Solving Equations

Emphasis solving Polynomials – Descartes Rule of Signs

Determine the number or real zeros for each of the following:

1. $x^4 - 5x^2 - 36 = 0$

Original 1 change in signs = 1 positive

Switch odd exponent coefficient signs:

$x^4 - 5x^2 - 36 = 0$

Still just 1 change = 1 negative

2. $x^3 + 3x^2 - 14x - 20 = 0$

Original 1 change = 1 positive

Change odds:

$-x^3 + 3x^2 + 14x - 20 = 0$

2 changes = 2 or 0 negatives

3. $x^3 - 2x^2 + 3x - 6 = 0$

Original 3 changes = 3 or 1 positive

Change odds:

$-x^3 - 2x^2 - 3x - 6 = 0$

zero changes = 0 negative

4. $x^4 - 14x^2 + 45 = 0$

original 2 changes = 2 or 0 positive

Change odds:

$x^4 - 14x^2 + 45 = 0$

2 changes = 2 or 0 negatives

5. $x^4 + 6x^2 + 8 = 0$

Original zero changes = 0 positive

Change odds:

$x^4 + 6x^2 + 8 = 0$

zero changes = 0 negatives

6. $x^4 + 3x^2 - 18 = 0$

Original 1 change = 1 positive

Change odd:

$x^4 + 3x^2 - 18 = 0$

1 change = 1 negative

7. $x^3 - 1 = 0$

Original 1 change = 1 positive

Change odds:

$-x^3 - 1 = 0$

zero changes = 0 negative

8. $x^3 + 3x^2 - x - 3 = 0$

Original 1 change = 1 positive

Change odds:

$-x^3 + 3x^2 + x - 3 = 0$

2 changes = 2 or 0 negatives

9. $x^3 - 2x^2 - 3x + 6 = 0$

Original 2 changes = 2 or 0 positive

Change odds:

$-x^3 - 2x^2 + 3x + 6 = 0$

1 change = 1 negative

10. $x^6 - 2x^4 - 4x^2 + 8 = 0$

Original 2 changes = 2 or 0 pos.

Change odds:

$x^6 - 2x^4 - 4x^2 + 8 = 0$

2 changes = 2 or 0 negatives

11. $x^5 + 2x^4 + 11x^3 + 22x^2 + 24x + 48 = 0$

Original zero changes = 0 pos.

Change odds:

$-x^5 + 2x^4 - 11x^3 + 22x^2 - 24x + 48 = 0$

5 changes = 5, 3, or 1 negatives

12. $x^6 + 5x^4 - 4x^2 - 20 = 0$

Original 1 change = 1 positive

Change odds:

$x^6 + 5x^4 - 4x^2 - 20 = 0$

1 change = 1 negative

13. $x^6 - x^4 - x^2 + 1 = 0$

Original 2 changes = 2 or 0 pos

Change odds:

$x^6 - x^4 - x^2 + 1 = 0$

2 changes = 2 or 0 negative

14. $x^8 - 26x^4 + 25 = 0$

Original 2 changes = 2 or 0 pos.

Change odd

$x^8 - 26x^4 + 25 = 0$

2 changes = 2 or 0 negative

15. $x^3 - 9x^2 + 33x - 25 = 0$

Original 3 changes = 3 or 1 pos.

Change odds

$-x^3 - 9x^2 - 33x - 25 = 0$

zero changes = 0 negatives

16. $x^3 + 2x^2 - 9x - 4 = 0$

Original 1 change = 1 positive

Change odds:

$-x^3 + 2x^2 + 9x - 4 = 0$

2 changes = 2 or 0 negatives

17. $x^4 + 2x^3 - 7x^2 - 6x + 12 = 0$

Original 2 changes = 2 or 0 pos

Change odds:

$x^4 - 2x^3 - 7x^2 + 6x + 12 = 0$

2 changes = 2 or 0 negatives

18. $x^4 - 2x^3 - 6x^2 - 4x - 16 = 0$

Original 1 change = 1 positive

Change odds:

$x^4 + 2x^3 - 6x^2 + 4x - 16 = 0$

3 changes = 3 or 1 negatives

19. $x^4 - x^3 - 5x^2 - 103x + 300 = 0$

Original 2 changes = 2 or 0 pos

Change Odds:

$x^4 + x^3 - 5x^2 + 103x + 300 = 0$

2 changes = 2 or 0 negatives

20. $x^4 + 2x^3 + 2x - 1 = 0$

Original 1 change = 1 positive

Change odds:

$x^4 - 2x^3 - 2x - 1 = 0$

1 change = 1 negative