Intermediate Mathematical Challenge

Questions by Topic: 2003 – 2021 Collection

`www.CasperYC.club`

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Answers for UKMT Intermediate Challenges:

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

Comments and suggestions to DrYuFromShanghai@QQ.com

1   3D shapes

Q1 : 2008-Q12

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 units, what is the surface area of the sculpture in square units?
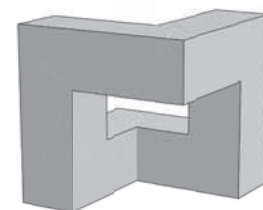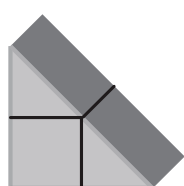
A 36   B 42   C 48   D 54   E 60
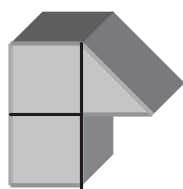

Q2 : 2008-Q6

Four of these shapes can be placed together to make a cube. Which is the odd one out?

A   B   C   D   E
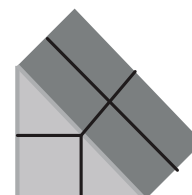
Q3 : 2010-Q12

A cuboid is cut away from a cube of side 10 cm as shown.

By what fraction does the total surface area of the solid decrease as a result?

A $\dfrac{1}{4}$ B $\dfrac{1}{6}$ C $\dfrac{1}{10}$ D $\dfrac{1}{12}$ E $\dfrac{1}{18}$
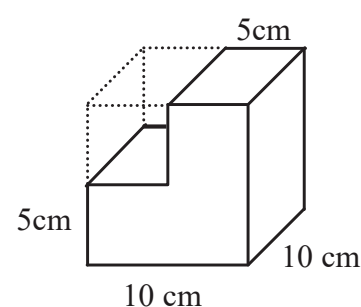
Q4 : 2010-Q19

A snail is at one corner of the top face of a cube with side length 1 m. The snail can crawl at a speed of 1 m per hour. What proportion of the cube's surface is made up of points which the snail could reach within one hour?

A $\dfrac{\pi}{16}$ B $\dfrac{\pi}{8}$ C $\dfrac{1}{4}$ D $\dfrac{1}{2}$ E $\dfrac{\sqrt{3}}{4}$

Q5:   2011-Q8   www.CasperYC.club/ukmtnav

A square piece of card has a square of side 2 cm cut out from each of its corners. The remaining card is then folded along the dotted lines shown to form an open box whose total internal surface area is 180 cm^2.
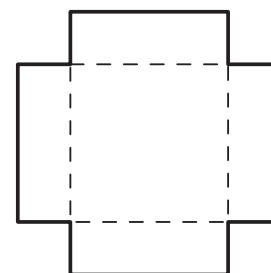
What is the volume of the open box in cm^3?

A 100   B 128   C 162   D 180   E 200

Q6:   2013-Q7   www.CasperYC.club/ukmtnav

The faces of a regular octahedron are to be painted so that no two faces which have an edge in common are painted in the same colour. What is the smallest number of colours required?
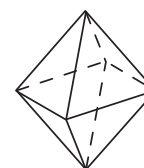
A 2   B 3   C 4   D 6   E 8

Q7:   2015-Q17   www.CasperYC.club/ukmtnav

The football shown is made by sewing together 12 black pentagonal panels and 20 white hexagonal panels. There is a join wherever two panels meet along an edge.

How many joins are there?

A 20   B 32   C 60   D 90   E 180

Q8:   2015-Q7   www.CasperYC.club/ukmtnav

A tetrahedron is a solid figure which has four faces, all of which are triangles.

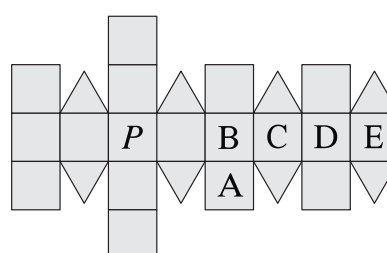What is the product of the number of edges and the number of vertices of the tetrahedron?
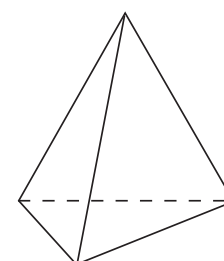
A 8   B 10   C 12   D 18   E 24

Q9:   2016-Q11   www.CasperYC.club/ukmtnav

The net shown consists of squares and equilateral triangles. The net is folded to form a rhombicuboctahedron, as shown.

When the face marked P is placed face down on a table, which face will be facing up?
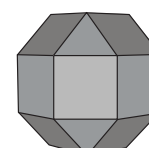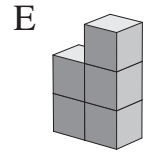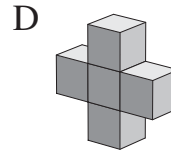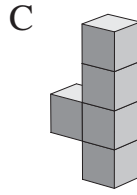
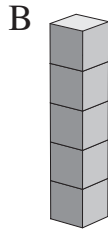A   B   C   D   E

Q10 : 2019-Q2

Each of the five shapes shown below is made from five unit cubes.

Which has the smallest surface area?
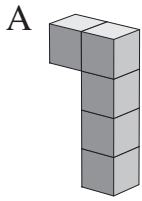
A   B   C   D   E

2 Algebraic

Q11 : 2003-Q23

Given that it takes a men b hours to paint c square metres of the Forth Bridge, how long would it take d men to paint e square metres of the bridge?

A $\dfrac{abe}{cd}$ B $\dfrac{abd}{ce}$ C $\dfrac{abc}{de}$ D $\dfrac{acd}{be}$ E $\dfrac{ace}{bd}$

Q12 : 2003-Q4

The coach of the Irish hockey team has a maximum speed of 60 miles per hour. If it travels at this speed for two hours, roughly how many kilometres does it travel?

A 120   B 160   C 200   D 240   E 280

Q13 : 2003-Q7

Last year a newspaper reported that Turkish football team Sarigol Municipality transferred four of its players in return for a fee of 225 sacks of cement, needed to repair their stadium. At the same rate of exchange, how many sacks of cement would be the transfer fee for a full team of eleven players and one reserve?

A 233   B 450   C 675   D 900   E 2700

Q14 : 2003-Q9

It has been estimated that the mass of insects caught by spiders in a year in the UK is equal to the mass of the human population of the UK. Assuming this population is 60 million and the average mass of a human is 70 kg, what is the mass, in tonnes, of insects caught by spiders per year in the UK?

A 4.2   B 42   C 4200   D 420 000   E 4 200 000

Q15 :   2004-Q22   www.CasperYC.club/ukmtnav

In a maths exam with N questions, you score m marks for a correct answer to each of the first q questions and $m + 2$ marks for a correct answer to each of the remaining questions. What is the maximum possible score?

A $(m+2)N - 2q$ B Nm C $mq + (m+2)q$ D $N(m + 1)$ E $Nm + q(m+2)$

Q16 :   2004-Q8   www.CasperYC.club/ukmtnav

In March 2003 Welshman Tony Evans dropped a ball from an aircraft a mile above the Mojave desert to see if it would bounce. The ball was made from 6 million rubber bands, had a circumference of 14 ft 8 in, weighed 2600 pounds and took Mr Evans five years to build. On average, roughly how many rubber bands did he add each day whilst building the ball?

A   3   B   33   C   330   D   3300   E   33 000

Q17 :   2005-Q12   www.CasperYC.club/ukmtnav

One gallon of honey provides enough fuel for a bee to fly about seven million miles. Roughly how many bees could fly one thousand miles if they had ten gallons of honey to share between them?

A   7 000   B   70 000   C   700 000   D   7 000 000   E   70 000 000

Q18 :   2005-Q17   www.CasperYC.club/ukmtnav

Platinum is a very rare metal, even rarer than gold. Its density is 21.45 g/cm^3. Assuming that the world production has been about 110 tonnes for each of the past 50 years, and negligible before that, which of the following has a comparable volume to that of the total amount of platinum ever produced?

A   a shoe box   B   a cupboard   C   a house

         D   Buckingham Palace   E   the Grand Canyon

Q19 :   2005-Q4   www.CasperYC.club/ukmtnav

Which of the following expressions is equal to 2005?

A $(1^2 + 1)(10^2 + 1)$ B $(2^2 + 1)(20^2 + 1)$ C $(3^2 + 1)(30^2 + 1)$

         D $(4^2 + 1)(40^2 + 1)$ E $(5^2 + 1)(50^2 + 1)$

Q20 :   2006-Q10   www.CasperYC.club/ukmtnav

Gill is 18 this year. She and I went to a restaurant for lunch to celebrate her birthday. The bill for lunch for the two of us came to £25.50. Gill paid the bill by credit card and I left a £2.50 tip in cash. We agreed to split the total cost equally. How much did I owe Gill?

A   £11   B   £11.50   C   £12   D   £12.50   E   £13

Q21 : 2006-Q17   `www.CasperYC.club/ukmtnav`

Last year, on the television programme *Antiques Roadshow*, a painting was said to be worth £15 000 although the painting had originally cost only 50p. As a percentage of the original price, what would be the approximate profit if the painting were to be sold for £15 000?

A 15 000 %   B 30 000 %   C 300 000 %   D 1 500 000 %   E 3 000 000 %

Q22 : 2006-Q6   `www.CasperYC.club/ukmtnav`

Harriet Hare and Turbo Tortoise want to cross the finish line together on their 12 mile woodland race. Turbo sets off at 8:15 am and trots at a constant speed of 4 mph. Given that Harriet runs at a constant speed of 8 mph, at what time should she set off?

A 9:45 am   B 10:15 am   C 10:45 am   D 11:15 am   E 11:45 pm

Q23 : 2007-Q1   `www.CasperYC.club/ukmtnav`

At midnight on 15 December 2005, the moon reached its highest point in the sky, an event which occurs every 18.6 years. In which year will it next occur?

A 2007   B 2008   C 2023   D 2024   E 2191

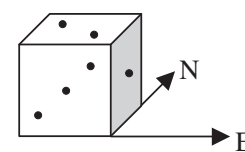**Q24 :** 2007-Q14   `www.CasperYC.club/ukmtnav`

If p is a positive integer and q is a negative integer, which of the following is greatest?

A $p - q$ B $q - p$ C $p + q$ D $-p - q$ E More information needed

Q25 : 2007-Q22   `www.CasperYC.club/ukmtnav`

The diagram shows an ordinary die in which the scores on opposite faces always total 7. It is placed on a horizontal table with the '1' face facing East. The die is moved four times, rotating it each time through 90° about an edge. The faces in contact with the table are first 1, then 2, then 3, then 5. In which direction is the '1' face facing after this sequence of moves?

A West   B East   C North   D South   E Up

Q26 : 2007-Q4   `www.CasperYC.club/ukmtnav`

Between them, Ginger and Victoria eat two thirds of a cake. If Ginger eats one quarter of the cake, what fraction of the cake does Victoria eat?

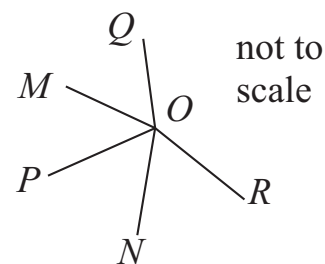A $\dfrac{1}{2}$ B $\dfrac{2}{5}$ C $\dfrac{3}{8}$ D $\dfrac{4}{9}$ E $\dfrac{5}{12}$

3   Angles

Q27 :   2003-Q14   www.CasperYC.club/ukmtnav

In the diagram, $\angle MON = 130°$. The reflection of OP in OM is OQ and the reflection of OP in ON is OR. What is the size of $\angle QOR$?

A   100°   B   120°   C   140°   D   150°   E   160°

not to scale

Q28 :   2003-Q15   www.CasperYC.club/ukmtnav

Each interior angle of a particular polygon is an obtuse angle which is a whole number of degrees. What is the greatest number of sides the polygon could have?
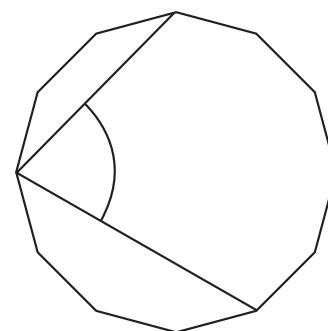
A   90   B   179   C   180   D   359   E   360

Q29 :   2003-Q22   www.CasperYC.club/ukmtnav

The diagram shows a regular dodecagon (a polygon with twelve equal sides and equal angles). What is the size of the marked angle?

A   67.5°   B   72°   C   75°

D   82.5°   E   85°

Q30 :   2003-Q8   www.CasperYC.club/ukmtnav

Lines AB and CD are parallel and $BC = BD$. Given that x is an acute angle not equal to 60°, how many *other* angles in this diagram are equal to x?

A   1   B   2   C   3   D   4   E   5

not to scale
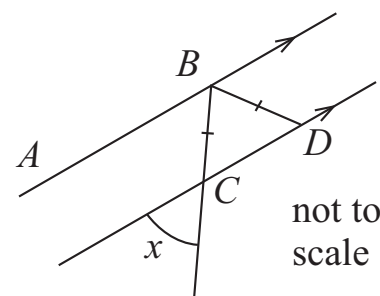
Q31 :   2004-Q4   www.CasperYC.club/ukmtnav

What is the value of $a + b + c + d + e + f$?

A   360   B   540   C   720   D   900

E   it depends on the triangle