United Kingdom
Mathematics Trust

Junior Mathematical Challenge

Questions by Topic: 2007 – 2018 Collection

www.CasperYC.club

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Comments and suggestions to DrYuFromShanghai@QQ.com

Answers for UKMT Junior Challenges:

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
1	C	E	E	A	E	B	C	B	C	D	B	B	B	E	E	D	A	B	E	C	A	E	A	1
2	C	B	C	D	D	E	B	A	D	E	B	E	E	C	E	B	E	A	D	D	E	D	E	2
3	A	B	A	C	A	A	C	C	B	B	D	A	B	E	C	C	D	E	D	A	A	C	A	3
4	C	D	C	D	B	D	E	C	E	C	E	D	C	C	C	E	A	C	E	E	E	B	D	4
5	A	A	C	A	C	C	B	B	E	E	D	D	B	D	D	A	B	A	C	A	C	E	E	5
6	B	D	D	A	B	E	D	D	A	D	B	C	E	D	A	A	B	C	D	D	B	C	B	6
7	D	C	A	C	C	C	C	A	D	C	C	A	D	B	D	B	A	A	A	B	A	A	C	7
8	E	C	E	E	E	E	A	E	D	A	E	D	A	B	A	A	C	A	B	D	A	D	E	8
9	C	E	B	C	B	C	E	E	C	E	A	A	A	C	B	E	D	E	D	C	B	A	E	9
10	A	B	A	E	D	B	D	D	D	B	B	E	C	E	E	D	E	D	E	C	E	D	C	10
11	C	D	E	E	B	D	A	B	A	E	C	C	C	B	C	D	D	C	B	D	D	E	C	11
12	E	D	B	C	A	B	E	C	A	C	A	C	E	B	E	B	B	B	D	A	D	B	D	12
13	D	B	D	A	D	A	D	A	D	C	D	B	E	C	D	A	A	C	C	D	E	B	B	13
14	D	E	E	B	C	C	D	C	E	D	E	D	A	A	B	D	E	D	B	E	D	D	A	14
15	C	A	C	D	C	D	A	D	C	B	E	C	A	E	A	E	C	E	A	D	E	E	D	15
16	D	D	B	C	D	C	D	C	B	A	D	E	B	D	B	E	D	B	D	E	C	A	B	16
17	E	D	D	B	E	D	E	D	C	B	A	D	D	A	E	C	B	C	B	B	D	E	C	17
18	B	C	B	D	D	B	A	A	B	B	B	D	C	D	A	E	B	D	A	B	C	B	C	18
19	E	B	C	D	D	B	E	D	A	D	A	C	D	E	D	C	D	B	A	C	B	E	D	19
20	E	E	D	B	C	A	B	E	E	A	D	B	A	A	B	B	C	A	B	B	E	D	E	20
21	D	A	E	A	C	E	D	A	B	A	E	C	B	B	C	D	C	A	C	D	D	D	B	21
22	D	C	E	D	E	D	C	B	D	D	D	E	D	B	E	C	E	E	B	B	A	E	A	22
23	B	A	B	C	A	E	B	B	E	B	C	E	E	A	D	D	D	B	E	A	B	B	E	23
24	A	B	A	E	B	A	C	C	C	E	C	B	D	D	B	C	B	D	E	B	B	B	D	24
25	D	D	D	B	A	D	B	B	B	D	B	A	C	A	C	A	E	D	E	D	D	E	B	25
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	

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1 3D shapes

Q1 : 2008_Q10 www.CasperYC.club/ukmtnav

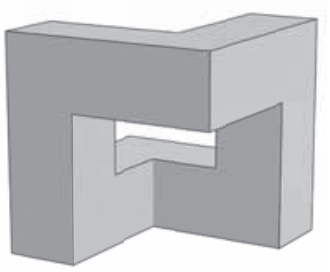
The faces of a cube are painted so that any two faces which have an edge in common are painted different colours. What is the smallest number of colours required?

A 2 B 3 C 4 D 5 E 6

Q2 : 2008_Q12 www.CasperYC.club/ukmtnav

The sculpture 'Cubo Vazado' [Emptied Cube] by the Brazilian artist Franz Weissmann is formed by removing cubical blocks from a solid cube to leave the symmetrical shape shown.

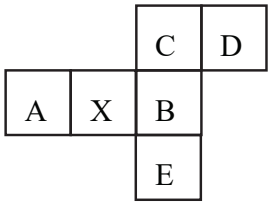
If all the edges have length 1, 2 or 3, what is the volume of the sculpture?



A 9 B 11 C 12 D 14 E 18

Q3 : 2010_Q4 www.CasperYC.club/ukmtnav

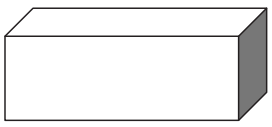
If the net shown is folded to make a cube, which letter is opposite X ?



A B C D E

Q4 : 2011_Q14 www.CasperYC.club/ukmtnav

The diagram shows a cuboid in which the area of the shaded face is one-quarter of the area of each of the two visible unshaded faces.

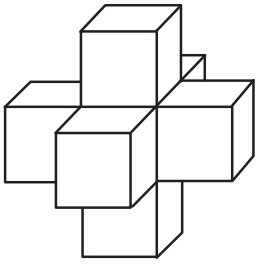


The total surface area of the cuboid is 72 cm^2. What, in cm^2, is the area of one of the visible unshaded faces of the cuboid?

A 16 B 28.8 C 32 D 36 E 48

Q5 : 2011_Q20 www.CasperYC.club/ukmtnav

One cube has each of its faces covered by one face of an identical cube, making a solid as shown. The volume of the solid is 875 cm^3. What, in cm^2, is the surface area of the solid?



A 750 B 800 C 875 D 900 E 1050

Q6 : 2012_Q6 www.CasperYC.club/ukmtnav

The diagrams on the right show three different views of the same cube. Which letter is on the face opposite U?

A I B P C K D M E O

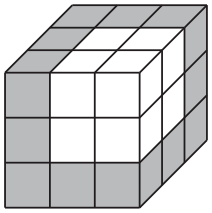
Q7 : 2013_Q10 www.CasperYC.club/ukmtnav

On standard dice the total number of pips on each pair of opposite faces is 7.
Two standard dice are placed in a stack, as shown, so that the total number of pips on the two touching faces is 5.
What is the total number of pips on the top and bottom faces of the stack?

A 5 B 6 C 7 D 8 E 9

Q8 : 2014_Q21 www.CasperYC.club/ukmtnav

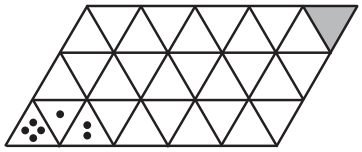
Pablo's teacher has given him 27 identical white cubes. She asks him to paint some of the faces of these cubes grey and then stack the cubes so that they appear as shown. What is the largest possible number of the individual white cubes which Pablo can leave with no faces painted grey?



A 8 B 12 C 14 D 15 E 16

Q9 : 2014_Q25 www.CasperYC.club/ukmtnav

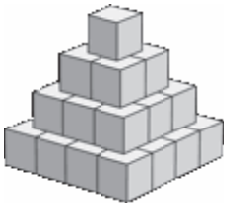
A die has the shape of a regular tetrahedron, with the four faces having 1, 2, 3 and 4 pips. The die is placed with 4 pips 'face down' in one corner of the triangular grid shown, so that the face with 4 pips precisely covers the triangle marked with 4 pips. The die is now 'rolled', by rotating about an edge without slipping, so that 1 pip is face down. It is rolled again, so that 2 pips are face down, as indicated. The rolling continues until the die rests on the shaded triangle in the opposite corner of the grid. How many pips are now face down?



A 1 B 2 C 3 D 4 E it depends on the route taken

Q10 : 2015_Q20 www.CasperYC.club/ukmtnav

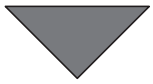
The diagram shows a pyramid made up of 30 cubes, each measuring 1 m × 1 m × 1 m.
What is the total surface area of the whole pyramid (including its base)?



A 30 m^2 B 62 m^2 C 72 m^2 D 152 m^2 E 180 m^2

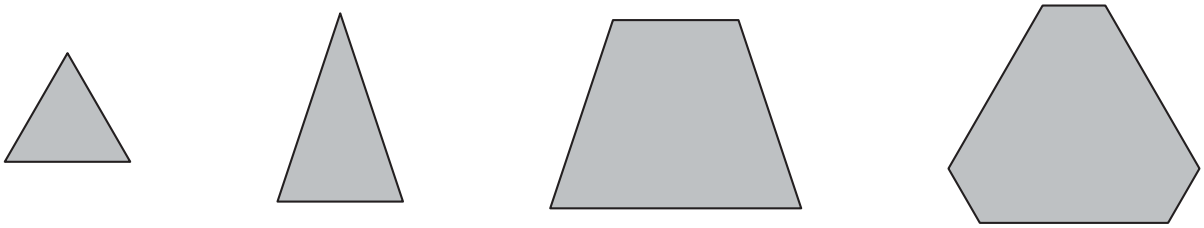
Q11 : 2016_Q10 www.CasperYC.club/ukmtnav

A square is folded exactly in half and then in half again.
Which of the following could not be the resulting shape?

A  B  C  D  E 

Q12 : 2017_Q24 www.CasperYC.club/ukmtnav

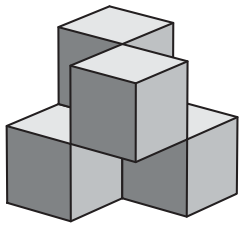
A large solid cube is cut into two pieces by a single plane cut. How many of the following four shapes could be the shape of the cross-section formed by the cut?



A 0 B 1 C 2 D 3 E 4

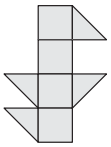
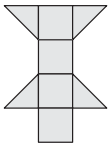
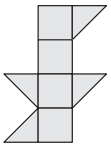
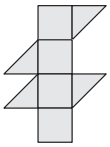
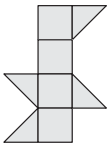
Q13 : 2018_Q13 www.CasperYC.club/ukmtnav

The diagram shows a shape made from four 3 cm × 3 cm × 3 cm wooden cubes joined by their edges.
What, in cm^2, is the surface area of the shape?
A 162 B 180 C 198 D 216 E 234



Q14 : 2018_Q19 www.CasperYC.club/ukmtnav

Which one of these could be folded to make a cube?

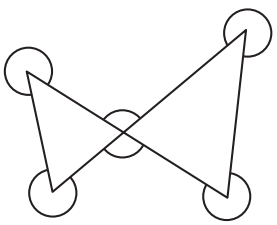
A  B  C  D  E 

2 Angles

Q15 : 2007_Q16 www.CasperYC.club/ukmtnav

What is the sum of the six marked angles?

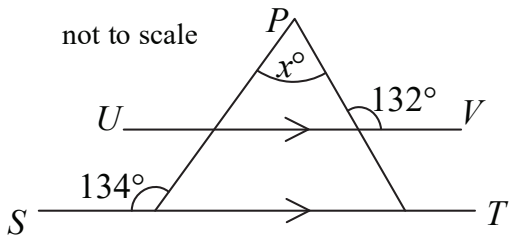
A 1080° B 1440° C 1620° D 1800°
E more information needed



Q16 : 2007_Q9 www.CasperYC.club/ukmtnav

In the diagram on the right, ST is parallel to UV.
What is the value of x ?

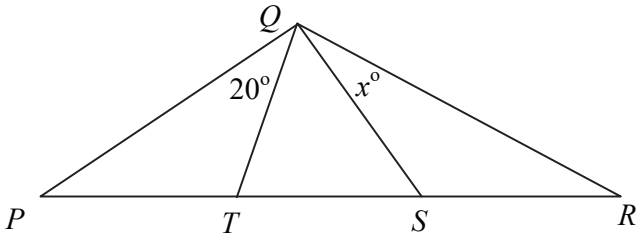
A 46 B 48 C 86 D 92 E 94



Q17 : 2008_Q19 www.CasperYC.club/ukmtnav

In the diagram on the right, $PT = QT = TS$, $QS = SR$, $\angle PQT = 20°$. What is the value of x?

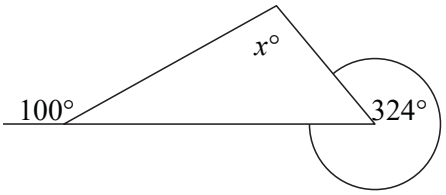
A 20 B 25 C 30
D 35 E 40



Q18 : 2008_Q4 www.CasperYC.club/ukmtnav

In this diagram, what is the value of x?

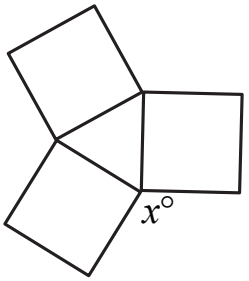
A 16 B 36 C 64 D 100 E 144



Q19 : 2009_Q10 www.CasperYC.club/ukmtnav

The diagram shows three squares of the same size. What is the value of x?

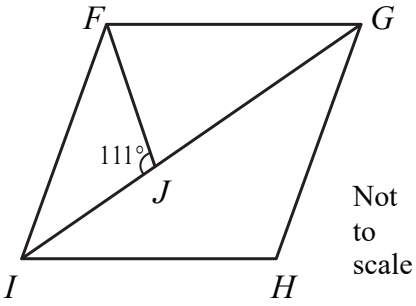
A 105 B 120 C 135 D 150 E 165



Q20 : 2009_Q19 www.CasperYC.club/ukmtnav

The diagram on the right shows a rhombus $FGHI$ and an isosceles triangle FGJ in which $GF = GJ$. Angle $FJI = 111°$.
What is the size of angle JFI ?

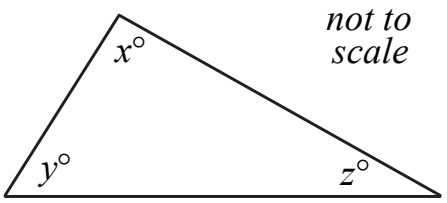
A 27° B 29° C 31° D 33° E $34\frac{1}{2}°$



Q21 : 2010_Q8 www.CasperYC.club/ukmtnav

In a triangle with angles $x°$, $y°$, $z°$ the mean of y and z is x.
What is the value of x?

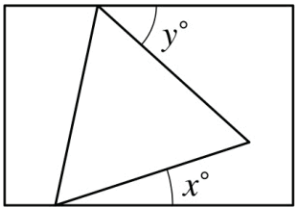
A 90 B 80 C 70 D 60 E 50



Q22 : 2011_Q11 www.CasperYC.club/ukmtnav

The diagram shows an equilateral triangle inside a rectangle.
What is the value of $x + y$?

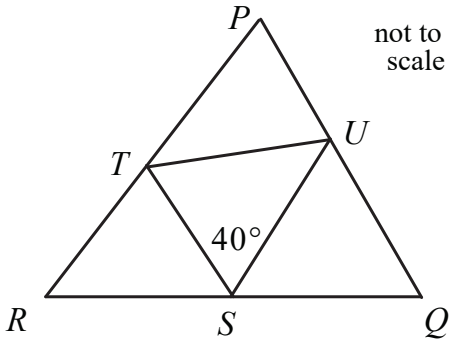
A 30 B 45 C 60 D 75 E 90



Q23 : 2011_Q23 www.CasperYC.club/ukmtnav

The points S, T, U lie on the sides of the triangle PQR, as shown, so that $QS = QU$ and $RS = RT$.
$\angle TSU = 40°$. What is the size of $\angle TPU$?

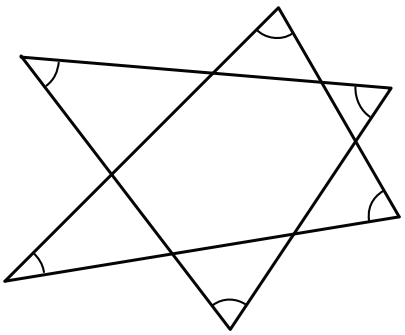
A 60° B 70° C 80° D 90° E 100°



Q24 : 2011_Q6 www.CasperYC.club/ukmtnav

What is the sum of the marked angles in the diagram?

A 90° B 180° C 240° D 300° E 360°



Q25 : 2012_Q19 www.CasperYC.club/ukmtnav

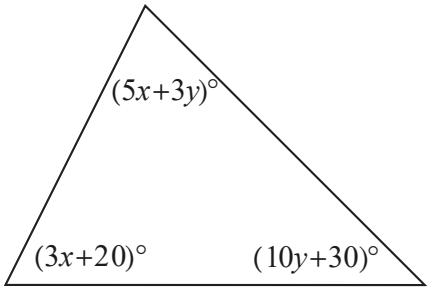
In rectangle $PQRS$, the ratio of $\angle PSQ$ to $\angle PQS$ is 1:5. What is the size of $\angle QSR$?

A 15° B 18° C 45° D 72° E 75°

Q26 : 2012_Q25 www.CasperYC.club/ukmtnav

The interior angles of a triangle are $(5x + 3y)°$, $(3x + 20)°$ and $(10y + 30)°$ where x, y are positive integers.
What is the value of $x + y$?

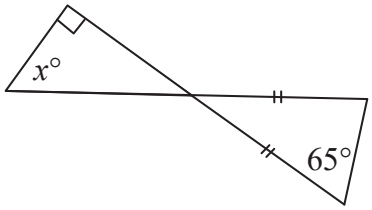
A 15 B 14 C 13 D 12 E 11



Q27 : 2013_Q3 www.CasperYC.club/ukmtnav

What is the value of x?

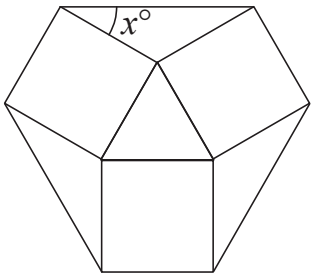
A 25 B 35 C 40 D 65 E 155



Q28 : 2014_Q10 www.CasperYC.club/ukmtnav

An equilateral triangle is surrounded by three squares, as shown.
What is the value of x?

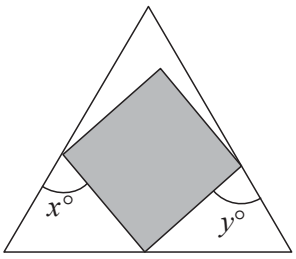
A 15 B 18 C 24 D 30 E 36



Q29 : 2015_Q16 www.CasperYC.club/ukmtnav

The diagram shows a square inside an equilateral triangle.
What is the value of $x + y$?

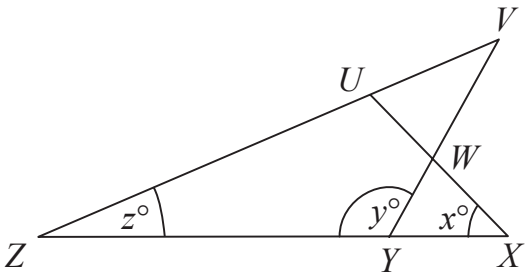
A 105 B 120 C 135 D 150 E 165



Q30 : 2015_Q25 www.CasperYC.club/ukmtnav

The four straight lines in the diagram are such that $VU = VW$. The sizes of $\angle UXZ$, $\angle VYZ$ and $\angle VZX$ are $x°$, $y°$ and $z°$.

Which of the following equations gives x in terms of y and z?



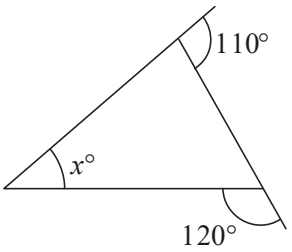
A $x = y - z$ B $x = 180 - y - z$ C $x = y - \frac{z}{2}$

D $x = y + z - 90$ E $x = \frac{y - z}{2}$

Q31 : 2015_Q6 www.CasperYC.club/ukmtnav

What is the value of x in this triangle?

A 45 B 50 C 55 D 60 E 65

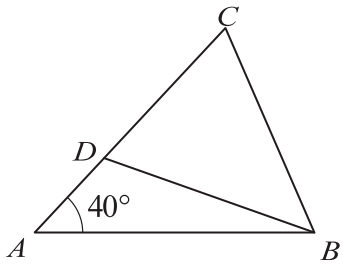


Q32 : 2016_Q14 www.CasperYC.club/ukmtnav

In the diagram, $AB = AC$ and D is a point on AC such that $BD = BC$. Angle BAC is 40°.

What is angle ABD ?

A 15° B 20° C 25° D 30° E 35°

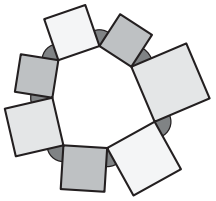


Q33 : 2017_Q11 www.CasperYC.club/ukmtnav

Seven squares are drawn on the sides of a heptagon so that they are outside the heptagon, as shown in the diagram.

What is the sum of the seven marked angles?

A 315° B 360° C 420° D 450° E 630°

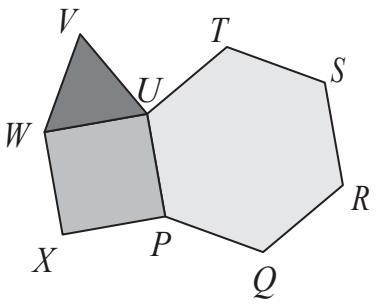


Q34 : 2017_Q19 www.CasperYC.club/ukmtnav

The diagram shows a regular hexagon $PQRSTU$, a square $PUWX$ and an equilateral triangle UVW.

What is the angle TVU ?

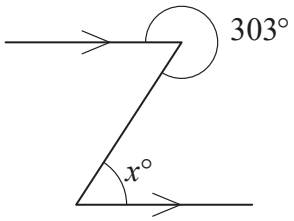
A 45° B 42° C 39° D 36° E 33°



Q35 : 2017_Q3 www.CasperYC.club/ukmtnav

What is the value of x ?

A 43 B 47 C 53 D 57 E 67

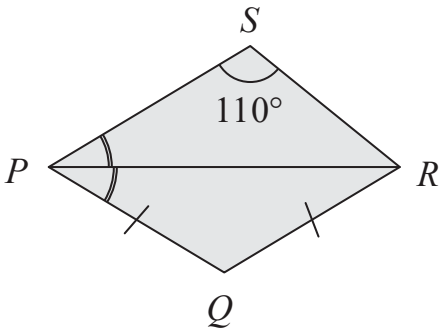


Q36 : 2018_Q12 www.CasperYC.club/ukmtnav

The diagram shows a quadrilateral $PQRS$ in which PQ and QR have the same length. Also PR bisects $\angle SPQ$, the ratio of $\angle SPR$ to $\angle PRS$ is 2 : 3 and $\angle PSR = 110°$.

How large is angle PQR?

A 124° B 120° C 110° D 90° E 28°



Q37 : 2018_Q22 www.CasperYC.club/ukmtnav

In the triangles PQR and STU, $\angle RPQ = 2 \times \angle UST$, $\angle PRQ = 2 \times \angle SUT$ and $\angle RQP = \frac{1}{5} \times \angle UTS$.

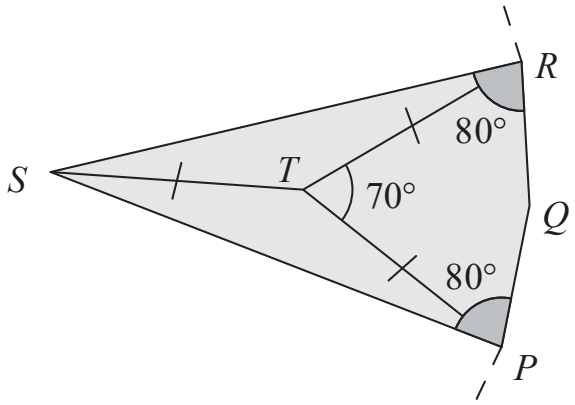
How large is $\angle UTS$?

A 90° B 100° C 120° D 150° E more information needed

Q38 : 2018_Q25 www.CasperYC.club/ukmtnav

In the diagram PQ and QR are sides of a regular n-sided polygon, $\angle SPQ = \angle SRQ = 80°$, $\angle PTR = 70°$ and $PT = ST = RT$.
What is the value of n?

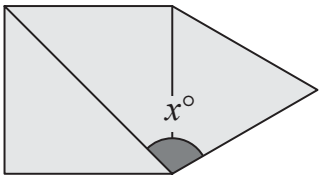
A 15 B 18 C 20 D 24 E 30



Q39 : 2018_Q3 www.CasperYC.club/ukmtnav

The diagram shows an equilateral triangle, a square, and one diagonal of the square.
What is the value of x?

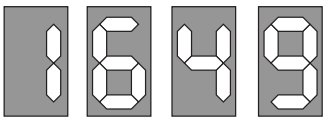
A 105 B 110 C 115 D 120 E 135

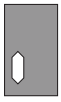
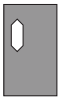
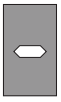


3 Averages

Q40 : 2007_Q11 www.CasperYC.club/ukmtnav

A station clock shows each digit by illuminating up to seven bars in a display. For example, the displays for 1, 6, 4 and 9 are shown.
When all the digits from 0 to 9 are shown in turn, which bar is used least?



A  B  C  D  E 

Q41 : 2007_Q12 www.CasperYC.club/ukmtnav

The six-member squad for the Ladybirds five-a-side team consists of a 2-spot ladybird, a 10-spot, a 14-spot, an 18-spot, a 24-spot and a pine ladybird (on the bench). The average number of spots for members of the squad is 12. How many spots has the pine ladybird?

A 4 B 5 C 6 D 7 E 8

Q42 : 2009_Q14 www.CasperYC.club/ukmtnav

Karen was given a mark of 72 for Mayhematics. Her average mark for Mayhematics and Mathemagics was 78. What was her mark for Mathemagics?

A 66 B 75 C 78 D 82 E 84

Q43 : 2010_Q14 www.CasperYC.club/ukmtnav

The Severn Bridge has carried just over 300 million vehicles since it was opened in 1966. On average, roughly how many vehicles is this per day?

A 600 B 2 000 C 6 000 D 20 000 E 60 000

Q44 : 2010_Q20 www.CasperYC.club/ukmtnav

Nicky has to choose 7 different positive whole numbers whose mean is 7. What is the largest possible such number she could choose?

A 7 B 28 C 34 D 43 E 49

Q45 : 2011_Q13 www.CasperYC.club/ukmtnav

What is the mean of $\frac{2}{3}$ and $\frac{4}{9}$?

A $\frac{1}{2}$ B $\frac{2}{9}$ C $\frac{7}{9}$ D $\frac{3}{4}$ E $\frac{5}{9}$

Q46 : 2013_Q2 www.CasperYC.club/ukmtnav

Heidi is 2.1 m tall, while Lola is only 1.4 m tall. What is their average height?

A 1.525 m B 1.6 m C 1.7 m D 1.725 m E 1.75 m

Q47 : 2013_Q23 www.CasperYC.club/ukmtnav

In our school netball league a team gains a certain whole number of points if it wins a game, a lower whole number of points if it draws a game and no points if it loses a game. After 10 games my team has won 7 games, drawn 3 and gained 44 points. My sister's team has won 5 games, drawn 2 and lost 3. How many points has her team gained?

A 28 B 29 C 30 D 31 E 32

Q48 : 2013_Q4 www.CasperYC.club/ukmtnav

Gill went for a five-hour walk. Her average speed was between 3 km/h and 4 km/h. Which of the following could be the distance she walked?

A 12 km B 14 km C 19 km D 24 km E 35 km

Q49 : 2014_Q19 www.CasperYC.club/ukmtnav

Jack and Jill played a game for two people. In each game, the winner was awarded 2 points and the loser 1 point. No games were drawn. Jack won exactly 4 games and Jill had a final score of 10 points. How many games did they play?

A 5 B 6 C 7 D 8 E impossible to determine

Q50 : 2015_Q9 www.CasperYC.club/ukmtnav

According to a newspaper report, "A 63-year-old man has rowed around the world without leaving his living room." He clocked up 25 048 miles on a rowing machine that he received for his 50th birthday.

Roughly how many miles per year has he rowed since he was given the machine?

A 200 B 500 C 1000 D 2000 E 4000

Q51 : 2017_Q2 www.CasperYC.club/ukmtnav

Nadiya is baking a cake. The recipe says that her cake should be baked in the oven for 1 hour and 35 minutes. She puts the cake in the oven at 11:40 am. At what time should she take the cake out of the oven?

A 12:15 pm B 12:40 pm C 1:05 pm D 1:15 pm E 2:15 pm

Q52 : 2017_Q20 www.CasperYC.club/ukmtnav

The range of a list of integers is 20, and the median is 17.

What is the smallest possible number of integers in the list?

A 1 B 2 C 3 D 4 E 5

Q53 : 2017_Q25 www.CasperYC.club/ukmtnav

The distance between Exeter and London is 175 miles. Sam left Exeter at 10:00 on Tuesday for London. Morgan left London for Exeter at 13:00 the same day. They travelled on the same road. Up to the time when they met, Sam's average speed was 25 miles per hour, and Morgan's average speed was 35 miles an hour.

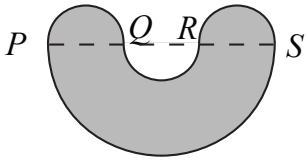
At what time did Sam and Morgan meet?

A 17:00 B 15:55 C 15:30 D 15:00 E 14:40

4 Circles

Q54 : 2007_Q19 www.CasperYC.club/ukmtnav

The points P, Q, R, S lie in order along a straight line, with $PQ = QR = RS = 2$ cm. Semicircles with diameters PQ, QR, RS and SP join to make the shape shown on the right. What, in cm², is the area of the shape?



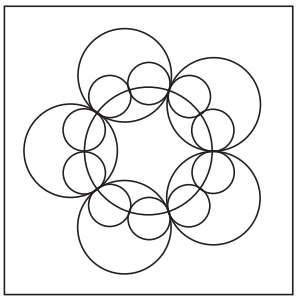
A 5π B $9\pi/2$ C 4π D $7\pi/2$ E 3π

Q55 : 2010_Q5 www.CasperYC.club/ukmtnav

The diagram shows a pattern of 16 circles inside a square.

The central circle passes through the points where the other circles touch.

The circles divide the square into regions. How many regions are there?

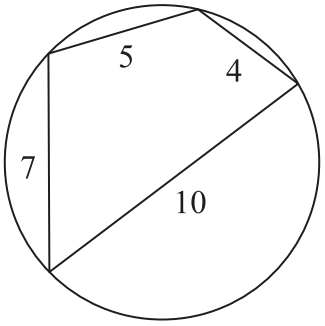


A 17 B 26 C 30 D 32 E 38

Q56 : 2016_Q20 www.CasperYC.club/ukmtnav

A cyclic quadrilateral has all four vertices on the circumference of a circle. Brahmagupta (598−670AD) gave the following formula for the area, A, of a cyclic quadrilateral whose edges have lengths a, b, c, d : $A = \sqrt{(s-a)(s-b)(s-c)(s-d)}$, where s is half of the perimeter of the quadrilateral.

What is the area of the cyclic quadrilateral with sides of length 4 cm, 5 cm, 7 cm and 10 cm?



A 6 cm² B 13 cm² C 26 cm² D 30 cm² E 36 cm²

5 Combinations and Probability

Q57 : 2007_Q15 www.CasperYC.club/ukmtnav

I choose three numbers from this number square, including one number from each row and one number from each column. I then multiply the three numbers together. What is the largest possible product?

1	2	3
4	5	6
7	8	9

A 72 B 96 C 105 D 162 E 504

Q58 : 2009_Q15 www.CasperYC.club/ukmtnav

In Matt's pocket there are 8 watermelon jellybeans, 4 vanilla jellybeans and 4 butter popcorn jellybeans. What is the smallest number of jellybeans he must take out of his pocket to be certain that he takes at least one of each flavour?

A 3 B 4 C 8 D 9 E 13

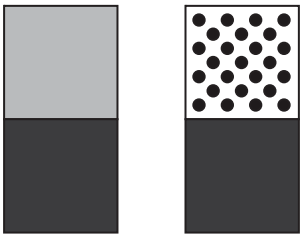
Q59 : 2012_Q15 www.CasperYC.club/ukmtnav

Talulah plants 60 tulip bulbs. When they flower, she notes that half are yellow; one third of those which are not yellow are red; and one quarter of those which are neither yellow nor red are pink. The remainder are white. What fraction of the tulips are white?

A $\frac{1}{24}$ B $\frac{1}{12}$ C $\frac{1}{6}$ D $\frac{1}{5}$ E $\frac{1}{4}$

Q60 : 2013_Q25 www.CasperYC.club/ukmtnav

For Beatrix's latest art installation, she has fixed a 2×2 square sheet of steel to a wall. She has two 1×2 magnetic tiles, both of which she attaches to the steel sheet, in any orientation, so that none of the sheet is visible and the line separating the two tiles cannot be seen. As shown alongside, one tile has one black cell and one grey cell; the other tile has one black cell and one spotted cell.



How many different looking 2×2 installations can Beatrix obtain?

A 4 B 8 C 12 D 14 E 24

Q61 : 2016_Q24 www.CasperYC.club/ukmtnav

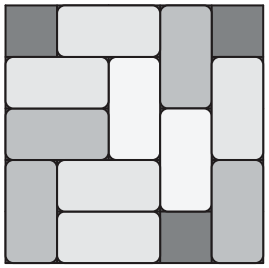
Part of a wall is to be decorated with a row of four square tiles. Three different colours of tiles are available and there are at least two tiles of each colour available. Tiles of all three colours must be used.

In how many ways can the row of four tiles be chosen?

A 12 B 18 C 24 D 36 E 48

Q62 : 2016_Q25 www.CasperYC.club/ukmtnav

Beatrix places dominoes on a 5×5 board, either horizontally or vertically, so that each domino covers two small squares. She stops when she cannot place another domino, as in the example shown in the diagram.



When Beatrix stops, what is the largest possible number of squares that may still be uncovered?

A 4 B 5 C 6 D 7 E 8

Q63 : 2016_Q9 www.CasperYC.club/ukmtnav

One of the three symbols +, −, × is inserted somewhere between the digits of 2016 to give a new number. For example, 20 − 16 gives 4.

How many of the following four numbers can be obtained in this way?

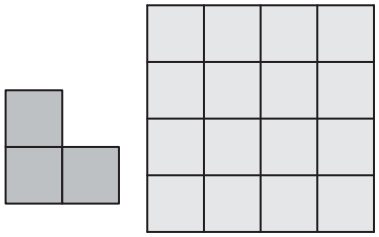
36 195 207 320

A 0 B 1 C 2 D 3 E 4

Q64 : 2018_Q15 www.CasperYC.club/ukmtnav

Beatrix places copies of the L-shape shown on a 4 × 4 board so that each L-shape covers exactly three cells of the board. She is allowed to turn around or turn over an L-shape.

What is the largest number of L-shapes she can place on the board without overlaps?



A 2 B 3 C 4 D 5 E 6

Q65 : 2018_Q18 www.CasperYC.club/ukmtnav

Between them, the two five-digit integers M and N contain all ten digits from 0 to 9.

What is the least possible difference between M and N?

A 123 B 247 C 427 D 472 E 742

Q66 : 2018_Q20 www.CasperYC.club/ukmtnav

A drawer contains ten identical yellow socks, eight identical blue socks and four identical pink socks.

Amrita picks socks from the drawer without looking.

What is the smallest number of socks she must pick to be sure that she has at least two pairs of matching socks?

A 5 B 6 C 8 D 11 E 13

6 Equations

Q67 : 2009_Q11 www.CasperYC.club/ukmtnav

In a sequence of numbers, each term after the first three terms is the sum of the previous three terms. The first three terms are −3, 0, 2 . Which is the first term to exceed 100?

A 11th term B 12th term C 13th term D 14th term E 15th term

Q68 : 2009_Q18

Six friends are having dinner together in their local restaurant. The first eats there every day, the second eats there every other day, the third eats there every third day, the fourth eats there every fourth day, the fifth eats there every fifth day and the sixth eats there every sixth day. They agree to have a party the next time they all eat together there. In how many days' time is the party?

A 30 days B 60 days C 90 days D 120 days E 360 days

Q69 : 2009_Q23

The currency used on the planet Zog consists of bank notes of a fixed size differing only in colour. Three green notes and eight blue notes are worth 46 zogs; eight green notes and three blue notes are worth 31 zogs. How many zogs are two green notes and three blue notes worth?

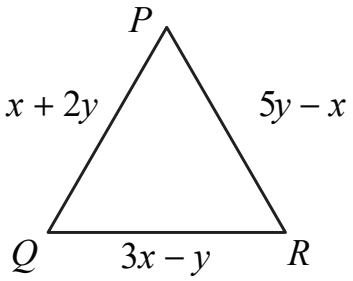
A 13 zogs B 16 zogs C 19 zogs D 25 zogs E 27 zogs

Q70 : 2010_Q17

The lengths, in cm, of the sides of the equilateral triangle PQR are as shown.

Which of the following could *not* be the values of x and y?

A (18, 12) B (15, 10) C (12, 8) D (10, 6) E (3, 2)



Q71 : 2010_Q22

Kiran writes down six different prime numbers, p, q, r, s, t, u, all less than 20, such that $p + q = r + s = t + u$. What is the value of $p + q$?

A 16 B 18 C 20 D 22 E 24

Q72 : 2011_Q12

If ▲ + ▲ = ■ and ■ + ▲ = ● and ♦ = ● + ■ + ▲, how many ▲s are equal to ♦ ?

A 2 B 3 C 4 D 5 E 6

Q73 : 2013_Q18 www.CasperYC.club/ukmtnav

Weighing the baby at the clinic was a problem. The baby would not keep still and caused the scales to wobble. So I held the baby and stood on the scales while the nurse read off 78 kg. Then the nurse held the baby while I read off 69 kg. Finally I held the nurse while the baby read off 137 kg. What was the combined weight of all three ?

A 142 kg B 147 kg C 206 kg D 215 kg E 284 kg

(*This problem appeared in the first Schools' Mathematical Challenge in 1988 − 25 years ago.*)

Q74 : 2017_Q22 www.CasperYC.club/ukmtnav

In the window of Bradley's Bicycle Bazaar there are some unicycles, some bicycles and some tricycles. Laura sees that there are seven saddles in total, thirteen wheels in total and more bicycles than tricycles.

How many unicycles are in the window?

A 1 B 2 C 3 D 4 E 5

Q75 : 2018_Q6 www.CasperYC.club/ukmtnav

The diagram shows a partially completed magic square, in which all rows, all columns and both main diagonals have the same total.

What is the value of $x + y$?

A 10 B 11 C 12 D 13 E 14

4		
	7	y
6	5	x

7 Fractions

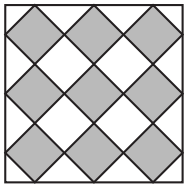
Q76 : 2007_Q10 www.CasperYC.club/ukmtnav

Which of the following has the largest value?

A $\frac{1}{2}+\frac{1}{4}$ B $\frac{1}{2}-\frac{1}{4}$ C $\frac{1}{2}\times\frac{1}{4}$ D $\frac{1}{2}\div\frac{1}{4}$ E $\frac{1}{4}\div\frac{1}{2}$

Q77 : 2007_Q5 www.CasperYC.club/ukmtnav

In the diagram, the small squares are all the same size. What fraction of the large square is shaded?



A $\frac{9}{20}$ B $\frac{9}{16}$ C $\frac{3}{7}$ D $\frac{3}{5}$ E $\frac{1}{2}$

Q78 : 2007_Q6 www.CasperYC.club/ukmtnav

When the following fractions are put in their correct places on the number line, which fraction is in the middle?

A $-\frac{1}{7}$ B $\frac{1}{6}$ C $-\frac{1}{5}$ D $\frac{1}{4}$ E $-\frac{1}{3}$

Q79 : 2008_Q11 www.CasperYC.club/ukmtnav

In 1833 a ship arrived in Calcutta with 120 tons remaining of its cargo of ice. One third of the original cargo was lost because it had melted on the voyage. How many tons of ice was the ship carrying when it set sail?

A 40 B 80 C 120 D 150 E 180

Q80 : 2008_Q14 www.CasperYC.club/ukmtnav

A solid wooden cube is painted blue on the outside. The cube is then cut into eight smaller cubes of equal size. What fraction of the total surface area of these new cubes is blue?

A $\frac{1}{8}$ B $\frac{1}{3}$ C $\frac{3}{8}$ D $\frac{1}{2}$ E $\frac{3}{4}$

Q81 : 2008_Q9 www.CasperYC.club/ukmtnav

Which of the following has the smallest value?

A $\frac{1}{2}-\frac{1}{3}$ B $\frac{1}{3}-\frac{1}{4}$ C $\frac{1}{4}-\frac{1}{5}$ D $\frac{1}{5}-\frac{1}{6}$ E $\frac{1}{6}-\frac{1}{7}$

Q82 : 2009_Q9 www.CasperYC.club/ukmtnav

How many different digits appear when $\frac{20}{11}$ is written as a recurring decimal?

A 2 B 3 C 4 D 5 E 6

Q83 : 2010_Q6 www.CasperYC.club/ukmtnav

Which of the following has the largest value?

A $6 \div \frac{1}{2}$ B $5 \div \frac{1}{3}$ C $4 \div \frac{1}{4}$ D $3 \div \frac{1}{5}$ E $2 \div \frac{1}{6}$

Q84 : 2011_Q17 www.CasperYC.club/ukmtnav

Last year's match at Wimbledon between John Isner and Nicolas Mahut, which lasted 11 hours and 5 minutes, set a record for the longest match in tennis history. The fifth set of the match lasted 8 hours and 11 minutes.

Approximately what fraction of the whole match was taken up by the fifth set?

A $\frac{1}{5}$ B $\frac{2}{5}$ C $\frac{3}{5}$ D $\frac{3}{4}$ E $\frac{9}{10}$

Q85 : 2012_Q8 www.CasperYC.club/ukmtnav

Tommy Thomas's tankard holds 480ml when it is one quarter empty. How much does it hold when it is one quarter full?

A 120 ml B 160 ml C 240 ml D 960 ml E 1440 ml

Q86 : 2013_Q13 www.CasperYC.club/ukmtnav

When painting the lounge, I used half of a 3 litre can to complete the first coat of paint. I then used two thirds of what was left to complete the second coat. How much paint was left after both coats were complete?

A 150 ml B 200 ml C 250 ml D 500 ml E 600 ml

Q87 : 2014_Q6 www.CasperYC.club/ukmtnav

The diagram shows a square divided into strips of equal width. Three strips are black and two are grey. What fraction of the perimeter of the square is grey?

A $\frac{1}{5}$ B $\frac{1}{4}$ C $\frac{4}{25}$ D $\frac{1}{3}$ E $\frac{2}{5}$

Q88 : 2015_Q12 www.CasperYC.club/ukmtnav

A fish weighs the total of 2 kg plus a third of its own weight. What is the weight of the fish in kg?

A $2\frac{1}{3}$ B 3 C 4 D 6 E 8

Q89 : 2015_Q18 www.CasperYC.club/ukmtnav

Each of the fractions $\frac{2637}{18\,459}$ and $\frac{5274}{36\,918}$ uses the digits 1 to 9 exactly once. The first fraction simplifies to $\frac{1}{7}$. What is the simplified form of the second fraction?

A $\frac{1}{8}$ B $\frac{1}{7}$ C $\frac{5}{34}$ D $\frac{9}{61}$ E $\frac{2}{7}$

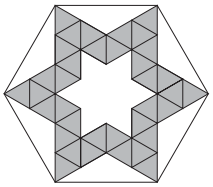
Q90 : 2015_Q21 www.CasperYC.club/ukmtnav

Gill is now 27 and has moved into a new flat. She has four pictures to hang in a horizontal row on a wall which is 4800 mm wide. The pictures are identical in size and are 420 mm wide. Gill hangs the first two pictures so that one is on the extreme left of the wall and one is on the extreme right of the wall. She wants to hang the remaining two pictures so that all four pictures are equally spaced. How far should Gill place the centre of each of the two remaining pictures from a vertical line down the centre of the wall?

A 210 mm B 520 mm C 730 mm D 840 mm E 1040 mm

Q91 : 2015_Q22 www.CasperYC.club/ukmtnav

The diagram shows a shaded region inside a regular hexagon.
The shaded region is divided into equilateral triangles.
What fraction of the area of the hexagon is shaded?



A $\frac{3}{8}$ B $\frac{2}{5}$ C $\frac{3}{7}$ D $\frac{5}{12}$ E $\frac{1}{2}$

Q92 : 2015_Q3 www.CasperYC.club/ukmtnav

What is the value of $\frac{12\,345}{1+2+3+4+5}$?

A 1 B 8 C 678 D 823 E 12 359

Q93 : 2015_Q5 www.CasperYC.club/ukmtnav

The difference between $\frac{1}{3}$ of a certain number and $\frac{1}{4}$ of the same number is 3. What is that number?

A 24 B 36 C 48 D 60 E 72

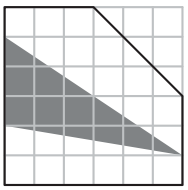
Q94 : 2016_Q19 www.CasperYC.club/ukmtnav

Three boxes under my stairs contain apples or pears or both. Each box contains the same number of pieces of fruit. The first box contains all twelve of the apples and one-ninth of the pears.
How many pieces of fruit are there in each box?

A 14 B 16 C 18 D 20 E 36

Q95 : 2016_Q21 www.CasperYC.club/ukmtnav

The diagram shows a pentagon drawn on a square grid. All vertices of the pentagon and triangle are grid points.



What fraction of the area of the pentagon is shaded?

A $\frac{2}{7}$ B $\frac{1}{3}$ C $\frac{2}{5}$ D $\frac{1}{4}$ E $\frac{2}{9}$

Q96 : 2016_Q5 www.CasperYC.club/ukmtnav

What is the value of $\frac{1}{25} + 0.25$?

A 0.29 B 0.3 C 0.35 D 0.50 E 0.65

Q97 : 2016_Q8 www.CasperYC.club/ukmtnav

What is the value of $\frac{2+4+6+8+10+12+14+16+18+20}{1+2+3+4+5+6+7+8+9+10}$?

A 2 B 10 C 20 D 40 E 1024

Q98 : 2017_Q7 www.CasperYC.club/ukmtnav

If you work out the values of the following expressions and then place them in increasing numerical order, which comes in the middle?

A $\frac{2}{3}+\frac{4}{5}$ B $\frac{2}{3}\times\frac{4}{5}$ C $\frac{3}{2}+\frac{5}{4}$ D $\frac{2}{3}\div\frac{4}{5}$ E $\frac{3}{2}\times\frac{5}{4}$

Q99 : 2017_Q9 www.CasperYC.club/ukmtnav

In William Shakespeare's play *As You Like It*, Rosalind speaks to Orlando about "He that will divide a minute into a thousand parts".

Which of the following is equal to the number of seconds in one thousandth of one minute?

A 0.24 B 0.6 C 0.024 D 0.06 E 0.006

Q100 : 2018_Q10 www.CasperYC.club/ukmtnav

Adding four of the five fractions $\frac{1}{2}, \frac{1}{3}, \frac{1}{6}, \frac{1}{9}$ and $\frac{1}{18}$ gives a total of 1.

Which of the fractions is not used?

A $\frac{1}{2}$ B $\frac{1}{3}$ C $\frac{1}{6}$ D $\frac{1}{9}$ E $\frac{1}{18}$

Q101 : 2018_Q8

Gill scored a goal half way through the second quarter of a 'teachers versus pupils' netball match. At that point, what fraction of the whole match remained to be played?

A $\frac{1}{4}$ B $\frac{3}{8}$ C $\frac{1}{2}$ D $\frac{5}{8}$ E $\frac{3}{4}$

8 Geometry

Q102 : 2007_Q13

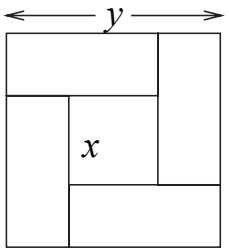
Points P and Q have coordinates $(1, 4)$ and $(1, -2)$ respectively. For which of the following possible coordinates of point R would triangle PQR **not** be isosceles?

A $(-5, 4)$ B $(7, 1)$ C $(-6, 1)$ D $(-6, -2)$ E $(7, -2)$

Q103 : 2007_Q23

The diagram shows a square with sides of length y divided into a square with sides of length x and four congruent rectangles.

What is the length of the longer side of each rectangle?



A $\frac{y-x}{2}$ B $\frac{y+2x}{3}$ C $y-x$ D $\frac{2y}{3}$ E $\frac{y+x}{2}$

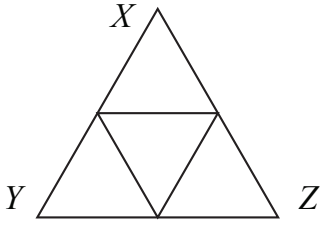
Q104 : 2007_Q25

A piece of paper in the shape of a polygon is folded in half along a line of symmetry. The resulting shape is also folded in half, again along a line of symmetry. The final shape is a triangle. How many possibilities are there for the number of sides of the original polygon?

A 3 B 4 C 5 D 6 E 7

Q105 : 2007_Q7

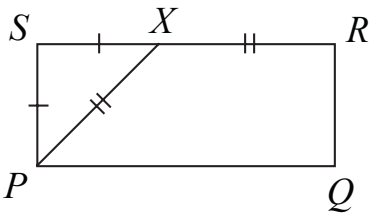
The equilateral triangle XYZ is fixed in position. Two of the four small triangles are to be painted black and the other two are to be painted white. In how many different ways can this be done?



A 3 B 4 C 5 D 6 E more than 6

Q106 : 2008_Q13 www.CasperYC.club/ukmtnav

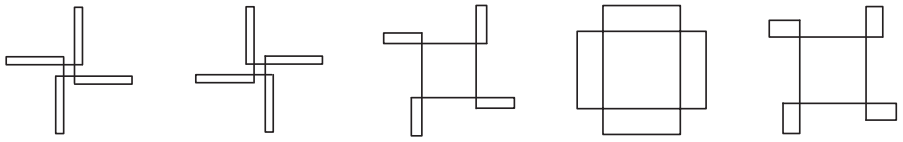
A rectangle $PQRS$ is cut into two pieces along PX, where $PX = XR$ and $PS = SX$ as shown. The two pieces are reassembled without turning either piece over, by matching two edges of equal length. Not counting the original rectangle, how many different shapes are possible?



A 1 B 2 C 3 D 4 E 5

Q107 : 2008_Q16 www.CasperYC.club/ukmtnav

The figures below are all drawn to scale. Which figure would result from repeatedly following the instructions in the box on the right?

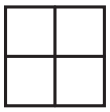
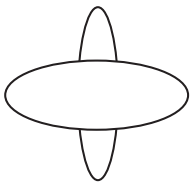
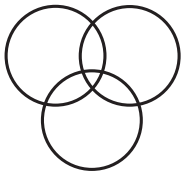


A B C D E

Move forward 2 units.
Turn right.
Move forward 15 units.
Turn right.
Move forward 20 units.
Turn right.

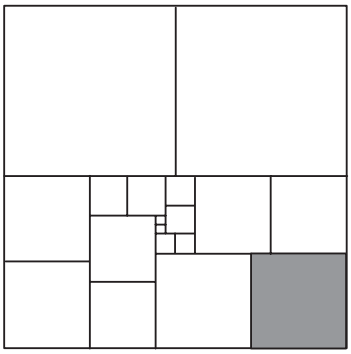
Q108 : 2008_Q2 www.CasperYC.club/ukmtnav

Which of these diagrams could be drawn without taking the pen off the page and without drawing along a line already drawn?

A  B  C  D  E 

Q109 : 2008_Q25 www.CasperYC.club/ukmtnav

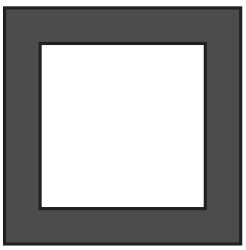
A large square is divided into adjacent pairs of smaller squares with integer sides, as shown in the diagram (which is not drawn to scale). Each size of smaller square occurs only twice. The shaded square has sides of length 10. What is the area of the large square?



A 1024 B 1089 C 1156 D 1296 E 1444

Q110 : 2008_Q6 www.CasperYC.club/ukmtnav

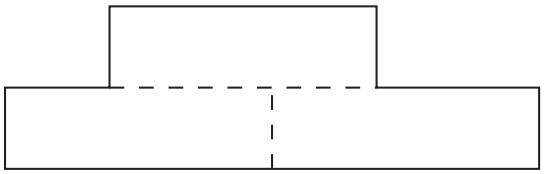
The diagram shows a single floor tile in which the outer square has side 8cm and the inner square has side 6cm. If Adam Ant walks once around the perimeter of the inner square and Annabel Ant walks once around the perimeter of the outer square, how much further does Annabel walk than Adam?



A 2 cm B 4 cm C 6 cm D 8 cm E 16 cm

Q111 : 2008_Q8 www.CasperYC.club/ukmtnav

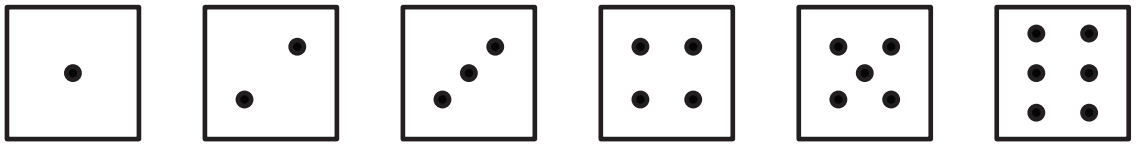
The shape on the right is made up of three rectangles, each measuring 3cm by 1cm. What is the perimeter of the shape?



A 16 cm B 18 cm C 20 cm D 24 cm E More information needed

Q112 : 2009_Q2 www.CasperYC.club/ukmtnav

How many of the six faces of a die (shown below) have fewer than three lines of symmetry?



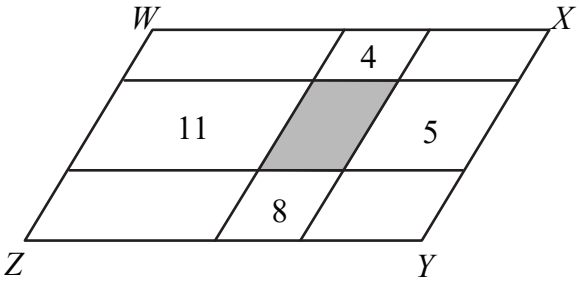
A 2 B 3 C 4 D 5 E 6

Q113 : 2009_Q24 www.CasperYC.club/ukmtnav

The parallelogram $WXYZ$ shown in the diagram on the right has been divided into nine smaller parallelograms. The perimeters, in centimetres, of four of the smaller parallelograms are shown.

The perimeter of $WXYZ$ is 21 cm.

What is the perimeter of the shaded parallelogram?



A 5 cm B 6 cm C 7 cm D 8 cm E 9 cm

Q114 : 2009_Q4 www.CasperYC.club/ukmtnav

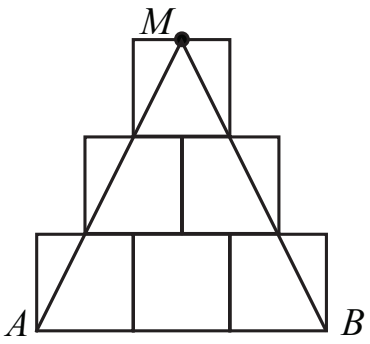
Which of the following points is *not* at a distance of 1 unit from the origin?

A (0, 1) B (1, 0) C (0, −1) D (−1, 0) E (1, 1)

Q115 : 2009_Q6 www.CasperYC.club/ukmtnav

Each square in the figure is 1 unit by 1 unit. What is the area of triangle *ABM* (in square units)?

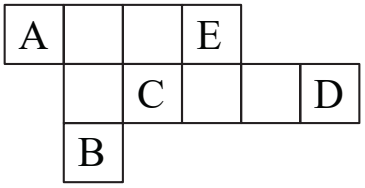
A 4 B 4.5 C 5 D 5.5 E 6



Q116 : 2009_Q8 www.CasperYC.club/ukmtnav

The figure on the right shows an arrangement of ten square tiles. Which labelled tile could be removed, but still leave the length of the perimeter unchanged?

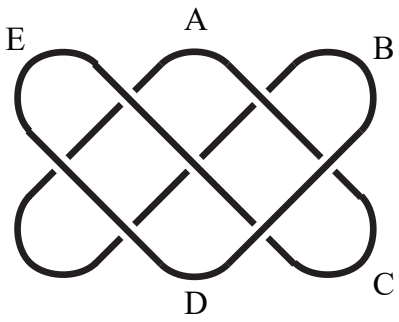
A B C D E



Q117 : 2010_Q13 www.CasperYC.club/ukmtnav

The diagram shows a Lusona, a sand picture of the Tshokwe people from the West Central Bantu area of Africa. To draw a Lusona the artist uses a stick to draw a single line in the sand, starting and ending in the same place without lifting the stick in between. At which point could this Lusona have started?

A B C D E

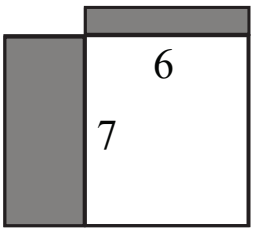


Q118 : 2010_Q15 www.CasperYC.club/ukmtnav

A 6 by 8 and a 7 by 9 rectangle overlap with one corner coinciding as shown.

What is the area (in square units) of the region *outside* the overlap?

A 6 B 21 C 27 D 42 E 69



Q119 : 2010_Q2 www.CasperYC.club/ukmtnav

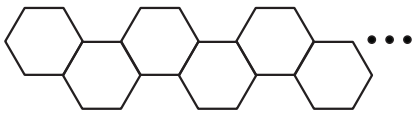
Each letter in the abbreviation shown is rotated through 90° clockwise. Which of the following could be the result?

U K M T

A B C D E

Q120 : 2010_Q21 www.CasperYC.club/ukmtnav

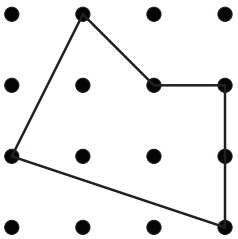
A shape consisting of a number of regular hexagons is made by continuing to the right the pattern shown in the diagram, with each extra hexagon sharing one side with the preceding one. Each hexagon has a side length of 1 cm. How many hexagons are required for the perimeter of the whole shape to have length 2010 cm?



A 335 B 402 C 502 D 670 E 1005

Q121 : 2010_Q23 www.CasperYC.club/ukmtnav

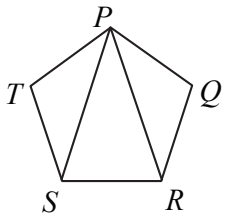
A single polygon is made by joining dots in the 4 × 4 grid with straight lines, which meet only at dots at their end points. No dot is at more than one corner. The diagram shows a five-sided polygon formed in this way. What is the greatest possible number of sides of a polygon formed by joining the dots using these same rules?



A 12 B 13 C 14 D 15 E 16

Q122 : 2011_Q10 www.CasperYC.club/ukmtnav

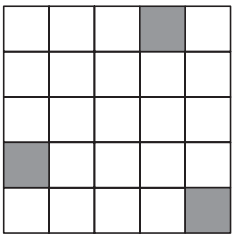
You want to draw the shape on the right without taking your pen off the paper and without going over any line more than once. Where should you start?



A only at T or Q B only at P C only at S or R
D at any point E the task is impossible

Q123 : 2011_Q15 www.CasperYC.club/ukmtnav

What is the smallest number of *additional* squares which must be shaded so that this figure has at least one line of symmetry *and* rotational symmetry of order 2 ?



A 3 B 5 C 7 D 9 E more than 9

Q124 : 2011_Q25 www.CasperYC.club/ukmtnav

The diagram shows a trapezium made from three equilateral triangles.

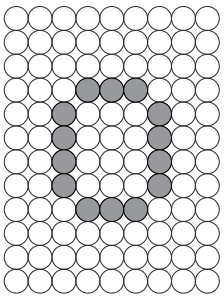
Three copies of the trapezium are placed together, without gaps or overlaps and so that only complete edges coincide, to form a polygon with N sides.

How many different values of N are possible?

A 4 B 5 C 6 D 7 E 8

Q125 : 2011_Q3 www.CasperYC.club/ukmtnav

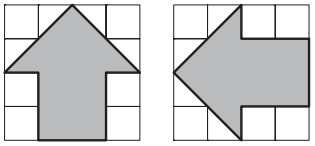
A train display shows letters by lighting cells in a grid, such as the letter 'o' shown. A letter is made **bold** by also lighting any unlit cell immediately to the right of one in the normal letter. How many cells are lit in a **bold** 'o'?



A 22 B 24 C 26 D 28 E 30

Q126 : 2012_Q10 www.CasperYC.club/ukmtnav

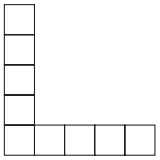
The diagram shows two arrows drawn on separate 4 cm × 4 cm grids. One arrow points North and the other points West.
When the two arrows are drawn on the same 4 cm × 4 cm grid (still pointing North and West) they overlap. What is the area of overlap?



A 4 cm² B 4½ cm² C 5 cm² D 5½ cm² E 6 cm²

Q127 : 2012_Q12 www.CasperYC.club/ukmtnav

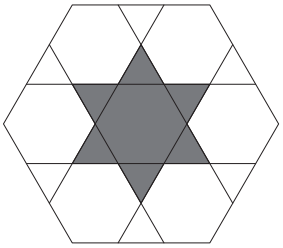
Laura wishes to cut this shape, which is made up of nine small squares, into pieces that she can then rearrange to make a 3 × 3 square.
What is the smallest number of pieces that she needs to cut the shape into so that she can do this?



A 2 B 3 C 4 D 5 E 6

Q128 : 2012_Q22 www.CasperYC.club/ukmtnav

The diagram shows a design formed by drawing six lines in a regular hexagon. The lines divide each edge of the hexagon into three equal parts.
What fraction of the hexagon is shaded?



A $\frac{1}{5}$ B $\frac{2}{9}$ C $\frac{1}{4}$ D $\frac{3}{10}$ E $\frac{5}{16}$

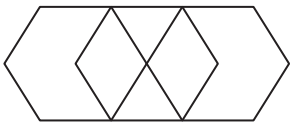
Q129 : 2012_Q4 www.CasperYC.club/ukmtnav

Beatrix looks at the word JUNIOR in a mirror.
How many of the reflected letters never look the same as the original, no matter how Beatrix holds the mirror?

A 1 B 2 C 3 D 4 E 5

Q130 : 2013_Q12 www.CasperYC.club/ukmtnav

How many hexagons are there in the diagram?



A 4 B 6 C 8 D 10 E 12

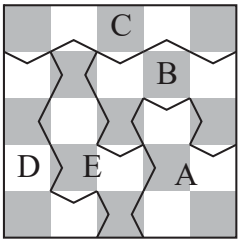
Q131 : 2013_Q14 www.CasperYC.club/ukmtnav

Each side of an isosceles triangle is a whole number of centimetres. Its perimeter has length 20 cm. How many possibilities are there for the lengths of its sides?

A 3 B 4 C 5 D 6 E 7

Q132 : 2013_Q17 www.CasperYC.club/ukmtnav

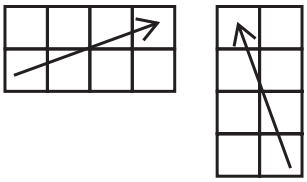
A 5 cm × 5 cm square is cut into five pieces, as shown.
Each cut is a sequence of identical copies of the same shape but pointing up, down, left or right.
Which piece has the longest perimeter?



A B C D E

Q133 : 2013_Q20 www.CasperYC.club/ukmtnav

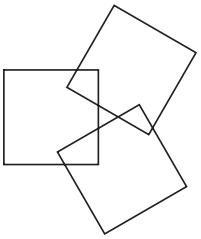
A 'long knight' moves on a square grid. A single move, as shown, consists of moving three squares in one direction (horizontally or vertically) and then one square at right angles to the first direction. What is the smallest number of moves a long knight requires to go from one corner of an 8 × 8 square board to the diagonally opposite corner?



A 4 B 5 C 6 D 7 E 8

Q134 : 2013_Q24 www.CasperYC.club/ukmtnav

Three congruent squares overlap as shown. The areas of the three overlapping sections are 2 cm^2, 5 cm^2 and 8 cm^2 respectively. The total area of the non-overlapping parts of the squares is 117 cm^2.
What is the side-length of each square?



A 6 cm B 7 cm C 8 cm D 9 cm E 10 cm

Q135 : 2013_Q5 www.CasperYC.club/ukmtnav

The diagram shows a weaver's design for a *rihlèlò*, a winnowing tray from Mozambique.

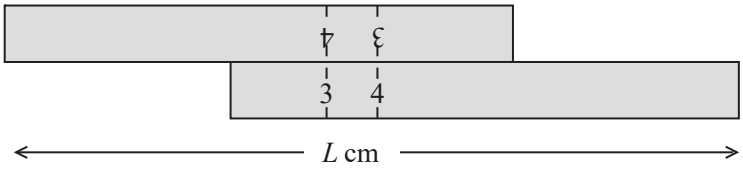
How many lines of symmetry does the design have?

A 0 B 1 C 2 D 4 E 8

Q136 : 2013_Q8 www.CasperYC.club/ukmtnav

Two identical rulers are placed together, as shown (not to scale).

Each ruler is exactly 10 cm long and is marked in centimetres from 0 to 10. The 3 cm mark on each ruler is aligned with the 4 cm mark on the other.

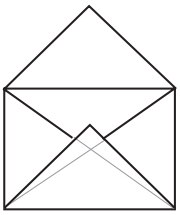


The overall length is L cm. What is the value of L?

A 13 B 14 C 15 D 16 E 17

Q137 : 2014_Q15 www.CasperYC.club/ukmtnav

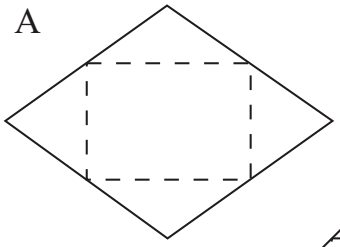
The diagram shows a rectangular envelope made by folding (and gluing) a single piece of paper.



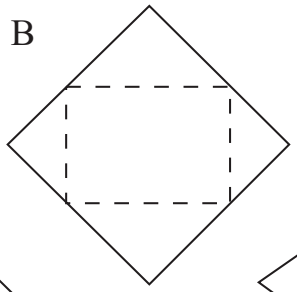
What could the original unfolded piece of paper look like?

(The dashed lines are the fold lines.)

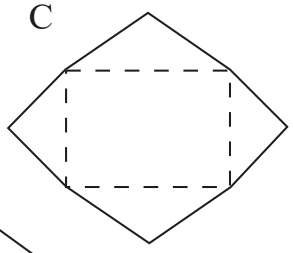
A



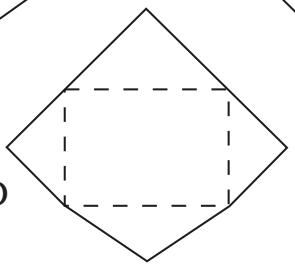
B



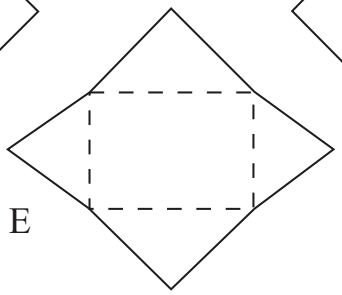
C



D



E

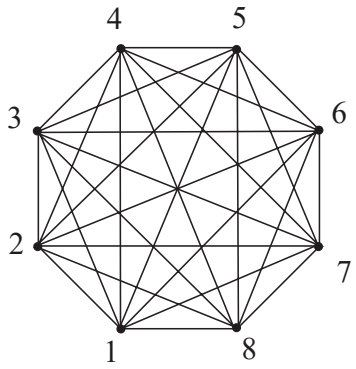


Q138 : 2015_Q13 www.CasperYC.club/ukmtnav

In the figure shown, each line joining two numbers is to be labelled with the sum of the two numbers that are at its end points.

How many of these labels are multiples of 3?

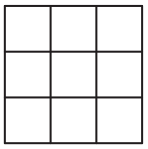
A 10 B 9 C 8 D 7 E 6



Q139 : 2016_Q16 www.CasperYC.club/ukmtnav

Each of the nine small squares in this grid can be coloured completely black or completely white.

What is the largest number of squares that can be coloured black so that the design created has rotational symmetry of order 2, but no lines of symmetry?

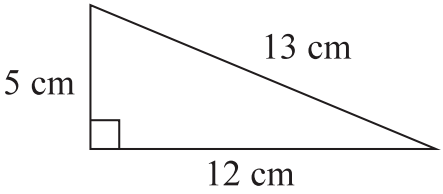


A 4 B 5 C 6 D 7 E 8

Q140 : 2016_Q22 www.CasperYC.club/ukmtnav

Four copies of the triangle shown are joined together, without gaps or overlaps, to make a parallelogram.

What is the largest possible perimeter of the parallelogram?

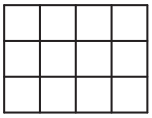


A 46 cm B 52 cm C 58 cm D 62 cm E 76 cm

Q141 : 2017_Q14 www.CasperYC.club/ukmtnav

Mathias is given a grid of twelve small squares. He is asked to shade grey exactly four of the small squares so that his grid has two lines of reflection symmetry.

How many different grids could he produce?



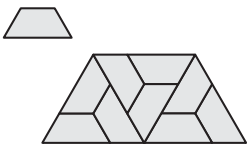
A 2 B 3 C 4 D 5 E 6

Q142 : 2017_Q21 www.CasperYC.club/ukmtnav

The small trapezium on the right has three equal sides and angles of 60° and 120°. Nine copies of this trapezium can be placed together to make a larger version of it, as shown.

The larger trapezium has perimeter 18 cm.

What is the perimeter of the smaller trapezium?

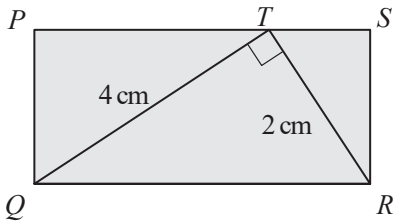


A 2 cm B 4 cm C 6 cm D 8 cm E 9 cm

Q143 : 2017_Q8 www.CasperYC.club/ukmtnav

The diagram shows a rectangle $PQRS$ and T is a point on PS such that QT is perpendicular to RT. The length of QT is 4 cm. The length of RT is 2 cm.

What is the area of the rectangle $PQRS$?



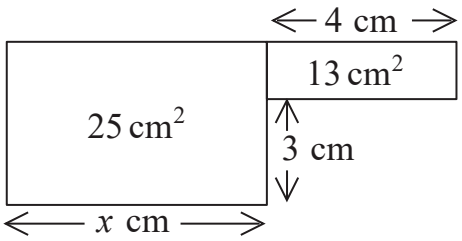
A 6 cm^2 B 8 cm^2 C 10 cm^2 D 12 cm^2 E 16 cm^2

Q144 : 2018_Q17 www.CasperYC.club/ukmtnav

The areas of the two rectangles in the diagram are 25 cm^2 and 13 cm^2 as indicated.

What is the value of x?

A 3 B 4 C 5 D 6 E 7



Q145 : 2018_Q4 www.CasperYC.club/ukmtnav

The perimeter of the regular decagon P is 8 times the perimeter of the regular octagon Q.

Each edge of the regular octagon Q is 10 cm long.

How long is each edge of the regular decagon P?

A 8 cm B 10 cm C 40 cm D 60 cm E 64 cm

9 Logic

Q146 : 2007_Q18 www.CasperYC.club/ukmtnav

The letters J, M, C represent three different non-zero digits.

What is the value of $J + M + C$?

$$\begin{array}{r} J\ J \\ M\ M \\ \hline C\ C \\ \hline J\ M\ C \end{array}$$

A 19 B 18 C 17 D 16 E 15

Q147 : 2007_Q21 www.CasperYC.club/ukmtnav

A list of ten numbers contains two of each of the numbers 0, 1, 2, 3, 4. The two 0s are next to each other, the two 1s are separated by one number, the two 2s by two numbers, the two 3s by three numbers and the two 4s by four numbers. The list starts 3, 4, ... What is the last number?

A 0 B 1 C 2 D 3 E 4

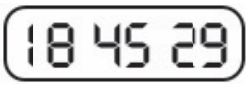
Q148 : 2007_Q8 www.CasperYC.club/ukmtnav

Amy, Ben and Chris are standing in a row. If Amy is to the left of Ben and Chris is to the right of Amy, which of these statements must be true?

A Ben is furthest to the left B Chris is furthest to the right C Amy is in the middle
D Amy is furthest to the left E None of statements A, B, C, D is true

Q149 : 2008_Q22 www.CasperYC.club/ukmtnav

On a digital clock displaying hours, minutes and seconds, how many times in each 24-hour period do all six digits change simultaneously?



A 0 B 1 C 2 D 3 E 24

Q150 : 2008_Q24 www.CasperYC.club/ukmtnav

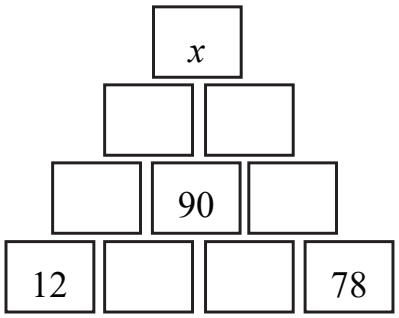
The list 2, 1; 3, 2; 2, 3; 1, 4; describes itself, since there are two 1s, three 2s, two 3s and one 4. There is exactly one other list of eight numbers containing only the numbers 1, 2, 3, and 4 that, in the same way, describes the numbers of 1s, 2s, 3s and 4s in that order. What is the total number of 1s and 3s in this other list?

A 2 B 3 C 4 D 5 E 6

Q151 : 2009_Q20 www.CasperYC.club/ukmtnav

In the diagram on the right, the number in each box is obtained by adding the numbers in the two boxes immediately underneath.

What is the value of x?



A 300 B 320 C 340
D 360 E more information needed

Q152 : 2009_Q22 www.CasperYC.club/ukmtnav

Starting at the square containing the 2, you are allowed to move from one square to the next either across a common edge, or diagonally through a common corner. How many different routes are there passing through exactly two squares containing a 0 and ending in one of the squares containing a 9?

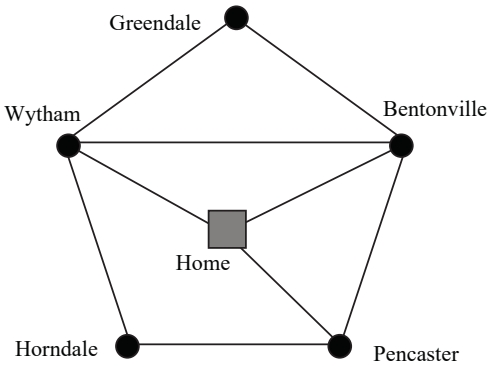
2	0	0	9
0	0	0	9
0	0	0	9
9	9	9	9

A 7 B 13 C 15 D 25 E 32

Q153 : 2010_Q19 www.CasperYC.club/ukmtnav

Pat needs to travel down every one of the roads shown at least once, starting and finishing at home. What is the smallest number of the five villages that Pat will have to visit more than once?

A 1 B 2 C 3 D 4 E 5



Q154 : 2010_Q3 www.CasperYC.club/ukmtnav

Which of the following could have a length of 2010 mm?

A a table B an oil tanker C a teaspoon D a school hall E a hen's egg

Q155 : 2011_Q24 www.CasperYC.club/ukmtnav

Two adults and two children wish to cross a river. They make a raft but it will carry only the weight of one adult or two children. What is the minimum number of times the raft must cross the river to get all four people to the other side? (N.B. The raft may not cross the river without at least one person on board.)

A 3 B 5 C 7 D 9 E 11

Q156 : 2012_Q14 www.CasperYC.club/ukmtnav

A pattern that repeats every six symbols starts as shown below:

♥ ♣ ♥ ♦ ♥ ♠ ♥ ♣ ♥ ♦ ♥ ♠ ...

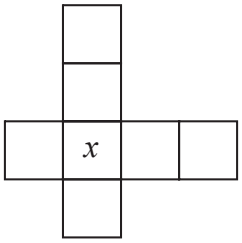
Which are the 100th and 101st symbols, in that order, in the pattern?

A ♦ ♥ B ♥ ♦ C ♥ ♣ D ♠ ♥ E ♣ ♥

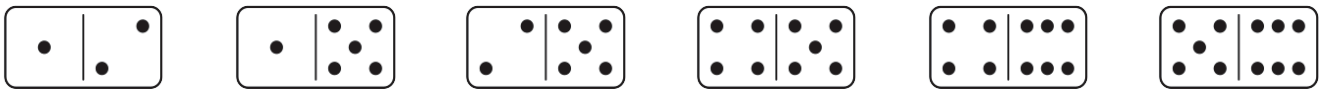
Q157 : 2012_Q18 www.CasperYC.club/ukmtnav

The numbers 2, 3, 4, 5, 6, 7, 8 are to be placed, one per square, in the diagram shown such that the four numbers in the horizontal row add up to 21 and the four numbers in the vertical column also add up to 21. Which number should replace x ?

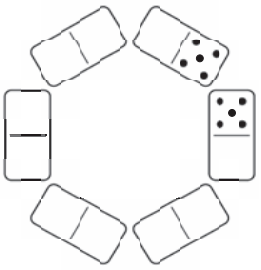
A 2 B 3 C 5 D 7 E 8

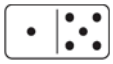


Q158 : 2012_Q21 www.CasperYC.club/ukmtnav



Dominic wants to place the six dominoes above in a hexagonal ring so that, for every pair of adjacent dominoes, the numbers of pips match. The ring on the right indicates how one adjacent pair match.

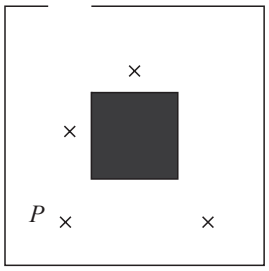


In a completed ring, how many of the other five dominoes can he definitely *not* place adjacent to  ?

A 1 B 2 C 3 D 4 E 5

Q159 : 2012_Q9 www.CasperYC.club/ukmtnav

The diagram on the right shows the positions of four people (each marked ×) in an Art Gallery. In the middle of the room is a stone column. Ali can see none of the other three people. Bea can see only Caz. Caz can see Bea and Dan. Dan can see only Caz.

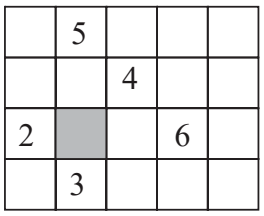


Who is at position *P*?

A Ali B Bea C Caz D Dan E More information needed

Q160 : 2013_Q21 www.CasperYC.club/ukmtnav

The 5 × 4 grid is divided into blocks. Each block is a square or a rectangle and contains the number of cells indicated by the integer within it.



Which integer will be in the same block as the shaded cell?

A 2 B 3 C 4 D 5 E 6

Q161 : 2013_Q22 www.CasperYC.club/ukmtnav

Two numbers in the 4 × 4 grid can be swapped to create a Magic Square (in which all rows, all columns and both main diagonals add to the same total).

9	6	3	16
4	13	10	5
14	1	8	11
7	12	15	2

What is the sum of these two numbers?

A 12 B 15 C 22 D 26 E 28

Q162 : 2014_Q11 www.CasperYC.club/ukmtnav

The first two terms of a sequence are 1 and 2. Each of the following terms in the sequence is the sum of all the terms which come before it in the sequence.

Which of these is *not* a term in the sequence?

A 6 B 24 C 48 D 72 E 96

Q163 : 2014_Q12 www.CasperYC.club/ukmtnav

In this subtraction, P, Q, R, S and T represent single digits.

$$\begin{array}{rrrrr} 7 & Q & 2 & S & T \\ -\,P & 3 & R & 9 & 6 \\ \hline 2 & 2 & 2 & 2 & 2 \end{array}$$

What is the value of $P + Q + R + S + T$?

A 30 B 29 C 28 D 27 E 26

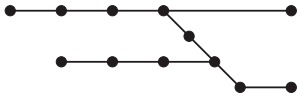
Q164 : 2014_Q16 www.CasperYC.club/ukmtnav

Only one of the following statements is true. Which one?

A 'B is true' B 'E is false' C 'Statements A to E are true'
D 'Statements A to E are false' E 'A is false'

Q165 : 2014_Q17 www.CasperYC.club/ukmtnav

The diagram is a 'map' of Jo's local rail network, where the dots represent stations and the lines are routes. Jo wants to visit all the stations, travelling only by train, starting at any station and ending at any station, with no restrictions on which routes are taken.
What is the smallest number of stations that Jo must go to more than once?



A 1 B 2 C 3 D 4 E 5

Q166 : 2014_Q20 www.CasperYC.club/ukmtnav

Box P has p chocolates and box Q has q chocolates, where p and q are both odd and $p > q$.
What is the smallest number of chocolates which would have to be moved from box P to box Q so that box Q has more chocolates than box P?

A $\frac{q-p+2}{2}$ B $\frac{p-q+2}{2}$ C $\frac{q+p-2}{2}$ D $\frac{p-q-2}{2}$ E $\frac{q+p+2}{2}$

Q167 : 2015_Q17 www.CasperYC.club/ukmtnav

Knave of Hearts: "I stole the tarts."
Knave of Clubs: "The Knave of Hearts is lying."
Knave of Diamonds: "The Knave of Clubs is lying."
Knave of Spades: "The Knave of Diamonds is lying."

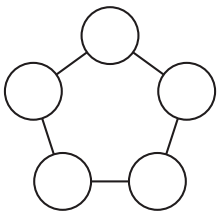
How many of the four Knaves were telling the truth?

A 1 B 2 C 3 D 4 E more information needed

Q168 : 2016_Q13 www.CasperYC.club/ukmtnav

The diagram shows five circles placed at the corners of a pentagon. The numbers 1, 2, 3, 4, 5 are placed in the circles shown, one in each, so that the numbers in adjacent circles always differ by more than 1.

What is the sum of the numbers in the two circles adjacent to the circle which contains the number 5?



A 3 B 4 C 5 D 6 E 7

Q169 : 2016_Q18 www.CasperYC.club/ukmtnav

In the addition sum shown, each letter represents a different non-zero digit. What digit does X represent?

$$\begin{array}{cccc} & S & E & E \\ + & S & E & E \\ \hline A & X & E & S \end{array}$$

A 1 B 3 C 5 D 7 E 9

Q170 : 2017_Q13 www.CasperYC.club/ukmtnav

Consider the following three statements.

(i) Doubling a positive number always makes it larger.
(ii) Squaring a positive number always makes it larger.
(iii) Taking the positive square root of a positive number always makes it smaller.

Which statements are true?

A All three B None C Only (i) D (i) and (ii) E (ii) and (iii)

Q171 : 2017_Q18 www.CasperYC.club/ukmtnav

What is the sum of the digits in the completed crossnumber?

ACROSS
1. A cube
3. A power of 11

DOWN
2. A square

A 25 B 29 C 32 D 34 E 35

Q172 : 2017_Q23 www.CasperYC.club/ukmtnav

The positive integers from 1 to 150 inclusive are placed in a 10 by 15 grid so that each cell contains exactly one integer. Then the multiples of 3 are given a red mark, the multiples of 5 are given a blue mark, and the multiples of 7 are given a green mark.

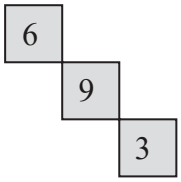
How many cells have more than 1 mark?

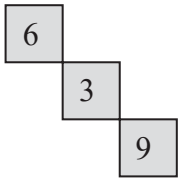
A 10 B 12 C 15 D 18 E 19

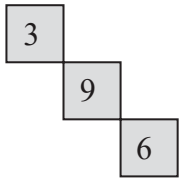
Q173 : 2017_Q6 www.CasperYC.club/ukmtnav

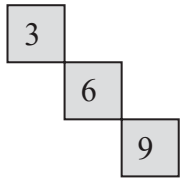
In a magic square, the numbers in each row, each column and the two main diagonals have the same total. This magic square uses the integers 2 to 10. Which of the following are the missing cells?

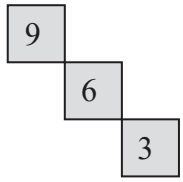
	10	5
8		4
7	2	

A 

B 

C 

D 

E 

Q174 : 2018_Q2 www.CasperYC.club/ukmtnav

A train carriage has 80 seats. On my journey I noticed that all the seats in my carriage were taken and 7 people were standing.

At Banbury, 9 people left the carriage, 28 people entered it and all seats were taken.

How many people now had no seat?

A 0 B 7 C 16 D 26 E 35

Q175 : 2018_Q21 www.CasperYC.club/ukmtnav

There are ——— vowels in this short sentence.

Which of the following options should replace "———" to make the sentence in the box true?

A twelve B thirteen C fourteen D fifteen E sixteen

10 Number Work

Q176 : 2007_Q1 www.CasperYC.club/ukmtnav

What is the value of $0.1 + 0.2 + 0.3 \times 0.4$?

A 0.24 B 0.312 C 0.42 D 1.0 E 1.5

Q177 : 2007_Q14 www.CasperYC.club/ukmtnav

If the line on the right were 0.2 mm thick, how many metres long would the line need to be to cover an area of one square metre?

A 0.5 B 5 C 50 D 500 E 5000

Q178 : 2007_Q2 www.CasperYC.club/ukmtnav

My train was scheduled to leave at 17:40 and to arrive at 18:20. However, it started five minutes late and the journey then took 42 minutes. At what time did I arrive?

A 18:21 B 18:23 C 18:25 D 18:27 E 18:29

Q179 : 2007_Q24

The pages of a book are numbered 1, 2, 3, … . In total, it takes 852 digits to number all the pages of the book. What is the number of the last page?

A 215 B 314 C 320 D 329 E 422

Q180 : 2007_Q3

What is the remainder when 354972 is divided by 7 ?

A 1 B 2 C 3 D 4 E 5

Q181 : 2007_Q4

Which of the following numbers is three less than a multiple of 5 and three more than a multiple of 6?

A 12 B 17 C 21 D 22 E 27

Q182 : 2008_Q1

Which of these calculations produces a multiple of 5?

A $1 \times 2 + 3 + 4$ B $1 + 2 \times 3 + 4$ C $1 \times 2 + 3 \times 4$ D $1 + 2 \times 3 \times 4$ E $1 \times 2 \times 3 \times 4$

Q183 : 2008_Q15

An active sphagnum bog deposits a depth of about 1 metre of peat per 1000 years. Roughly how many millimetres is that per day?

A 0.0003 B 0.003 C 0.03 D 0.3 E 3

Q184 : 2008_Q17

In this *Multiplication Magic Square*, the **product** of the three numbers in each row, each column and each of the diagonals is 1. What is the value of $r + s$?

p	q	r
s	1	t
u	4	$\frac{1}{8}$

A $\frac{1}{2}$ B $\frac{9}{16}$ C $\frac{5}{4}$ D $\frac{33}{16}$ E 24

Q185 : 2008_Q18

Granny swears that she is getting younger. She has calculated that she is four times as old as I am now, but remembers that 5 years ago she was five times as old as I was at that time. What is the sum of our ages now?

A 95 B 100 C 105 D 110 E 115

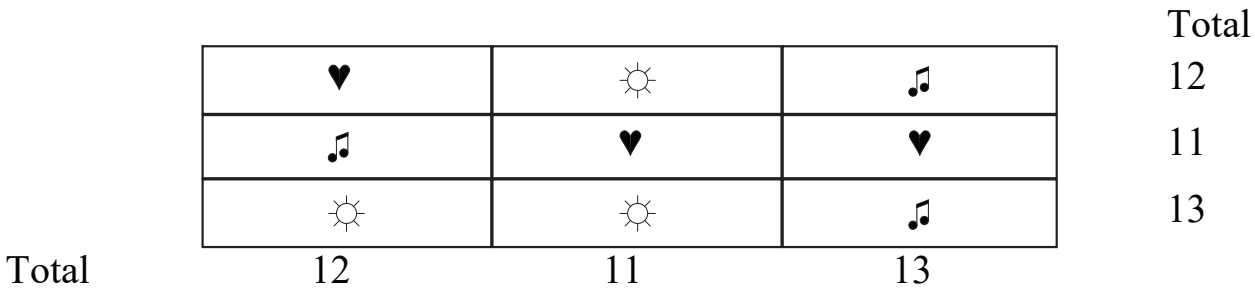
Q186 : 2008_Q20 www.CasperYC.club/ukmtnav

If all the whole numbers from 1 to 1000 inclusive are written down, which digit appears the smallest number of times?

A 0 B 2 C 5 D 9 E none: no single digit appears fewer times than all the others

Q187 : 2008_Q21 www.CasperYC.club/ukmtnav

What is the value of ♥ if each row and each column has the total given?



A 3 B 4 C 5 D 6 E more information needed

Q188 : 2008_Q23 www.CasperYC.club/ukmtnav

In a 7-digit numerical code each group of four adjacent digits adds to 16 and each group of five adjacent digits adds to 19. What is the sum of all seven digits?

A 21 B 25 C 28 D 32 E 35

Q189 : 2008_Q5 www.CasperYC.club/ukmtnav

At Spuds-R-Us, a 2.5kg bag of potatoes costs £1.25. How much would one tonne of potatoes cost?

A £5 B £20 C £50 D £200 E £500

Q190 : 2009_Q1 www.CasperYC.club/ukmtnav

What is the value of 9002 – 2009?

A 9336 B 6993 C 6339 D 3996 E 3669

Q191 : 2009_Q13 www.CasperYC.club/ukmtnav

The sum of ten consecutive integers is 5. What is the largest of these integers?

A 2 B 3 C 4 D 5 E more information needed

Q192 : 2009_Q3 www.CasperYC.club/ukmtnav

Which of the following is correct?

A $0 \times 9 + 9 \times 0 = 9$ B $1 \times 8 + 8 \times 1 = 18$ C $2 \times 7 + 7 \times 2 = 27$
D $3 \times 6 + 6 \times 3 = 36$ E $4 \times 5 + 5 \times 4 = 45$

Q193 : 2009_Q7 www.CasperYC.club/ukmtnav

How many minutes are there from 11:11 until 23:23 on the same day?

A 12 B 720 C 732 D 1212 E 7212

Q194 : 2010_Q1 www.CasperYC.club/ukmtnav

What is $2010 + (+2010) + (-2010) - (+2010) - (-2010)$?

A 0 B 2010 C 4020 D 6030 E 8040

Q195 : 2010_Q12 www.CasperYC.club/ukmtnav

Sir Lance has a lot of tables and chairs in his house. Each rectangular table seats eight people and each round table seats five people. What is the smallest number of tables he will need to use to seat 35 guests and himself, without any of the seating around these tables remaining unoccupied?

A 4 B 5 C 6 D 7 E 8

Q196 : 2010_Q24 www.CasperYC.club/ukmtnav

The year 2010 belongs to a special sequence of twenty-five consecutive years: each number from 1988 to 2012 contains a repeated digit.
Each of the following belongs to a sequence of consecutive years, where each number in the sequence contains at least one repeated digit.
Which of them belongs to the next such sequence of at least twenty years?

A 2099 B 2120 C 2199 D 2989 E 3299

Q197 : 2010_Q25 www.CasperYC.club/ukmtnav

What is the value of $P + Q + R$ in the multiplication on the right?

A 13 B 12 C 11 D 10 E 9

$$\begin{array}{cccccc} & P & Q & P & Q \\ \times & & R & R & R \\ \hline 6 & 3 & 9 & 0 & 2 & 7 \end{array}$$

Q198 : 2010_Q9 www.CasperYC.club/ukmtnav

Which of the following is the longest period of time?

A 3002 hours B 125 days C $17\frac{1}{2}$ weeks D 4 months E $\frac{1}{3}$ of a year

Q199 : 2011_Q1 www.CasperYC.club/ukmtnav

What is the value of $2 \times 0 \times 1 + 1$?

A 0 B 1 C 2 D 3 E 4

Q200 : 2011_Q21 www.CasperYC.club/ukmtnav

Gill leaves Lille by train at 09:00. The train travels the first 27 km at 96 km/h. It then stops at Lens for 3 minutes before travelling the final 29 km to Lillers at 96 km/h. At what time does Gill arrive at Lillers?

A 09:35 B 09:38 C 09:40 D 09:41 E 09:43

Q201 : 2011_Q22 www.CasperYC.club/ukmtnav

Last week Evariste and Sophie both bought some stamps for their collections. Each stamp Evariste bought cost him £1.10, whilst Sophie paid 70p for each of her stamps. Between them they spent exactly £10. How many stamps did they buy in total?

A 9 B 10 C 11 D 12 E 13

Q202 : 2011_Q4 www.CasperYC.club/ukmtnav

The world's largest coin, made by the Royal Mint of Canada, was auctioned in June 2010. The coin has mass 100 kg, whereas a standard British £1 coin has mass 10 g.
What sum of money in £1 coins has the same mass as the record-breaking coin?

A £100 B £1000 C £10 000 D £100 000 E £1 000 000

Q203 : 2011_Q9 www.CasperYC.club/ukmtnav

What is the smallest possible difference between two different nine-digit integers, each of which includes all of the digits 1 to 9?

A 9 B 18 C 27 D 36 E 45

Q204 : 2012_Q1 www.CasperYC.club/ukmtnav

What is the smallest four-digit positive integer which has four different digits?

A 1032 B 2012 C 1021 D 1234 E 1023

Q205 : 2012_Q11

In the following expression, each ☐ is to be replaced with either + or – in such a way that the result of the calculation is 100.

123 ☐ 45 ☐ 67 ☐ 89

The number of + signs used is p and the number of – signs used is m. What is the value of $p - m$?

A −3 B −1 C 0 D 1 E 3

Q206 : 2012_Q16

Beth, Carolyn and George love reading their favourite bedtime story together. They take it in turns to read a page, always in the order Beth, then Carolyn, then George. All twenty pages of the story are read on each occasion. One evening, Beth is staying at Grandma's house but Carolyn and George still read the same bedtime story and take it in turns to read a page with Carolyn reading the first page.

In total, how many pages are read by the person who usually reads that page?

A 1 B 2 C 4 D 6 E 7

Q207 : 2012_Q2

What is half of 1.01?

A 5.5 B 0.55 C 0.505 D 0.5005 E 0.055

Q208 : 2012_Q20

Aroon says his age is 50 years, 50 months, 50 weeks and 50 days old. What age will he be on his next birthday?

A 56 B 55 C 54 D 53 E 51

Q209 : 2012_Q5

One of the mascots for the 2012 Olympic Games is called 'Wenlock' because the town of Wenlock in Shropshire first held the Wenlock Olympian Games in 1850. How many years ago was that?

A 62 B 152 C 158 D 162 E 172

Q210 : 2012_Q7

A small ink cartridge has enough ink to print 600 pages. Three small cartridges can print as many pages as two medium cartridges. Three medium cartridges can print as many pages as two large cartridges. How many pages can be printed using a large cartridge?

A 1200 B 1350 C 1800 D 2400 E 5400

Q211 : 2013_Q1 www.CasperYC.club/ukmtnav

Which of the following has the largest value?

A $1-0.1$ B $1-0.01$ C $1-0.001$ D $1-0.0001$ E $1-0.00001$

Q212 : 2013_Q16 www.CasperYC.club/ukmtnav

Ulysses, Kim, Mei and Tanika have their 12th, 14th, 15th and 15th birthdays today. In what year will their ages first total 100?

A 2023 B 2024 C 2025 D 2057 E 2113

Q213 : 2013_Q6 www.CasperYC.club/ukmtnav

What is the value of $((1-1)-1)-(1-(1-1))$?

A -2 B -1 C 0 D 1 E 2

Q214 : 2014_Q1 www.CasperYC.club/ukmtnav

What is $(999-99+9)\div 9$?

A 91 B 99 C 100 D 101 E 109

Q215 : 2014_Q14 www.CasperYC.club/ukmtnav

Which of these is equal to one million millimetres?

A 1 metre B 10 metres C 100 metres D 1 kilometre E 10 kilometres

Q216 : 2014_Q18 www.CasperYC.club/ukmtnav

Which of these statements is true?

A $15\,614 = 1 + 5^6 - 1 \times 4$ B $15\,615 = 1 + 5^6 - 1 \times 5$ C $15\,616 = 1 + 5^6 - 1 \times 6$
D $15\,617 = 1 + 5^6 - 1 \times 7$ E $15\,618 = 1 + 5^6 - 1 \times 8$

Q217 : 2014_Q2 www.CasperYC.club/ukmtnav

How many minutes are there in $\frac{1}{12}$ of a day?

A 240 B 120 C 60 D 30 E 15

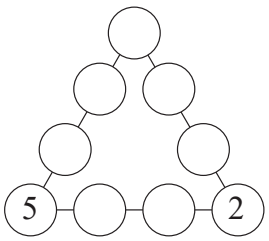
Q218 : 2014_Q22 www.CasperYC.club/ukmtnav

In the division calculation $952\,473 \div 18$, which two adjacent digits should be swapped in order to increase the result by 100?

A 9 and 5 B 5 and 2 C 2 and 4 D 4 and 7 E 7 and 3

Q219 : 2014_Q23 www.CasperYC.club/ukmtnav

Sam wants to complete the diagram so that each of the nine circles contains one of the digits from 1 to 9 inclusive and each contains a different digit. Also, the digits in each of the three lines of four circles must have the same total. What is this total?



A 17 B 18 C 19 D 20 E 21

Q220 : 2014_Q3 www.CasperYC.club/ukmtnav

In my row in the theatre the seats are numbered consecutively from T1 to T50. I am sitting in seat T17 and you are sitting in seat T39. How many seats are there between us?

A 23 B 22 C 21 D 20 E 19

Q221 : 2014_Q4 www.CasperYC.club/ukmtnav

The number 987 654 321 is multiplied by 9. How many times does the digit 8 occur in the result?

A 1 B 2 C 3 D 4 E 9

Q222 : 2014_Q5 www.CasperYC.club/ukmtnav

What is the difference between the smallest 4-digit number and the largest 3-digit number?

A 1 B 10 C 100 D 1000 E 9899

Q223 : 2014_Q7 www.CasperYC.club/ukmtnav

What is $2014 - 4102$?

A -2012 B -2088 C -2092 D -2098 E -2112

Q224 : 2015_Q1 www.CasperYC.club/ukmtnav

Which of the following calculations gives the largest answer?

A $1-2+3+4$ B $1+2-3+4$ C $1+2+3-4$ D $1+2-3-4$ E $1-2-3+4$

Q225 : 2015_Q10 www.CasperYC.club/ukmtnav

In the expression $1 \square 2 \square 3 \square 4$ each $\square$ is to be replaced by either $+$ or $\times$. What is the largest value of all the expressions that can be obtained in this way?

A 10 B 14 C 15 D 24 E 25

Q226 : 2015_Q2 www.CasperYC.club/ukmtnav

It has just turned 22:22. How many minutes are there until midnight?

A 178 B 138 C 128 D 108 E 98

Q227 : 2015_Q24 www.CasperYC.club/ukmtnav

A *palindromic number* is a number that reads the same when the order of its digits is reversed. What is the difference between the largest and smallest five-digit palindromic numbers that are both multiples of 45?

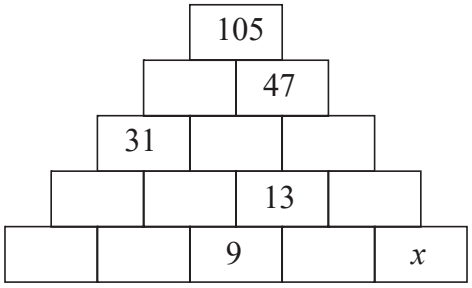
A 9180 B 9090 C 9000 D 8910 E 8190

Q228 : 2015_Q4 www.CasperYC.club/ukmtnav

In this partly completed pyramid, each rectangle is to be filled with the sum of the two numbers in the rectangles immediately below it.

What number should replace x?

A 3 B 4 C 5 D 7 E 12



Q229 : 2015_Q7 www.CasperYC.club/ukmtnav

The result of the calculation 123 456 789 × 8 is almost the same as 987 654 321 except that two of the digits are in a different order. What is the sum of these two digits?

A 3 B 7 C 9 D 15 E 17

Q230 : 2016_Q1 www.CasperYC.club/ukmtnav

Which of the following is closest to zero?

A $6+5+4$ B $6+5-4$ C $6+5\times4$ D $6-5\times4$ E $6\times5\div4$

Q231 : 2016_Q12 www.CasperYC.club/ukmtnav

The musical *Rent* contains a song that starts 'Five hundred and twenty five thousand six hundred minutes'.

Which of the following is closest to this length of time?

A a week B a year C a decade D a century E a millennium

Q232 : 2016_Q15 www.CasperYC.club/ukmtnav

How many of these four expressions are perfect squares?

$1^3 + 2^3$ $1^3 + 2^3 + 3^3$ $1^3 + 2^3 + 3^3 + 4^3$ $1^3 + 2^3 + 3^3 + 4^3 + 5^3$

A 0 B 1 C 2 D 3 E 4

Q233 : 2016_Q2 www.CasperYC.club/ukmtnav

What number is twenty-one less than sixty thousand?

A 59 979 B 59 981 C 57 900 D 40 001 E 39 000

Q234 : 2016_Q3 www.CasperYC.club/ukmtnav

One lap of a standard running track is 400 m.

How many laps does each athlete run in a 5000 m race?

A 4 B 5 C 8 D 10 E $12\frac{1}{2}$

Q235 : 2016_Q4 www.CasperYC.club/ukmtnav

In January 1859, an eight-year-old boy dropped a newly-hatched eel into a well in Sweden (apparently in order to keep the water free of insects). The eel, named Åle, finally died in August 2014.

How many years old was Åle when it died?

A 135 B 145 C 155 D 165 E 175

Q236 : 2016_Q6 www.CasperYC.club/ukmtnav

Gill is now 28 years old and is a teacher of Mathematics at a school which has 600 pupils. There are 30 more girls than boys at the school.

How many girls are at Gill's school?

A 270 B 300 C 315 D 330 E 345

Q237 : 2017_Q1 www.CasperYC.club/ukmtnav

Which of the following calculations gives the largest answer?

A $2 - 1$ B $2 \div 1$ C 2×1 D 1×2 E $2 + 1$

Q238 : 2017_Q16 www.CasperYC.club/ukmtnav

In New Threeland there are three types of coins: the 2p; the 5p; and one other. The smallest number of coins needed to make 13p is three. The smallest number of coins needed to make 19p is three. What is the value of the third type of coin?

A 4p B 6p C 7p D 9p E 12p

Q239 : 2017_Q17 www.CasperYC.club/ukmtnav

I add up all even numbers between 1 and 101. Then from my total I subtract all odd numbers between 0 and 100.

What is the result?

A 0 B 50 C 100 D 255 E 2525

Q240 : 2017_Q5 www.CasperYC.club/ukmtnav

What is the value of $201 \times 7 - 7 \times 102$?

A 142 800 B 793 C 693 D 607 E 0

Q241 : 2018_Q1 www.CasperYC.club/ukmtnav

What is the value of $(222 + 22) \div 2$?

A 111 B 112 C 122 D 133 E 233

Q242 : 2018_Q11 www.CasperYC.club/ukmtnav

How many digits are there in the correct answer to the calculation 123 123 123 123 ÷ 123?

A 4 B 6 C 8 D 10 E 12

Q243 : 2018_Q16 www.CasperYC.club/ukmtnav

How many pairs of digits (p, q) are there so that the five-digit integer '$p869q$' is a multiple of 15?

A 2 B 3 C 4 D 5 E 6

Q244 : 2018_Q23 www.CasperYC.club/ukmtnav

Ali wants to fill the empty squares so that the number in each square after the fourth from the left is the sum of the numbers in the four squares to its left.

2		0		1		8	

What number should Ali write in the final square?

A 16 B 8 C 4 D 2 E 1

Q245 : 2018_Q5 www.CasperYC.club/ukmtnav

My train left Southampton at 06:15 and arrived in Birmingham at 08:48 later that morning. How many minutes did the journey take?

A 153 B 193 C 233 D 1463 E 1501

Q246 : 2018_Q7 www.CasperYC.club/ukmtnav

How many integers are greater than $20 + 18$ and also less than 20×18?

A 320 B 321 C 322 D 323 E 324

11 Percentages

Q247 : 2007_Q20 www.CasperYC.club/ukmtnav

At halftime, Boarwarts Academy had scored all of the points so far in their annual match against Range Hill School. In the second half, each side scored three points. At the end of the match, Boarwarts Academy had scored 90% of the points. What fraction of the points in the match was scored in the second half?

A $\frac{3}{100}$ B $\frac{3}{50}$ C $\frac{1}{10}$ D $\frac{9}{50}$ E $\frac{1}{5}$

Q248 : 2008_Q3 www.CasperYC.club/ukmtnav

All of the Forty Thieves were light-fingered, but only two of them were caught red-handed. What percentage is that?

A 2 B 5 C 10 D 20 E 50

Q249 : 2009_Q12 www.CasperYC.club/ukmtnav

Gill is 21 this year. At the famous visit to the clinic in 1988, her weight was calculated to be 5kg, but she now weighs 50kg. What has been the percentage increase in Gill's weight from 1988 to 2009?

A 900% B 1000% C 5000% D 9000% E 10 000%

Q250 : 2009_Q16 www.CasperYC.club/ukmtnav

The kettle in Keith's kitchen is 80% full. After 20% of the water in it has been poured out, there are 1152 ml of water left. What volume of water does Keith's kitchen kettle hold when it is full?

A 1400 ml B 1600 ml C 1700 ml D 1800 ml E 2000 ml

Q251 : 2009_Q25 www.CasperYC.club/ukmtnav

In Miss Quaffley's class, one third of the pupils bring a teddy bear to school. Last term, each boy took 12 books out of the library, each girl took 17 books and each teddy bear took 9 books. In total, 305 books were taken out. How many girls are there in Miss Quaffley's class?

A 4 B 7 C 10 D 13 E 16

Q252 : 2010_Q16 www.CasperYC.club/ukmtnav

One of the examination papers for Amy's Advanced Arithmetic Award was worth 18% of the final total. The maximum possible mark on this paper was 108 marks. How many marks were available overall?

A 420 B 480 C 540 D 560 E 600

Q253 : 2011_Q16 www.CasperYC.club/ukmtnav

The pupils in Year 8 are holding a mock election. A candidate receiving more votes than any other wins. The four candidates receive 83 votes between them. What is the smallest number of votes the winner could receive?

A 21 B 22 C 23 D 41 E 42

Q254 : 2011_Q5 www.CasperYC.club/ukmtnav

All old Mother Hubbard had in her cupboard was a Giant Bear chocolate bar. She gave each of her children one-twelfth of the chocolate bar. One third of the bar was left. How many children did she have?

A 6 B 8 C 12 D 15 E 18

Q255 : 2011_Q7 www.CasperYC.club/ukmtnav

Peter Piper picked a peck of pickled peppers. 1 peck = $\frac{1}{4}$ bushel and 1 bushel = $\frac{1}{9}$ barrel. How many **more** pecks must Peter Piper pick to fill a barrel?

A 12 B 13 C 34 D 35 E 36

Q256 : 2012_Q24 www.CasperYC.club/ukmtnav

After playing 500 games, my success rate at Spider Solitaire is 49%. Assuming I win every game from now on, how many extra games do I need to play in order that my success rate increases to 50% ?

A 1 B 2 C 5 D 10 E 50

Q257 : 2013_Q15 www.CasperYC.club/ukmtnav

The Grand Old Duke of York had 10 000 men. He lost 10% of them on the way to the top of the hill, and he lost 15% of the rest as he marched them back down the hill. What percentage of the 10 000 men were still there when they reached the bottom of the hill?

A $76\frac{1}{2}\%$ B 75% C $73\frac{1}{2}\%$ D $66\frac{2}{3}\%$ E 25%

Q258 : 2017_Q4 www.CasperYC.club/ukmtnav

A download is 95% complete. What fraction is yet to be downloaded?

A $\frac{1}{2}$ B $\frac{1}{5}$ C $\frac{1}{9}$ D $\frac{1}{10}$ E $\frac{1}{20}$

Q259 : 2018_Q9 www.CasperYC.club/ukmtnav

The approximate cost of restoring the Flying Scotsman was £4 million. This was about 500 times the cost of building the steam engine in 1923.

Roughly what did the engine cost to build?

A £800 B £2000 C £8000 D £20 000 E £80 000

12 Prime Numbers

Q260 : 2007_Q17 www.CasperYC.club/ukmtnav

Just William's cousin, Sweet William, has a rectangular block of fudge measuring 2 inches by 3 inches by 6 inches. He wants to cut the block up into cubes whose side lengths are whole numbers of inches. What is the smallest number of cubes he can obtain?

A 3 B 8 C 15 D 29 E 36

Q261 : 2007_Q22 www.CasperYC.club/ukmtnav

Only one choice of the digit d gives a prime number for each of the three-digit numbers read across and downwards in the diagram on the right. Which digit is d ?

	5	
1	d	3
	7	

A 4 B 5 C 6 D 7 E 8

Q262 : 2009_Q5 www.CasperYC.club/ukmtnav

Which of the following numbers is divisible by 7?

A 111 B 1111 C 11 111 D 111 111 E 1 111 111

Q263 : 2010_Q18 www.CasperYC.club/ukmtnav

Sam's 101st birthday is tomorrow. So Sam's age in years changes from a square number (100) to a prime number (101). How many times has this happened before in Sam's lifetime?

A 1 B 2 C 3 D 4 E 5

Q264 : 2010_Q7 www.CasperYC.club/ukmtnav

Mr Owens wants to keep the students quiet during a Mathematics lesson. He asks them to multiply all the numbers from 1 to 99 together and then tell him the last-but-one digit of the result. What is the correct answer?

A 0 B 1 C 2 D 8 E 9

Q265 : 2011_Q18 www.CasperYC.club/ukmtnav

Peri the winkle leaves on Monday to go and visit Granny, 90m away. Except for rest days, Peri travels 1m each day (24-hour period) at a constant rate and without pause. However, Peri stops for a 24-hour rest every tenth day, that is, after every nine days' travelling. On which day of the week does Peri arrive at Granny's?

A Sunday B Monday C Tuesday D Wednesday E Thursday

Q266 : 2011_Q19 www.CasperYC.club/ukmtnav

A list is made of every digit that is the units digit of at least one prime number. How many of the following numbers appear in the list?

A 1 B 2 C 3 D 4 E 5

Q267 : 2011_Q2 www.CasperYC.club/ukmtnav

How many of the integers 123, 234, 345, 456, 567 are multiples of 3?

A 1 B 2 C 3 D 4 E 5

Q268 : 2012_Q13 www.CasperYC.club/ukmtnav

In the multiplication grid on the right, the input factors (in the first row and the first column) are all missing and only some of the products within the table have been given.

What is the value of A + B + C + D + E?

A 132 B 145 C 161 D 178 E 193

×					
	A	10		20	
	15	B	40		
	18		C	60	
		20		D	24
			56		E

Q269 : 2012_Q23 www.CasperYC.club/ukmtnav

Peter wrote a list of all the numbers that could be produced by changing one digit of the number 200. How many of the numbers on Peter's list are prime?

A 0 B 1 C 2 D 3 E 4

Q270 : 2012_Q3 www.CasperYC.club/ukmtnav

Which of the following has exactly one factor other than 1 and itself?

A 6 B 8 C 13 D 19 E 25

Q271 : 2014_Q8 www.CasperYC.club/ukmtnav

How many prime numbers are there in the list

$$1,\ 12,\ 123,\ 1234,\ 12\,345,\ 123\,456\ ?$$

A 0 B 1 C 2 D 3 E 4

Q272 : 2015_Q11 www.CasperYC.club/ukmtnav

What is the smallest prime number that is the sum of three different prime numbers?

A 11 B 15 C 17 D 19 E 23

Q273 : 2015_Q14 www.CasperYC.club/ukmtnav

Digits on a calculator are represented by a number of horizontal and vertical illuminated bars. The digits and the bars which represent them are shown in the diagram.

How many digits are both prime and represented by a prime number of illuminated bars?

A 0 B 1 C 2 D 3 E 4

Q274 : 2015_Q15 www.CasperYC.club/ukmtnav

Which of the following is divisible by all of the integers from 1 to 10 inclusive?

A 23×34 B 34×45 C 45×56 D 56×67 E 67×78

Q275 : 2015_Q19 www.CasperYC.club/ukmtnav

One of the following cubes is the smallest cube that can be written as the sum of three positive cubes. Which is it?

A 27 B 64 C 125 D 216 E 512

Q276 : 2015_Q8 www.CasperYC.club/ukmtnav

Which of the following has the same remainder when it is divided by 2 as when it is divided by 3?

A 3 B 5 C 7 D 9 E 11

Q277 : 2016_Q11 www.CasperYC.club/ukmtnav

Which of the following statements is false?

A 12 is a multiple of 2 B 123 is a multiple of 3 C 1234 is a multiple of 4
D 12 345 is a multiple of 5 E 123 456 is a multiple of 6

Q278 : 2017_Q10 www.CasperYC.club/ukmtnav

Which of the following integers is not a multiple of 45?

A 765 B 675 C 585 D 495 E 305

Q279 : 2017_Q15 www.CasperYC.club/ukmtnav

What is the remainder when the square of 49 is divided by the square root of 49?

A 0 B 2 C 3 D 4 E 7

13 Ratio

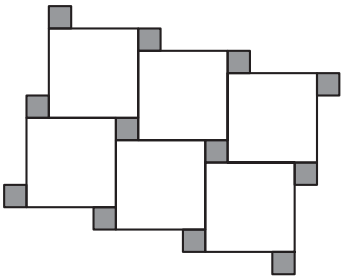
Q280 : 2008_Q7 www.CasperYC.club/ukmtnav

King Harry's arm is twice as long as his forearm, which is twice as long as his hand, which is twice as long as his middle finger, which is twice as long as his thumb. His new bed is as long as four arms. How many thumbs length is that?

A 16 B 32 C 64 D 128 E 256

Q281 : 2009_Q17 www.CasperYC.club/ukmtnav

The tiling pattern shown uses two sizes of square, with sides of length 1 and 4. A very large number of these squares is used to tile an enormous floor in this pattern. Which of the following is closest to the ratio of the number of grey tiles on the floor to the number of white tiles?



A 1:1 B 4:3 C 3:2 D 2:1 E 4:1

Q282 : 2009_Q21 www.CasperYC.club/ukmtnav

A rectangular sheet of paper is divided into two pieces by a single straight cut. One of the pieces is then further divided into two, also by a single straight cut.
Which of the following could *not* be the total number of edges of the resulting three pieces?

A 9 B 10 C 11 D 12 E 13

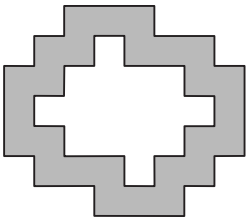
Q283 : 2010_Q10 www.CasperYC.club/ukmtnav

At the Marldon Apple-Pie-Fayre bake-off, prize money is awarded for 1st, 2nd and 3rd places in the ratio 3 : 2 : 1. Last year Mrs Keat and Mr Jewell shared third prize equally.
What fraction of the total prize money did Mrs Keat receive?

A $\frac{1}{4}$ B $\frac{1}{5}$ C $\frac{1}{6}$ D $\frac{1}{10}$ E $\frac{1}{12}$

Q284 : 2010_Q11 www.CasperYC.club/ukmtnav

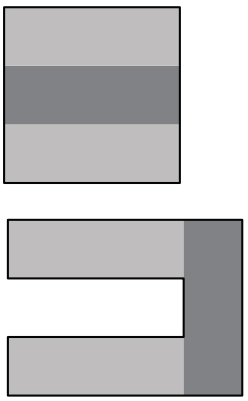
In the diagram shown, all the angles are right angles and all the sides are of length 1 unit, 2 units or 3 units.
What, in square units, is the area of the shaded region?



A 22 B 24 C 26 D 28 E 30

Q285 : 2011_Q8 www.CasperYC.club/ukmtnav

A square is divided into three congruent rectangles.
The middle rectangle is removed and replaced on the side of the original square to form an octagon as shown.
What is the ratio of the length of the perimeter of the square to the length of the perimeter of the octagon?



A 3:5 B 2:3 C 5:8 D 1:2 E 1:1

Q286 : 2012_Q17 www.CasperYC.club/ukmtnav

There are six more girls than boys in Miss Spelling's class of 24 pupils. What is the ratio of girls to boys in this class?

A 5:3 B 4:1 C 3:1 D 1:4 E 3:5

Q287 : 2013_Q11

Usain runs twice as fast as his mum. His mum runs five times as fast as his pet tortoise, Turbo. They all set off together for a run down the same straight path. When Usain has run 100 m, how far apart are his mum and Turbo the tortoise?

A 5 m B 10 m C 40 m D 50 m E 55 m

Q288 : 2013_Q19

A swimming club has three categories of members: junior, senior, veteran. The ratio of junior to senior members is 3 : 2 and the ratio of senior members to veterans is 5 : 2.

Which of the following could be the total number of members in the swimming club?

A 30 B 35 C 48 D 58 E 60

Q289 : 2013_Q7

After tennis training, Andy collects twice as many balls as Roger and five more than Maria. They collect 35 balls in total. How many balls does Andy collect?

A 20 B 19 C 18 D 16 E 8

Q290 : 2013_Q9

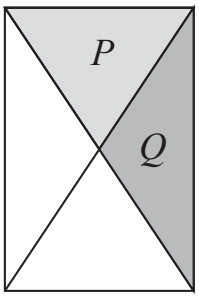
Peter has three times as many sisters as brothers. His sister Louise has twice as many sisters as brothers. How many children are there in the family?

A 15 B 13 C 11 D 9 E 5

Q291 : 2014_Q13

A rectangle is split into triangles by drawing in its diagonals.

What is the ratio of the area of triangle P to the area of triangle Q?



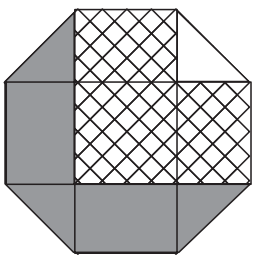
A 1 : 1 B 1 : 2 C 2 : 1 D 2 : 3

E the ratio depends on the lengths of the sides of the rectangle

Q292 : 2014_Q24

The diagram shows a regular octagon with sides of length 1. The octagon is divided into regions by four diagonals.

What is the difference between the area of the hatched region and the area of the region shaded grey?

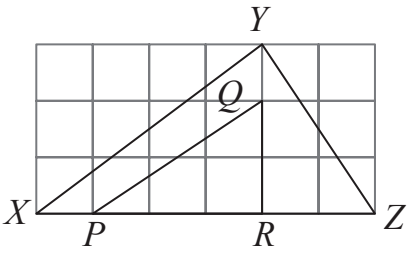


A 0 B $\frac{1}{8}$ C $\frac{1}{4}$ D $\frac{1}{2}$ E 1

Q293 : 2014_Q9 www.CasperYC.club/ukmtnav

Triangles XYZ and PQR are drawn on a square grid. What fraction of the area of triangle XYZ is the area of triangle PQR?

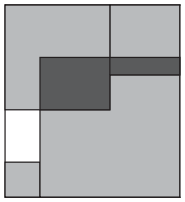
A $\frac{1}{4}$ B $\frac{7}{18}$ C $\frac{1}{2}$ D $\frac{5}{18}$ E $\frac{1}{3}$



Q294 : 2015_Q23 www.CasperYC.club/ukmtnav

The diagram shows four shaded glass squares, with areas 1 cm^2, 4 cm^2, 9 cm^2 and 16 cm^2, placed in the corners of a rectangle. The largest square overlaps two others. The area of the region inside the rectangle but not covered by any square (shown unshaded) is 1.5 cm^2.

What is the area of the region where squares overlap (shown dark grey)?



A 2.5 cm^2 B 3 cm^2 C 3.5 cm^2 D 4 cm^2 E 4.5 cm^2

Q295 : 2016_Q17 www.CasperYC.club/ukmtnav

In a group of 48 children, the ratio of boys to girls is 3 : 5.

How many boys must join the group to make the ratio of boys to girls 5 : 3?

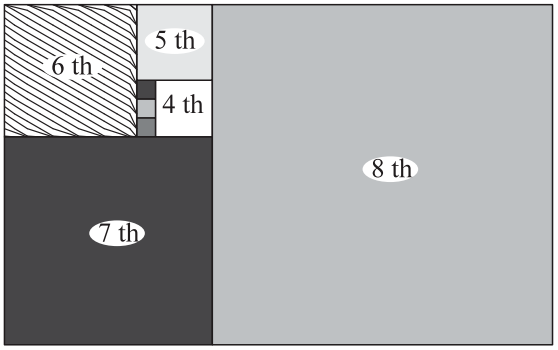
A 48 B 40 C 32 D 24 E 8

Q296 : 2016_Q23 www.CasperYC.club/ukmtnav

The diagram shows the first few squares of a 'spiral' sequence of squares. All but the first three squares have been numbered. After the first six squares, the sequence is continued by placing the next square alongside three existing squares – the largest existing square and two others.

The three smallest squares have sides of length 1.

What is the side length of the 12th square?



A 153 B 123 C 83 D 53 E 13

Q297 : 2016_Q7 www.CasperYC.club/ukmtnav

A distance of 8 km is approximately 5 miles.

Which of the following is closest to 1.2 km?

A 0.75 miles B 1 mile C 1.2 miles D 1.6 miles E 1.9 miles

Q298 : 2017_Q12 www.CasperYC.club/ukmtnav

Last year, at the school where Gill teaches Mathematics, 315 out of the 600 pupils were girls. This year, the number of pupils in the school has increased to 640. The proportion of girls is the same as it was last year.

How many girls are there at the school this year?

A 339 B 338 C 337 D 336 E 335

Q299 : 2018_Q14 www.CasperYC.club/ukmtnav

Billy has three times as many llamas as lambs.

Milly has twice as many lambs as llamas.

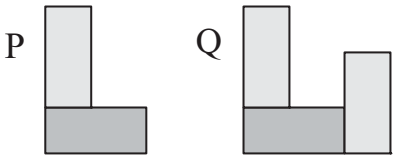
They have 17 animals in total.

How many of the animals are llamas?

A 5 B 6 C 7 D 8 E 9

Q300 : 2018_Q24 www.CasperYC.club/ukmtnav

The shapes P and Q are formed from two and three identical rectangles, respectively. Their perimeters are 58 cm and 85 cm respectively.



What is the perimeter of one of the rectangles?

A 30 cm B 31 cm C 32 cm D 33 cm E 34 cm

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