KeyConcept Descartes' Rule of Signs

Let $P(x) = a_n x^n + \cdots + a_1 x + a_0$ be a polynomial function with real coefficients. Then

- the number of positive real zeros of $P(x)$ is the same as the number of changes in sign of the coefficients of the terms, or is less than this by an even number, and

- the number of negative real zeros of $P(x)$ is the same as the number of changes in sign of the coefficients of the terms of $P(-x)$, or is less than this by an even number.

State the possible number of positive real zeros, negative real zeros, and imaginary zeros of $f(x) = x^5 - 9x^4 - 4x^3 + 5x^2 + 7x - 20$.

$F(-x) = -x^5 \quad 9x^4 \quad 4x^3 \quad 5x^2 \quad 7x \quad 20$

No of positive real zeros	No of negative real zeros	No of imaginary zeros	Total number of zeroes
3	2		5
3			
	0		

The possible number of positive real zeros =   or

The possible number of negative real zeros =   or

So, the possible number of imaginary zeroes are   ,   or