Name: _____

Geometric Reasoning

Date:

Time:

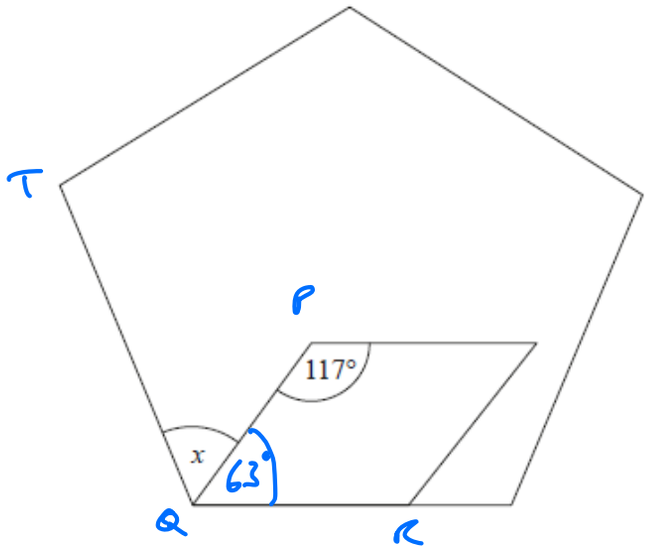
Total marks available:

Total marks achieved: _____

Questions

Q1.

The diagram shows a regular pentagon and a parallelogram.



Interior ∠ of regular pentagon

$= 180 - \frac{360}{5}$

$= 108°$

$\angle TQR = 108°$

$\angle PQR = 63°$ (allied ∠s)

Work out the size of the angle marked *x*.
You must show all your working.

$\therefore \quad x = 108 - 63$

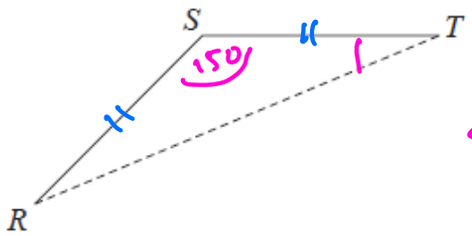
$x = 45°$ ..... °

(Total for question = 4 marks)

Interior angle

$= 180 - \frac{360}{12} = 150°$

Q2.



$\angle STR = \frac{180 - 150}{2}$

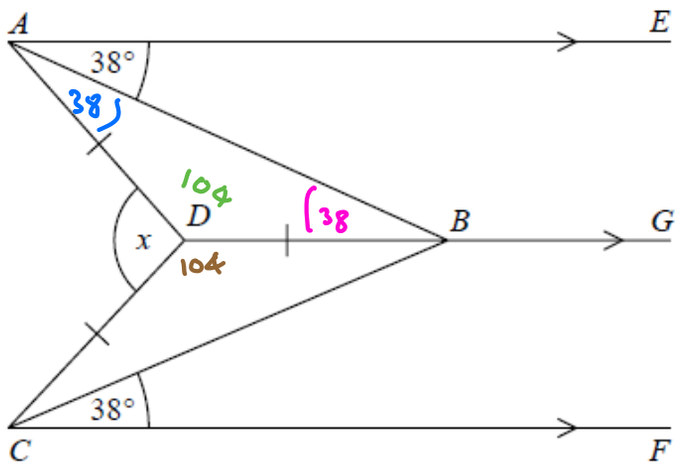
RS and *ST* are 2 sides of a regular 12-sided polygon.
RT is a diagonal of the polygon.

Work out the size of angle *STR*.
You must show your working.

$\angle STR = 15°$ ..... °

(Total for question = 3 marks)

Q3.



$\angle ABD = 38°$
(alternate $\angle$s equal)

$\angle DAB = 38°$
(base $\angle$s of isos $\triangle$)

$\angle ADB = 180 - 38 - 38$
$= 104°$
($\angle$ sum of $\triangle$)

By symmetry
$\angle CDB = 104°$

AE, *DBG* and *CF* are parallel.
DA = *DB* = *DC*.
Angle *EAB* = angle *BCF* = 38°

Work out the size of the angle marked *x*.
You must show your working.

$x = 360 - 104 - 104$

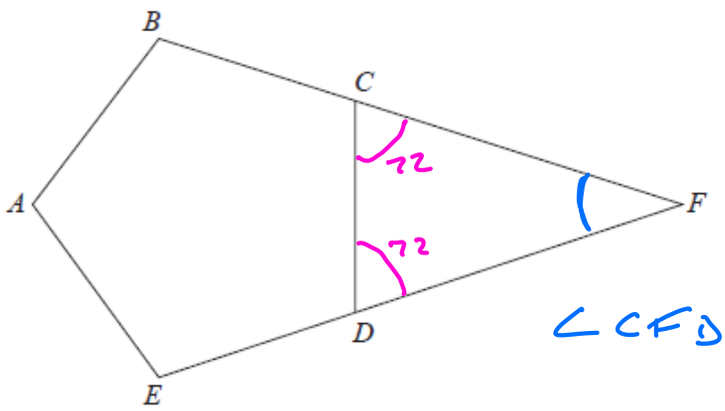
$x = 152°$ (angles at a point sum to 360°)

$x = 152°$ .....°

(Total for question = 3 marks)

Exterior angle of regular pentagon $= \frac{360}{5} = 72°$

Q4.



$\angle CFD = 180 - 72 - 72$
$= 36°$
($\angle$ sum of $\triangle$)

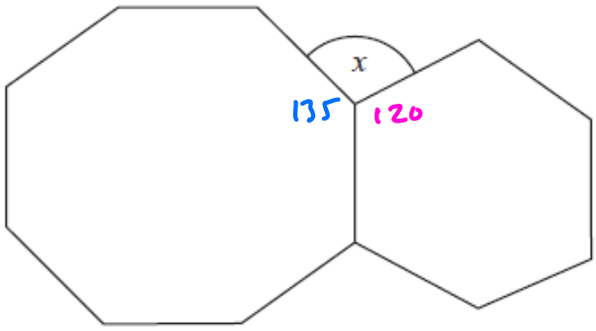
ABCDE is a regular pentagon.
BCF and *EDF* are straight lines.

Work out the size of angle *CFD*.
You must show how you get your answer.

$\angle CFD = 36°$ .....°

(Total for question = 3 marks)

Q5.



Interior angle of regular octagon

$= 180 - \frac{360}{8} = 135°$

Interior angle of regular hexagon

$= 180 - \frac{360}{6} = 120°$

$x = 360 - 135 - 120$

(angles at a point sum to 360°)

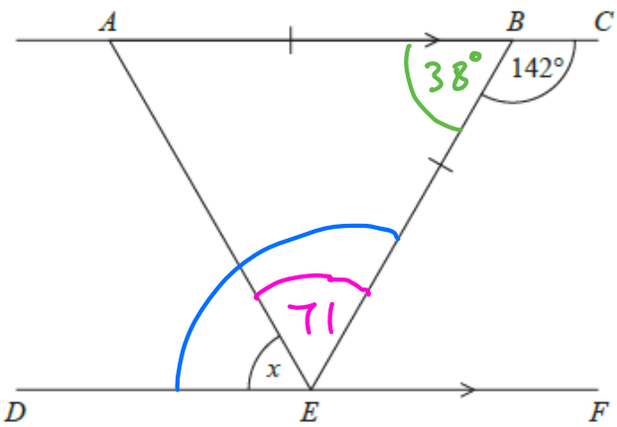
The diagram shows a regular octagon and a regular hexagon.

Find the size of the angle marked *x*
You must show all your working.

x = 105° .....º

(Total for question = 3 marks)

Q6.



$\angle AB = 38°$

(∠s on a str line)

$\angle AEB = \frac{180 - 38}{2}$

(base ∠s of isos △)

$\angle AEB = 71°$

$\angle BED = 142°$

(alternate ∠s)

$x = 142 - 71 = 71°$

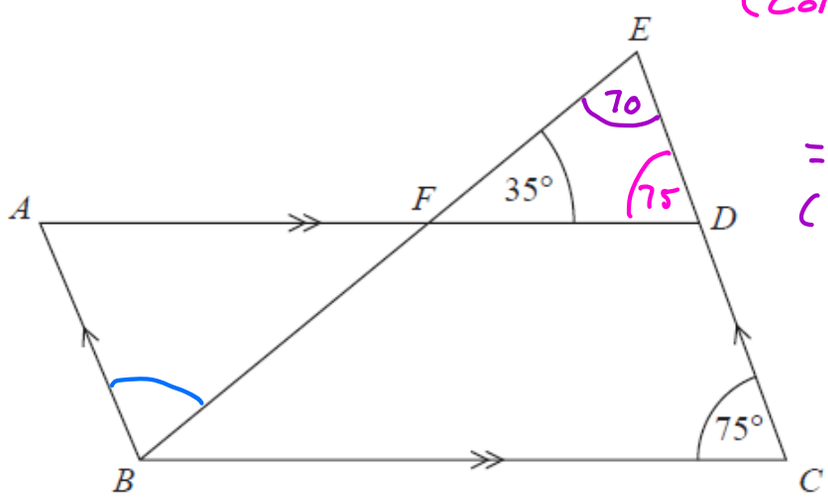
ABC and *DEF* are parallel straight lines.
ABE is an isosceles triangle with *AB* = *BE*.
Angle *CBE* = 142°

Work out the size of angle *x*.
Give a reason for each stage in your working.

$x = 71°$ .....°

(Total for question = 5 marks)

Q7.



$\angle EDF = 75°$
(corresponding ∠s)

$\angle FED$
$= 180 - 35 - 75$
(∠ sum of △)
$= 70°$

ABCD is a parallelogram.
EDC is a straight line.
F is the point on *AD* so that *BFE* is a straight line.

Angle *EFD* = 35°
Angle *DCB* = 75°

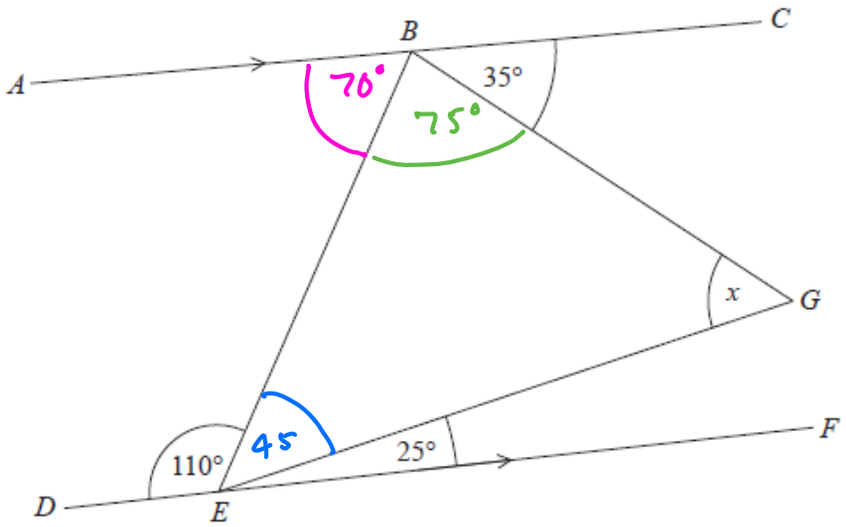
Show that angle *ABF* = 70°
Give a reason for each stage of your working.

$\angle ABF = 70°$
(alternate ∠s are equal)

(Total for question = 4 marks)

Q8.

BEG is a triangle.



$\angle BEG = 180 - 110 - 25$
$= 45°$
($\angle$s on a str line)

$\angle ABE = 70°$ (alternate $\angle$s)

$\angle EBG = 180 - 70 - 35$
$= 75°$
($\angle$s on a str line)

$x = 180 - 45 - 75$
($\angle$ sum of $\triangle$)

ABC and *DEF* are parallel lines.

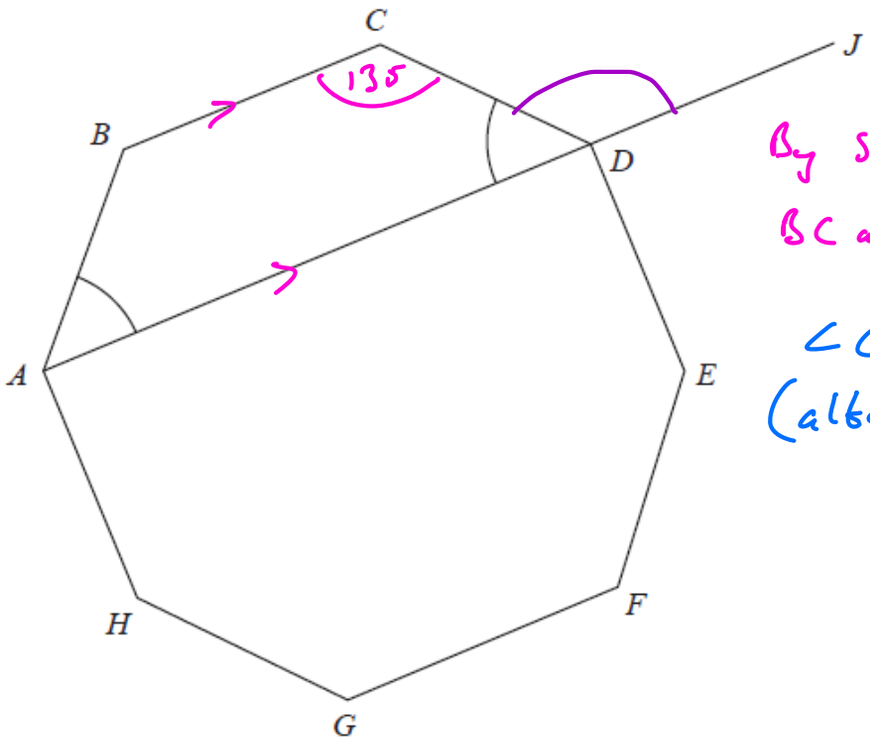
Work out the size of angle *x*.
Give a reason for each stage of your working.

$x = 60°$ .....°

(Total for question = 4 marks)

Interior angle of regular octagon $= 180 - \frac{360}{8} = 135°$

Q9.



By symmetry
BC and AD are //

$\angle CDJ = 135°$
(alternate $\angle$s)

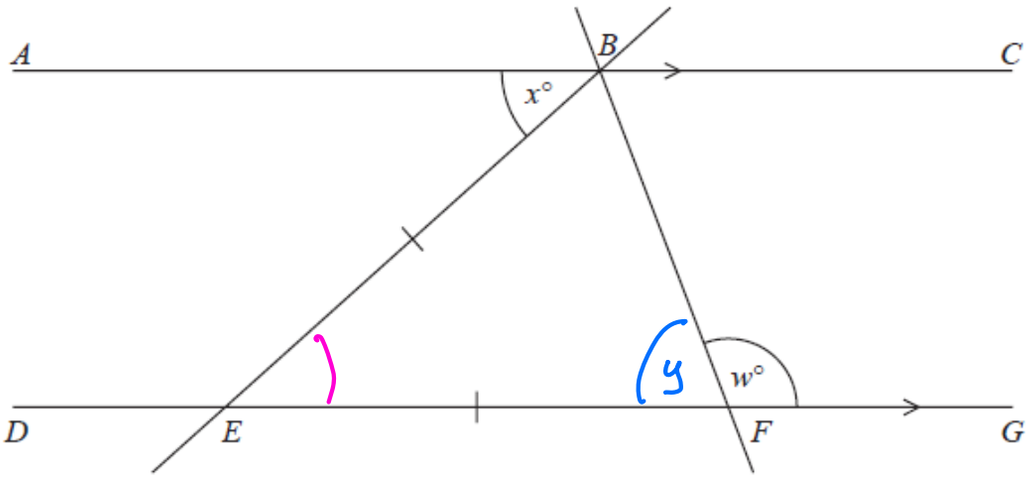
ABCDEFGH is a regular octagon.
ADJ is a straight line.

angle *BAD* = angle *CDA*

Show that angle *CDJ* = 135°

(Total for question = 4 marks)

Q10.



In the diagram *ABC* and *DEFG* are parallel lines.
Angle *ABE* = *x*°
EB = *EF*

Show that $w = 90 + \frac{1}{2}x$

Give a reason for each stage of your working.

$\angle FEB = x^\circ$
(alternate angles)

$y = \frac{180 - x}{2} = 90 - \frac{x}{2}$
(base ∠s of isos △)

$w = 180 - y$ (∠s on a str line)

$w = 180 - \left(90 - \frac{x}{2}\right)$

$= 180 - 90 + \frac{x}{2} = 90 + \frac{x}{2}$

(Total for question = 4 marks)

Mark Scheme

Q1.

Question	Answer	Mark	Mark scheme	Additional guidance
	45	P1	for 180 – 117 (=63) **or** states, or uses, exterior angle + x =117	Angles may be shown on the diagram. Any angle labelled correctly as 63 and not contradicted scores this mark
		P1	for process to find the exterior or the interior angle of the pentagon, eg 360 ÷ 5(=72) **or** 180 – (360 ÷ 5) (=108) **or** ((5–2) × 180) ÷ 5 (=108)	Exterior = 108 or interior =72 does not score the mark
		P1	for a complete process to find x, eg 180 – "72" – "63" **or** "108" – "63" **or** 117 – "72"	
		A1	cao	An answer of 45 with no supporting working scores 0

Q2.

Question	Working	Answer	Mark	Notes
		15	P1	for a process to find the interior or exterior angle of a regular 12 sided polygon e.g. $\frac{10\times180}{12}$ (= 150) or $\frac{360}{12}$ (= 30), must be no contradictions
			P1	for process to find angle STR, eg $\frac{180-"150"}{2}$ or $\frac{"30"}{2}$
			A1	cao

Q3.

Paper 1MA1: 1H			
Question	Working	Answer	Notes
		152	M1 Start to method ABD = 38° **and** BAD or DBC or DCB = 38° M1 ADB or BDC = 180 – 2 × 38 (= 104) A1 for 152 with working

Q4.

Question	Working	Answer	Mark	Notes
		36	3	P1 a correct process to find either an interior or an exterior angle, e.g. (180 × 3) ÷ 5 (= 108) or 360 ÷ 5 (= 72) P1 (dep) a complete process to find angle *CFD* A1 cao

Q5.

Question	Working	Answer	Notes
		105	P1 for process to find the exterior angle or interior angle of a hexagon or octagon P1 for process to find the both exterior angles or both interior angles A1 for 105 from correct working

Q6.

Question	Working	Answer	Mark	Notes
		71°	M1	finds an angle using parallel lines, e.g. *BEF* as 38° or *EAB* as *x*.
			M1	shows a complete process to arrive at the required angle could be evidenced by angles shown on the diagram
			A1	cao
			C1	alternate, corresponding or allied (co-interior) unambiguously given *and appropriate for their working*
			C1	for all other reasons given, e.g. Angles on a straight line add up to 180, Angles in a triangle add up to 180, Base angles of an isosceles triangle are equal *and appropriate for their working*

Q7.

Question	Working	Answer	Mark	Notes
	CB extended to form *CG*	Reasoning	B1	for 35 **or** 75 **or** 145 **or** 105 **or** *DEF* = 70, marked on the diagram or 3 letter description
			M1	for 180-70-35 **or** 180-75-35 **or** a correct pair of angles that would lead to 75 or 70, eg *AFB* = 35 and *FAB* = 75 **or** *AFB* = 35 and *ABG* = 75 **or** *FBC* = 35 and *ABG* = 75 **or** *EDF* = 75 and *DEF* = 70 **or** *FDC* = 105 and *FBC* = 35 **or** *ABC* = 105 and *FBC* = 35
			C2	(dep on B1M1) All figures correct with all appropriate reasons stated. Angles must be clearly labelled or on the diagram. Full solution must be seen
			(C1	(dep on B1 or M1) for one reason clearly used and stated.) Corresponding angles are equal, alternate angles are equal, opposite angles in a parallelogram are equal, angles in a triangle sum to 180, angles on a straight line sum to 180, vertically opposite angles are equal, vertically opposite angles are equal, angles in a quadrilateral sum to 360, co-interior angles sum to 180, allied angles sum to 180, angles around a point sum to 360

Q8.

Question	Answer	Mark	Mark scheme	Additional guidance
	60	M1	use of parallel lines to find an angle eg *ABE*=70 **or** *EBG*=75 **or** *EBC* = 110 **or** shows parts of *x* as 35 or 25	Parts of *x* should be identified on the diagram by the insertion of a dividing line through angle *x* (need not be identified or drawn parallel).
		M1	for a complete method to find angle *x*; could be in working or on the diagram	Correct method can be implied from angles on the diagram if no ambiguity or contradiction.
		A1	for *x* = 60	
		C1	(dep on M1) for one reason linked to parallel lines and one other reason, supported by working taken from: alternate angles are equal, allied angles / co-interior angles add up to 180, angles on a straight line add up to 180, angles in a triangle add up to 180°	Underlined words need to be shown; reasons need to be linked to their method; any reasons not linked do not credit. There should be no incorrect reasons given.

Q9.

Question	Working	Answer	Mark	Notes
		Correct conclusion from correct working	M1	for a method to find the interior angle, e.g. $(8 - 2) \times 180 \div 8$ (= 135) or exterior angle, e.g. $360 \div 8$ (= 45) of a regular octagon
			A1	for interior angle = 135 or exterior angle = 45
			M1	for method to find size of angle *CDA*, e.g. $(360 - 135 \times 2)/2$ (= 45) or for stating and using *BC* parallel to *AD*
			C1	for method to complete the solution with angle *CDJ* = 135 e.g. 180 − "45" (= 135) or angle *BCD* and angle *CDJ* are alternate angles

Q10.

Question	Working	Answer	Mark	Notes
		shown	M1	for use of parallel lines to find an angle, e.g. angle $BEF = x$
			M1	(dep M1) for second step, e.g. for angle $EBF = \frac{180 - x}{2}$ oe or angle $EFB = \frac{180 - x}{2}$ oe
			M1	for complete method leading to $w = 90 + \frac{1}{2}x$
			C1	for complete set of reasons linked to method: Alternate angles are equal Base angles of an isosceles triangle are equal, Angles in a triangle add up to 180 Angles on a straight line add up to 180