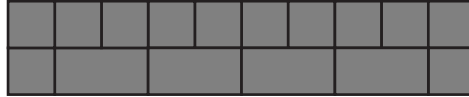


A1 Larry has some white rectangular tiles and some grey square tiles. The white tiles are twice as long as the grey tiles but have the same width.

He makes a row of white tiles, like this:



He then builds a 'bridge' of grey tiles over the white tiles, like this:



a) How many grey tiles does he need to build a bridge over a row of 40 white tiles?

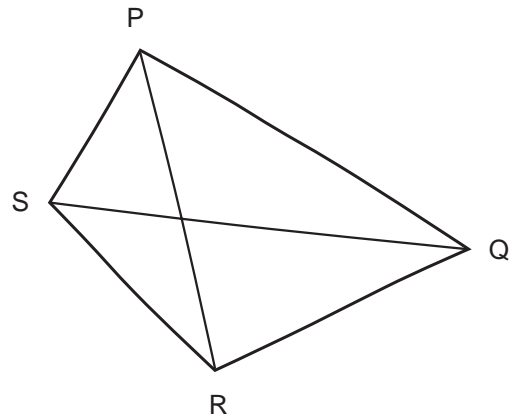
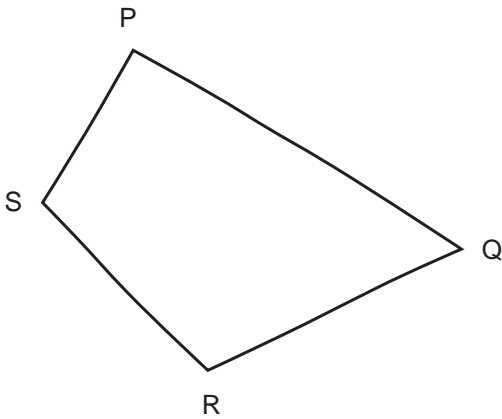
Show how you obtained your answer.

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

G1 Tim sketches a quadrilateral.

He draws the diagonals of the quadrilateral.

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Tim notices that one of the diagonals has cut the area of the quadrilateral in half.

He says

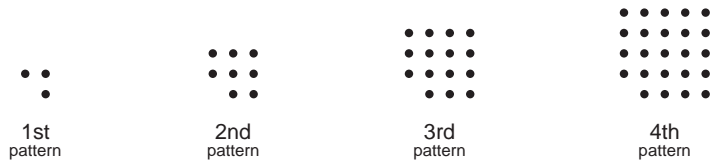
“Whatever quadrilateral I draw,
at least one of the diagonals will always cut the area of the quadrilateral in half”.

Is Tim right?

.....

Explain your answer.

A2 Karen and Josie are looking at these first four patterns in a sequence of dot patterns:



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- a) Karen wants to calculate the number of dots in the 4th and 20th pattern. She says each pattern looks like a square with a dot missing from one corner.

Use **Karen's** idea to *calculate* the number of dots in

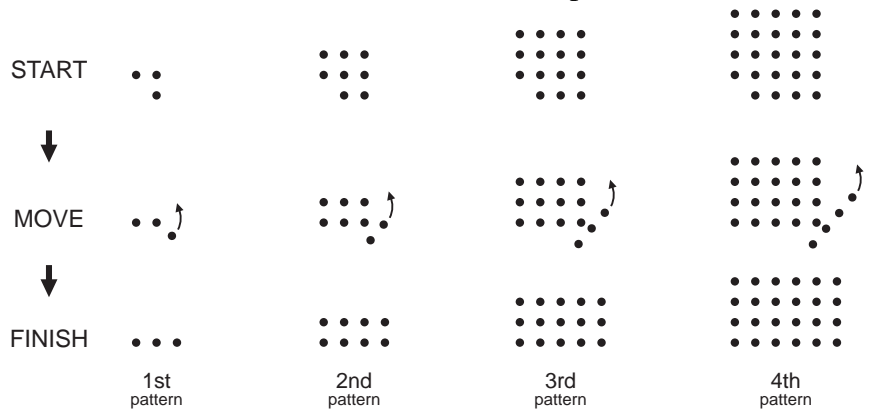
i. the 4th pattern

Show how you obtained your answer

ii. the 20th pattern.

Show how you obtained your answer

- b) Josie also wants to calculate the number of dots in the 4th and 20th pattern. She says she can change each pattern into a rectangle, like this:



Use **Josie's** idea to *calculate* the number of dots in

i. the 4th pattern

Show how you obtained your answer

ii. the 20th pattern.

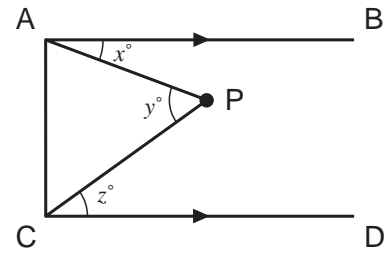
Show how you obtained your answer

- c) Write an expression for the number of dots in the n th pattern, using

- i. Karen's way of looking at the pattern
- ii. Josie's way of looking at the pattern.

G3 In the diagram, line AB is parallel to line CD, and AC is at right angles to both lines.

Points A, B, C and D are fixed.
Point P can move anywhere between AB and CD, but stays connected to A and C (the straight lines PA and PC can stretch or shrink).



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Astrid, Burt, Cleo, Dilip and Emma are discussing whether this statement is true:

$x^\circ + z^\circ$ is equal to y° .

Astrid's answer

I could have a triangle APC with these angles. →

Then
 $y = 180 - 51 - 67 = 62$,
 $x = 90 - 51 = 39$, and $z = 90 - 67 = 23$.

But $62 = 39 + 23$, and as
 $180 - 51 - 67 = (90 - 51) + (90 - 67)$,
 I could have a triangle with other angles.
 So $y = x + z$.

So Astrid says it's true

Burt's answer

The angle sum of triangle ACP is 180° , so $y + a + c = 180$.

Angles A and C are 90° , so I can write $90 - x$ for a , and $90 - z$ for c .

So $y + (90 - x) + (90 - z) = 180$,
 so $y - x - z = 0$,
 so $y = x + z$.

So Burt says it's true

Cleo's answer

I measured the angles in the original diagram. I then moved P to another place and measured the angles again.

I made this table:

	x	z	y
So both times I found that $x + z$ equals y .	21	36	57
	17	32	49

So Cleo says it's true

Dilip's answer

The angle sum of triangle ACP is 180° .

So I can write $a + c = 180 - y = 180 - (x + z)$.
 Also $y = 180 - (a + c)$.

So $y = 180 - (180 - (x + z)) = x + z$.

So Dilip says it's true

Emma's answer

I drew a line through P parallel to lines AB and CD.

The new line cuts angle y into two parts.
 The top part (●) is equal to x because the new line is parallel to AB. The bottom part (◆) is equal to z because the new line is parallel to CD.
 So, altogether, y is equal to $x + z$.

So Emma says it's true

- Whose answer do you like best?
- Whose answer is closest to what you would do?
- 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: $x^{\circ} + z^{\circ}$ is equal to y° .

Astrid's answer ...

	agree	don't know	disagree
--	-------	------------	----------

shows you that the statement is always true	1	2	3
--	---	---	---

only shows you that the statement is true for some examples	1	2	3
--	---	---	---

shows you why the statement is true	1	2	3
--	---	---	---

Burt's answer ...

shows you that the statement is always true	1	2	3
--	---	---	---

only shows you that the statement is true for some examples	1	2	3
--	---	---	---

shows you why the statement is true	1	2	3
--	---	---	---

Cleo's answer ...

shows you that the statement is always true	1	2	3
--	---	---	---

only shows you that the statement is true for some examples	1	2	3
--	---	---	---

shows you why the statement is true	1	2	3
--	---	---	---

Dilip's answer ...

shows you that the statement is always true	1	2	3
--	---	---	---

only shows you that the statement is true for some examples	1	2	3
--	---	---	---

shows you why the statement is true	1	2	3
--	---	---	---

Emma's answer ...

shows you that the statement is always true	1	2	3
--	---	---	---

only shows you that the statement is true for some examples	1	2	3
--	---	---	---

shows you why the statement is true	1	2	3
--	---	---	---

LA1 Pam and Viv 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.

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

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

a) Are Pam's and Viv's statements saying the same thing?

b) The PRODUCT of two whole numbers is 1247.

Suppose Viv 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 Pam's statement true?

Explain your answer.

d) Is Viv's statement true?

Explain your answer.

- A4 a) $4!$ means $4 \times 3 \times 2 \times 1$.
 $5!$ means $5 \times 4 \times 3 \times 2 \times 1$.

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Is $5!$ exactly divisible by 3 ?

Explain your answer.

- b) What does $50!$ mean?

- c) Is $50!$ exactly divisible by 19 ?

Explain your answer.

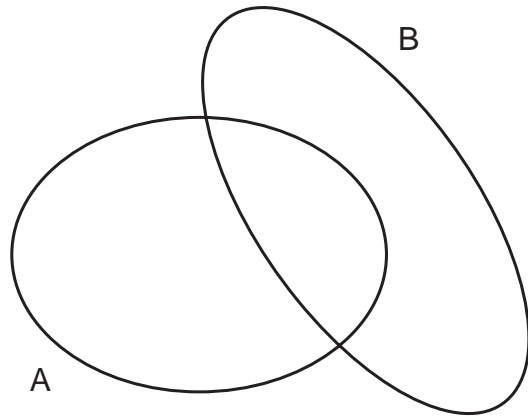
G2 The two ovals A and B have the same area.

The ovals overlap.

a) Do the two non-overlapping regions have the same area?

.....

Explain your answer.



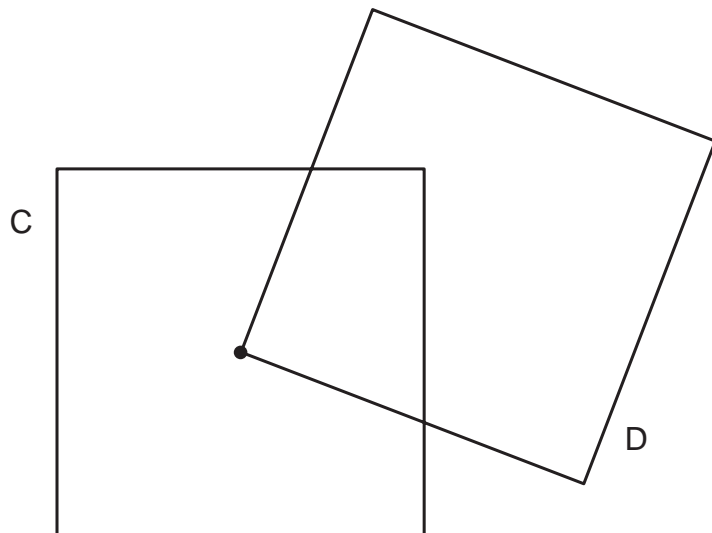
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b) Squares C and D are identical. One corner of D is at the centre of C.

What fraction of C is overlapped by D?

.....

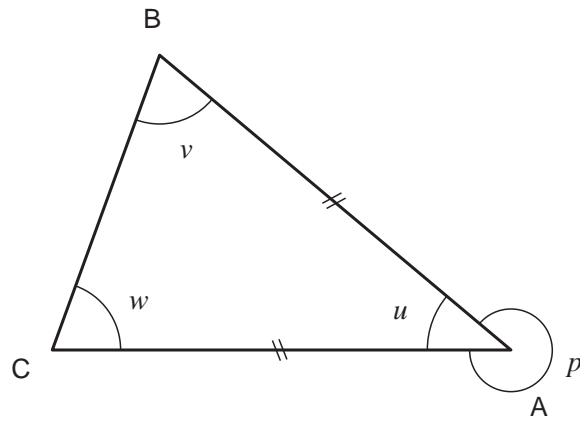
Explain your answer.



G4

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The diagram shows a triangle ABC.
Side AB is the same length as side AC.



- a) Find the size of angle v , when angle p is 320° .

.....

Write down each step of your calculation.

- b) Write down your first step again and give a reason for the step.

- c) Write down your next steps again and give a reason for each one.

A3 The drawing shows the calendar for last July.
A square is drawn around nine of the numbers.
The top-left number and bottom-right number in the square are circled.

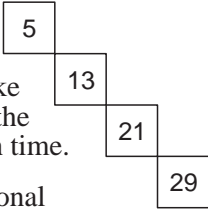
July						
M	T	W	T	F	S	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

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Ashok, Beryl, Cora, Dave and Ethan are discussing whether this statement is true:

When there are nine numbers in the square, the bottom-right number will be 16 more than the top-left number.

Ashok's answer



Look at a 'diagonal' line like this one. You can see that the numbers increase by 8 each time.

So if you go from one diagonal number to the next-but-one diagonal number, it increases by $8 + 8$ which is 16.

So Ashok says it's true

Beryl's answer

For a square with 9 numbers, you can get from the first circled number to the second by going 2 steps across and 2 steps down.

Each step across is an increase of 1 day.
Each step down is an increase of 1 week.

So altogether, the number increases by $1 + 1 + 7 + 7$, which is 16.

So Beryl says it's true

Cora's answer

Think of a square of nine numbers.
Call the first number n .

Then this shows the first row and column. The numbers go up by a day at a time in each row and by a week at a time in each column.

n	$n+1$	$n+1+1$
$n+7$	-	-
$n+7+7$	-	-

So the last number is $n + 1 + 1 + 7 + 7$, which is $n + 16$.

So Cora says it's true

Dave's answer

It works for the original square because 27 is 16 more than 11.

11	12	13
18	19	20
25	26	27

It also works for this square, because 21 is 16 more than 5.

5	6	7
12	13	14
19	20	21

So Dave says it's true

Ethan's answer

Draw a square full of numbers.
Let x be the first number in the square.
Let d be the number of days in a week.
Let s be the number of numbers in the square.

Then the last number in the square is $x + d + s$.

But $d = 7$ and $s = 9$, so the last number is $x + 7 + 9$ which is $x + 16$.

So Ethan says it's true

- Whose answer do you like best?
- Whose answer is closest to what you would do?
- 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 there are nine numbers in the square,
the bottom-right number will be 16 more than
the top-left number.**

<i>Ashok's answer ...</i>	agree	don't know	disagree
shows you that the statement is always true	1	2	3
only shows you that the statement is true for some examples	1	2	3
shows you why the statement is true	1	2	3

<i>Beryl's answer ...</i>	agree	don't know	disagree
shows you that the statement is always true	1	2	3
only shows you that the statement is true for some examples	1	2	3
shows you why the statement is true	1	2	3

<i>Cora's answer ...</i>	agree	don't know	disagree
shows you that the statement is always true	1	2	3
only shows you that the statement is true for some examples	1	2	3
shows you why the statement is true	1	2	3

<i>Dave's answer ...</i>	agree	don't know	disagree
shows you that the statement is always true	1	2	3
only shows you that the statement is true for some examples	1	2	3
shows you why the statement is true	1	2	3

<i>Ethan's answer ...</i>	agree	don't know	disagree
shows you that the statement is always true	1	2	3
only shows you that the statement is true for some examples	1	2	3
shows you why the statement is true	1	2	3

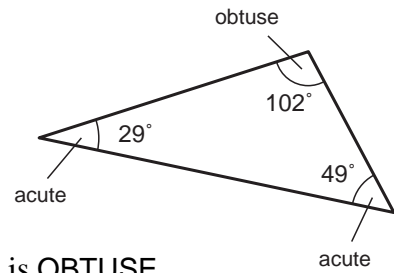
LG1 Jack and Bob are thinking about the angles of this triangle.

They notice that two angles are ACUTE.

They notice that one angle is OBTUSE.

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

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



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a) Are Jack's and Bob's statements saying the same thing?

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

Suppose Bob 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 Jack's statement true?

Explain your answer.

d) Is Bob's statement true?

Explain your answer.

*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.