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Logic

Standing in line

- 1 In a line, counting from the front, the piglet is number 30 and the chick is number 36. How many friends stand between them?



Answer: _____

Who is the tallest

- 2 We know that the fox is taller than the puppy, the frog is taller than the fox, the chick is shorter than the puppy, the bunny is shorter than the chick. Who is the second tallest?

☐ A puppy ☐ B frog ☐ C fox ☐ D bunny ☐ E chick

Answer: _____

How many in the family

- 3 A team has 26 friends, including the piglet. The piglet shakes hands once with each other friend on the team. How many friends does the piglet shake hands with?



Answer: _____

Balance scales

- 4 1 carrot weighs the same as 4 fish, 1 fish weighs the same as 2 corn cobs, 1 corn cob weighs the same as 4 strawberries. 1 carrot weighs the same as how many strawberries?



Answer: _____

Adding or taking the same each time

- 5 Find the pattern, then fill in the missing number in the empty box.

720 731 744 ? 776 795

Answer: _____

Which picture comes next

- 6 The pictures keep repeating in the pattern shown below. Which picture is number 87?



A B C D

Answer: _____

Yesterday, today, tomorrow

- 7 Today is Thursday. What day will it be in 123 days?

Thu ^{123 days}
today → ?

A Monday B Tuesday C Thursday D Sunday

Answer: _____

Letter patterns

- 8 These letters follow a pattern. Which letter goes in the empty box?

R P N L ?

A K B I C M D J

Answer: _____

Mystery number table

- 9 In each row, the third number is made from the first two in the same way. Find the number for the question mark.

8 11 30

10 12 34

4 4

Answer: _____

Crack the code

- 10 The secret code is a 3-digit number with different digits. Each row is one guess.  means one digit is right and in the right place.  means one digit is right but in the wrong place.  means no digit is right. What is the code?

934 

923 

136 

428  

419 

(A) 896 (B) 246 (C) 846 (D) 834

Answer: _____

Arithmetic

Quick calculating

- 11 Work it out quickly, then fill in the answer in the empty box.

$$74 + 14 + 26 + 86 + 94 = \boxed{}$$

Answer: _____

What number goes in the box

- 12 What number goes in the empty box?

$$\boxed{} \div 5 = 4$$

Answer: _____

Pictures for numbers

- 13 Each kind of picture stands for a number. What number is the carrot?

$$\text{mushroom} + \text{mushroom} = 64$$

$$\text{mushroom} + \text{strawberry} = 33$$

$$\text{strawberry} + \text{carrot} = 44$$

$$\text{carrot} = \boxed{}$$

Answer: _____

Sharing to make it equal

- 14 If the puppy gives the chick 27 fish, they both have the same number of fish. At first, how many more fish did the puppy have than the chick?



Answer: _____

Age puzzles

- 15 This year, the ages of the puppy and the frog add up to 27. What will their ages add up to in 4 years?



Answer: _____

Counting animal legs

- 16 In the yard there are 6 hens and 8 dogs. How many legs are there in all?



Answer: _____

Planting trees and sawing logs

- 17 The path around a lake is 96 metres long. A tree is planted every 6 metres. How many trees are there?



Answer: _____

Letter sums

- 18 Each letter stands for a digit. Different letters are different digits. Fill in the empty box.

$$AB - BA = 27$$

$$A - B = \boxed{}$$

Answer: _____

Sharing so no one gets the same

- 19 Share all 22 eggs among 3 children. Everyone gets some, and no two children get the same number. At most how many can the child with the fewest get?



Answer: _____

Evening out for three friends

- 20 At first, the bear cub has 64 carrots, the piglet has 25 carrots and the fox has 16 carrots. The bear cub gives some to the piglet and the fox so that all three have the same number of carrots. How many carrots must the bear cub give the fox?



Answer: _____

More than and times as many

- 21 The chick has 2 times as many apples as the piglet. The chick has 34 more apples than the piglet. How many apples does the chick have?

chick	?	?
piglet	?	

Answer: _____

A new operation

- 22 There is a new operation called the star. The first line shows how it works. Work out the second line.

$$a \star b = (a + b) \times 2$$

$$(2 \star 12) \star 3 = \boxed{}$$

Answer: _____

Quick multiplication

- 23 Work it out quickly, then fill in the answer in the empty box.

$$102 \times 3 = \boxed{}$$

Answer: _____

Number Theory

Counting numbers

- 24 How many even numbers are there from 107 to 350?

Answer: _____

Even or odd

- 25 Is the answer to this sum even or odd?

$$30 + 31 + 32 + 33 + 34 + 35$$

☐ A Even ☐ B Odd

Answer: _____

Tens and ones

- 26 How many two-digit numbers have the digit 3 in them?

Answer: _____

Which term of the sequence

- 27 The numbers go 116, 120, 124, 128, ... Which number is in position 99?

116 120 124 128 ... ?

Answer: _____

Counting digits

- 28 Write the numbers from 1 to 110. How many times do you write the digit 5?

Answer: _____

Making numbers from digits

- 29 Use the digits 7, 6, 8, 5, each one at most once. What is the smallest number with 2 digits you can make?

7 6 8 5

Answer: _____

Adding up the digits

- 30 Find the biggest number with 3 digits whose digits add up to 11.

Answer: _____

Two numbers from four digits

- 31 Use all four digits 7, 5, 3, 4, each one once, to write two 2-digit numbers. What is the largest possible sum of the two numbers?

7 5 3 4

Answer: _____

Divisible by both numbers

- 32 From 1 to 101, how many numbers can be divided exactly by both 4 and 9?

Answer: _____

Exact division and remainders

- 33 What is the smallest three-digit number that leaves 5 when divided by 13?

Answer: _____

Sum and difference

- 34 Together, the kitten and the chick have 204 strawberries. The kitten has 32 more strawberries than the chick. How many strawberries does the chick have?

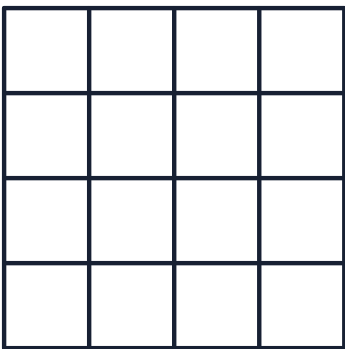


Answer: _____

Geometry

Counting squares

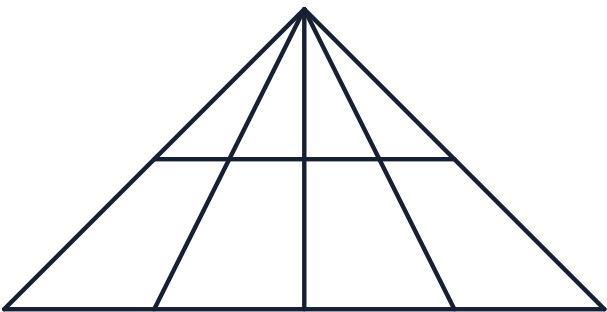
- 35 How many squares are there in the picture in all?



Answer: _____

Counting triangles

- 36 How many triangles are there in the picture in all?



Answer: _____

Counting line segments

- 37 The picture has 6 points on one straight line. How many line segments are there in all?



Answer: _____

Counting rectangles

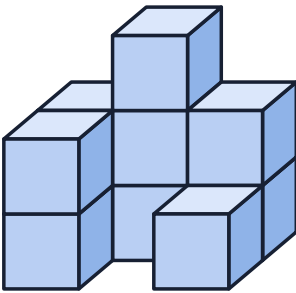
- 38** How many rectangles are there in the picture in all? Squares count as rectangles too.



Answer: _____

Counting cubes

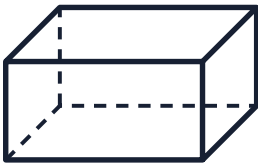
- 39** At least how many more cubes do you need to make a big cube with 3 layers, 3 rows in each layer and 3 cubes in each row?



Answer: _____

How many sides and corners

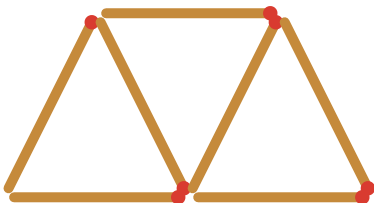
- 40** The picture shows a box shape. How many edges does it have?



Answer: _____

Matchstick shapes

- 41** Making 3 triangles in a row like in the picture takes 7 matchsticks. How many matchsticks do you need for 40 triangles like this?



Answer:

Cutting cakes, drawing lines

- 42 Draw 4 straight lines on a sheet of paper. At most how many parts can the lines split the paper into?



Answer: _____

Perimeter of joined shapes

- 43 2 squares, each with sides of 5 centimetres, are put together in a row like the picture. What is the perimeter of the new shape in centimetres?



Answer: _____

Combinatorics

How many ways to choose

- 44 There are 4 roads from home to school, and 6 roads from school to the park. How many ways can you go from home to the park through the school?



Answer: _____

How many numbers can you make

- 45 Using the digits 4, 5, 6, 8, how many numbers with 2 different digits can you make?

4 5 6 8

Answer: _____

Ways to line up

- 46 There are four friends: piglet, bear cub, fox, frog. They stand in a line, and the frog and the bear cub always stand next to each other. How many ways can they line up?



Answer: _____

Handshakes

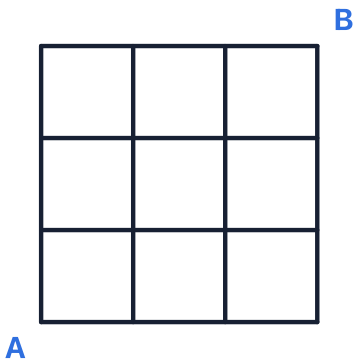
- 47 10 teams play, and every two teams play each other exactly once. How many games are there in all?



Answer: _____

Counting paths

- 48 Follow the lines. Each step can only go right or up. How many ways are there to go from A to B?



Answer: _____

Coin combinations

- 49 How many ways can you make 25 coins using coins worth 2, 5, 10? You can take any number of each kind, and the order doesn't matter.



Answer: _____

Picking marbles to be sure

- 50 A box has 6 red marbles, 2 blue marbles and 12 yellow marbles. Without looking, what is the smallest number of marbles you must take out to be sure to get 2 of the same colour?



Answer: _____

Making even and odd numbers

- 51 Using the digits 2, 7, 4, 5, how many odd numbers with 3 different digits can you make?

2 7 4 5

Answer: _____

Choosing and giving prizes

- 52 3 children run a race, and nobody finishes at the same time. How many ways can you give out one first prize and one second prize?



Answer: _____

Paying with coins

- 53** You have coins marked 2, 2, 20, 50. Without getting change, how many different amounts can you pay exactly?



2 2 20 50

Answer: _____

Sure even when unlucky

- 54** A box has 6 red marbles, 5 blue marbles and 2 yellow marbles. Without looking, at least how many marbles must you take out to be sure to have all 3 colours?



Answer: _____

Answers and solutions

1. Answer: 5 · Standing in line

How to think: Don't count the two friends at the ends.

Solution: 36 minus 30 equals 6. We don't count number 36, so 6 minus 1 equals 5 friends in between.

2. Answer: fox · Who is the tallest

How to think: Line the friends up from tallest to shortest.

Solution: From tallest to shortest: frog, fox, puppy, chick, bunny. So it's the fox.

3. Answer: 25 · How many in the family

How to think: Nobody shakes hands with themselves, and that goes for the piglet too.

Solution: Don't count the piglet: 26 minus 1 equals 25.

4. Answer: 32 · Balance scales

How to think: Swap each thing for the lighter one, one step at a time.

Solution: Swap 1 carrot step by step for lighter things: 4 times 2 times 4, that is 32 strawberries.

5. Answer: 759 · Adding or taking the same each time

How to think: Look at each pair of numbers side by side. How much bigger or smaller is the next number?

Solution: The step into the empty box adds 15: 744 plus 15 equals 759. Check: 759 plus 17 equals 776.

6. Answer: 🍌 · Which picture comes next

How to think: Find how many pictures it takes to start over. Circle one group.

Solution: Picture number 87 is picture number 2 of its group, the same as picture number 2 of the first group.

7. Answer: Monday · Yesterday, today, tomorrow

How to think: Every 7 days, you come back to the same day of the week.

Solution: Go 4 days more: Friday, Saturday, Sunday, Monday. So in 123 days, it will be Monday.

8. Answer: J · Letter patterns

How to think: Say the alphabet A, B, C, D, E... and count how many steps apart the letters are.

Solution: Each time we go back 2 steps in the alphabet. 2 steps before L is J.

9. Answer: 12 · Mystery number table

How to think: Look at the first row: how do the first two numbers make the third? Try adding, taking away, multiplying.

Solution: Row one: 8 plus 11 times 2 equals 30. Row two: 10 plus 12 times 2 equals 34. So row three: 4 plus 4 times 2 equals 12.

10. Answer: 246 · Crack the code

How to think: Try each answer: check it against every guess row and see if all of them match.

Solution: The code 246 matches every row: the right number of  and  in each one.

11. Answer: 294 · Quick calculating

How to think: Find two numbers that add up to a round 100, and pair them up.

Solution: 74 plus 26 equals 100, 14 plus 86 equals 100. In all: 200 plus 94 equals 294.

12. Answer: 20 · What number goes in the box

How to think: Multiplying and dividing undo each other.

Solution: 5 times 4 equals 20. Check: 20 divided by 5 equals 4.

13. Answer: 43 · Pictures for numbers

How to think: Start with the line that has only one kind of picture.

Solution: We see that the mushroom is 32, so the strawberry is 33 minus 32 equals 1, and the carrot is 44 minus 1 equals 43.

14. Answer: 54 · Sharing to make it equal

How to think: Giving away 27 means the puppy has 27 fewer and the chick has 27 more.

Solution: When the puppy has 27 fewer and the chick has 27 more, they are equal. So at first, the puppy had this many more than the chick: 27 plus 27 equals 54.

15. Answer: 35 · Age puzzles

How to think: Each year, each friend gets 1 year older.

Solution: Each friend gets 4 years older, so together they add 4 plus 4 equals 8. The total is 27 plus 8 equals 35.

16. Answer: 44 · Counting animal legs

How to think: Each hen has 2 legs, and each dog has 4 legs.

Solution: 6 hens have 12 legs, 8 dogs have 32 legs. In all: 12 plus 32 equals 44 legs.

17. Answer: 16 · Planting trees and sawing logs

How to think: Walking once around the lake brings you back to the first tree.

Solution: 96 metres splits into 16 gaps of 6 metres. On a closed loop, trees equal gaps: 16 trees.

18. Answer: 3 · Letter sums

How to think: Try any two digits: 31 minus 13 equals 18, and 41 minus 14 equals 27. What do you notice?

Solution: For example, 96 minus 69 equals 27. AB minus BA is always 9 times A minus B. 27 divided by 9 equals 3. So A minus B is 3.

19. Answer: 6 · Sharing so no one gets the same

How to think: The children must get different numbers. Try lining them up from fewest to most.

Solution: If the child with the fewest had 7, the group would need at least 7 plus 8 plus 9, which is 24. That is more than 22. With 6 it works, for example 6, 7, 9. So the answer is 6.

20. Answer: 19 · Evening out for three friends

How to think: At the end, all three have the same. Put everything together and share it equally among 3 friends.

Solution: Together they have 64 plus 25 plus 16 equals 105. Shared among 3: 105 divided by 3 equals 35. The fox has 16, so needs 35 minus 16 equals 19 more.

21. Answer: 68 · More than and times as many

How to think: Draw a bar model: the piglet has 1 part, the chick has 2 parts of the same size.

Solution: The chick has 2 parts and the piglet has 1 part, so the difference is exactly 1 part: 34. So the chick has 34 times 2, which is 68 apples.

22. Answer: 62 · A new operation

How to think: The first line is the rule: a is the number before the star, and b is the number after it.

Solution: Brackets first, with 2 for a and 12 for b: (2 plus 12) times 2 equals 28. Then 28 for a and 3 for b: (28 plus 3) times 2 equals 62.

23. Answer: 306 · Quick multiplication

How to think: 102 is very close to 100. Multiply by 100 first, it's easier.

Solution: 102 is 100 and 2 more. 3 times 100 equals 300, and 3 times 2 equals 6. 300 plus 6 equals 306.

24. Answer: 122 · Counting numbers

How to think: Even numbers end in 0, 2, 4, 6 or 8.

Solution: The numbers are 108, 110, ... up to 350: there are 122 numbers.

25. Answer: Odd · Even or odd

How to think: You don't need to work out the whole sum. Just count how many odd numbers there are.

Solution: There are 3 odd numbers. Pairing them up leaves one odd number over, so the answer is odd.

26. Answer: 18 · Tens and ones

How to think: Which digit is fixed? Which digit can you choose freely?

Solution: 3 as the ones digit: 9 numbers. As the tens digit: 10 numbers. 33 was counted twice: 9 plus 10 minus 1 equals 18.

27. Answer: 508 · Which term of the sequence

How to think: How many steps is it from the first number to position 99?

Solution: There are 98 steps, each adding 4: 98 times 4 equals 392. 116 plus 392 equals 508.

28. Answer: 21 · Counting digits

How to think: Count the ones place first, then the tens place.

Solution: Ones place: 11 times, tens place: 10 times. 11 plus 10 equals 21 times.

29. Answer: 56 · Making numbers from digits

How to think: Put the smallest digit first, but it can't be 0.

Solution: The first digit is 5, then the other digits go from smallest to biggest: you get 56.

30. Answer: 920 · Adding up the digits

How to think: For the biggest number, the first digit must be as big as possible.

Solution: The biggest first digit possible is 9, so the number is 920.

31. Answer: 127 · Two numbers from four digits

How to think: A digit in the tens place is worth 10 times as much as in the ones place. Which digits go in the tens place?

Solution: The two largest digits 5, 7 go in the tens place, and 3, 4 go in the ones place: 74 plus 53 equals 127.

32. Answer: 2 · Divisible by both numbers

How to think: List the numbers you can divide exactly by 9, then find one you can also divide by 4.

Solution: The smallest number you can divide by both 4 and 9 is 36. The numbers are 36, 72. That makes 2.

33. Answer: 109 · Exact division and remainders

How to think: A number that leaves 5 when divided by 13 is a number that 13 goes into exactly, plus 5.

Solution: 104 is the smallest three-digit number that 13 goes into exactly. 104 plus 5 equals 109.

34. Answer: 86 · Sum and difference

How to think: Take away the extra that the kitten has over the chick, and the two are equal.

Solution: 204 minus 32 equals 172. 172 divided by 2 equals 86. So the chick has 86 strawberries.

35. Answer: 30 · Counting squares

How to think: Count the small 1-box squares first, then the 4-box squares, the 9-box squares...

Solution: Count from small to big: 16 plus 9 plus 4 plus 1 equals 30 squares.

36. Answer: 20 · Counting triangles

How to think: Count the 1-part triangles first, then the triangles made of 2 parts, 3 parts...

Solution: Above the line across there are 10 triangles, and there are also 10 big triangles going down to the bottom: 10 plus 10 equals 20.

37. Answer: 15 · Counting line segments

How to think: Count in order: the segments starting at the first point, then the ones starting at the second point, and so on.

Solution: Count the segments starting at each point: 5 plus 4 plus 3 plus 2 plus 1 equals 15 segments.

38. Answer: 18 · Counting rectangles

How to think: Count the 1-box shapes, then the shapes made of 2 boxes, 3 boxes...

Solution: There are 6 ways to choose across and 3 ways to choose up and down: 6 times 3 equals 18 rectangles.

39. Answer: 17 · Counting cubes

How to think: How many small cubes does a big cube with 3 layers need in all?

Solution: The big cube has 27 cubes and 10 are already there: 27 minus 10 equals 17 cubes.

40. Answer: 12 · How many sides and corners

How to think: An edge is a line where two faces meet. Count in groups: bottom edges, side edges, top edges.

Solution: The bottom base has 4 edges, the top base has 4 edges, and there are 4 side edges: 4 plus 4 plus 4 equals 12 edges.

41. Answer: 81 · Matchstick shapes

How to think: The first triangle needs 3 sticks. Each next triangle shares 1 stick with the one before it.

Solution: The first triangle needs 3 sticks, and the 39 triangles after it need 2 more each: 3 plus 39 times 2 equals 81 sticks.

42. Answer: 11 · Cutting cakes, drawing lines

How to think: With no lines there is 1 part. The first line makes 2 parts.

Solution: We start with 1 part. The first line adds 1, the second adds 2, the third adds 3, and so on. The number of parts goes 1, 2, 4, 7, 11. So 4 lines make at most 11 parts.

43. Answer: 30 · Perimeter of joined shapes

How to think: The perimeter is the length all the way around the outside of the shape. Lines inside don't count.

Solution: The new shape is a rectangle 10 centimetres long and 5 centimetres wide. The perimeter is 10 plus 5 plus 10 plus 5 equals 30.

44. Answer: 24 · How many ways to choose

How to think: Choose a road to school first, then choose the road after that.

Solution: After each road to school, there are 6 roads to go on, and there are 4 roads to school: 4 times 6 equals 24 ways.

45. Answer: 12 · How many numbers can you make

How to think: Choose the first digit first, then the next digits.

Solution: The first place has 4 choices, the next has 3: 4 times 3 equals 12 numbers.

46. Answer: 12 · Ways to line up

How to think: Think of the frog and the bear cub as one friend stuck together. Now there are only 3 parts to arrange.

Solution: 3 parts can be arranged in 3 times 2 times 1 equals 6 ways. In each one, the frog and the bear cub can swap in 2 ways: 6 times 2 equals 12 ways.

47. Answer: 45 · Handshakes

How to think: The first team plays the 9 other teams.

Solution: Add up each team's new games: 9 plus 8 plus 7 plus 6 plus 5 plus 4 plus 3 plus 2 plus 1 equals 45 games.

48. Answer: 20 · Counting paths

How to think: Points on the bottom edge and on the left edge have only 1 way to get there.

Solution: Write the number of ways at each point: each point is the point on its left plus the point below. There are 20 ways to reach B.

49. Answer: 6 · Coin combinations

How to think: Start by using as many coins worth 10 as you can.

Solution: List them one by one, starting with the most coins worth 10, without missing any: there are 6 ways.

50. Answer: 4 · Picking marbles to be sure

How to think: Think of the unluckiest case: the marbles you take out are never the ones you want.

Solution: The unluckiest case: the first 3 marbles are all different colours. The next one is sure to match one of them: 3 plus 1 equals 4 marbles.

51. Answer: 12 · Making even and odd numbers

How to think: An odd number ends in 1, 3, 5, 7 or 9. Choose the ones digit first.

Solution: An odd number ends in 1, 3, 5, 7 or 9. The numbers are: 245, 247, 257, 275, 425, 427, 457, 475, 527, 547, 725, 745. That makes 12 numbers.

52. Answer: 6 · Choosing and giving prizes

How to think: Which of the 3 children could win first prize?

Solution: First prize has 3 choices. For each one, second prize has 2 choices: 3 times 2 equals 6 ways.

53. Answer: 11 · Paying with coins

How to think: Try paying with one coin, then two coins, then three. Write down each amount.

Solution: The amounts you can pay are 2, 4, 20, 22, 24, 50, 52, 54, 70, 72, 74. An amount you can make two ways counts only once. That makes 11 amounts.

54. Answer: 12 · Sure even when unlucky

How to think: Think of the unluckiest case: the marbles you take out are never the ones you want.

Solution: The unluckiest case is taking all of the two biggest colours first: 6 plus 5 equals 11 marbles, and one colour is still missing. The next marble must be the last colour: 11 plus 1 equals 12.
