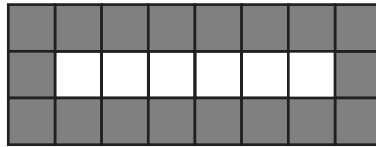


1 Lisa has some white square tiles and some grey square tiles.
They are all the same size.

She makes a row
of white tiles.



She surrounds the white
tiles by a single layer
of grey tiles.



a) How many grey tiles does she need to surround a row of 60 white tiles?

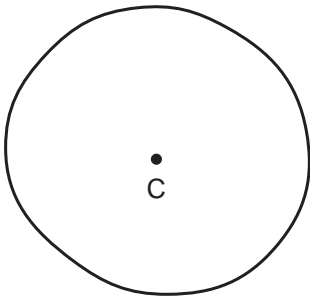
Show how you obtained your answer.

b) Write an expression for the number of grey tiles
needed to surround a row of n white tiles.

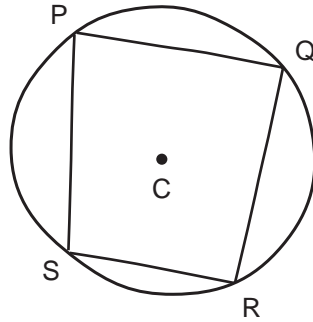
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A1

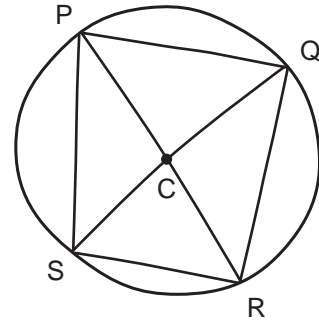
2 Vincent sketches a circle.
He calls the centre C.



He then draws a quadrilateral PQRS, whose corners lie on the circle.



He then draws the diagonals of the quadrilateral.



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G1

Vincent says

“Whatever quadrilateral I draw with corners on a circle,
the diagonals will always cross at the centre of the circle”.

Is Vincent right?

.....

Explain your answer.

3 Joe and Fred are thinking about the pair of numbers 5 and 9.

They notice that the SUM ($5 + 9$) is EVEN.

They notice that the PRODUCT (5×9) is ODD.

Joe says: If the SUM of two whole numbers is EVEN, their PRODUCT is ODD.

Fred says: If the PRODUCT of two whole numbers is ODD, their SUM is EVEN.

a) Are Joe's and Fred's statements saying the same thing?

b) The PRODUCT of two whole numbers is 1247.

Suppose Fred is right.

Which one of these must also be right? Tick (✓) one box.

- You can be sure that the SUM of the two numbers is EVEN.
- You can be sure that the SUM of the two numbers is ODD.
- You can't be sure whether the SUM is ODD or EVEN until you know what the two numbers are.

c) Is Joe's statement true?

Explain your answer.

d) Is Fred's statement true?

Explain your answer.

4 Aysha, Brian, Coby, Deon, Eric and Fiona were trying to prove whether the following statement is true or false:

When you add any 2 even numbers, your answer is always even.

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A3

Aysha's answer

a is any whole number.
 b is any whole number.
 $2a$ and $2b$ are any two even numbers.
 $2a + 2b = 2(a + b)$.

So Aysha says it's true

Brian's answer

$2 + 2 = 4$ $4 + 2 = 6$
 $2 + 4 = 6$ $4 + 4 = 8$
 $2 + 6 = 8$ $4 + 6 = 10$

So Brian says it's true

Coby's answer

Even numbers are numbers that can be divided by 2. When you add numbers with a common factor, 2 in this case, the answer will have the same common factor.

So Coby says it's true

Deon's answer

Even numbers end in 0, 2, 4, 6 or 8. When you add any two of these the answer will still end in 0, 2, 4, 6 or 8.

So Deon says it's true

Eric's answer

Let $x =$ any whole number, $y =$ any whole number.
 $x + y = z$
 $z - x = y$
 $z - y = x$
 $z + z - (x + y) = x + y = 2z$

So Eric says it's true

Fiona's answer

●●●●● + ●●●●●
 ●●●●● + ●●●●●
 =
 ●●●●●●●●●●
 ●●●●●●●●●●

So Fiona says it's true

- a) Whose answer do you like best?
- b) Whose answer is closest to what you would do?
- c) Whose answer would get the best mark from your teacher?

- d) For each of the following, circle whether you agree, don't know, or disagree.

The statement is:

When you add any 2 even numbers, your answer is always even.

	agree	don't know	disagree
<i>Aysha's answer ...</i>			
shows you that the statement is always true	1	2	3
<i>Brian's answer ...</i>			
shows you that the statement is always true	1	2	3
<i>Coby's answer ...</i>			
shows you that the statement is always true	1	2	3
<i>Deon's answer ...</i>			
shows you that the statement is always true	1	2	3
<i>Eric's answer ...</i>			
shows you that the statement is always true	1	2	3
<i>Fiona's answer ...</i>			
shows you that the statement is always true	1	2	3

- e) Suppose it has now been proved that:

When you add any 2 even numbers, your answer is always even.

Zoe asks what needs to be done to prove whether:

When you add 2 even numbers that are square, your answer is always even.

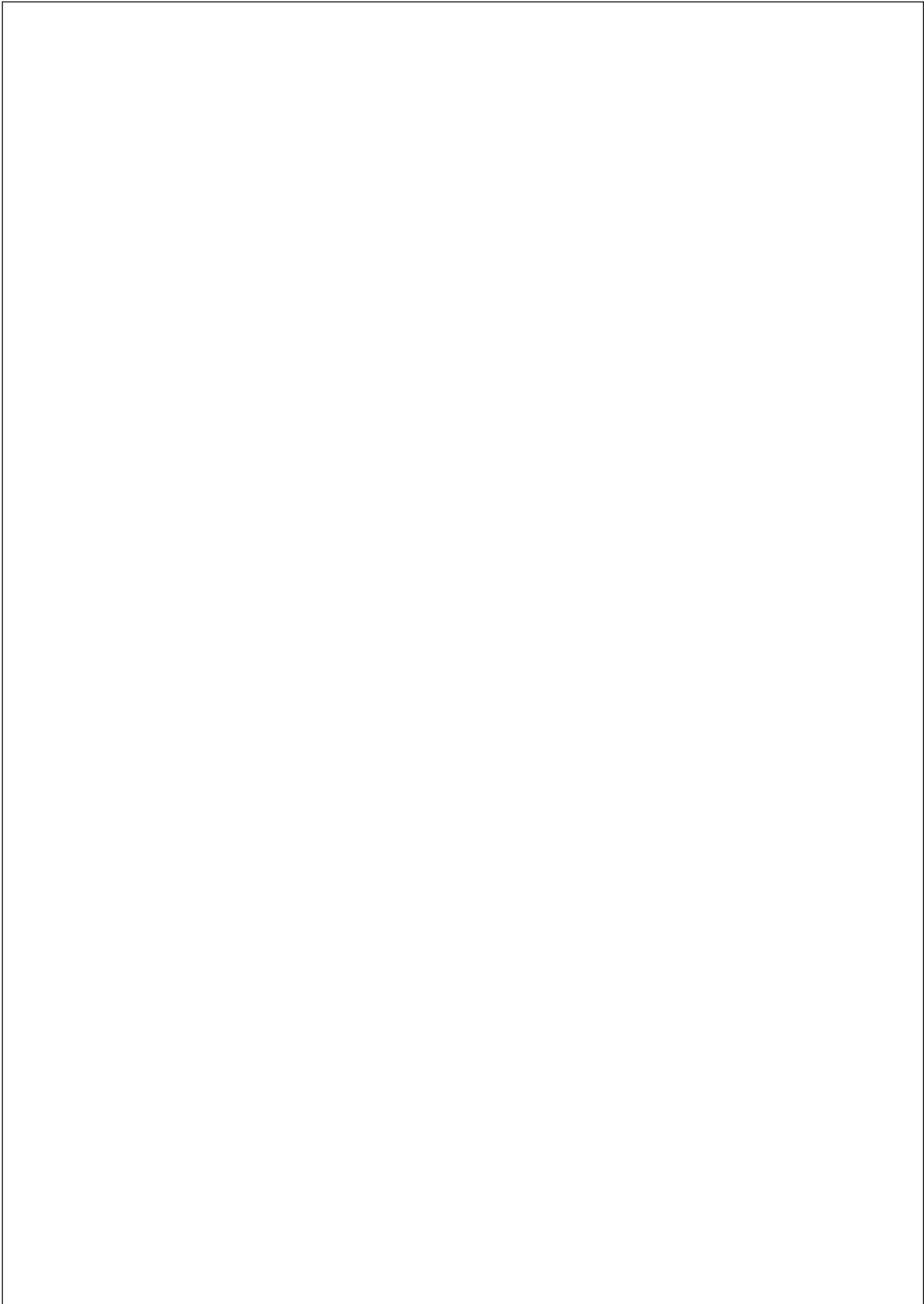
Tick (✓) either A or B.

(A) Zoe doesn't need to do anything, the first statement has already proved this.

(B) Zoe needs to construct a new proof.

- 5 Prove whether the following statement is true or false. Write your answer in a way that would get you as good a mark as possible.

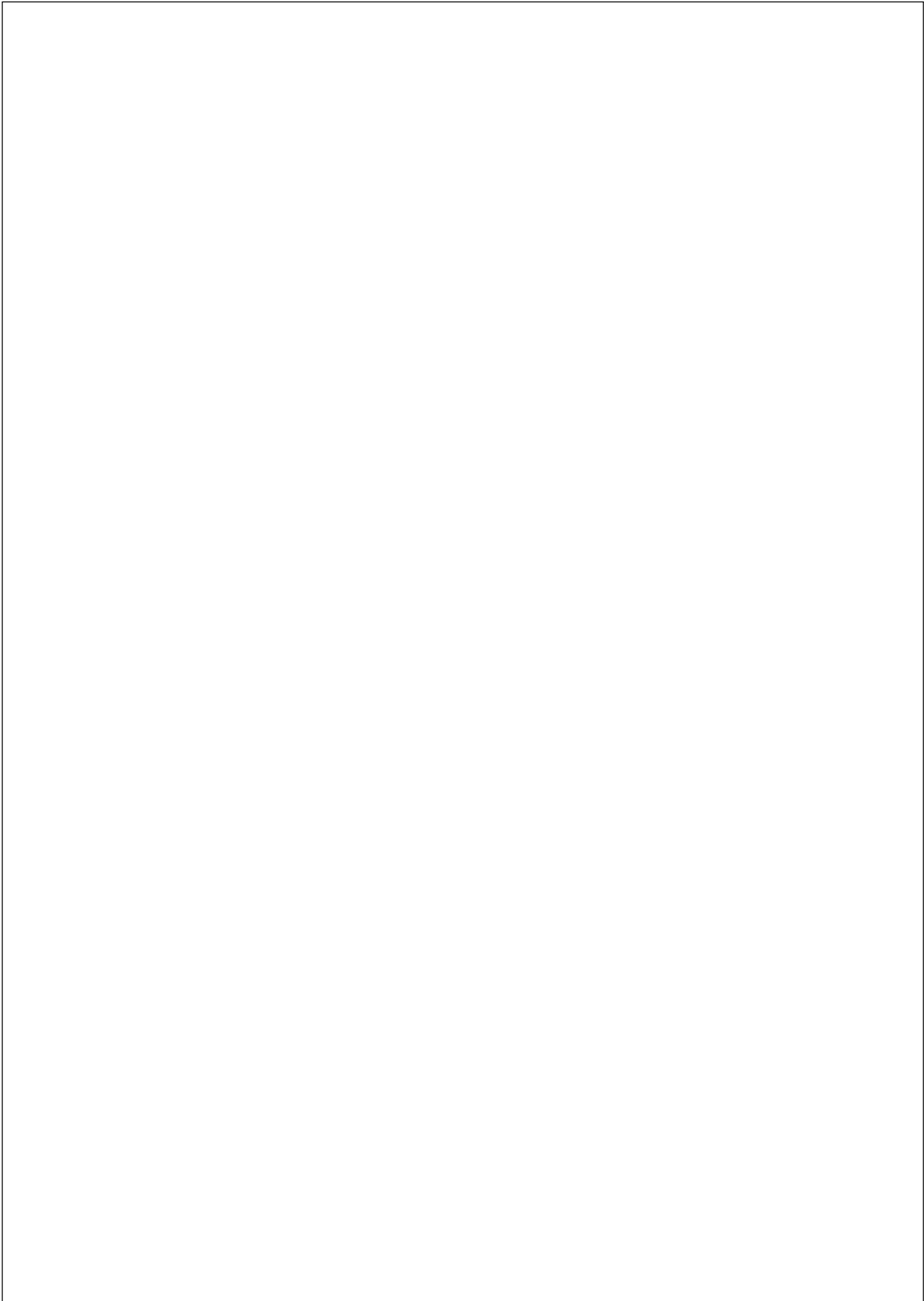
When you add any 2 odd numbers, your answer is always even.



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HA4

- 6 Prove whether the following statement is true or false. Write your answer in a way that would get you as good a mark as possible.

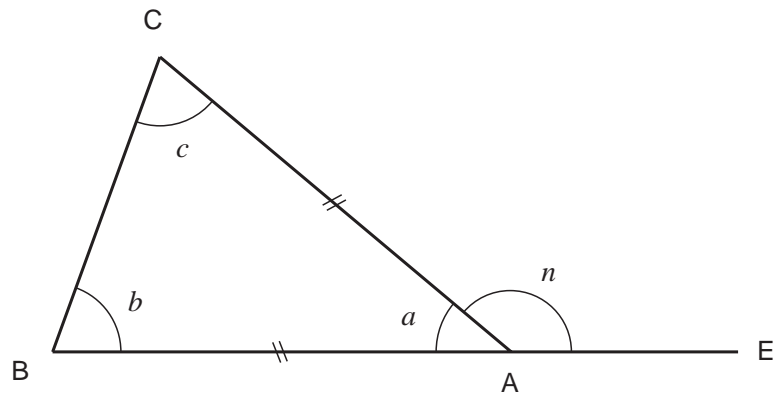
If p and q are any two odd numbers, $(p + q) \times (p - q)$ is always a multiple of 4.



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HA7

This diagram shows
a triangle ABC.
Side AB is the same
length as side AC.
Line BAE is straight.



- a) Find the value of c when $n = 140^\circ$.

.....

Write down each step of your calculation.

- b) Show that $c = \frac{1}{2}n$, whatever the value of n .

Write down all your steps.

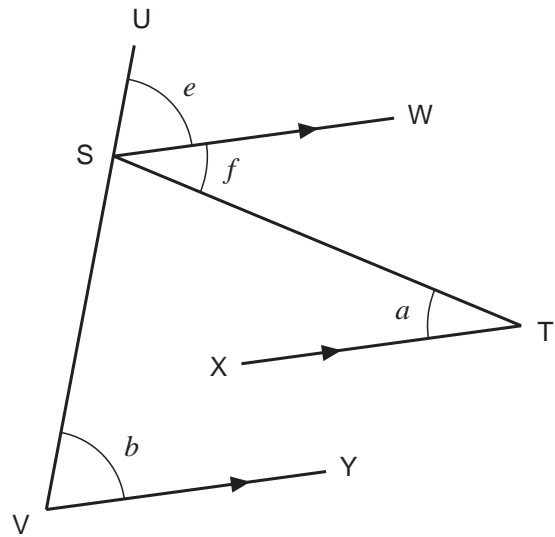
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G4

- c) In this diagram, lines SW, XT and VY are parallel. Line USV is straight.

Show that $a = \widehat{UST} - b$.

Write down all your steps.



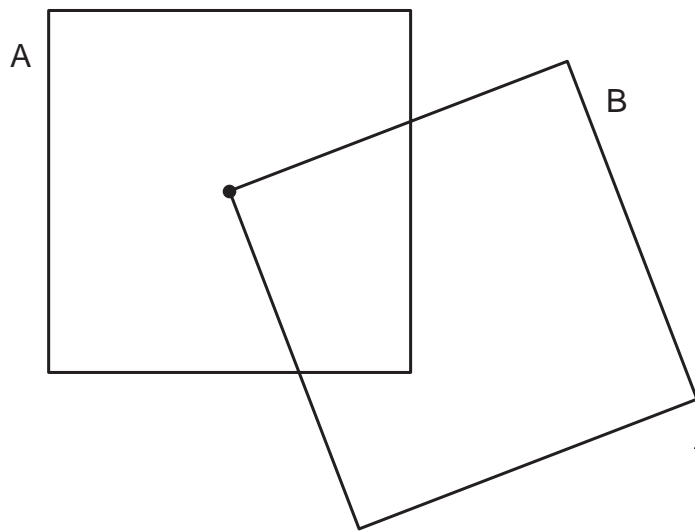
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- 8 Squares A and B are identical. One corner of B is at the centre of A.

What fraction of A is overlapped by B ?

.....

Explain your answer.



G2b

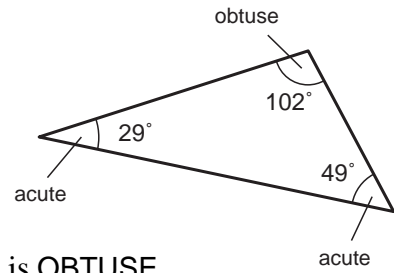
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Please go to the next question

9 Kath and Rose are thinking about the angles of this triangle.

They notice that two angles are ACUTE.

They notice that one angle is OBTUSE.



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LG1

Kath says: If two angles of a triangle are ACUTE, the third angle is OBTUSE.

Rose says: If one angle of a triangle is OBTUSE, the other two angles are ACUTE.

a) Are Kath's and Rose's statements saying the same thing?

b) A triangle has an OBTUSE angle of 113.62° .

Suppose Rose is right.

Which one of these must also be right? Tick (✓) one box.

- You can be sure that the other two angles are both ACUTE.
- You can be sure that the other two angles are not both ACUTE.
- You can't be sure whether the other two angles are both ACUTE until you know the size of both angles.

c) Is Kath's statement true?

Explain your answer.

d) Is Rose's statement true?

Explain your answer.

10 Asim, Beth, Cara, Declan, Erin and Frank were trying to prove whether the following statement is true or false:


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G3

When you add the interior angles of any triangle, your answer is always 180° .

Asim's answer

I tore the angles up and put them together.

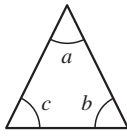


It came to a straight line which is 180° . I tried for an equilateral and an isosceles as well and the same thing happened.

So Asim says it's true

Beth's answer

I drew an isosceles triangle, with c equal to 65° .

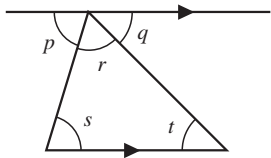


Statements	Reasons
$a = 180^\circ - 2c$	Base angles in isosceles triangle equal
$a = 50^\circ$	$180^\circ - 130^\circ$
$b = 65^\circ$	$180^\circ - (a + c)$
$c = b$	Base angles in isosceles triangle equal
$\therefore a + b + c = 180^\circ$.	

So Beth says it's true

Cara's answer

I drew a line parallel to the base of the triangle.



Statements	Reasons
$p = s$	Alternate angles between two parallel lines are equal
$q = t$	Alternate angles between two parallel lines are equal
$p + q + r = 180^\circ$...	Angles on a straight line
$\therefore s + t + r = 180^\circ$.	

So Cara says it's true

Declan's answer

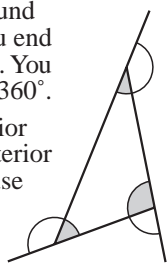
	a	b	c	total
I measured the angles of all sorts of triangles accurately and made a table.	110	34	36	180
	95	43	42	180
	35	72	73	180
They all added up to 180° .	10	27	143	180

So Declan says it's true

Erin's answer

If you walk all the way around the edge of the triangle, you end up facing the way you began. You must have turned a total of 360° .

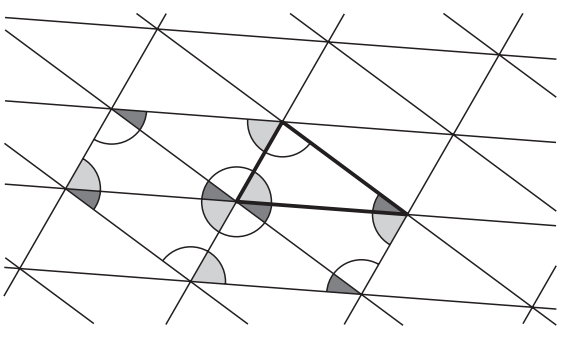
You can see that each exterior angle when added to the interior angle must give 180° because they make a straight line. This makes a total of 540° . $540^\circ - 360^\circ = 180^\circ$.



So Erin says it's true

Frank's answer

I drew a tessellation of triangles and marked all the equal angles.



I know that the angles round a point add up to 360° .

So Frank says it's true

- a) Whose answer do you like best?
- b) Whose answer is closest to what you would do?
- c) Whose answer would get the best mark from your teacher?

- d) For each of the following, circle whether you agree, don't know, or disagree.

The statement is:

When you add the interior angles of any triangle, your answer is always 180° .

	agree	don't know	disagree
<i>Asim's answer ...</i>			
shows you that the statement is always true	1	2	3
<i>Beth's answer ...</i>			
shows you that the statement is always true	1	2	3
<i>Cara's answer ...</i>			
shows you that the statement is always true	1	2	3
<i>Declan's answer ...</i>			
shows you that the statement is always true	1	2	3
<i>Erin's answer ...</i>			
shows you that the statement is always true	1	2	3
<i>Frank's answer ...</i>			
shows you that the statement is always true	1	2	3

- e) Suppose it has now been proved that:

When you add the interior angles of any triangle, your answer is always 180° .

Zak asks what needs to be done to prove whether:

When you add the interior angles of any right-angled triangle, your answer is always 180° .

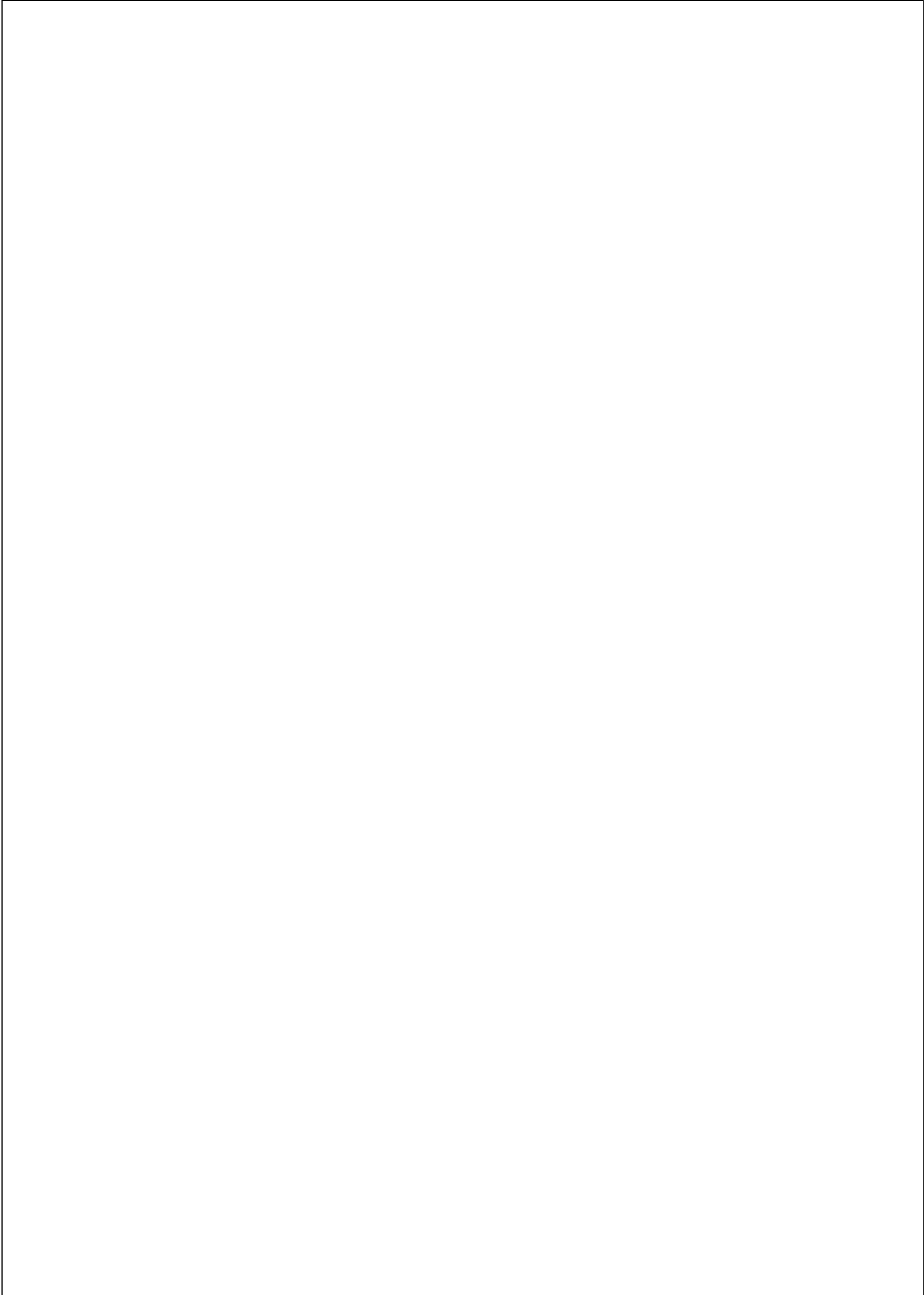
Tick (✓) either A or B.

(A) Zak doesn't need to do anything, the first statement has already proved this.

(B) Zak needs to construct a new proof.

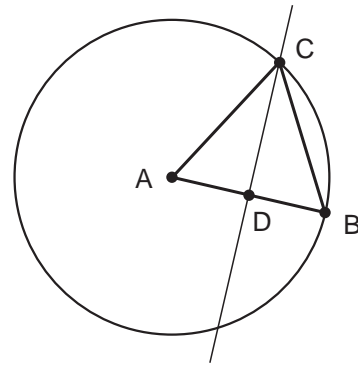
- 11 Prove whether the following statement is true or false. Write your answer in a way that would get you as good a mark as possible.

If you add the interior angles of any quadrilateral, your answer is always 360° .



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HG4

- 12 A is the centre of a circle and AB is a radius.
C is a point on the circumference where the perpendicular bisector of AB crosses the circle.
Prove whether the following statement is true or false. Write your answer in a way that would get you as good a mark as possible.



Triangle ABC is always equilateral.

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HG7

*WAIT! Please go back to any questions you left out, then check all your answers.
After that, if there is any time left over, please answer this questionnaire:*

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Z1 a) What did you feel about taking part in this survey?

b) Which question did you like best, and why?

c) Which question did you like least, and why?

d) Please add any other comments, if you wish to, about the survey.