



Precalculus

Topic: Real Zeros of Polynomials

Instructions

Solve the following problems related to real zeros of polynomials. Show all work clearly and check your solutions.

Practice Problems

1. Find all rational zeros of the polynomial, and write the polynomial in factored form.

(i) $P(x) = x^3 + 3x^2 - 4$

(ii) $P(x) = x^3 - 7x^2 + 14x - 8$

(iii) $P(x) = x^3 - 3x - 2$

(iv) $P(x) = x^3 + 4x^2 - 3x - 18$

(v) $P(x) = x^3 - 6x^2 + 12x - 8$

(vi) $P(x) = x^3 - x^2 - 8x + 12$

(vii) $P(x) = x^3 - 4x^2 + x + 6$

2. Find all the real zeros of the polynomial. Use the quadratic formula if necessary.

(i) $P(x) = x^3 + 4x^2 + 3x - 2$

(ii) $P(x) = x^3 - 5x^2 + 2x + 12$

(iii) $P(x) = x^4 - 6x^3 + 4x^2 + 15x - 4$

(iv) $P(x) = x^4 + 2x^3 - 2x^2 - 3x + 6$

(v) $P(x) = x^3 + 7x^2 + 4x - 9$

3. Use Descartes' Rule of Signs to determine how many positive and how many negative real zeros the polynomial can have. Then determine the possible total number of real zeros.

(i) $P(x) = x^3 - 3x^2 - x - 3$

(ii) $P(x) = 2x^6 - x^2 + 4x - 5$

(iii) $P(x) = 2x^5 + 5x^4 - 3x - 5x - 1$

(iv) $P(x) = x^4 + 3x^3 + x^2 + 12$

(v) $P(x) = x^5 + 4x^3 - 2x + 6$

4. Show that the given values for a and b are lower and upper bounds for the real zeros of the polynomial.

(i) $P(x) = 2x^3 + 5x^2 + x - 2$, $a = -3, b = 1$

(ii) $P(x) = x^4 - 2x^3 - 9x^2 + 2x + 8$, $a = -3, b = 5$

(iii) $P(x) = 2x^3 + 10x^2 - 39x + 9$, $a = -5, b = 2$

(iv) $P(x) = 3x^4 - 17x^3 + 24x^2 - 9x + 1$, $a = -2, b = 6$

5. Find integers that are upper and lower bounds for the real zeros of the polynomial.

(i) $P(x) = x^3 - 3x^2 + 4$

(ii) $P(x) = x^4 + 10x^2 + 8x - 12$

(iii) $P(x) = x^5 - x^4 - 6x^3 + 4x^2 + 11x + 3$

(iv) $P(x) = x^4 - 4x^3 + 3x^2 - 9x$

Multiple-Choice Questions

1. What are the real zeros of the polynomial $P(x) = x^3 - 4x^2 - 5x + 6$?

A. $x = 1, 2, -3$

B. $x = 1, -2, 3$

C. $x = 1, 3, -2$

D. $x = 2, -3, 5$

2. Which of the following polynomials has real zeros at $x = 1, -2, 3$?

A. $P(x) = (x - 1)(x + 2)(x - 3)$

B. $P(x) = (x + 1)(x - 2)(x + 3)$

C. $P(x) = (x - 1)(x - 2)(x + 3)$

D. $P(x) = (x + 1)(x - 3)(x - 2)$

3. What is the degree of the polynomial $P(x) = x^4 - 5x^3 + 6x^2 - 2x$?

- A. 1
 - B. 2
 - C. 3
 - D. 4
4. What are the real zeros of the polynomial $P(x) = x^3 + 4x^2 - 9x - 36$?
- A. $x = -1, -3, 3$
 - B. $x = -3, 1, 2$
 - C. $x = -2, 3, 4$
 - D. $x = -3, -1, 2$
5. The polynomial $P(x) = x^4 - 4x^3 - 5x^2 + 6x$ has real zeros at:
- A. $x = 0, -1, 2$
 - B. $x = 0, 1, -2$
 - C. $x = 1, -1, 0$
 - D. $x = 1, 2, 3$
6. What is the lower bound for the real zeros of the polynomial $P(x) = 2x^3 + 3x^2 - 2x - 1$?
- A. -1
 - B. 1
 - C. 2
 - D. -2

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