Aptitude

1. Numbers

- **Quadratic Identities:**
  - `(a + b)² = a² + b² + 2ab`
  - `(a − b)² = a² + b² − 2ab`
- **Divisibility Rules:**
  - Sum of digits divisible by 3 ⇒ Number divisible by 3
  - Last digit 0 or 5 ⇒ Number divisible by 5
  - Sum of digits divisible by 9 ⇒ Number divisible by 9
  - Difference of sum of alternate digits divisible by 11 ⇒ Number divisible by 11

#PROBLEMS :

1. The difference between a two-digit number and the number obtained by interchanging the positions of its digits is 36. What is the difference between the two digits of that number?
   Let number = `10x + y`
   Reverse = `10y + x`
   Difference: `(10x + y) − (10y + x) = 36` ⇒ `9(x − y) = 36` ⇒ `x − y = 4`
   Difference between digits = |x - y| = 4
   Answer: `4`
2. A two-digit number is such that the product of the digits is 8. When 18 is added to the number, then the digits are reversed. The number is:
   Let number = `10x + y`, Product: `x × y = 8`,
   After adding 18: `10x + y + 18 = 10y + x` ⇒ `9x − 9y = −18` ⇒ `x − y = −2` ⇒ `y − x = 2`

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Also, `x × y = 8`, try possible integers:
If `x = 2, y = 4` satisfies both:
Number = 24
Answer: 24
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3. The sum of the digits of a two-digit number is 15 and the difference between the digits is 3. What is the two-digit number?

   Let the ten's digit be x and unit's digit be y.
   Then, $x + y = 15$ and $x - y = 3$ or $y - x = 3$.
   Solving $x + y = 15$ and $x - y = 3$, we get: $x = 9$, $y = 6$.
   Solving $x + y = 15$ and $y - x = 3$, we get: $x = 6$, $y = 9$.
   So, the number is either 96 or 69.
   Hence, the number cannot be determined.
4. The sum of the squares of three numbers is 138, while the sum of their products taken two at a time is 131. Their sum is:
   Let the numbers be a, b and c.
   Then, _a^2 + b^2 + c^2 = 138 and (ab + bc + ca) = 131.
   (a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca) = 138 + 2 x 131 = 400.
   ⇒ (a + b + c) = 400 = 20.
5. A number consists of two digits. If the digits interchange places and the new number is added to the original number, then the resulting number will be divisible by:

   Let the ten's digit be x and unit's digit be y.
   Let the ten's digit be x and unit's digit be y.

   Then, number = 10x + y.

   Number obtained by interchanging the digits = 10y + x.
   (10y + x) = 11(x + y), which is divisible by 11.
6. The product of two numbers is 120 and the sum of their squares is 289. The sum of the number is:

   Let the numbers be x and y.
   Then, x__y = 120 and x_2 + _y_2 = 289.
   (_x + y)^2 = x^2 + _y^2 + 2x__y = 289 + (2 x 120) = 529
   x + y = 529 = 23.