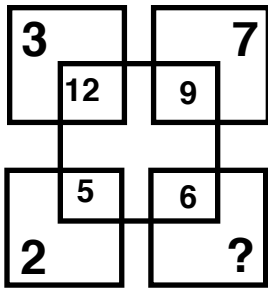


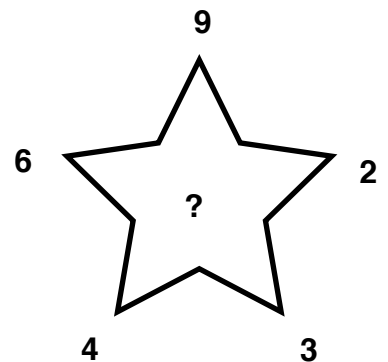
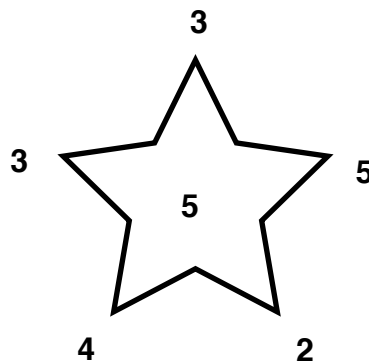
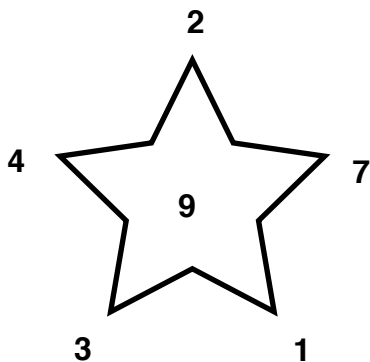
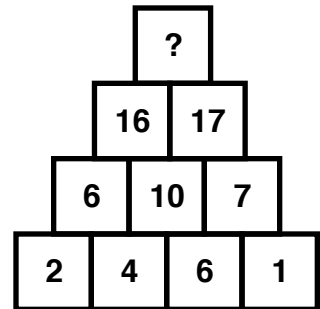
# What is the missing number?

## A Pattern Recognition Activity

### Sums and Differences

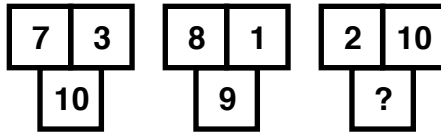


**Julie Eitel**



# Introduction

What is the missing number?



Find the pattern that was used to complete part of the figure and then use that same pattern to find the missing number that the ? sign represents.

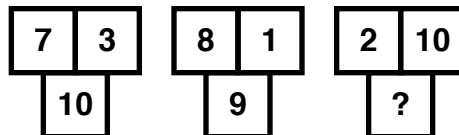
## Sums

The **sum** of a group of numbers is found by adding the numbers together to get their total. A common pattern in the problems that follow is to place 2 or 3 numbers in one part of a figure and then place their sum in another place in the figure. The best way to get started is to list several sums for some of the numbers in a figure and then see if that sum the answers to those sums also appear in the figure.

The examples below use sums to find the missing number.

### Example 1

What is the missing number?



**Look at the two figures on the left.** The sum of 7 and 3 is 10. The sum of 8 and 1 is 9.

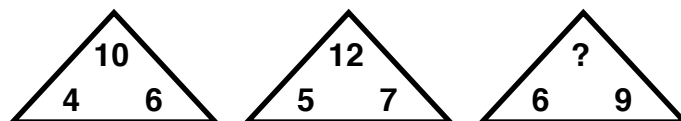
**Pattern:** Add the 2 numbers on the top to get the number on the bottom.

Look at the last figure. The sum of 2 and 10 is 12.

**Solution:** 12 is the missing number.

### Example 2

What is the missing number?



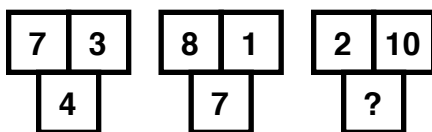
**Look at the two figures on the left.** The sum of 4 and 6 is 10. The sum of 5 and 7 is 12.

**Pattern:** Add the 2 numbers on the bottom to get the number on the top.

Look at the last figure. The sum of 6 and 9 is 15.

**Solution:** 15 is the missing number.

**What is the missing number?**



Find the pattern that was used to complete part of the figure then use that same pattern to find the missing number that the ? sign represents.

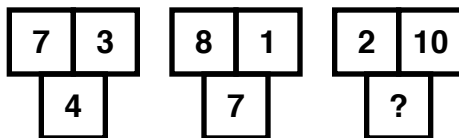
### Differences

The **difference** of 2 numbers is found by subtracting 2 numbers to get their difference. A common pattern is to place 2 numbers in one part of a figure and then place their difference in another place in the figure. The best way to get started is to list several differences for some of the numbers in a figure and then see if the answers to those differences also appear in the figure.

The examples below use differences to find the missing number.

#### Example 1

**What is the missing number?**



**Look at numbers in the 2 sets of squares on the left side of the figure above.**

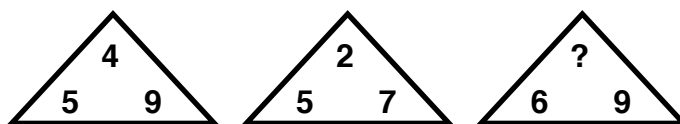
There are 2 differences.  $7 - 3 = 4$  and  $8 - 1 = 7$

**Pattern:** Subtract the 2 numbers on the top to get the number on the bottom.  
Look at the last figure. The difference of 2 and 10 is 8.

**Solution: 8 is the missing number.**

#### Example 2

**What is the missing number?**



**Look at numbers in the 2 triangles on the left of the figure above.**

There are 2 differences.  $9 - 5 = 4$  and  $7 - 5 = 2$

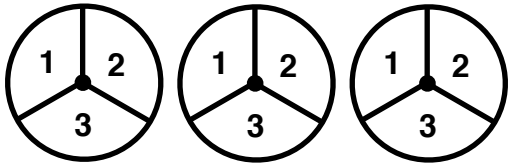
**Pattern:** Subtract the 2 numbers on the bottom to get the number on top.  
Look at the last figure. The difference of 9 and 6 is 3.

**Solution: 3 is the missing number.**

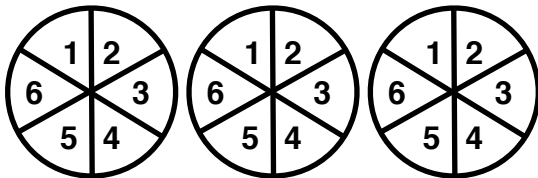
### Corresponding Positions.

The parts of each figure that are in the same position are in Corresponding Positions.

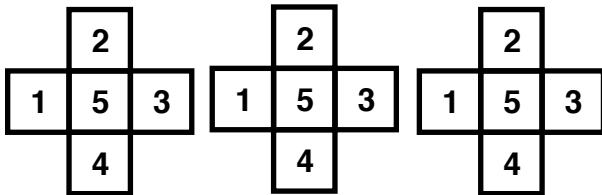
The 1 's are in Corresponding Positions in each of the 3 circles. So are the 2 and 3's.



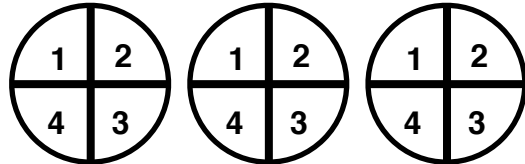
The 1 's are in Corresponding Positions in each of the 3 circles  
So are the 2 ,3 , 4 , 5 and 6's.



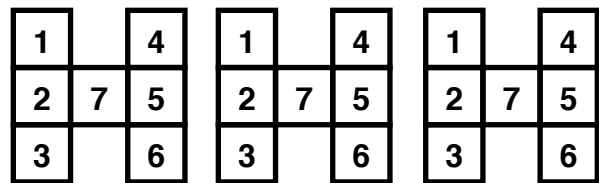
The 1 's are in Corresponding Positions in each of the 3 figures  
So are the 2 ,3 , 4 , 5 and 6's.



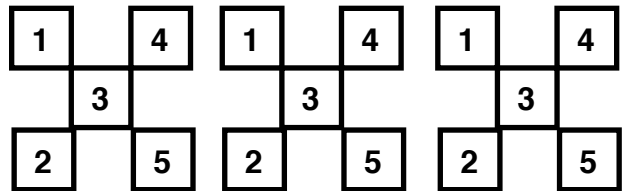
The 1 's are in Corresponding Positions in each of the 3 circles. So are the 2, 3 and 4's



The 1 's are in Corresponding Positions in each of the 3 figures  
So are the 2 ,3 , 4 , 5 , 6 and 7's.



The 1 's are in Corresponding Positions in each of the 3 figures  
So are the 2 ,3 , 4 , 5 , 6 and 7's.



### Adding numbers in Corresponding Positions.

Add the numbers in the corresponding squares for the 2 figures on the left and put their sums in the Corresponding Positions in the figure on the right.

$$\begin{array}{|c|c|c|} \hline 4 & 3 & 1 \\ \hline \end{array} \quad \begin{array}{|c|c|c|} \hline 5 & 6 & 8 \\ \hline \end{array} = \begin{array}{|c|c|c|} \hline 6 + 3 = 9 & 6 + 3 = 9 & 1 + 8 = 9 \\ \hline \end{array}$$

The sums of the numbers in Corresponding Positions are all 9.

Find the value for missing number represented by ?

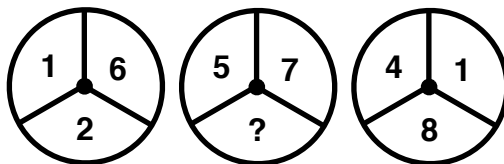
$$\begin{array}{|c|c|c|} \hline 4 & 3 & 1 \\ \hline \end{array} \quad \begin{array}{|c|c|c|} \hline 5 & 6 & ? \\ \hline \end{array} = \begin{array}{|c|c|c|} \hline 6 + 3 = 9 & 6 + 3 = 9 & 1 + ? = 9 \\ \hline \end{array}$$

$1 + 8 = 9$  so the missing number represented by ? is 8

**Example 1**  
**Corresponding Positions.**

**What is the missing number?**

**Hint: Sums.**



The top left segment of the circle on the left  
and the top left segment of the circle on the right are in Corresponding Positions.  
Add these 2 numbers together  $1 + 4 = 5$   
and put the 5 in the Corresponding Position in the circle in the center.

The top right segment of the circle on the left  
and the top right segment of the circle on the right are in Corresponding Positions.  
Add these 2 numbers together  $6 + 1 = 7$   
and put the 7 in the Corresponding Position in the circle in the center.

The bottom segment of the circle on the left  
and the bottom segment of the circle on the right are in Corresponding Positions.  
Add these 2 numbers together  $2 + 8 = 10$   
and put the 10 in the Corresponding Position in the circle in the center.

**Pattern:** Put the **sum** of the corresponding positions of the first 2 circles into the corresponding positions of the far right circle.

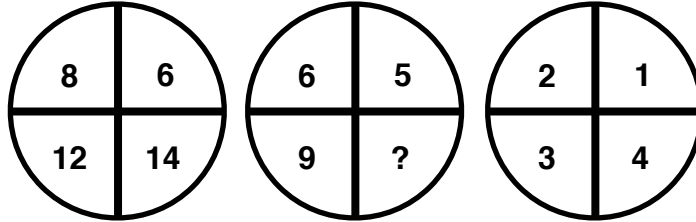
**Solution:** 10 is the missing number.

## Example 2

### Corresponding Positions..

What is the missing number?

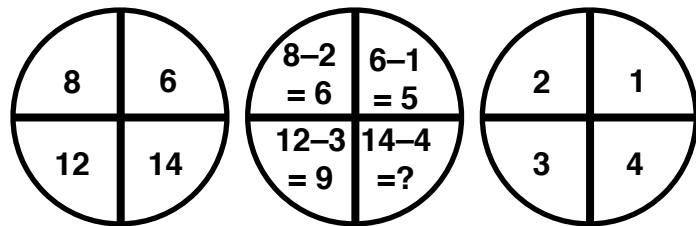
Hint: Differences.



Subtract the 2 numbers in the 2 parts of the left and right sides of the outside circles.

$$8 - 2 = 6 \quad 6 - 1 = 5 \quad 12 - 3 = 9 \quad \text{and} \quad 14 - 4 = ?$$

These differences can be found in the middle the 4 parts of the middle circle.



These sums can be found in the middle the 4 parts of the middle circle.

The difference in the 2 numbers in the 2 top left hand halves of the 2 outside circles  $8 - 2 = 6$  is placed in the top left hand segment of the middle circle.

The difference in the 2 numbers in the 2 top right hand halves of the 2 outside circles  $6 - 1 = 5$  is placed in the top right hand segment of the middle circle.

The difference in the 2 numbers in the 2 bottom left hand halves of the 2 outside circles  $12 - 3 = 9$  is placed in the bottom left hand segment of the middle circle.

The difference in the 2 numbers in the 2 bottom right hand halves of the 2 outside circles  $14 - 4 = 10$  is placed in the bottom right hand segment of the middle circle.

### Pattern:

The differences in the 2 numbers in the outside circles are placed in the 4 corresponding positions in the middle circle.

**Solution: 10 is the missing number.**

# What is the missing number?

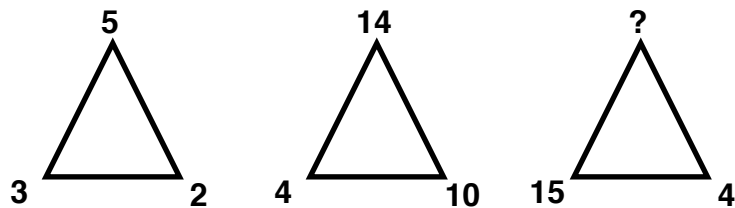
Name \_\_\_\_\_

## Sum and Differences

Use the sum and differences of the numbers in each figure to find the pattern that was used to complete part of the figure then use that same pattern to find the missing number that the ? sign represents.

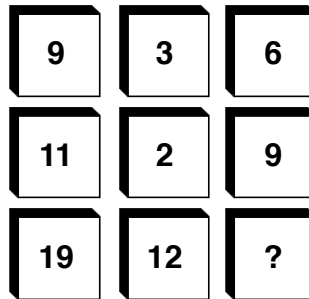
1. What is the missing number? \_\_\_\_\_

Hint: Sums.



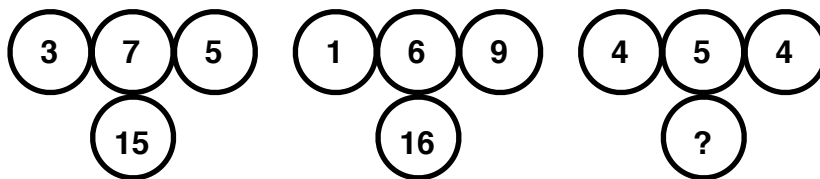
2. What is the missing number? \_\_\_\_\_

Hint: Differences.



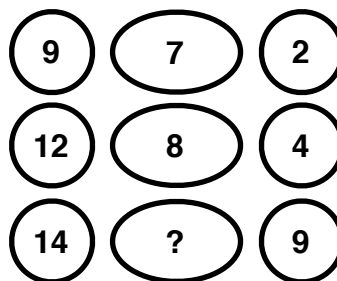
3. What is the missing number? \_\_\_\_\_

Hint: Sums



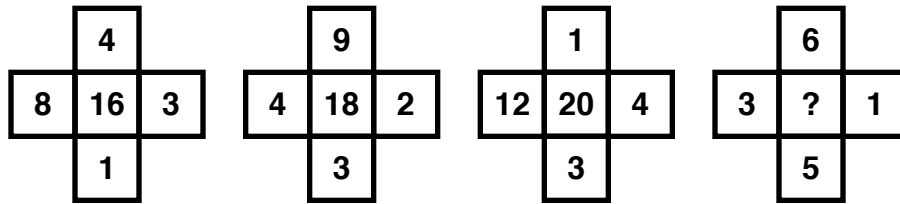
4. What is the missing number? \_\_\_\_\_

Hint: Differences.



5. What is the missing number? \_\_\_\_\_

Hint: Sums.



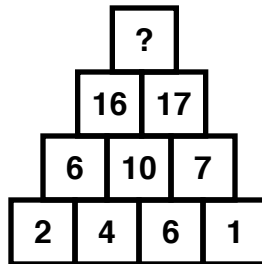
6. What is the missing number? \_\_\_\_\_

Hint: Differences.



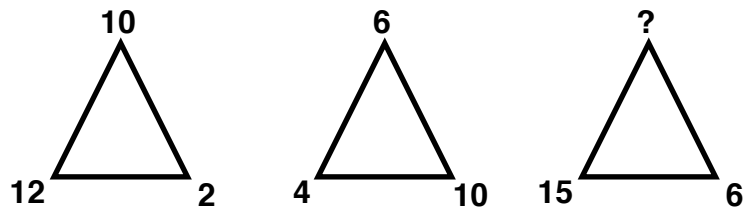
7. What is the missing number? \_\_\_\_\_

Hint: Sums.



8. What is the missing number? \_\_\_\_\_

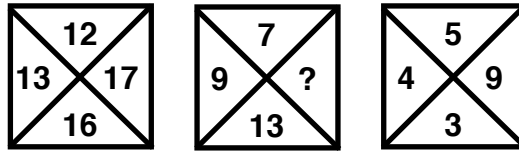
Hint: Differences.





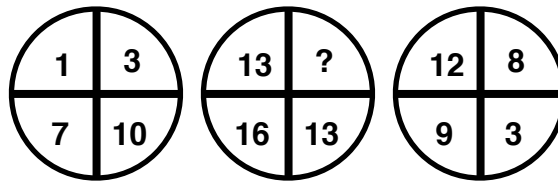
9. What is the missing number? \_\_\_\_\_

Hint: Differences.



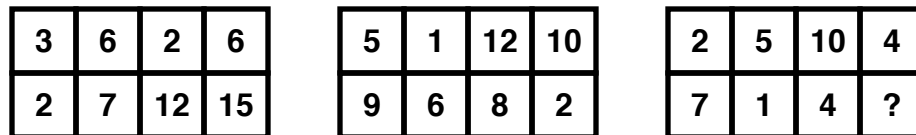
10. What is the missing number? \_\_\_\_\_

Hint: Sums.



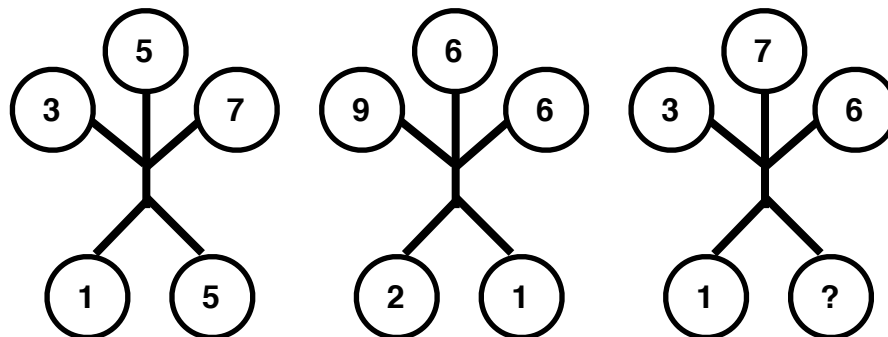
11. What is the missing number? \_\_\_\_\_

Hint: Differences.



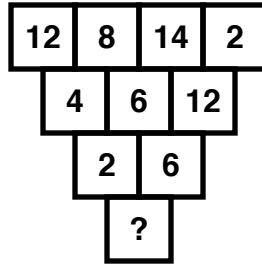
12. What is the missing number? \_\_\_\_\_

Hint: Sums.



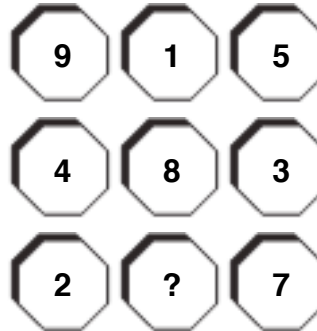
13. What is the missing number? \_\_\_\_\_

Hint: Differences.



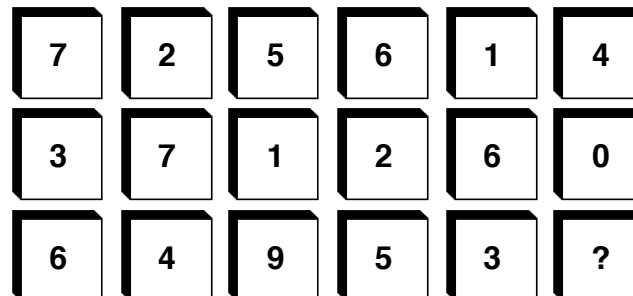
14. What is the missing number? \_\_\_\_\_

Hint: Sums.



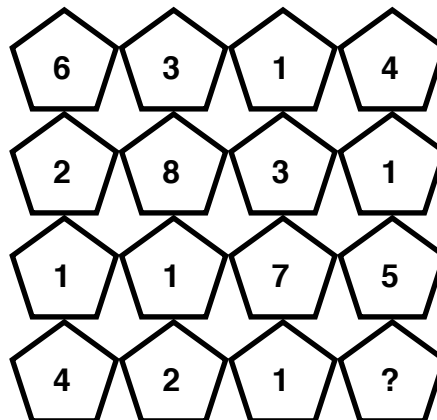
15. What is the missing number? \_\_\_\_\_

Hint: Differences.



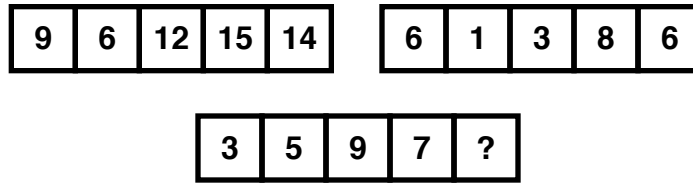
16. What is the missing number? \_\_\_\_\_

Hint: Sums.



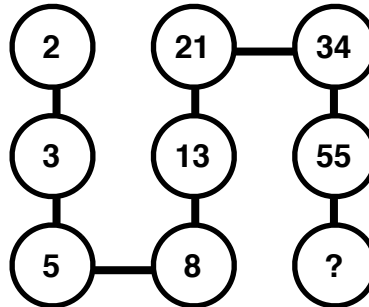
17. What is the missing number? \_\_\_\_\_

Hint: Differences.



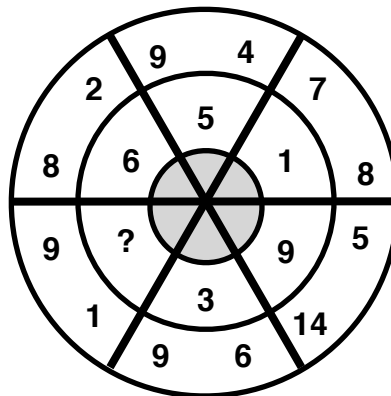
18. What is the missing number? \_\_\_\_\_

Hint: Sums.



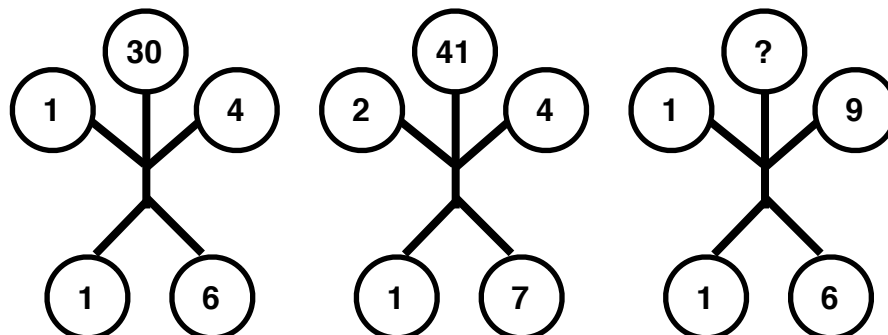
19. What is the missing number? \_\_\_\_\_

Hint: Differences.



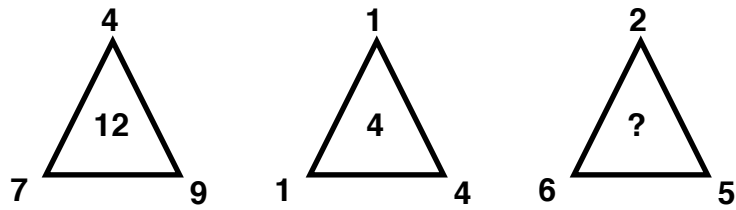
20. What is the missing number? \_\_\_\_\_

Hint: Sums.



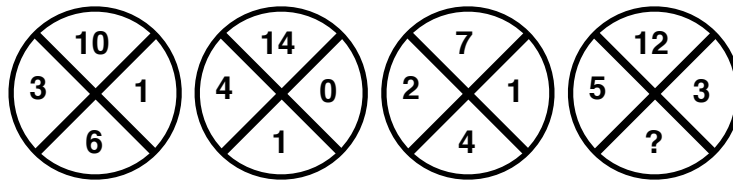
21. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



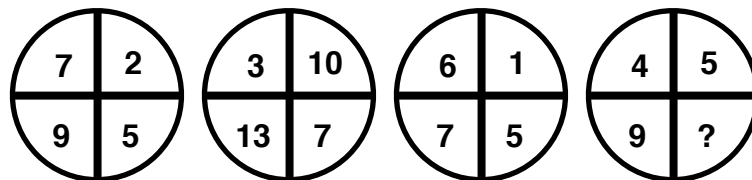
22. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



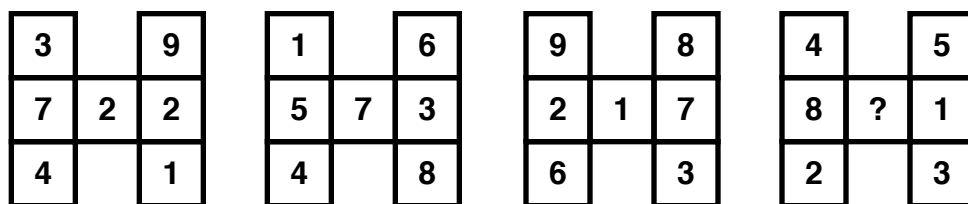
23. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



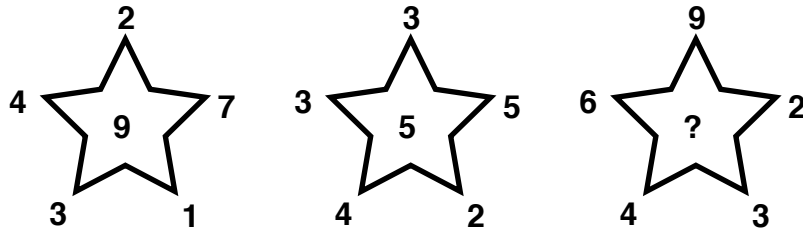
24. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



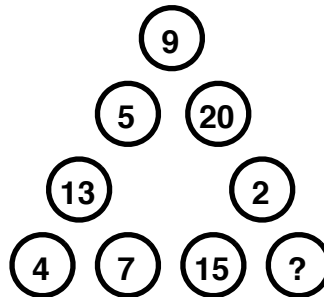
25. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



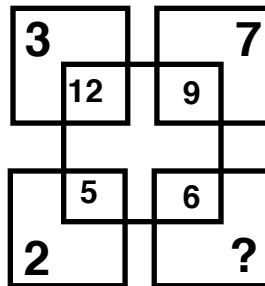
26. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



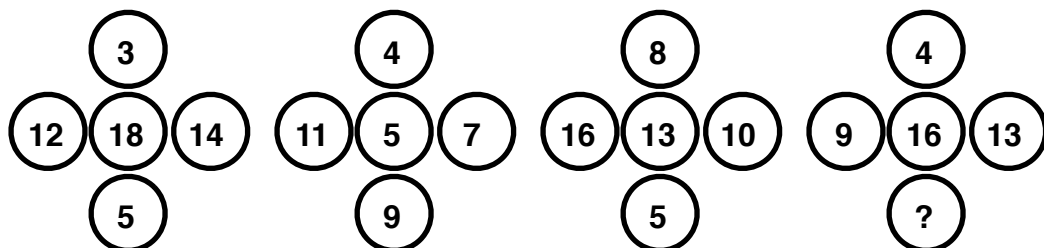
27. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



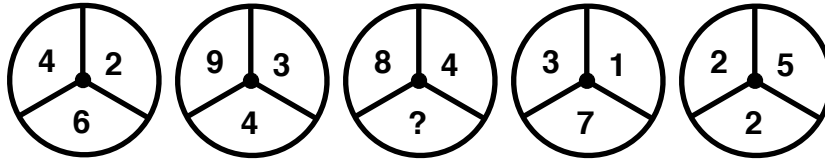
28. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



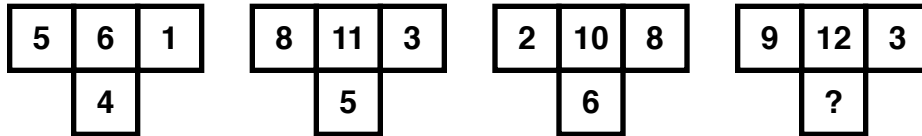
29. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



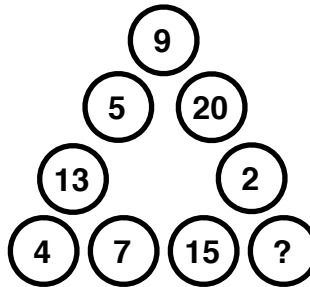
30. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



31. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



32. What is the missing number? \_\_\_\_\_

Hint: Sums and Differences.



## Sum and Differences Solutions.

1. **Solution: 19.** The number at the top vertex is the **sum** of the numbers at the two bottom vertex
2. **Solution: 7.** In each row, the number in the right square is the **difference** of the first two squares.
3. **Solution: 13.** Add up the numbers in the 3 top circles and place the **sum** in the bottom circle.
4. **Solution: 5.** The number in the middle oval is the **difference** of the numbers in the right and left circles.
5. **Solution: 15.** The number in the center square is the **sum** of the four outer numbers.
6. **Solution: 8.** Each number in the far right row is the **difference** in the corresponding numbers in the first and second rows. The first number in the far right row is the difference of the 2 first numbers in the first and second rows. The second number in the the far right row is the difference of the 2 second numbers in the first and second rows.
7. **Solution: 33.** Starting with numbers on the bottom row, **add** numbers in adjacent boxes together, and put the result in the box directly above. Continue in this pattern up the triangle.
8. **Solution: 9.** The top number is the **difference** of the 2 bottom numbers.
9. **Solution: 8.** Put the **difference** of the corresponding positions of the left and right hand squares into the corresponding positions of the center square.
10. **Solution: 11.** Put the **sum** of the corresponding positions of the left and right hand circles into the corresponding positions of the center circle.
11. **Solution: 13.** Put the **difference** of the corresponding positions of the first 2 figures into the corresponding positions of the far right figure.
12. **Solution: 6.** The **sum** of the 3 upper numbers is a 2 digit number. Place the 2 digits into the 2 circles at the bottom, 1 digit per circle.
13. **Solution: 4.** Starting with numbers on the top row, **subtract** numbers in adjacent boxes and put the result in the box directly above. Continue in this pattern up the triangle.
14. **Solution: 6** The numbers in each row and column **add** up to 15.  $2 + ? + 7 = 15$
15. **Solution: 8.** Divide the diagram into two 3 x 3 squares. The numbers in the left 3x3 square are repeated in the right 3x3 square but **decreased** by 1.
16. **Solution: 7.** The **sum** of the numbers in each column is always 14.  $4 + 1 + 1 + ? = 14$

17. **Solution: 8.** Put the **difference** of the numbers in the corresponding positions in the squares of the two top rows into the corresponding positions in the squares on the bottom row.
18. **Solution: 89.** Starting at the top left and following the lined path, **add** the first and second numbers together to get the third number.  $2 + 3 = 5$  Then add the second and third numbers together to get the fourth number.  $3 + 5 = 8$  Then add the third and fourth numbers together to get the fifth number.  $5 + 8 = 13$  Then add the fourth and fifth numbers together to get the sixth number  $8 + 13 = 21$ . Continue until you get to 89.
19. **Solution: 8.** The inner number in each segment equals the **difference** of the two numbers in the outer part of the segment.
20. **Solution: 35.** The “hands and “feet” each form 2 separate 2 digit numbers. The top number is the **sum** of these 2 digit numbers.
21. **Solution: 9.** The center number is the sum of the 2 bottom numbers minus the top number.
22. **Solution: 4.** In each circle, add the left and right hand numbers together, and subtract this sum from the top number to give the value at the bottom.
23. **Solution: 1.** In each circle, the number in the lower left segment equals the sum of the numbers in the top two segments, and the number in the lower right circle equals the difference between the numbers in the top two segments.
24. **Solution: 5.** In each H shape, the central number is equal to the difference between the sum of the 3 left hand numbers and the sum of the 3 right hand numbers.
25. **Solution: 10.** To find the center number in each star, find the sum of the top three numbers and subtract the the sum of the bottom two numbers
26. **Solution: 11.** Taking any side of the triangle, the sum of the two corner digits is written in one of the circles on that side, and the difference is written in the other circle.
27. **Solution: 9.** Taking numbers in diagonally opposite squares, calculate their sum, and put the answer in the small, inner square of the upper number. Calculate their difference, and put this answer in the small, inner square of the lower number.
28. **Solution: 2.** The central number equals the sum of the left and right hand digits, minus the sum of the upper and lower digits.
29. **Solution: 1.** Numbers in the 3 segments of the central circle equal the difference between the sum of the numbers in 2 corresponding segments of the 2 circles on the left and the sum of the 2 circles on the right.



**30. Solution: 6.** In each shape, use the left and right hand numbers as a source. The upper central number equals the sum of the left and right hand numbers, the bottom central number equals the difference of the left and right hand numbers.

**31. Solution: 11.** Taking any side of the triangle, the sum of the two corner digits is written in one of the circles on that side, and the difference is written in the other circle.

**32. Solution: 12 .** Working from top to bottom, the sum of the numbers in each row is put in the left hand box on the row below, and the difference between the two numbers in each row is put in the right hand box on the row below.