

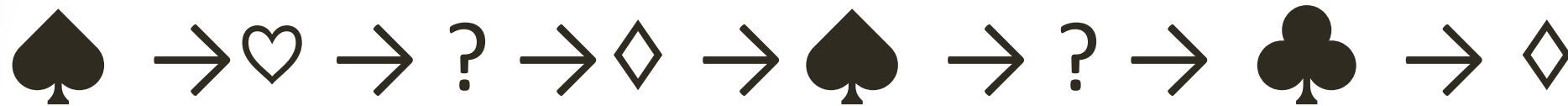
TEACHER COPY

**Lower Division
Grade 2, 3 & 4**





Logic & Non-Routine Problems

Example: Find out the missing shapes.



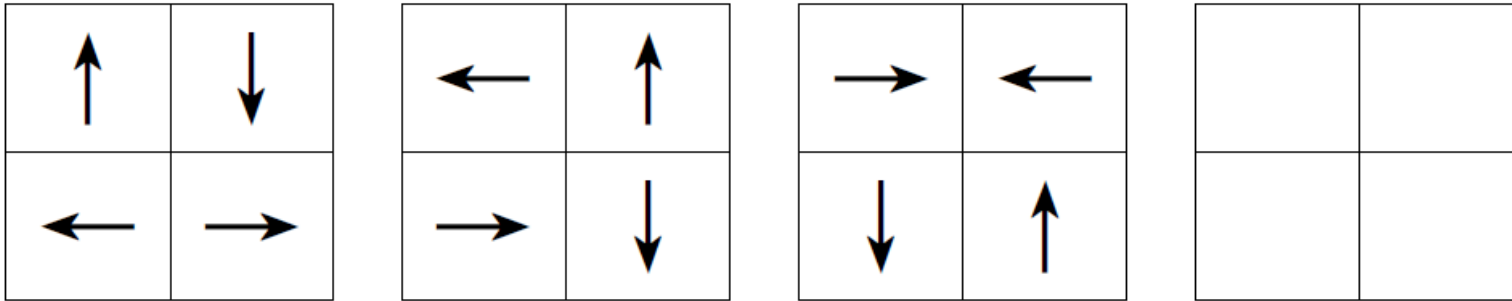
Solution:

The pattern is in a group of 4 shapes:  →  →  → 

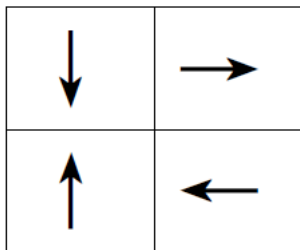
Answers are  and  .

Logic & Non-Routine Problems

1. What comes next in the following patterns? Complete the last shape below.



Solution:



Logic & Non-Routine Problems

Example: Kevin is shorter than Dylan. Dylan is taller than Thomas. David is taller than Kevin but shorter than Thomas. Rank all the children from the tallest to the shortest.

Solution:

Tallest						Shortest
Dylan	→	Thomas	→	David	→	Kevin

Logic & Non-Routine Problems

2. Jack, Jade, Daniel and Dickson are standing in a line to take photo. Jack is between Jade and Daniel. Jade is between Jack and Dickson. Dickson is to the left of Daniel. List their position in order from left to right.

Solution:

- 1st statement: Jade – Jack – Daniel or Daniel – Jack – Jade
- 2nd statement: Jack – Jade – Dickson or Dickson – Jade – Jack
- 3rd statement: Dickson – Daniel
- Combine the first two statements, the outcome will be either Dickson – Jade – Jack – Daniel or Daniel – Jack – Jade – Dickson
- Since Dickson is to the left of Daniel, their position from the left to the right will be **Dickson – Jade – Jack – Daniel**

Logic & Non-Routine Problems

Example: The operator \otimes acts on two numbers to give the following outcomes:

$$3 \otimes 2 = 15$$

$$5 \otimes 3 = 28$$

$$6 \otimes 1 = 57$$

$$9 \otimes 4 = 513$$

What is $7 \otimes 5$ equal to?

Solution

- $3 - 2 = 1$ $3 + 2 = 5$ \rightarrow $3 \otimes 2 = 15$
- $5 - 3 = 2$ $5 + 3 = 8$ \rightarrow $5 \otimes 3 = 28$
- $6 - 1 = 5$ $6 + 1 = 7$ \rightarrow $6 \otimes 1 = 57$
- $9 - 4 = 5$ $9 + 4 = 13$ \rightarrow $9 \otimes 4 = 513$
- $7 - 5 = 2$ $7 + 5 = 12$ \rightarrow $7 \otimes 5 = \mathbf{212}$

Logic & Non-Routine Problems

3. The operator ♥ acts on two numbers to give the following outcomes:

$$3 \heartsuit 2 = 61$$

$$4 \heartsuit 3 = 121$$

$$5 \heartsuit 2 = 103$$

$$5 \heartsuit 3 = 152$$

What is $2 \heartsuit 4$ equal to?

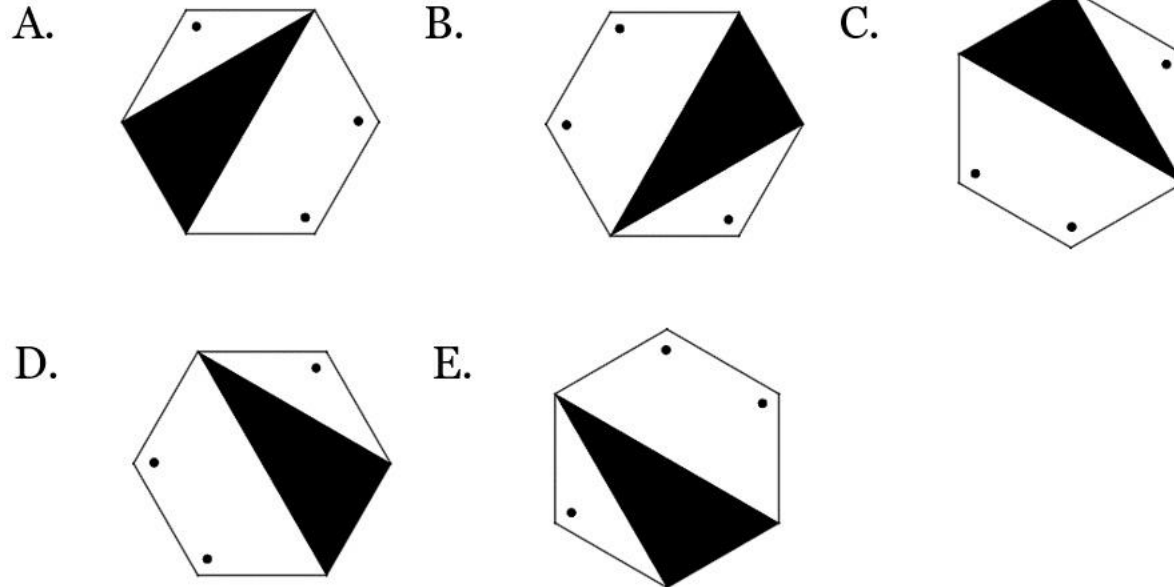
Solution

- $3 \times 2 = 6$ $3 - 2 = 1$ \rightarrow $3 \heartsuit 2 = 61$
- $4 \times 3 = 12$ $4 - 3 = 1$ \rightarrow $4 \heartsuit 3 = 121$
- $5 \times 2 = 10$ $5 - 2 = 3$ \rightarrow $5 \heartsuit 2 = 103$
- $5 \times 3 = 15$ $5 - 3 = 2$ \rightarrow $6 \heartsuit 6 = 152$
- $2 \times 4 = 8$ $4 - 2 = 2$ \rightarrow $7 \heartsuit 4 = \mathbf{82}$

Answer: **82**

Logic & Non-Routine Problems

Example: Which is the odd one out?



Solution:

Only D is not the rotation of A. So, D is the odd one out.

Logic & Non-Routine Problems

4. Which of these is the odd one out?

M F K H Z

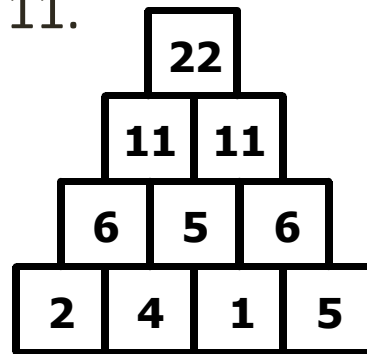
Solution:

Letters F, K, H and Z are written using 4 lines. Hence, M is the odd one out since it is written using 5 lines.

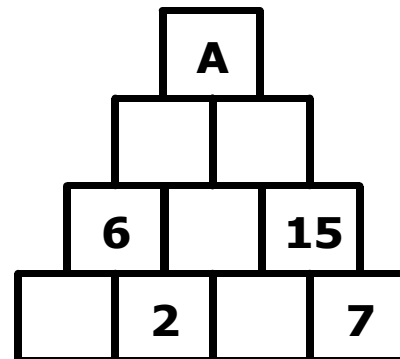
Answer: **M**

Logic & Non-Routine Problems

5. In the diagram below, any two numbers next to each other add up to the number above them. For example, $11 + 11 = 22$, that is why 22 is above the two 11's. Number 11 is above 6 and 5 because $6 + 5 = 11$.



Using the same rule, complete the diagram below. What number should replace A?



Logic & Non-Routine Problems

Solution:

By labelling the empty boxes with alphabets: B, C, D, E, F

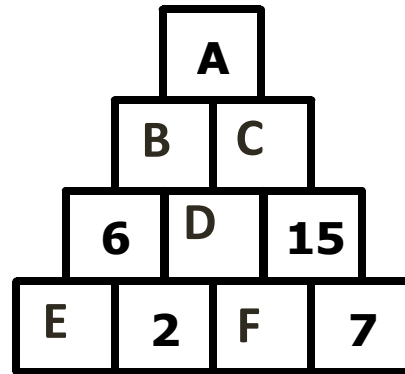
$$F = 15 - 7 = 8$$

$$D = 2 + 8 = 10$$

$$B = 6 + 10 = 16$$

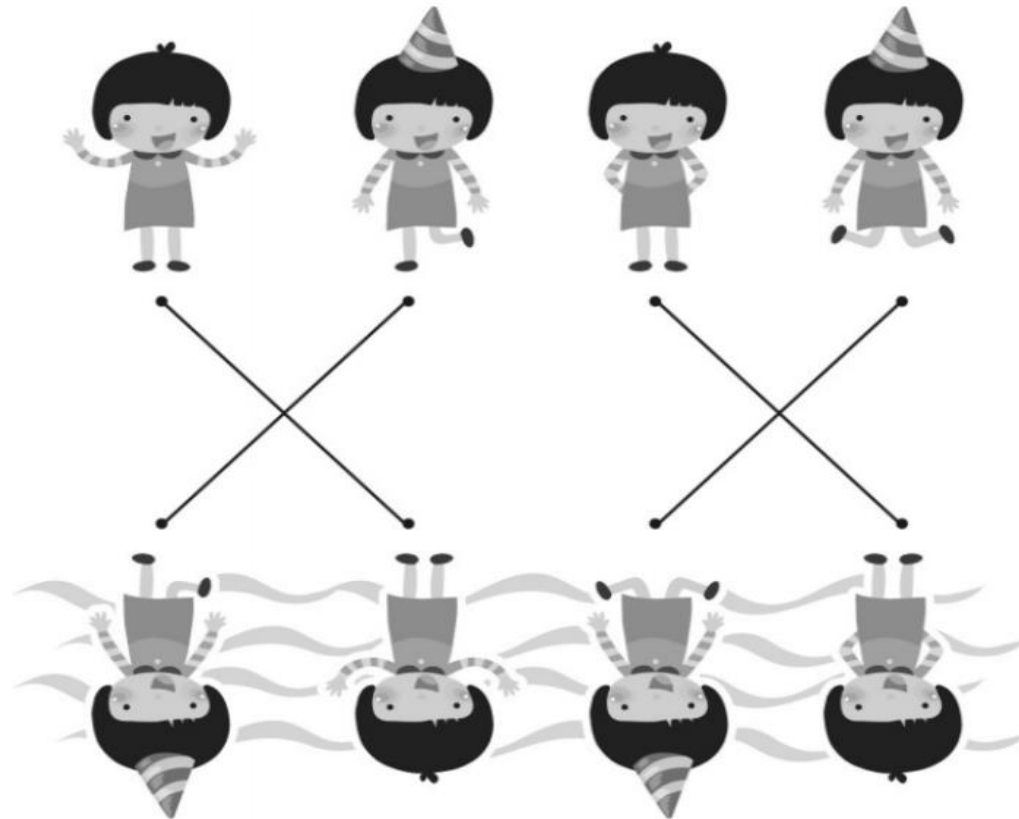
$$C = 15 + 10 = 25$$

$$A = 16 + 25 = 41$$



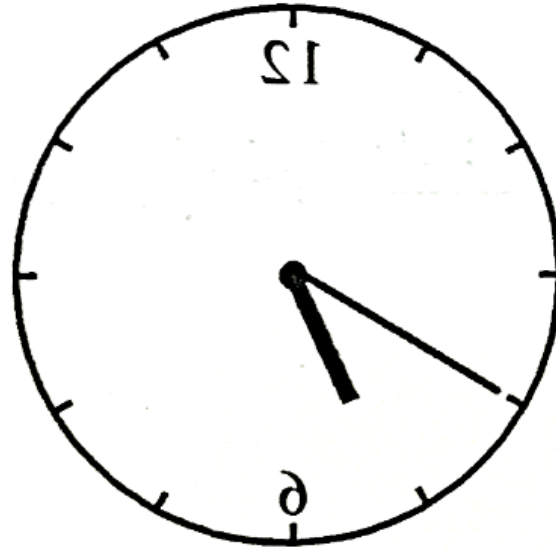
Geometric & Spatial Reasoning

Example: The upper pictures show the pictures of a girl above the water and the lower pictures show her images on the water. Draw lines that connect the girl's pictures above the water with her corresponding images on the water.



Geometric & Spatial Reasoning

6. A mirror shows the following image of a clock. What is the actual time?



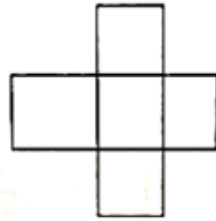
Answer: **6:40**

Geometric & Spatial Reasoning

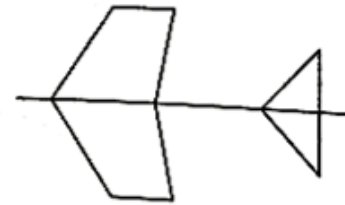
7. Which of the following **cannot be drawn** without lifting the pen and without tracing the same line more than once?



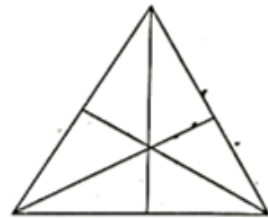
A



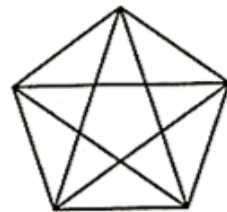
B



C



D



E

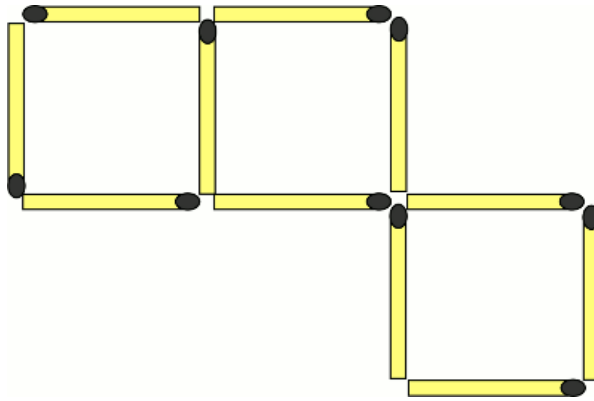


F

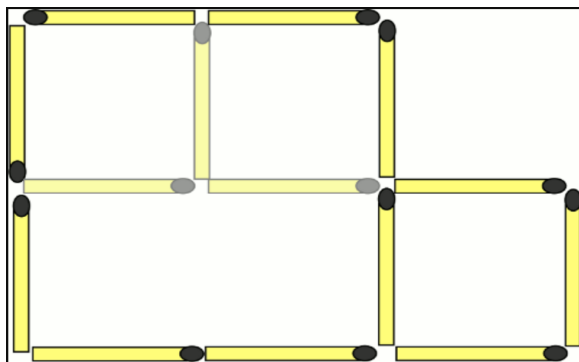
Answer: **D**

Geometric & Spatial Reasoning

Example: Move exactly 3 matches to show 2 different squares.

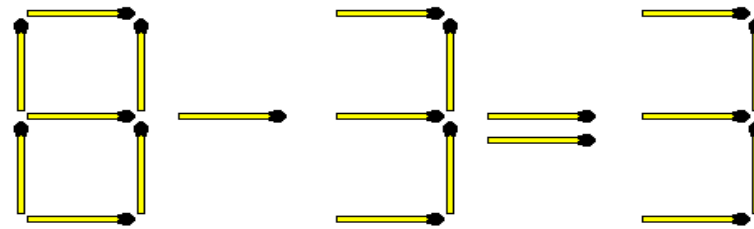


Solution

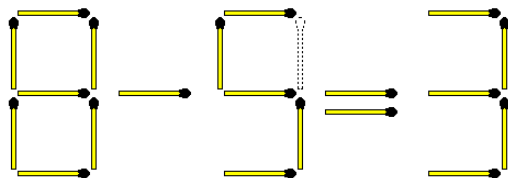
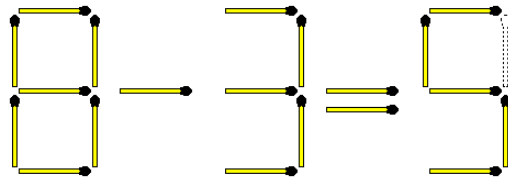
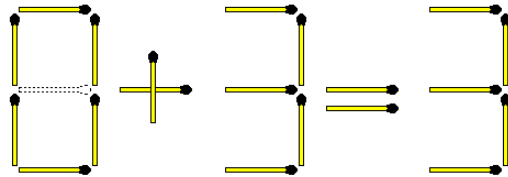


Geometric & Spatial Reasoning

8. Move only 1 matchstick to make the equation true. Can you find the 3 solutions?

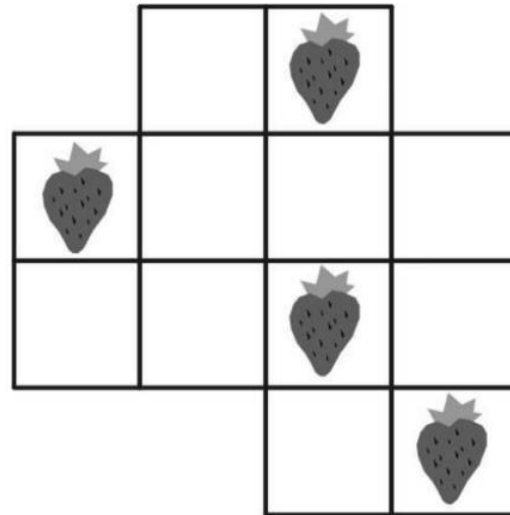


Answers

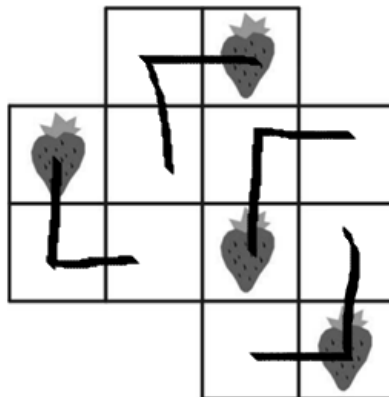


Geometric & Spatial Reasoning

9. Divide the picture into 4 identical pieces so that each piece will contain exactly one strawberry.

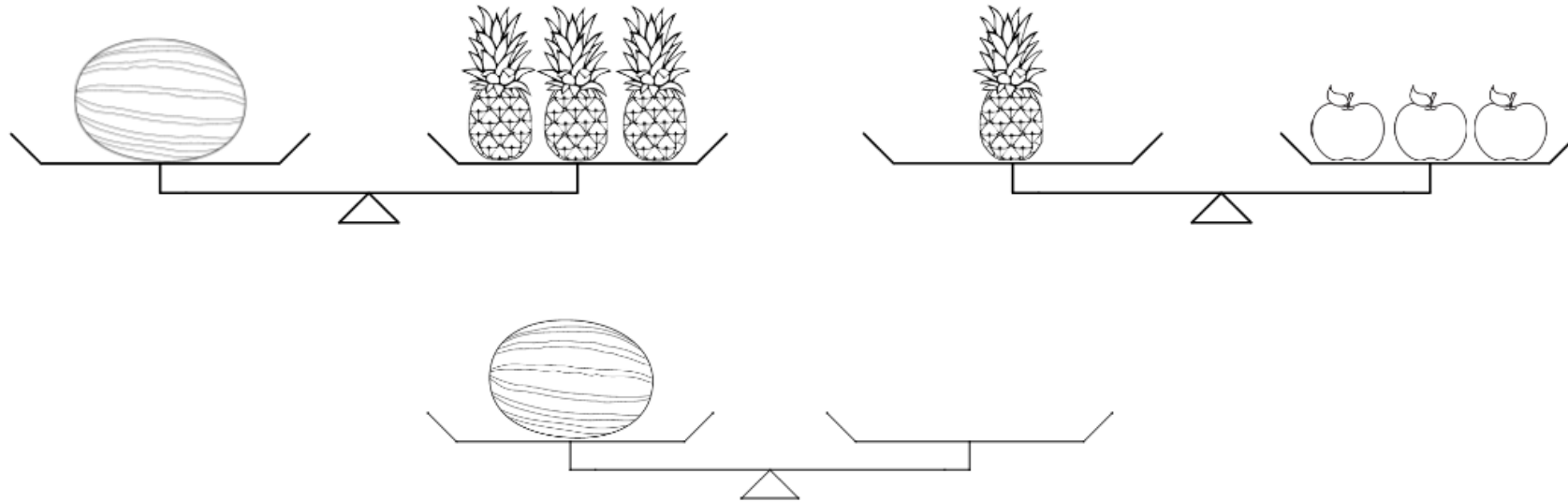


Solution:



Arithmetic & Number Concepts

10. How many apples should be placed on the right of the balance in the last figure?



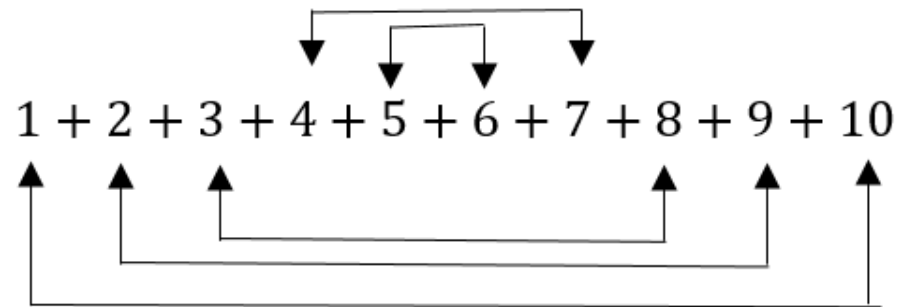
Answer: **9**

Arithmetic & Number Concepts

11. What is the value of

$$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10?$$

Solution:



$$\begin{aligned} & (1 + 10) + (2 + 9) + (3 + 8) + (4 + 7) + (5 + 6) \\ & = 11 + 11 + 11 + 11 + 11 = \mathbf{55} \end{aligned}$$

Arithmetic & Number Concepts

Example: I'm thinking of a number. If I add 13 to it, and then minus 6 from the result, I will get 49. What number I'm thinking of?

Solution:

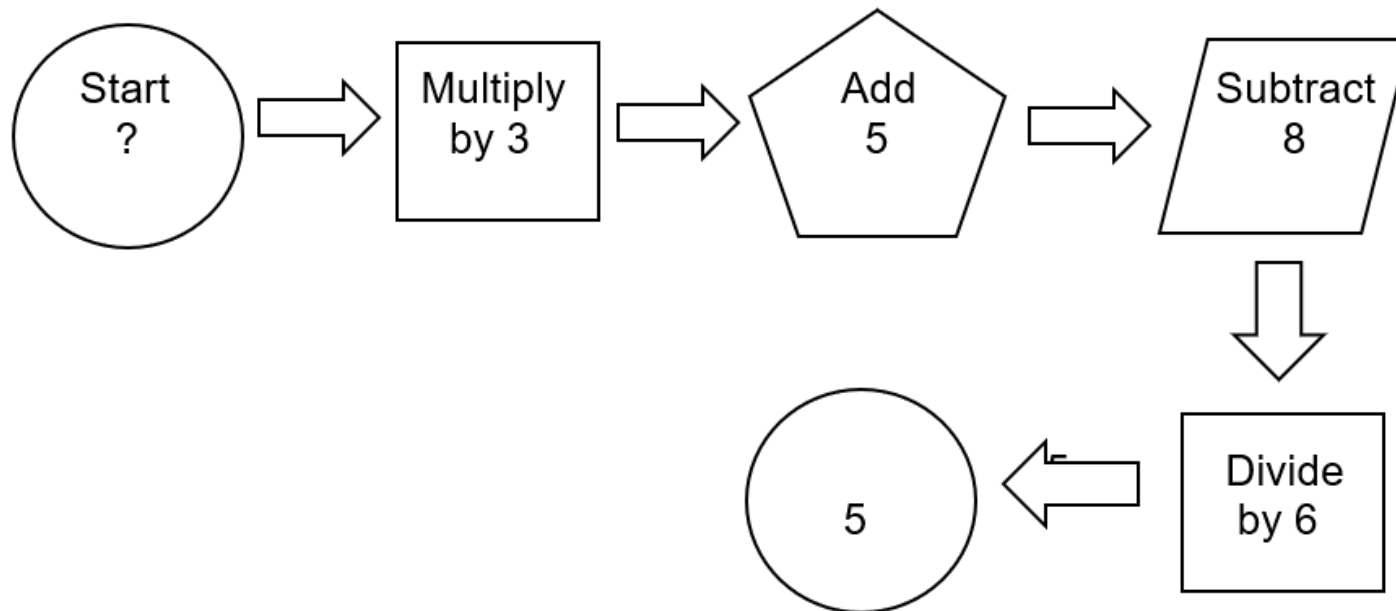
The result is given but there is missing number. We need to work backwards to find the missing number. To work backwards, we should apply the opposite operations.

Opposite of -6 is +6, and opposite of +13 is -13.

Answer = $49 + 6 - 13 = 42$

Arithmetic & Number Concepts

12. Consider the following. What number must be in the beginning?



Solution: $5 \times 6 = 30$, $30 + 8 = 38$, $38 - 5 = 33$, $33 / 3 = 11$

Arithmetic & Number Concepts

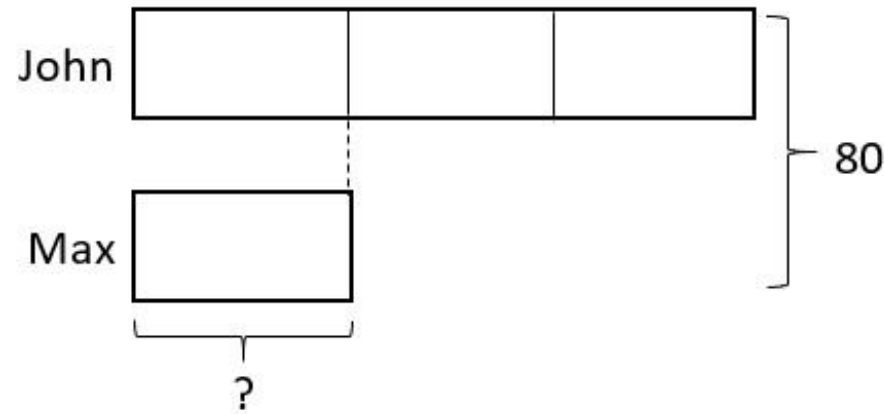
Example: John and Max have \$80 altogether. The money that John has is 3 times that of Max. How much money does each of them have?

Solution:

$$80 \div 4 = \$20$$

$$\$20 \times 3 = \$60$$

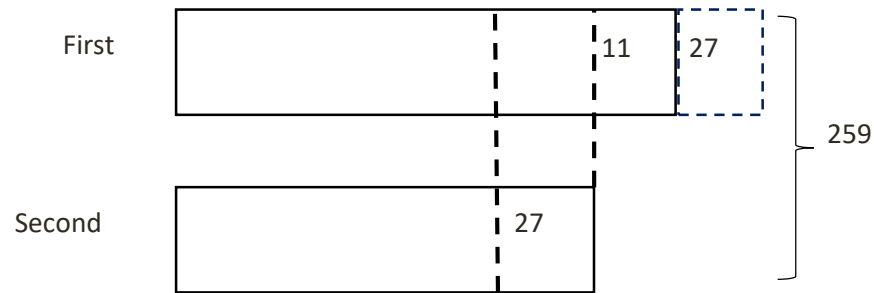
John has \$60 and Max has \$20.



Arithmetic & Number Concepts

13. There are altogether 259 apples in two baskets. After transferring 27 apples from the first to the second basket, the first basket will have 11 more apples than the second one. How many apples were in the second basket at first?

Solution



$$259 - 11 = 248 \quad 248 \div 2 = 124 \quad 124 - 27 = 97$$

Answer: There are 97 apples in the second basket at first.

Arithmetic & Number Concepts

14. The pages of a certain book are numbered consecutively from 1 to 100. How many page numbers contain the digit "5" and are also divisible by 5?

Answer: 11 numbers (5, 15, 25, 35, 45, 50, 55, 65, 75, 85, 95)

Arithmetic & Number Concepts

15. Put the digits 2, 3, 4 and 5 in the squares and calculate the sum to get the largest value. What is that value?

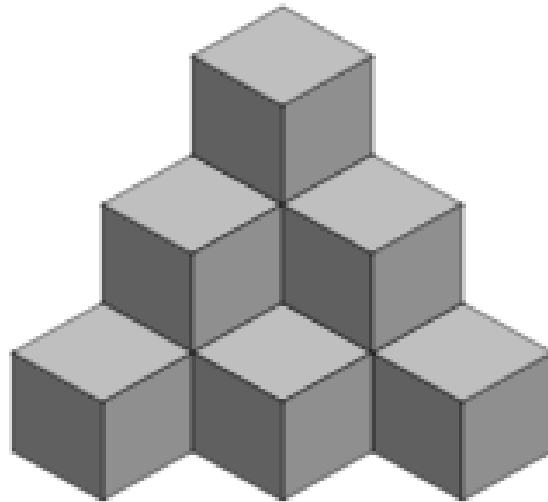
$$\square\square + \square\square$$

Solution:

The two biggest digits 4 and 5 must be in the tens place to get the largest possible sum. Therefore, the largest sum is $52 + 43$ or $53 + 42$, which is both equal to **95**.

Counting Techniques

Example: Some cubes are placed on the floor as shown in the diagram. How many cubes are there in the diagram?



Solution:

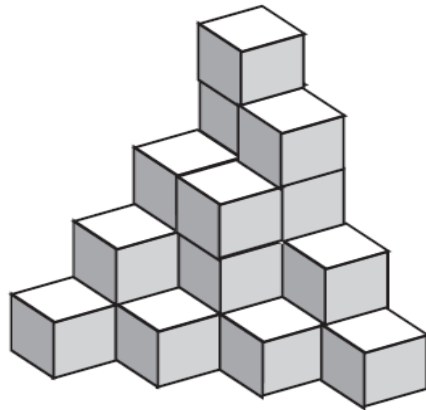
Top layer: 1 cubes

Middle layer: $2 + 1 = 3$ cubes

Bottom layer: $3 + 3 = 6$ cubes

Counting Techniques

16. The tower shown on the right is made by placing equal cubes on top of each other with no gaps. Not all cubes are visible. How many cubes does the tower contain?



Answer:

Row 1 (bottom of the figure): $4+3+2+1=10$

Row 2 (second from the bottom): $3+2+1=6$

Row 3 (third from the top): $2+2=4$

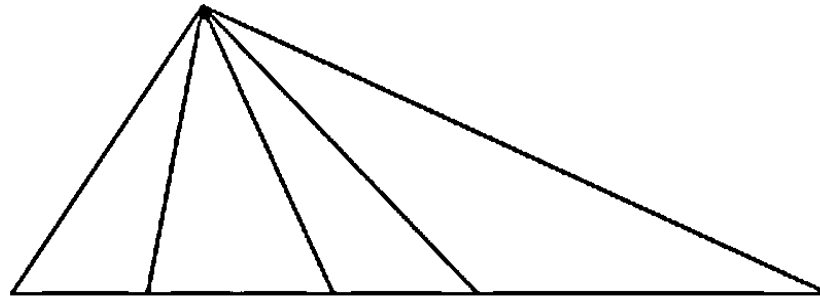
Row 4 (second from the top): 2

Row 5: (the top of the figure): 1

Hence, the total number is $10+6+4+2+1=23$

Counting Techniques

Example: How many triangles are there in the diagram below?



Solution:

1-part: 4

2-part: 3

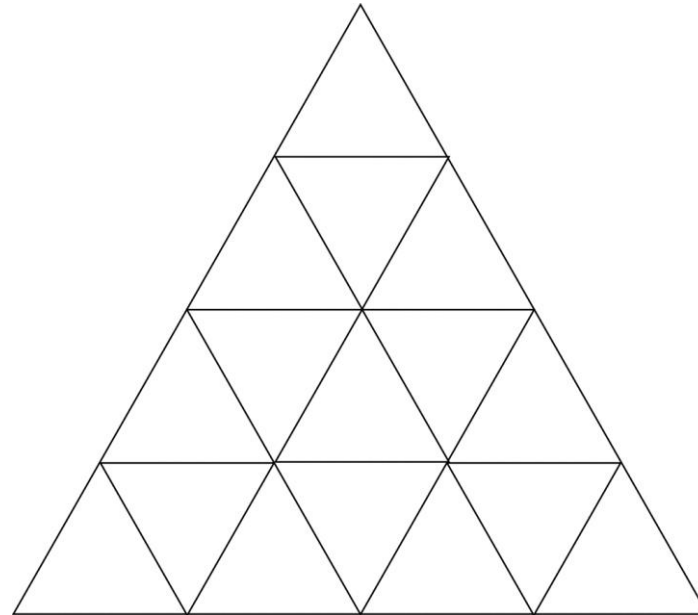
3-part: 2

4-part: 1

Total = $1+2+3+4=10$

Counting Techniques

17. How many triangles in the figure below?



Solution: $16+7+3+1=27$

Counting Techniques

18. How many two-digit numbers are there in which the digit on the right is larger than the digit on the left?

Answer: 36

Ones digit is 2: 12 (1 number)

Ones digit is 3: 13, 23 (2 numbers)

Ones digit is 4: 14, 24, 34 (3 numbers)

.....

Ones digit is 9: 19, 29, 39,...,89 (8 numbers)

$$8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 36$$

Therefore, there are **36** two-digit numbers that satisfy the condition.

Counting Techniques

19. How many digits are there in a book that has 84 pages?

Solution

Page 1 to 9: 9 digits

Page 10 to 84: $75 \times 2 = 150$ ($84 - 10 + 1 = 75$)

There are $9 + 150 = 159$ digits.

Counting Techniques

20. How many numbers between 10 and 99 have digits that differ by 4?

Solution

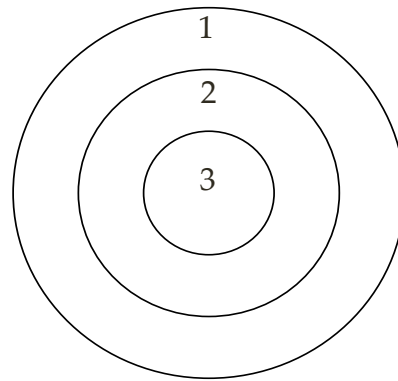
There are **11 numbers**:

15	51
26	62
37	73
48	84
59	95

40

Counting Techniques

21. Robin throws 3 darts which all land on a dart board. The number of points for each region is indicated on the dartboard. How many possible total points can Robin obtain?



Solution

$$1 + 1 + 1 = 3$$

$$1 + 1 + 2 = 4$$

$$1 + 1 + 3 = 5$$

$$1 + 2 + 3 = 6$$

$$2 + 2 + 1 = 5$$

$$2 + 2 + 2 = 6$$

$$2 + 2 + 3 = 7$$

$$3 + 3 + 1 = 7$$

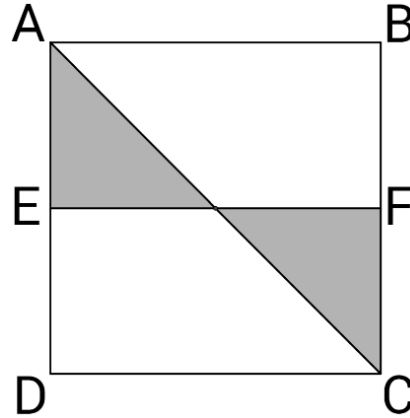
$$3 + 3 + 2 = 8$$

$$3 + 3 + 3 = 9$$

Answer: there are 7 possible total points.

Geometric & Spatial Reasoning

22. Figure ABCD is a square. Point E is the midpoint of AD and point F is the midpoint of BC. If the area of the shaded region is 10 cm^2 , what is the area of the square ABCD?



Solution: The area of each shaded triangle is $\frac{1}{8}$ of the area of the square. The area of the shaded region is equal to $\frac{1}{8} \times 2 = \frac{1}{4}$ of the area of the square. It is given that $\frac{1}{4}$ of the area of the square = 10 cm^2 . The area of the square = $10 \times 4 = \mathbf{40 \text{ cm}^2}$.

