EXERCISE 2.2

1. Find the zeroes of the following quadratic polynomials and verify the relationship between the zeroes and the coefficients.

(i) $x^2 - 2x - 8$ (ii) $4s^2 - 4s + 1$ (iii) $6x^2 - 3 - 7x$

(iv) $4u^2 + 8u$ (v) $t^2 - 15$ (vi) $3x^2 - x - 4$

2. Find a quadratic polynomial each with the given numbers as the sum and product of its zeroes respectively.

(i) $\frac{1}{4}, -1$ (ii) $\sqrt{2}, \frac{1}{3}$ (iii) $0, \sqrt{5}$

(iv) $1, 1$ (v) $-\frac{1}{4}, \frac{1}{4}$ (vi) $4, 1$

2.4 Division Algorithm for Polynomials

You know that a cubic polynomial has at most three zeroes. However, if you are given only one zero, can you find the other two? For this, let us consider the cubic polynomial $x^3 - 3x^2 - x + 3$. If we tell you that one of its zeroes is 1, then you know that $x - 1$ is a factor of $x^3 - 3x^2 - x + 3$. So, you can divide $x^3 - 3x^2 - x + 3$ by $x - 1$, as you have learnt in Class IX, to get the quotient $x^2 - 2x - 3$.

Next, you could get the factors of $x^2 - 2x - 3$, by splitting the middle term, as $(x + 1)(x - 3)$. This would give you

$$
\begin{aligned}
x^3 - 3x^2 - x + 3 &= (x - 1)(x^2 - 2x - 3) \\
&= (x - 1)(x + 1)(x - 3)
\end{aligned}
$$

So, all the three zeroes of the cubic polynomial are now known to you as $1, -1, 3$.

Let us discuss the method of dividing one polynomial by another in some detail. Before noting the steps formally, consider an example.

Example 6 : Divide $2x^2 + 3x + 1$ by $x + 2$.

$$
\begin{array}{r|l}
 & 2x - 1 \\
\hline
x + 2 & 2x^2 + 3x + 1 \\
 & \underline{\overset{-}{2x^2} \overset{-}{+} 4x} \\
 & -x + 1 \\
 & \underline{\overset{+}{-}x \overset{+}{-} 2} \\
 & 3
\end{array}
$$

Solution : Note that we stop the division process when either the remainder is zero or its degree is less than the degree of the divisor. So, here the quotient is $2x - 1$ and the remainder is 3. Also,

$$(2x - 1)(x + 2) + 3 = 2x^2 + 3x - 2 + 3 = 2x^2 + 3x + 1$$

i.e., $2x^2 + 3x + 1 = (x + 2)(2x - 1) + 3$

Therefore, Dividend = Divisor × Quotient + Remainder

Let us now extend this process to divide a polynomial by a quadratic polynomial.