Solutions – Middle Primary Division

1. $20 + 16 = 36$,

hence (C).

2. (Also UP1)
The numbers in order are 555, 556, 565, 566, 655,

hence (D).

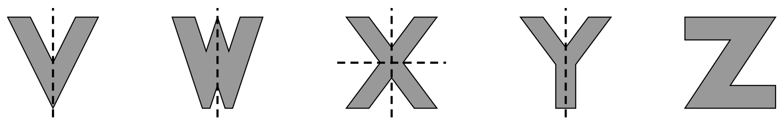
3. The digit 3 is in the thousands position, so it represents 3000,

hence (D).

4. I am 12 years old, so our combined ages are $6 + 12 = 18$,

hence (C).

5. Here are all possible lines of symmetry:



Although the Z shape has a point of symmetry, it does not have a line of symmetry,
hence (E).

6. (Also UP2)
One pizza will have 4 quarters, so two pizzas will have $2 \times 4 = 8$ quarters,

hence (D).

7. After 30 minutes it is 5 pm, and after another 15 minutes it is 5:15 pm,

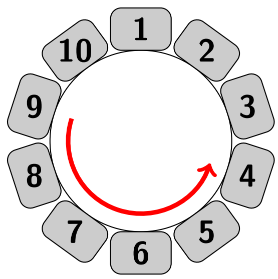
hence (E).

8. The number of wheels is $4 \times 2 + 2 \times 3 + 1 \times 4 = 18$,

hence (E).

9. (Also UP6)

The opposite chair is both 5 places forward and 5 places back. Five places back from chair 9 is chair 4,



hence (D).

10. (Also UP5)
Alternative 1
In cents, $500 \div 80 = 6r20$ so that he buys 6 chocolates and has 20 cents left,

hence (C).

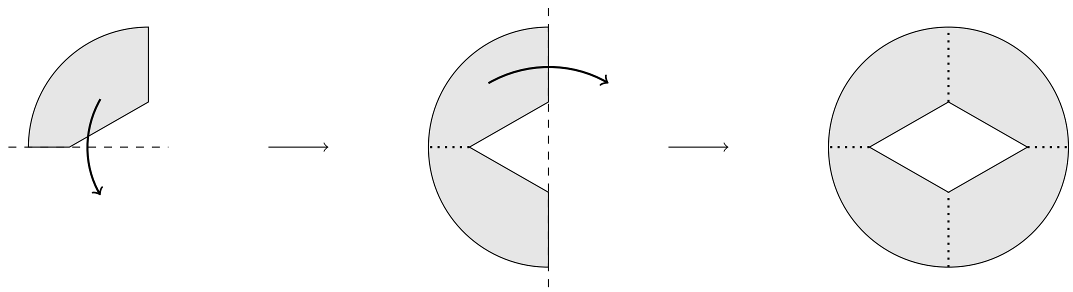
Alternative 2
Multiples of 80 are $80, 160, 240, 320, 400, 480, 560$. From this, he can afford 6 chocolates but not 7,

hence (C).

11. To make the total as large as possible, the large digits should have place value as large as possible. That is, 9 and 8 will be in the tens positions of the two numbers.
Then 3 and 2 will be in the units positions.
Then the sum is either $93 + 82 = 175$ or $92 + 83 = 175$, both with total 175,

hence (A).

12. (Also J6)
Each time the paper is unfolded, the two parts will be reflections of each other through the fold line.



hence (A).

13. (Also UP8)
She either has a 50c coin or not.
If she has a 50c coin, then she has one other 10c coin: $50 + 10 = 60$.
If she has no 50c coins, then she either has 0, 1, 2 or 3 20c coins:

$$20 + 20 + 20 = 60 \qquad 20 + 20 + 10 + 10 = 60$$
$$20 + 10 + 10 + 10 + 10 = 60 \qquad 10 + 10 + 10 + 10 + 10 + 10 = 60$$

In all, there are 5 possibilities,

hence (D).

14. Since there are 3 colours, you can't be sure that the first 3 beans include a pair.
However, with 4 beans, they can't all be different colours, so there must be a pair of the same colour.
So 4 beans (and no more) are needed to make sure you have a pair,

hence (B).

15. (Also UP11)
Starting from the outer end of the spiral (the loop on the rope) the dark and light sections are longest, and the light sections are of similar length to the dark sections.
As you move towards the other end of the rope, both dark and light sections get shorter. Only rope (A) shows this,

hence (A).

16. There are $3 + 6 + 2 + 1 + 4 = 16$ students, so half the class is 8 students.

The 6 with orange hats are in one-half of the class, and so the other two students in that half of the class have black hats.

So the only way to split the class into two equal groups is with orange and black in one group and red, green and yellow in the other,

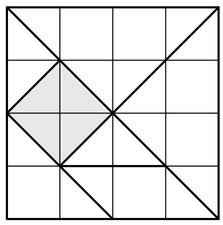
hence (A).

17. The sum of the first five digits is 22. Therefore the sum of the last two digits must be 12, as $34 - 22 = 12$. There are 7 possibilities for the last two digits: 39, 93, 48, 84, 57, 75, and 66,

hence (B).

18. (Also UP12)

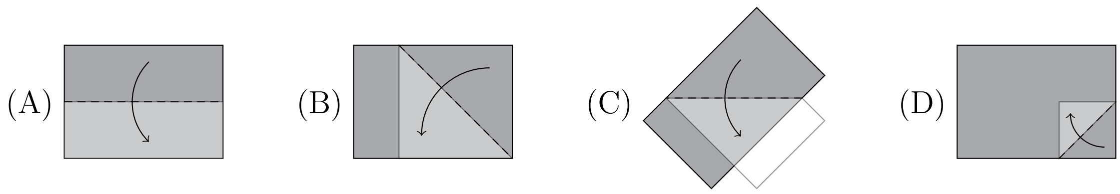
The large square must have side 8 cm. Then all of the corners of the pieces in the tangram lie on a grid of $2\,\text{cm} \times 2\,\text{cm}$ squares.



The shaded square has the same area as 2 of the grid squares, or $2 \times (2\,\text{cm} \times 2\,\text{cm}) = 8\,\text{cm}^2$,

hence (D).

19. No matter how a single fold is made, there will be one of the original right-angle corners that is on the boundary of the shape. Of the 5 shapes, (E) does not have any right angles, so it can't be made with a single fold. The other four figures can be made with a single fold:



hence (E).

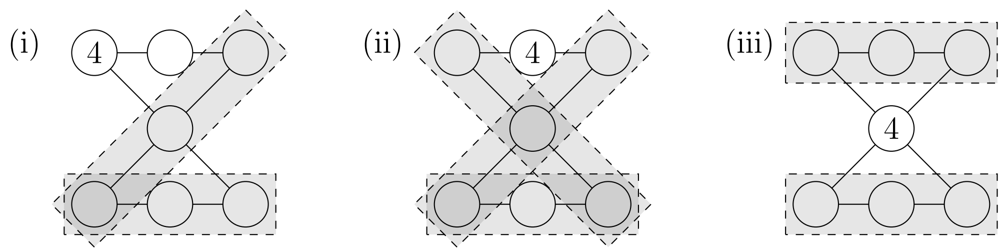
20. *Alternative 1*

There are 5 ways of making 12 from these numbers:

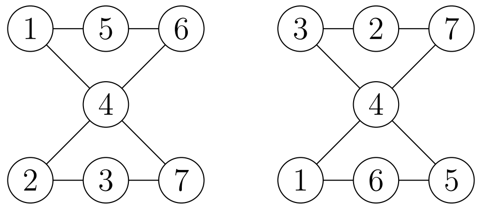
$7 + 4 + 1 = 12,\ 7 + 3 + 2 = 12,\ 6 + 5 + 1 = 12,\ 6 + 4 + 2 = 12,\ 5 + 4 + 3 = 12$

The number 4 is in 3 of these sums, and not in $1 + 5 + 6$ and $2 + 3 + 7$.

The number 4 could be either in a corner, a side or the centre:



However, the highlighted lines in each can only be $1+5+6$ and $2+3+7$ which don't have a number in common, so (i) and (ii) don't work. Placing 4 in the centre, there are several ways to arrange the other numbers:



hence (D).

Alternative 2

All seven circles add to $1+2+3+4+5+6+7=28$. The top and bottom rows together add to $2\times 12=24$. So the middle circle must be $28-24=4$,

hence (D).

21. Since each team played three games, we can complete the record for the Eagles, Falcons and Condors.

	Played	Win	Draw	Loss	Points
Eagles	3	3	0	0	9
Hawks	3				
Falcons	3	0	1	2	1
Condors	3	0	1	2	1

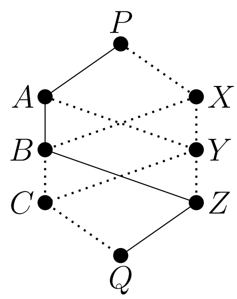
The Eagles won all their games, so the Hawks lost to the Eagles.

The Falcons and the Condors had no wins, so the game between them must have been drawn. Therefore both lost to the Hawks.

The Hawks' three games were 2 wins and 1 loss, for 6 points,

hence (C).

22. Label the points as shown and work down the diagram.



There is 1 route from P to A, and also 1 route from P to X.

Routes to B will come through either A or X, which gives only 2 routes. Likewise, there are 2 routes to Y.

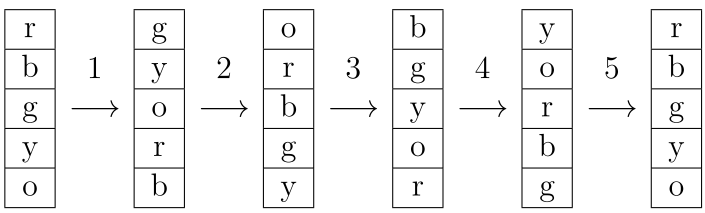
Routes to C will come through either B or Y. There are 2 routes to B and 2 routes to Y, so there are 4 routes to C. Likewise, there are 4 routes to Z.

Routes to Q are the 4 routes that come through C plus the 4 routes that come through Z, making 8 routes,

hence (D).

23. (Also UP21)

The discs are back in their original positions after 5 moves.



They will be in their original positions again after 10, 15 and 20 moves. After 1 more move, blue will be on the bottom,

hence (B).

24. (Also UP22)

Alternative 1

Replacing the leopard by another lion (of the same weight as the lion) would add 90 kg, and replacing the tiger by another lion would add 50 kg. Then 3 lions weigh $310 + 90 + 50 = 450$ kg and 1 lion weighs $450 \div 3 = 150$ kg,

hence (B).

Alternative 2

If the lion weighs 100 kg, then the leopard weighs 10 kg and the tiger 50 kg for a total of 160 kg. This is 150 kg too light. Adding $150 \div 3 = 50$ kg to each weight keeps the differences in weight the same. So the lion weighs 150 kg,

hence (B).

25. Jane must have given away her $2 coin, otherwise Tom would have $4 or more. Tom must end up with an even number of cents, so he must have given away his 5c coin.

With just these two coins given to Angus, Jane has $1.85 and Tom has $3.80. So it can't be done with just 2 coins given to Angus.

It can be done with 3 coins: if Tom gives away his 5c and his 10c he has $3.70, and if Jane gives away her $2, she has $1.85,

hence (B).

26. This table lists the numbers according to their first two digits.

First digit	Second digit 0	1	2	3	4	5	6	7	8	Count
1	101	112	123	134	145	156	167	178	189	9
2	202	213	224	235	246	257	268	279		8
3	303	314	325	336	347	358	369			7
4	404	415	426	437	448	459				6
5	505	516	527	538	549					5
6	606	617	628	639						4
7	707	718	729							3
8	808	819								2
9	909									1
										45

The total number of possibilities is $9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 45$,

hence (45).

27. Once the age of the younger daughter is known, the other four ages and the total can be calculated. Here are the first few possibilities:

Younger daughter	Older daughter	Younger son	Older son	Total
0	2	4	7	13
1	3	6	9	19
2	4	8	11	25

This pattern continues, with the total going up in 6s, since for each +1 on the younger daughter, there is +1 on the older daughter and +2 on both sons.

A total of 55 requires 30 more than in the last line above, which will happen 5 rows later. The final line shows:

Younger daughter	Older daughter	Younger son	Older son	Total
7	9	18	21	55

hence (7).

28. If A and B are both chosen, then the third stamp is either D or E. (2 possibilities)

If A but not B is chosen, then D must be chosen, and either C or E. (2 possibilities)

If B but not A is chosen, then E must be chosen, and either D or F. (2 possibilities)

If neither A nor B is chosen, then the 3 stamps must be in a row of three: CDE or DEF. (2 possibilities)

In all there are 8 possibilities,

hence (8).

29. (Also UP28)
The first cube uses 12 matches, then each subsequent cube uses 8 matches. Since $2016 - 12 = 2004$ and $2004 \div 8 = 250r4$, there are $1 + 250 = 251$ cubes made, with 4 matches left over,

hence (251).

30. (Also J20)
Consider the prime factorisation of $2016 = 2^5 \times 3^2 \times 7$. The factors of 2016 under 10 are 1, 2, 3, 4, 6, 7, 8 and 9.

Only 7 has prime factor 7, so this must be one of the ages.

The 3^2 in the prime factorisation will either be from $3 \times 6 = 2 \times 3^2$ or from $9 = 3^2$.

In the first case, the factorisation is $3 \times 6 \times 7 \times 16$, where 16 is too large.

In the second case, two of the ages are 7 and 9. Then the remaining two ages multiply to $2^5 = 32$, so they must be 4 and 8.

Hence the ages are 4, 7, 8 and 9, which add to 28,

hence (28).