Year 8 Mathematics Challenge 2021

Heats, Monday 17th to Wednesday 19th May 2021

via *Livestorm*

William Thallon

Teaching and Learning Adviser (Secondary Maths)

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@HfLSecMaths

Herts for Learning

The Four Rounds

Round 1 General Maths questions

Round 2 Memory Round

Round 3 Estimation Round

Round 4 General Maths questions

60 marks for each round.

Preliminaries

- You should have pens or pencils, rubbers, and rough working out paper only.
- No calculators, no measuring equipment, and no use of computers, phones, Internet etc!
- Your teacher has been sent a spreadsheet to record your answers. This should be returned by e-mail at the end.

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Round 1

General Mathematics Questions

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Round 1

Question 1

What is the mean of the first five square numbers?

Round 1

Question 2

Here is the start of a sequence of numbers.

1st term	2nd term	3rd term	4th term	5th term
2	5	10	17	26

...

What is the 20th term in the sequence?

Round 1

Question 3

a and b are two different positive integers.

Both a and b are less than 10.

The ratio of their **sum** to their **product** is **1 : 2**.

What are the values of a and b?

Round 1

Question 4

Dan takes some money on a shopping trip.

He spends **half** of the money on clothes.

He spends **one-third** of the **rest** on food.

He then has £46 left.

How much did he spend on clothes?

Round 1

Question 5

Here is a multiplication square with some missing numbers.

What number should go in the green square?

×	**2**	**3**	
5	10	15	
		24	104
		51	

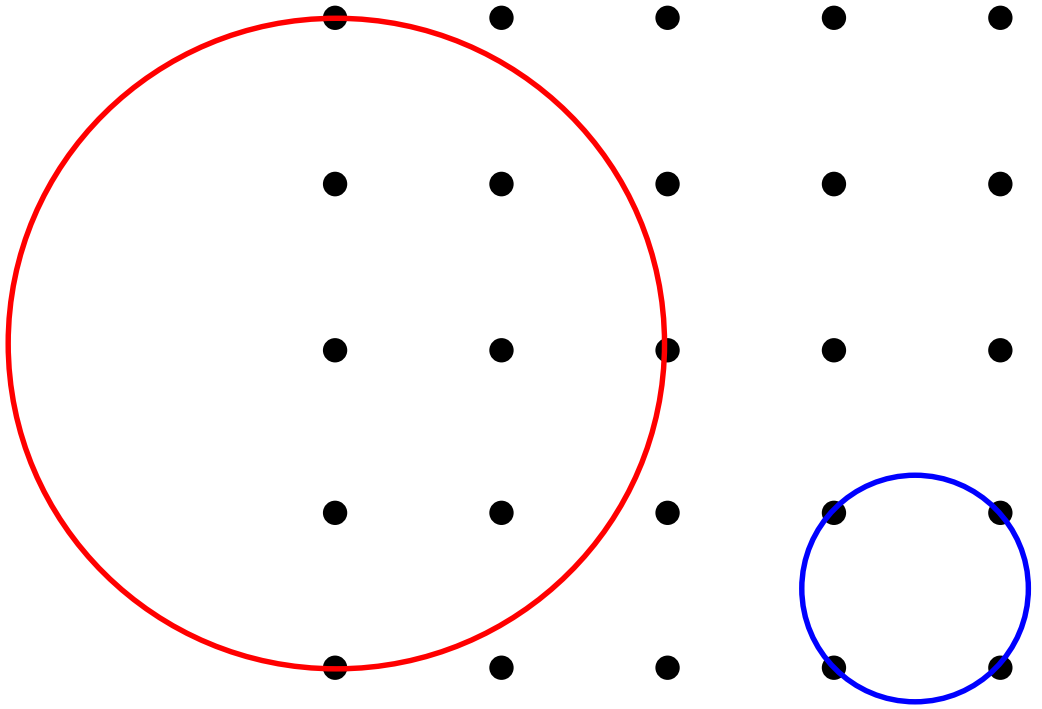
Round 1

Question 6

25 dots are arranged in a square array.

The **red circle** passes through **3** of the dots.

The **blue circle** passes through **4** of the dots.



What is the highest number of these dots a circle could pass through?

End of Round 1

Round 2

Memory Round

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Memory Round

We are going to show a mathematical poster to two members of the team (the **observers**).

The other two members of the team (the **scribes**) will not see the poster. The observers must describe the poster from memory, and the scribes must draw it.

The observers are not allowed to draw the poster, or make notes when they are looking at the poster.

When describing the poster, observers must use words only. They are not allowed to draw anything, or use their hands in any way.

Memory Round

The poster will be shown on the screen. The scribes must go into a different room, so they cannot see it.

The observers will have **four** chances to view the poster.

30 seconds to view
2 minutes to go and describe

30 seconds to view
2 minutes to describe

30 seconds to view
2 minutes to describe

30 seconds to view
2 minutes to describe

Scribes can draw at any time during the whole period.

Memory Round

Pencils and rubbers only. No rulers or other equipment.

Advice for Scribes: please note that the poster is in **landscape** orientation.

Advice for Observers: do not try to memorise the whole poster at the first viewing.

Each showing of the poster will be preceded by a 30-second warning, so the observers can get into position.

At the end, the finished poster should be photographed or scanned and sent in by e-mail.

(E-mail address to follow at end of round.)

Memory Round

You now have one minute to decide who will be the observers and who will be the scribes … and to get into position!

Memory Round

Poster about to be displayed for the first time.

$y = x^2$

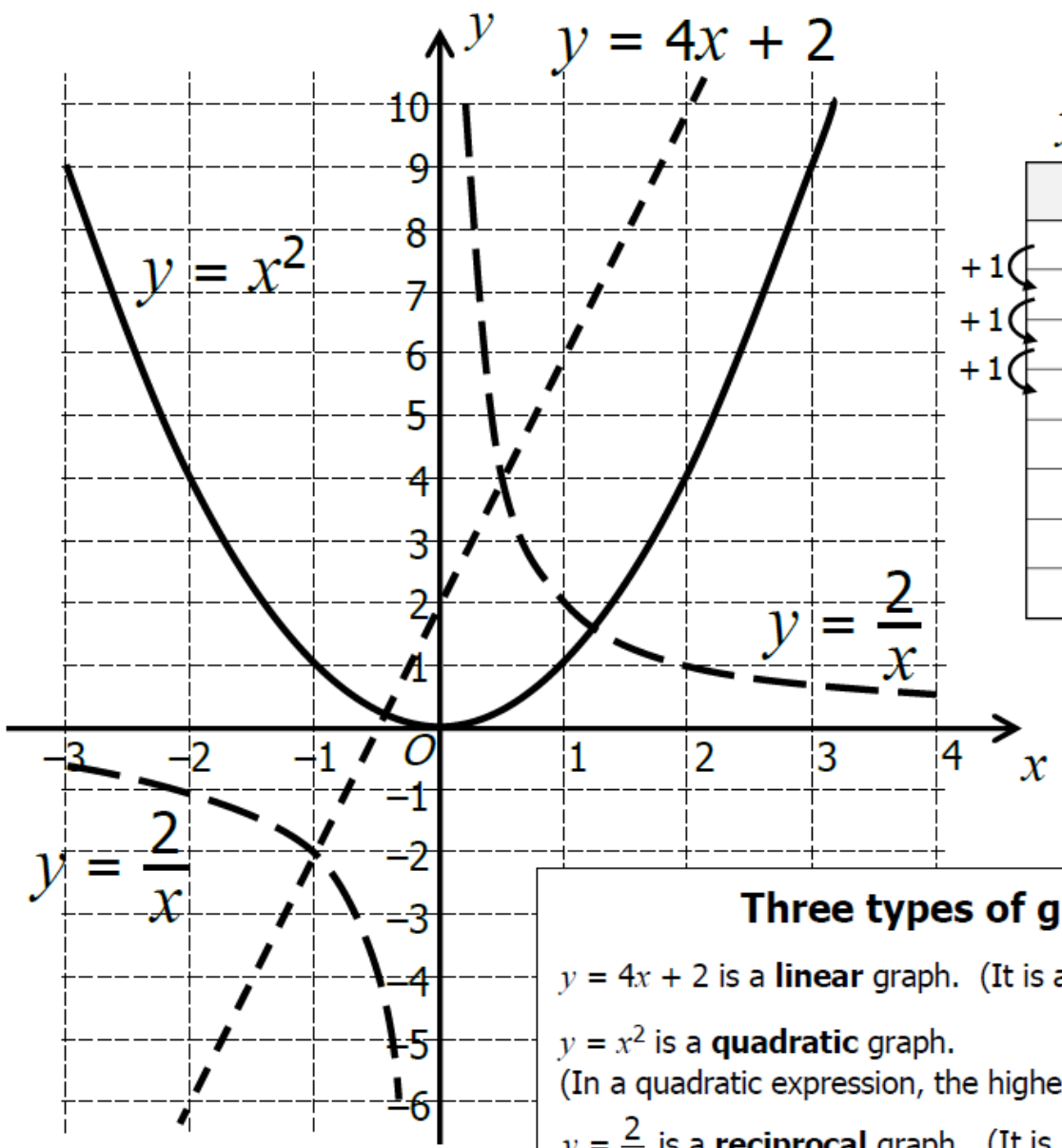
x	y	
−3	9	−5
−2	4	−3
−1	1	−1
0	0	+1
1	1	+3
2	4	+5
3	9	+7
4	16	

(Squaring a negative number gives a positive number)

$y = \frac{2}{x}$

x	y	
−2	−1	÷2 / ×2
−1	−2	
−0.5	−4	
0.5	4	
1	2	×8 / ÷8
2	1	
4	0.5	

(Note that 2 ÷ 0 is meaningless.)



$y = 4x + 2$

x	y	
−3	−10	+1 / +4
−2	−6	+1 / +4
−1	−2	+1 / +4
0	2	
1	6	
2	10	
3	14	
4	18	

Gradient = 4

Three types of graph

$y = 4x + 2$ is a **linear** graph. (It is a straight line.)

$y = x^2$ is a **quadratic** graph.
(In a quadratic expression, the highest power of x is 2.)

$y = \frac{2}{x}$ is a **reciprocal** graph. (It is $\frac{1}{x}$, the 'reciprocal of x', multiplied by 2.)

Round 2

Memory Round

Herts for Learning

Memory Round

Second viewing of poster coming up!

$y = x^2$

x	y	
−3	9	−5
−2	4	−3
−1	1	−1
0	0	+1
1	1	+3
2	4	+5
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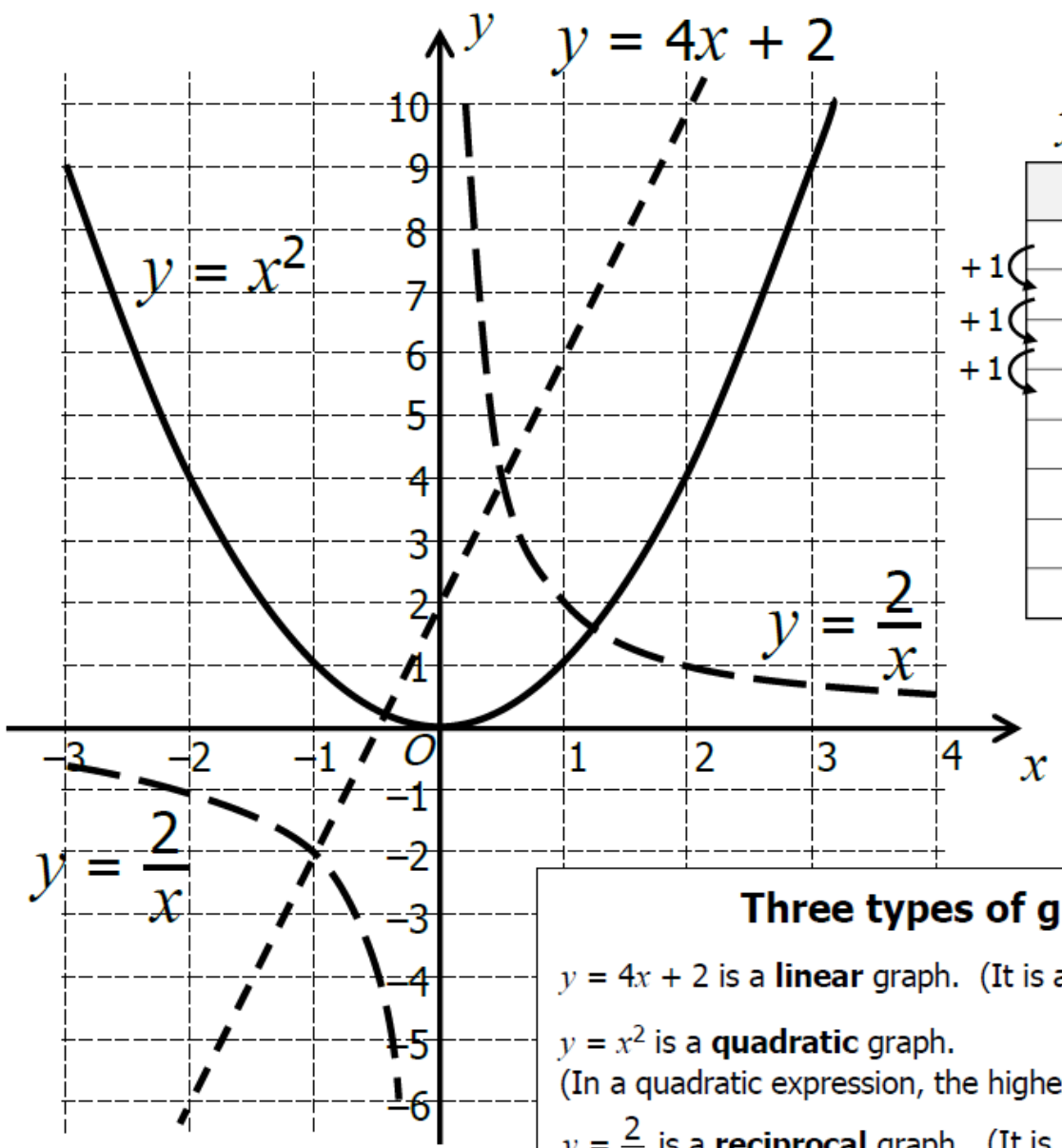

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Round 2

Memory Round

Herts for Learning

Memory Round

Third viewing of poster coming up!

$y = x^2$

x	y	
−3	9	−5
−2	4	−3
−1	1	−1
0	0	+1
1	1	+3
2	4	+5
3	9	+7
4	16	

(Squaring a negative number gives a positive number)

$y = \frac{2}{x}$

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4	0.5	

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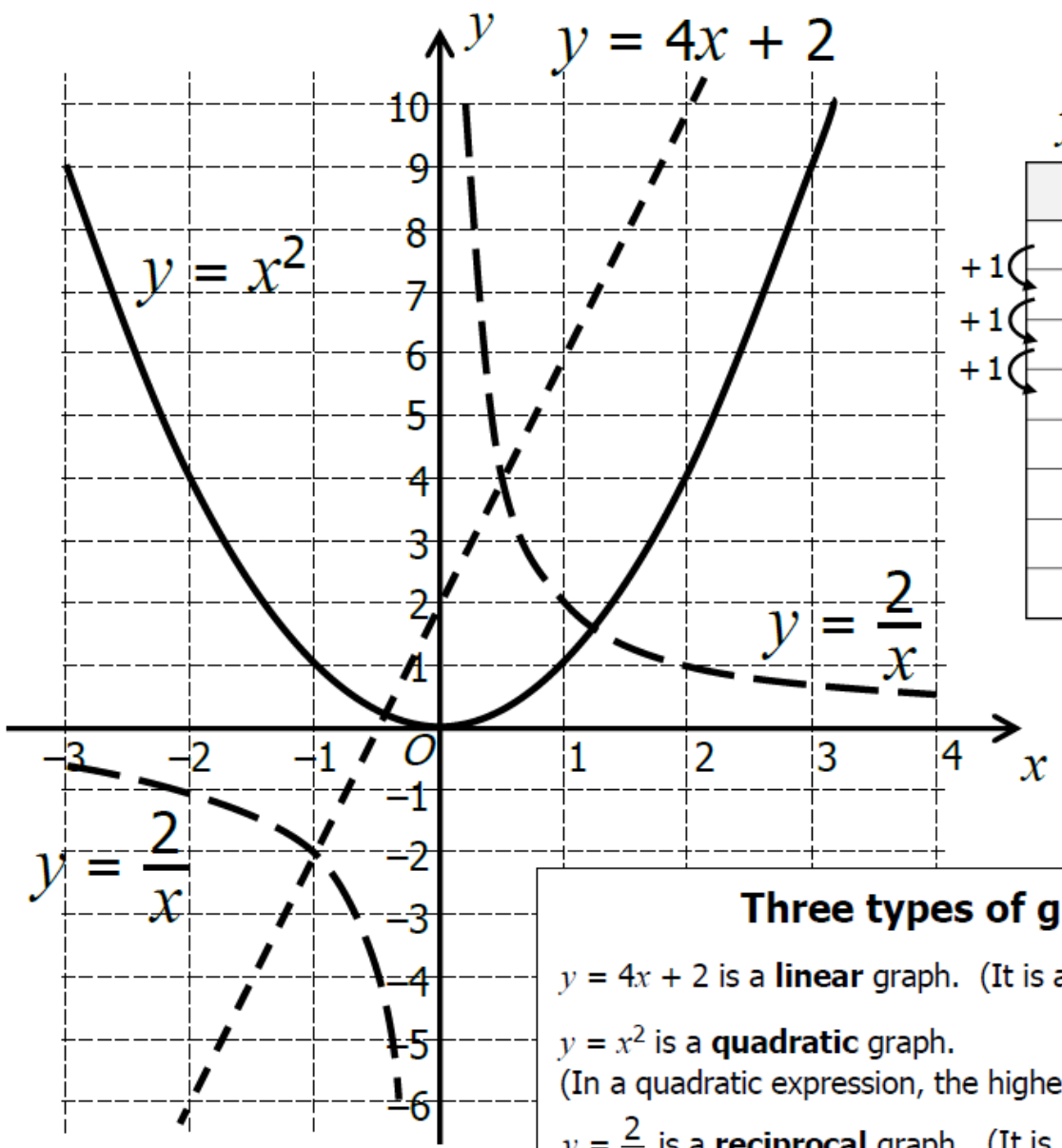

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Gradient = 4

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Round 2

Memory Round

Herts for Learning

Memory Round

Fourth and final viewing of poster coming up!

$y = x^2$

x	y	
−3	9	−5
−2	4	−3
−1	1	−1
0	0	+1
1	1	+3
2	4	+5
3	9	+7
4	16	

(Squaring a negative number gives a positive number)

$y = \frac{2}{x}$

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0.5	4	
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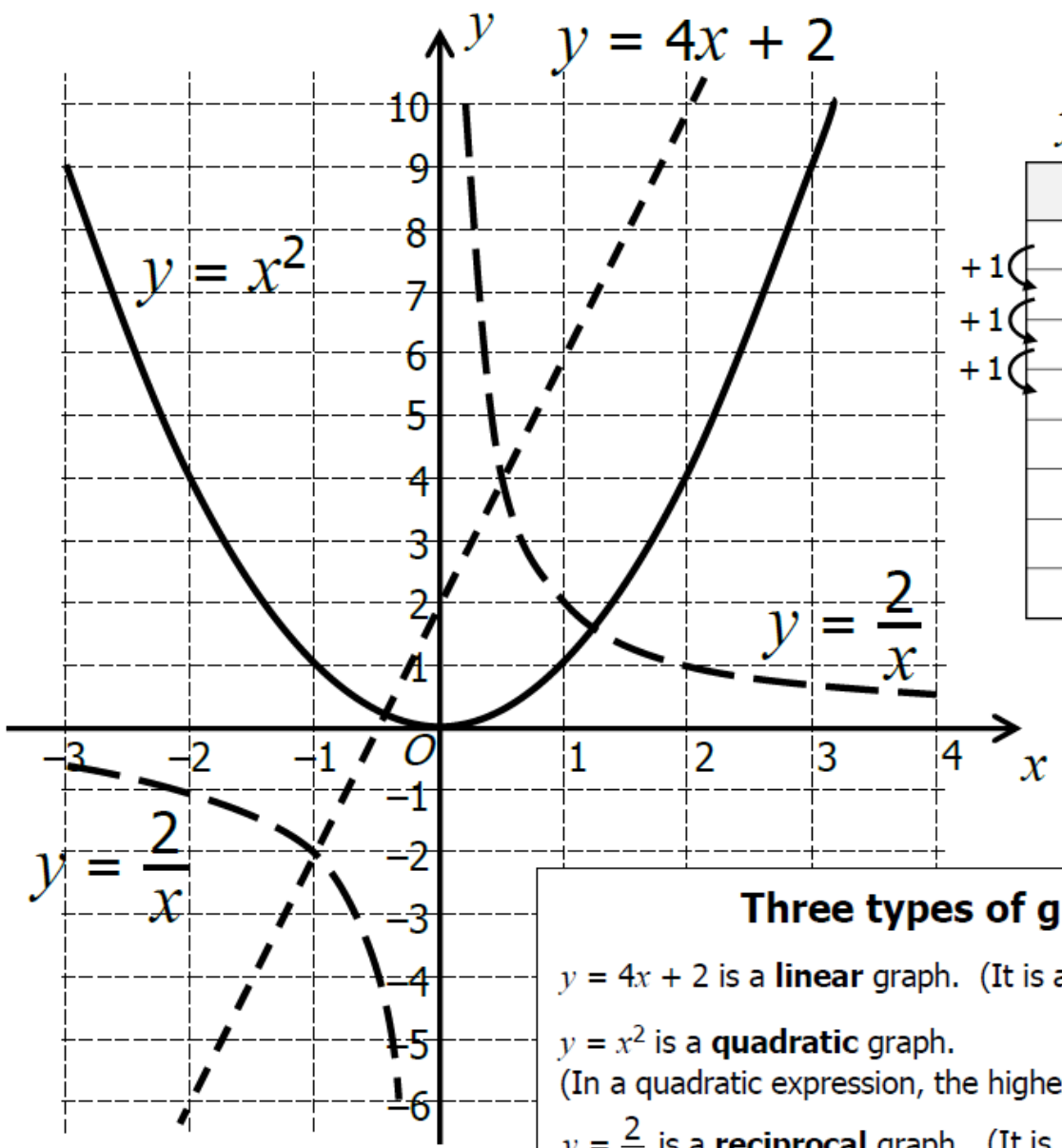

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Round 2

Memory Round

Herts for Learning

Memory Round

Time’s up!

Everyone should now come back into the main room.

End of Round 2

Round 3

Estimation Round

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Round 3

Question 1

Estimate the answer to this calculation:

$$\sqrt{\frac{1{,}725.9}{3.56}}$$

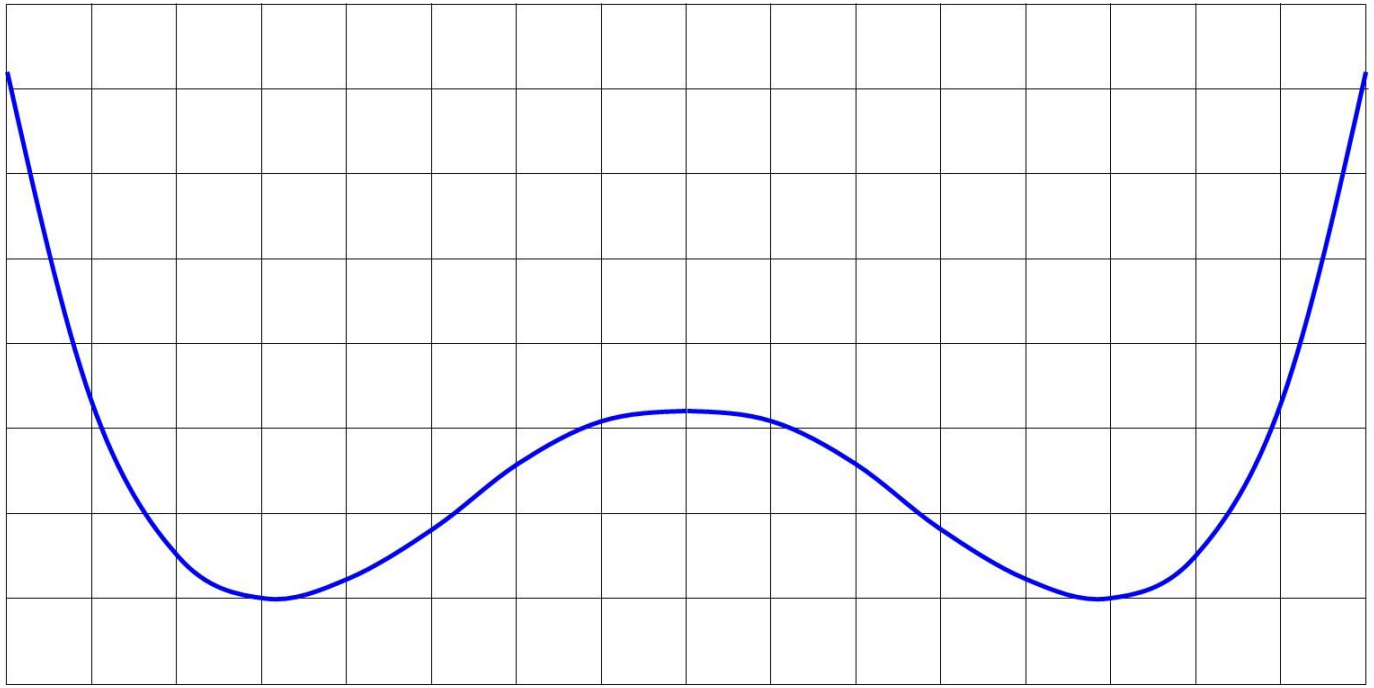
Give the answer to the nearest whole number.

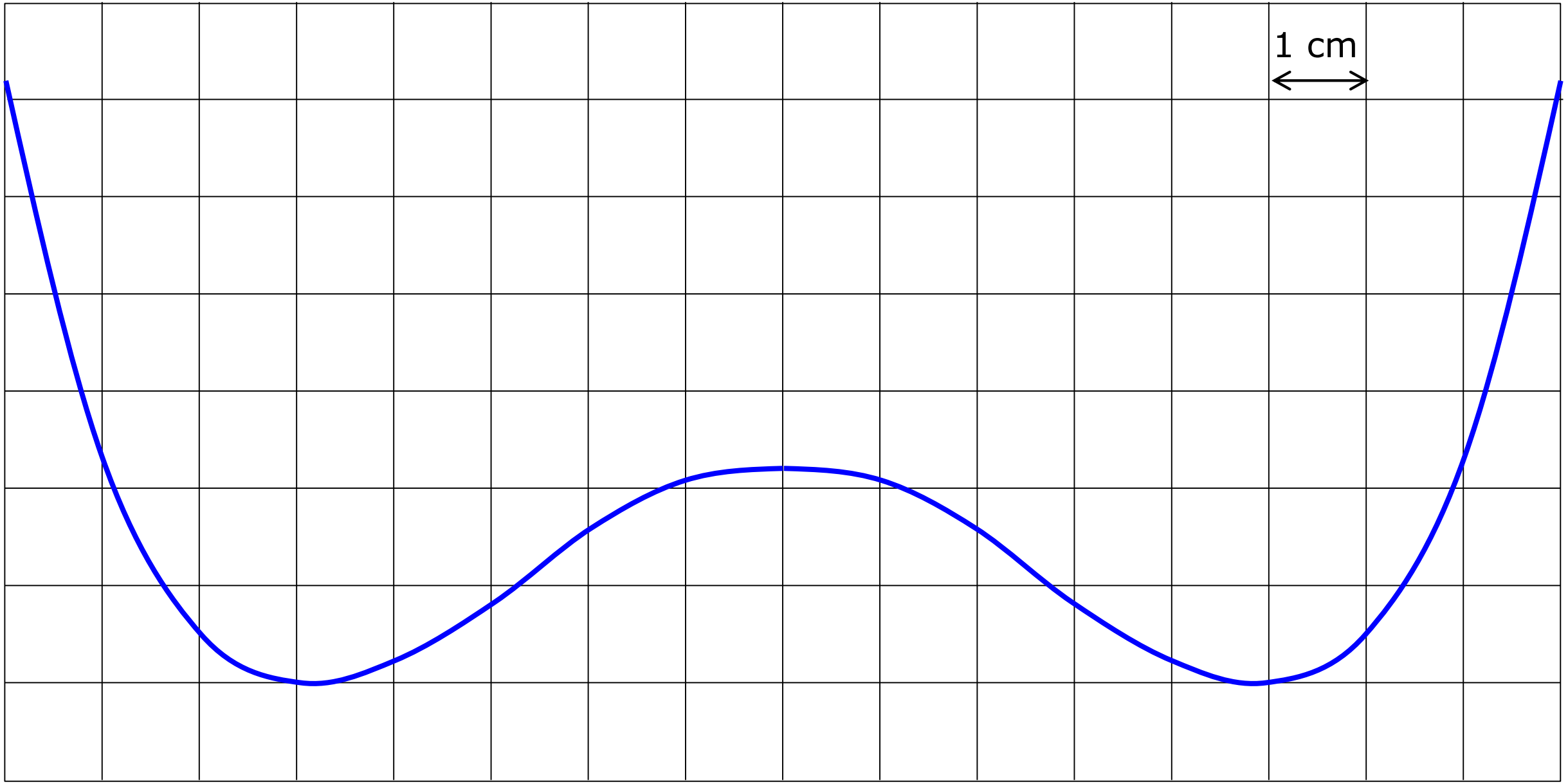
Round 3

Question 2

The blue curve is drawn on a centimetre-square grid.

Estimate the length of the curve, in cm.

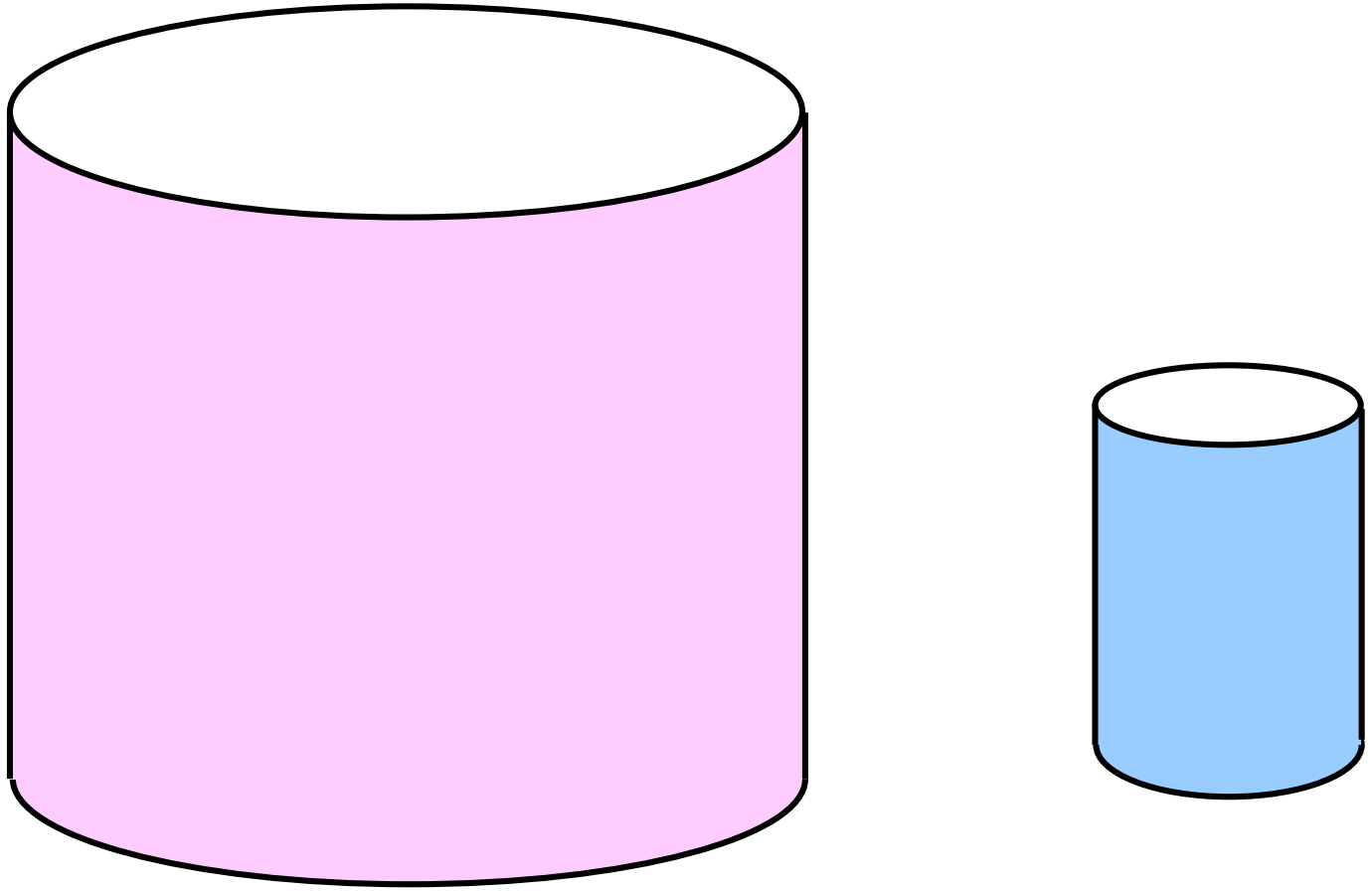



1 cm

Round 3

Question 3

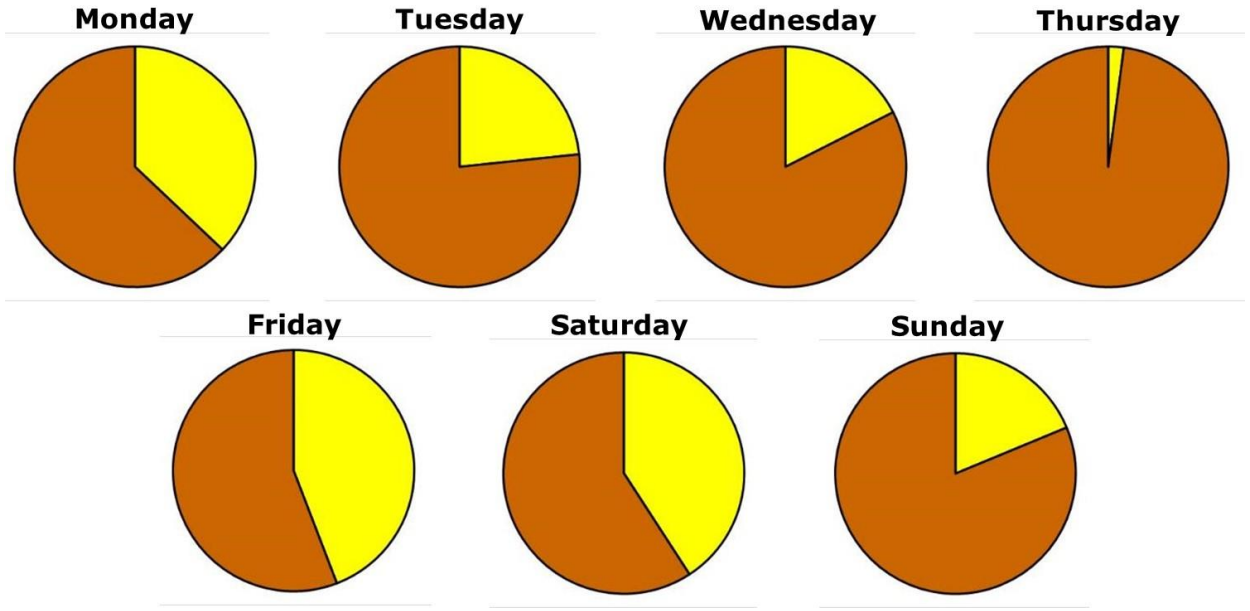
Estimate the number of cupfuls of the blue cylinder it would take to fill the pink cylinder.



Round 3

Question 4

These pie charts show the number of hours of sunshine each day of the week. (The yellow sectors indicate sunshine. Each day lasts 24 hours.)

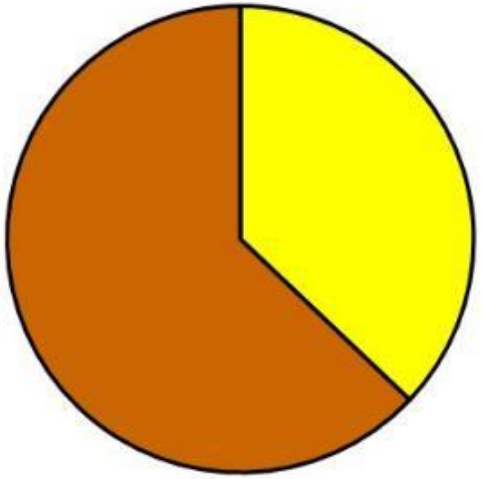


Estimate the total number of hours of sunshine over the week.

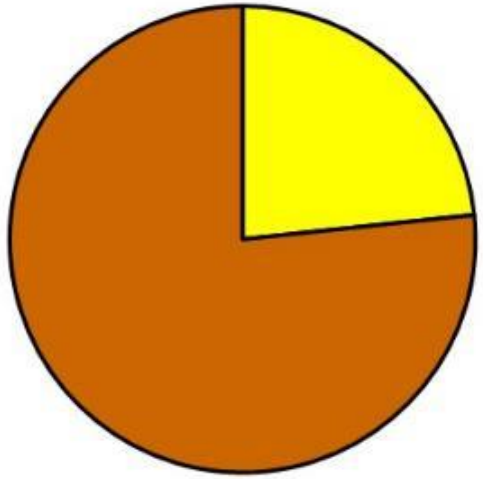
Round 3

Question 4

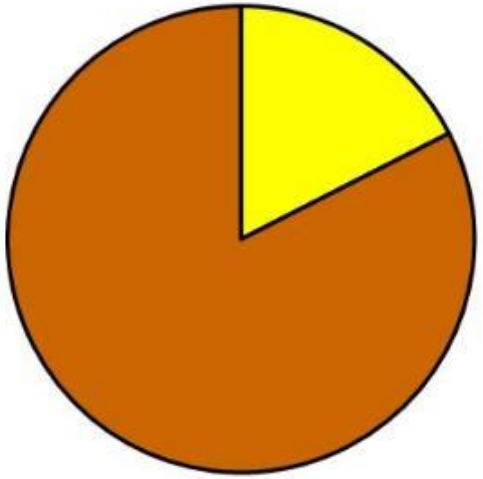
Monday



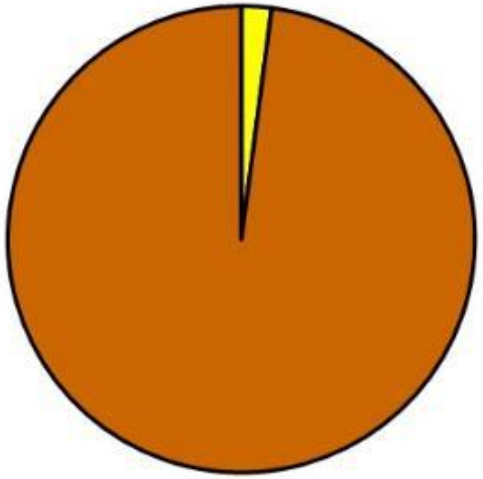
Tuesday



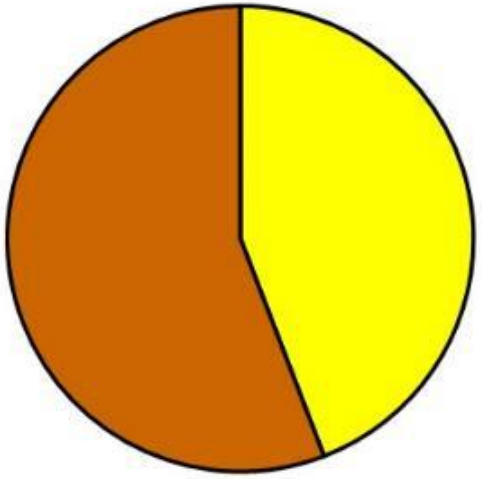
Wednesday



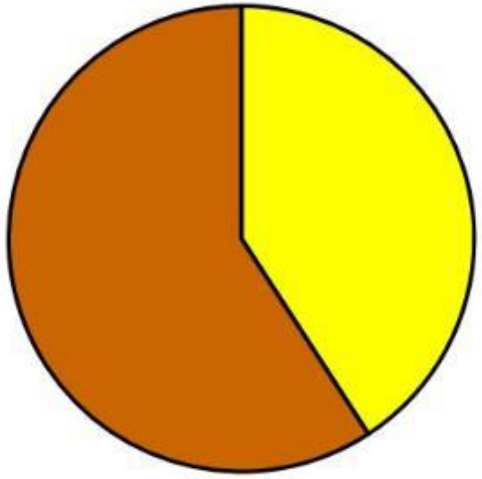
Thursday



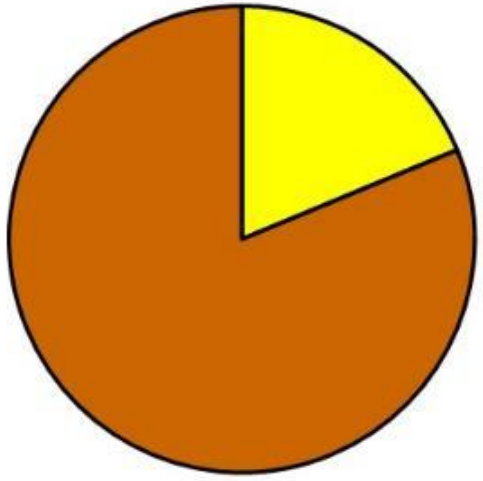
Friday



Saturday



Sunday

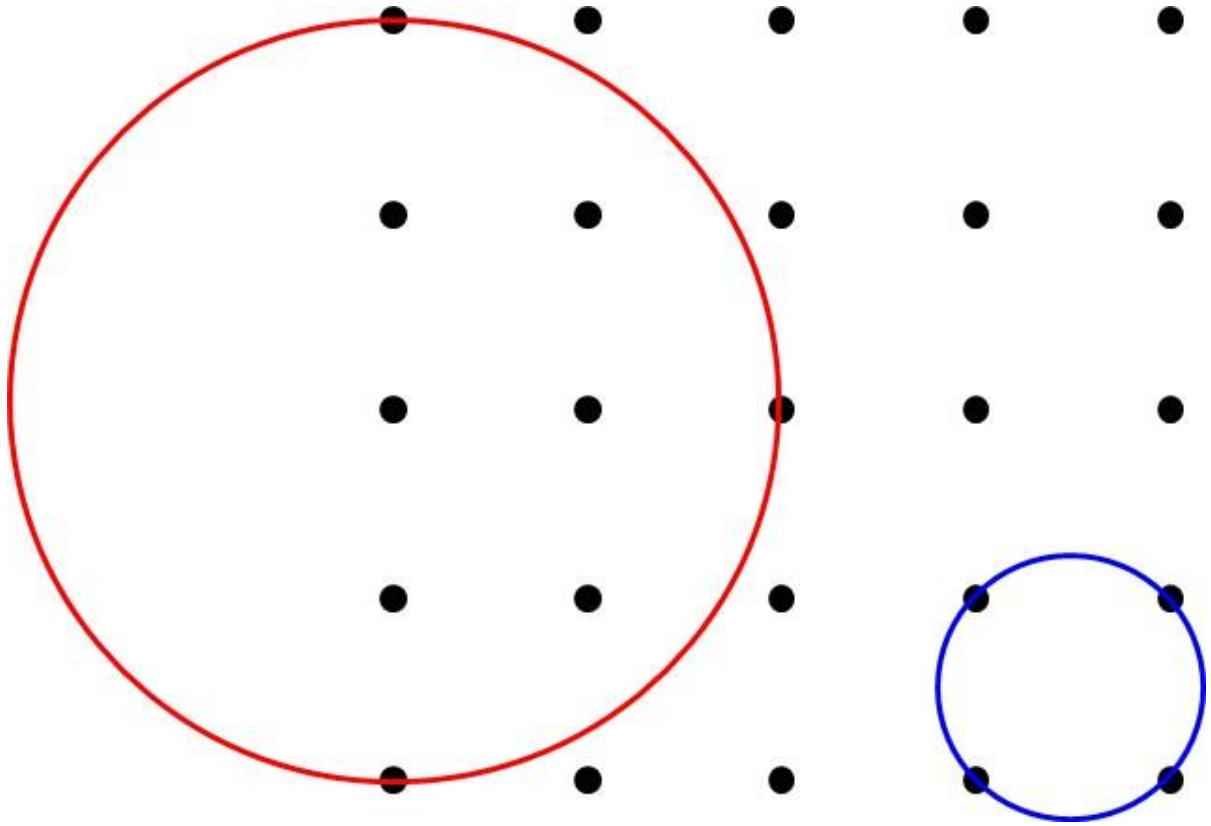


Round 3

Question 5

Estimate how long it is since this diagram was first displayed on the screen.

Give your answer in minutes.



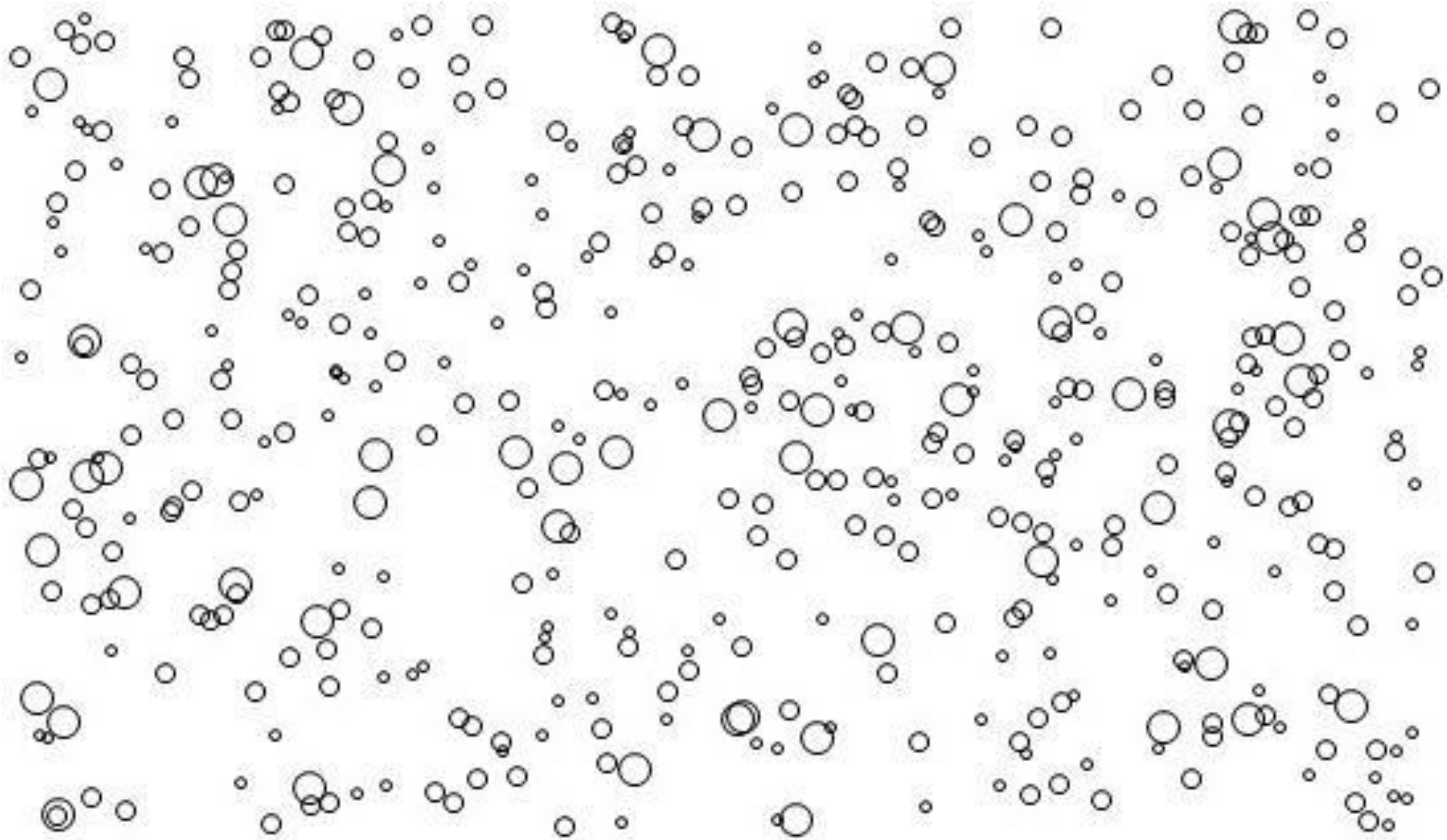
Round 3

Question 6

Estimate the number of circles on the next slide.

Round 3

Question 6



Round 3

Question 6

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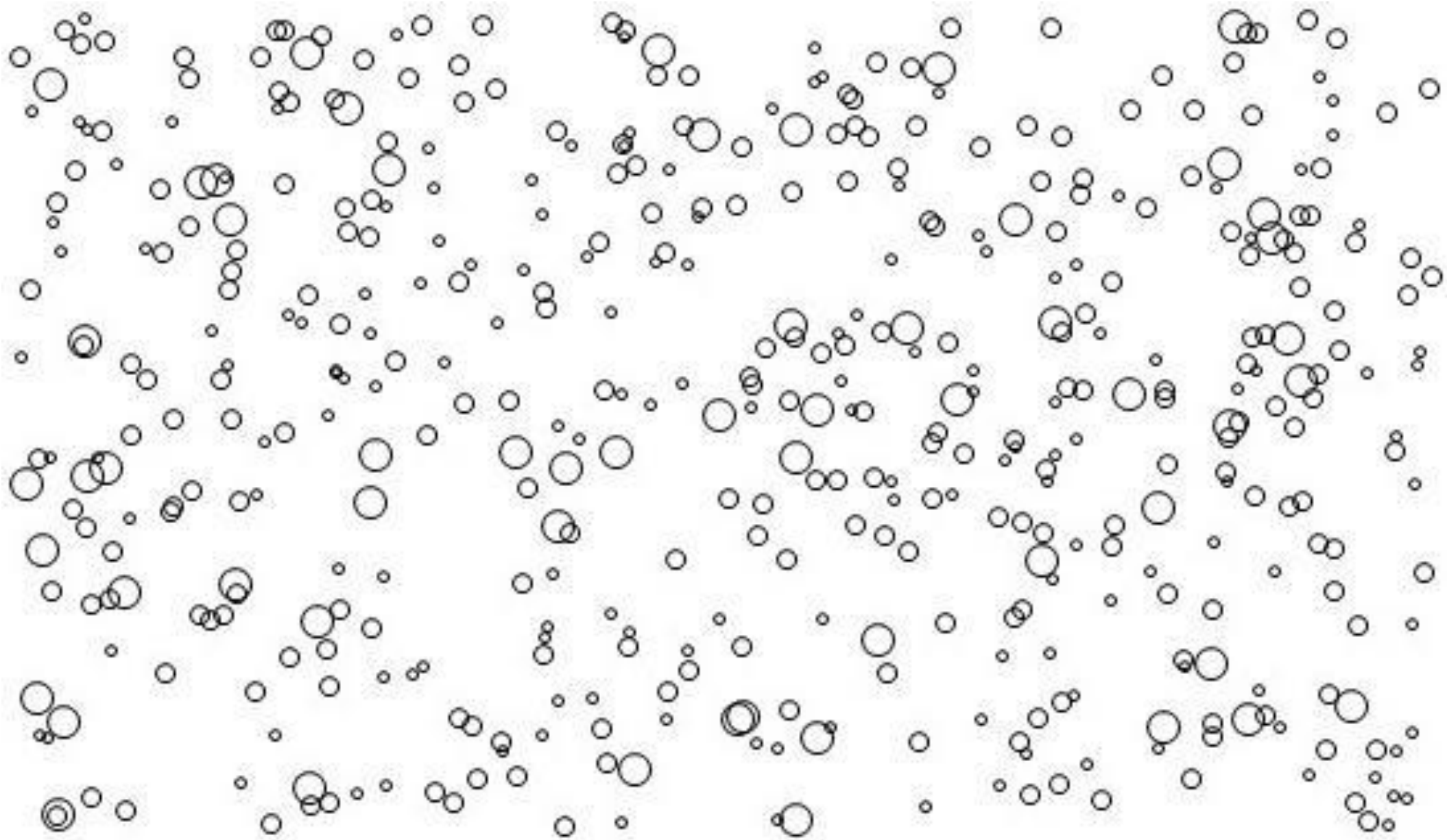
Round 3

Question 6



End of Round 3

Round 4

General Mathematics Questions

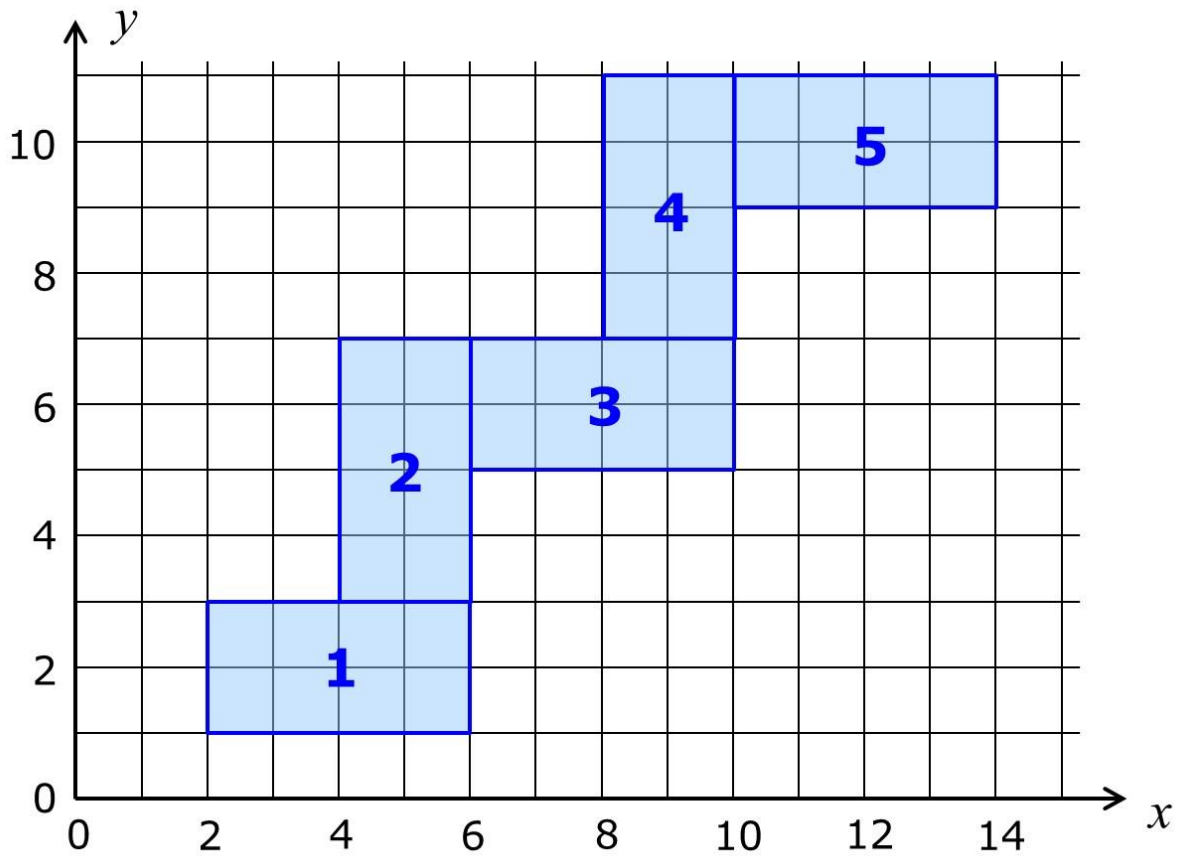
Herts for Learning

Round 4

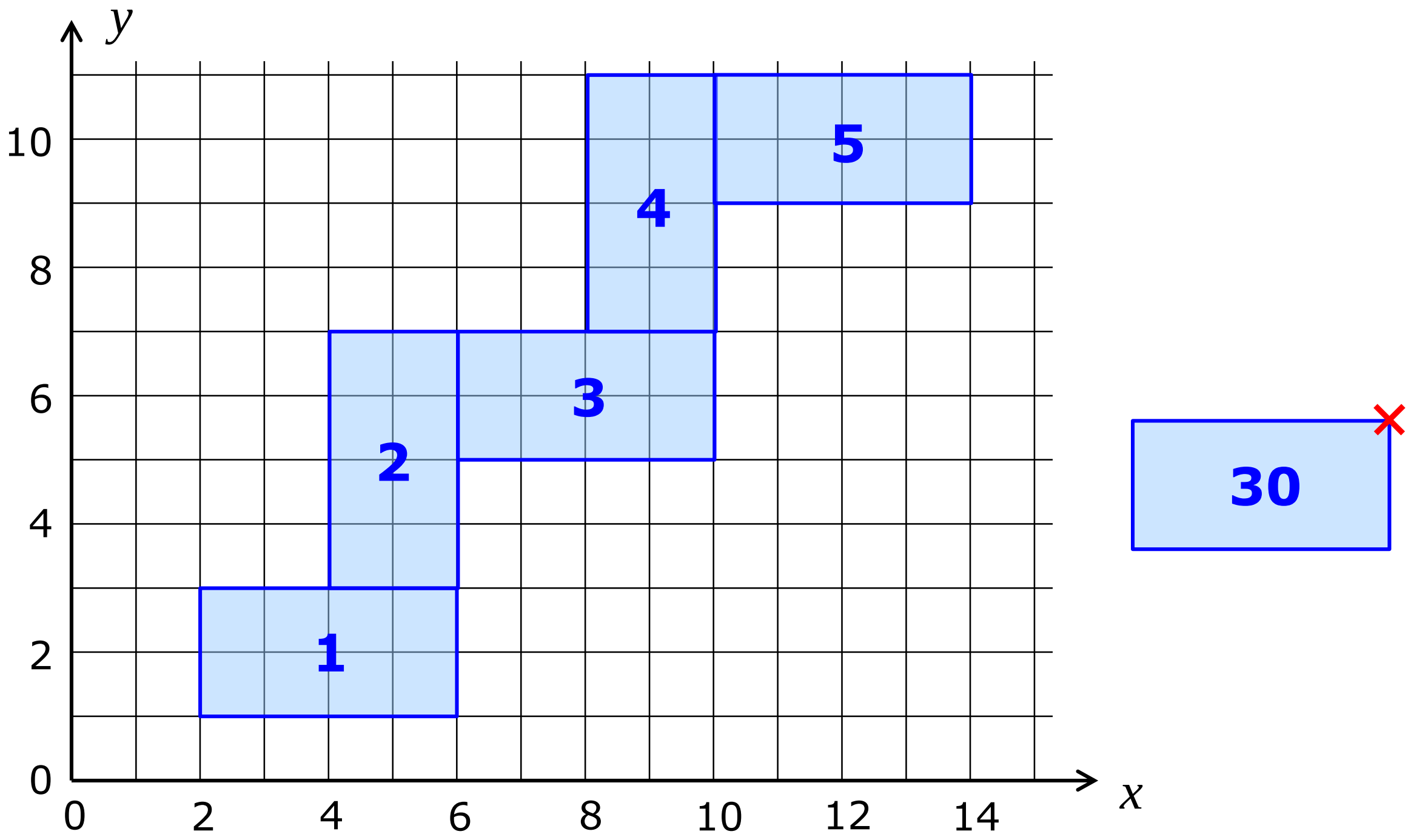
Question 1

The diagram shows a pattern of numbered rectangles on a co-ordinate grid.

All the rectangles are **congruent**.



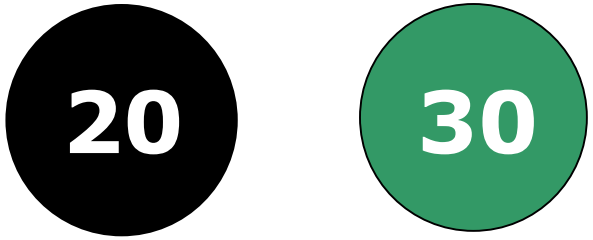
If the pattern were continued, what would be the co-ordinates of the **top right** corner of Rectangle **30**?


y
x
0
2
4
6
8
10
12
14
1
2
3
4
5
30

Round 4

Question 2

Fran has 20 black counters and 30 green counters.



She puts **65%** of the black counters and **80%** of the green counters into a bag.

What percentage of her counters has she put into the bag?

Round 4

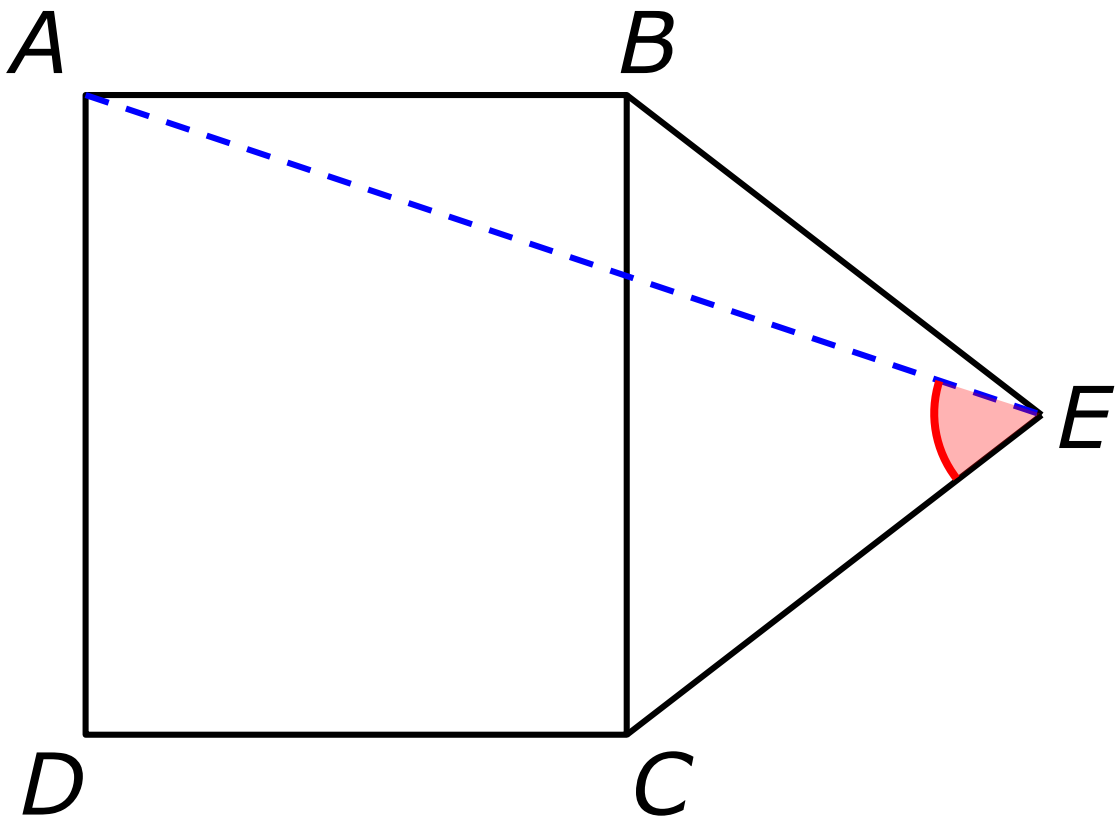
Question 3

ABCD is a square.

BCE is an equilateral triangle.

(They are not drawn accurately.)

Work out the size of angle *AEC*.



Round 4

Question 4

Work out the value of this expression.
Give your answer as a decimal.

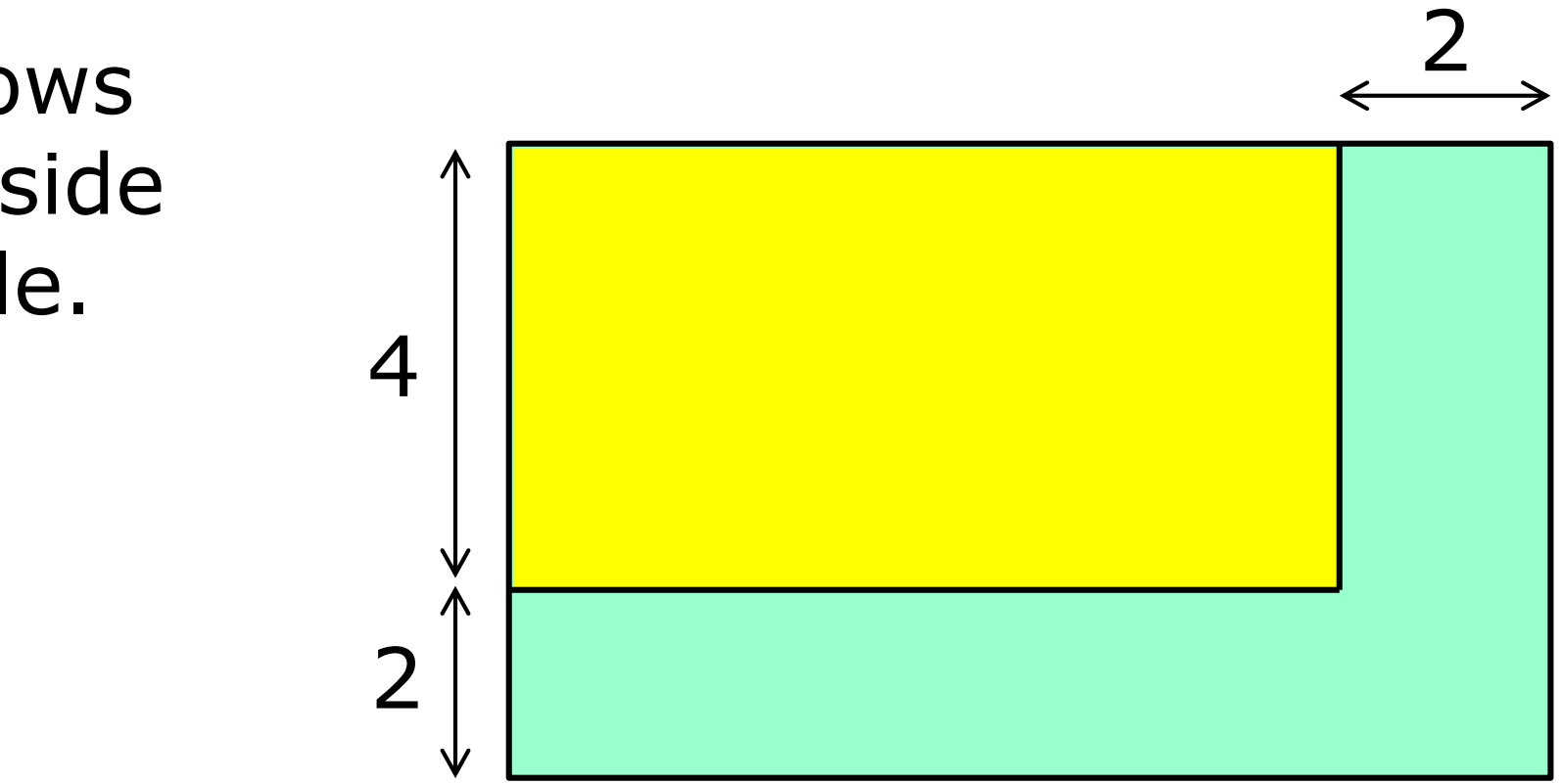
$$\frac{1}{1+\frac{1}{1+\frac{1}{2}}}$$

Round 4

Question 5

The diagram shows one rectangle inside another rectangle.

The yellow and green areas are equal.



(All lengths are in centimetres.)

What is the area of the yellow rectangle?

Round 4

Question 6

Hint

An **integer** is a whole number. It can be positive, negative or zero.

Round 4 **Question 6**

x and y are integers.

$$x + y = 1$$

$$x^2 + y^2 = 13$$

What is the value of $x^3 + y^3$?

End of Round 4

Year 8 Mathematics Challenge 2021

Heats, Monday 17th to Wednesday 19th May 2021

via *Livestorm*

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