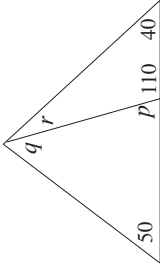


3. Reflect each shaded piece in the mirror line to make a symmetrical pattern. (8 marks)

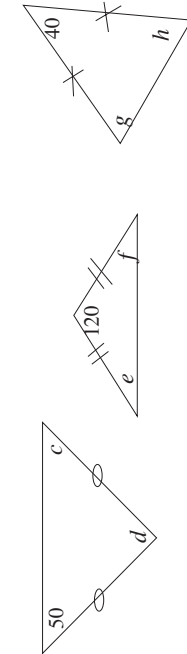
4. Write the correct angle size next to each letter: (10 marks)



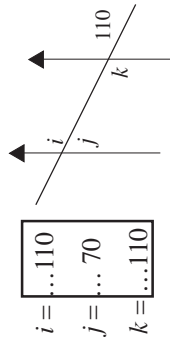
5. $p = \dots 70^\circ$
 $q = \dots 60^\circ$
 $r = \dots 30^\circ$ (6 marks)



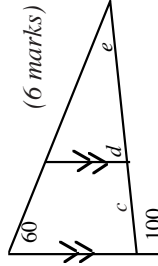
- 6.



- $a = \dots 75$ $c = \dots 50$ $e = \dots 30$ $g = \dots 70$
 $b = \dots 30$ $d = \dots 80$ $f = \dots 30$ $h = \dots 70$ (8 marks)

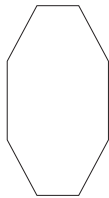
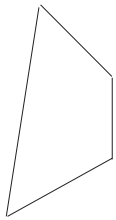
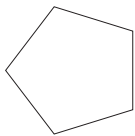


7. $i = \dots 110$
 $j = \dots 70$
 $k = \dots 110$ (6 marks)



8. d is alternate to .5...
 d is vertically opposite to .b....
 5 corresponds to .b....
 d corresponds to .4...
 6 corresponds to .c...
 a is alternate to .6... (6 marks)

9. (a) Name each of these polygons:



A...pentagon... B...quadrilateral... C...octagon...

(b) Which of these polygons are regular? ...A...

(1 mark)

10. Say whether each statement is true (T) or false (F):

A rectangle has two pairs of parallel sides

A trapezium has two pairs of parallel sides

A kite has a line of symmetry

The opposite angles of a parallelogram are equal

A parallelogram has mirror symmetry

...T...
...F...
...T...
...T...
...F...

(5 marks)

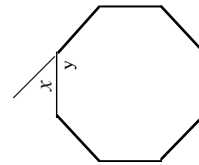
11. • It has 4 sides all of different lengths. (2 marks)

• It has 1 pair of parallel sides.

• It has no lines of symmetry.

What is it? ...trapezium...

12. This is a regular octagon. (4 marks)



Exterior angle $x = \dots 45^\circ$

Interior angle $y = \dots 135^\circ$

13. Draw the image of each flag under the given transformation: (12 marks)

reflection in the dotted line

reflection in the dotted line

rotation of -90° about L

rotation of 180° about P

rotation of 45° about N

rotation of 90° about M