AP Precalc

Write your questions and thoughts here!

1.4 Polynomial Functions and Rates of Change

1.4 Notes

Polynomial

"Poly" means many, or much. A nonconstant polynomial is a function with many terms in the following form:

$$p(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \cdots + a_2 x^2 + a_1 x + a_0$$

where n is a positive integer and a_i is a real number for each i from 1 to n.

Quick example: $p(x) =$

The leading term is _____ | The polynomial has degree ____ | The leading coefficient is _____

1. Example from above.
   What is the degree of the polynomial? What is the leading coefficient?

Sometimes, the polynomial will **not** be written in standard form. You have to look at the variables LARGEST exponent to find the leading term.

2. $f(x) = 14x^2 + 6x - 2x^6 + 1$
   What is the degree of the polynomial? What is the leading coefficient?

Local (Relative) Extrema (maxima and minima)

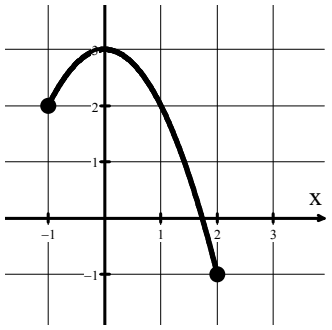
If a polynomial switches from increasing to decreasing, there will be

a _____, or _____, _____ output value.

If a polynomial switches from decreasing to increasing, there will be

a _____, or _____, _____ output value.

An **included endpoint** of a polynomial with a restricted domain may also have a local, or relative, extrema.



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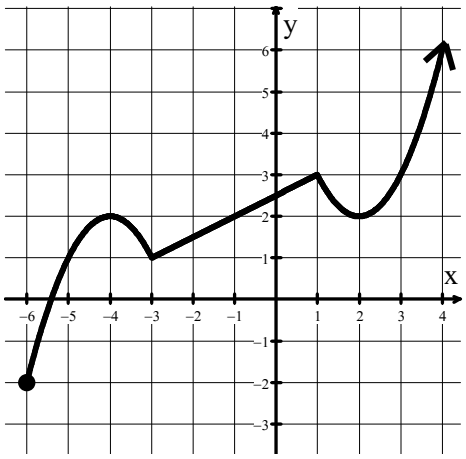
Global (Absolute) Extrema (maxima and minima)

Of all local maxima, the greatest is called the **global, or absolute**, maximum.

Of all local minima, the least is called the **global, or absolute**, minimum.

Find the extrema and where they occur. If there are none, cross it off and write NONE.



3. Absolute **min** of _____ when $x =$

4. Absolute **max** of _____ when $x =$

5. Relative **min**(s) at $x =$

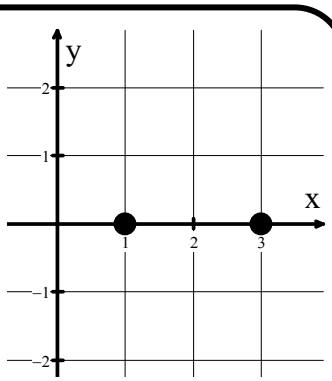
6. Relative **max**(es) at $x =$

Two Zeros = at least one extremum

If you have _____ of a polynomial (nonconstant polynomial),

then there must be at least _____ local extremum between the two

zeros.



7. Let f be a polynomial function with values $f(-2) = 0, f(0) = 5, f(4) = 0$, and $f(7) = -1$. Are there any guaranteed extrema? If so, state where they occur.

Even Degree = Absolute Extrema

If the polynomial has an even degree, there is either an absolute maximum or an absolute minimum.

Positive leading coefficient means you will have an absolute _____

Negative leading coefficient means you will have an absolute _____

Write your questions and thoughts here!

8. Is there an absolute maximum or minimum for each function?

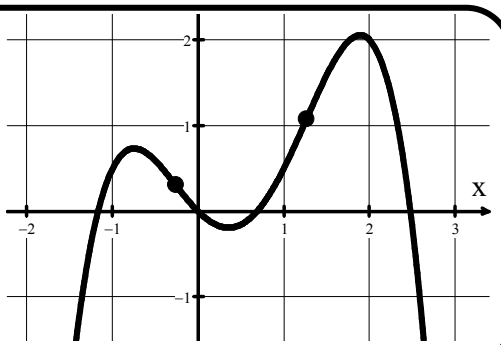
a. $f(x) = 3x^4 - 2x^3 - 5$

b. $f(x) = -x^6 + x^2 - x + 5$

c. $f(x) = 6x^3 + x^2 - 2$

Point of Inflection

A point of inflection occurs at input values where the rate of change changes from increasing to decreasing (or vice versa). This occurs when the graph is changing from concave up to concave down (or vice versa).



1.4 Polynomial Functions and Rates of Change

AP Precalculus

1.4 Practice

Find the leading coefficient and the degree of each polynomial.

1. $f(x) = 8x^4 - 4x^3 + 6x^2 + 10$

   L.C. _____ Degree: _____

2. $f(x) = 8x^2 - 3x$

   L.C. _____ Degree: _____

3. $f(x) = -5x^7 + 6x^4 - x$

   L.C. _____ Degree: _____

4. $f(x) = 3x^4 + 10x^5 - 8x^3 + 1$

   L.C. _____ Degree: _____

5. $f(x) = 5x^3 - 9x^2 + x^7 - 3x^8$

   L.C. _____ Degree: _____

6. $f(x) = 9x^6 - 2x^7$

   L.C. _____ Degree: _____

Let $f(x)$ be a polynomial function with the given values. Are there any guaranteed extrema? If so, state where they occur.

7. $f(-1) = 0, f(0) = 6,$ and $f(6) = 0.$

8. $f(0) = 6, f(3) = 2, f(6) = 0,$ and $f(10) = 0.$

9. $f(-5) = 0, f(0) = 5,$ and $f(5) = 7.$

Is there a global maximum or minimum for each function?

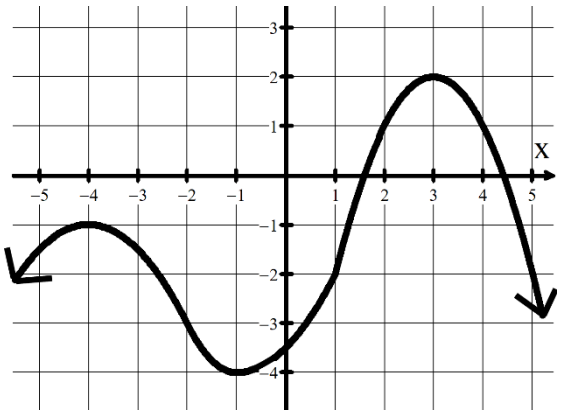
10. $f(x) = 2x^8 - x^3 + x^2 + 6$

11. $f(x) = -3x^4 + 5x - 1$

12. $f(x) = 6x^7 + 3x^4 - 4x + 2$

13. $f(x) = -4x^6 - 10x^2 - 7$

Find the following extrema. If there are none, cross it off and write NONE.

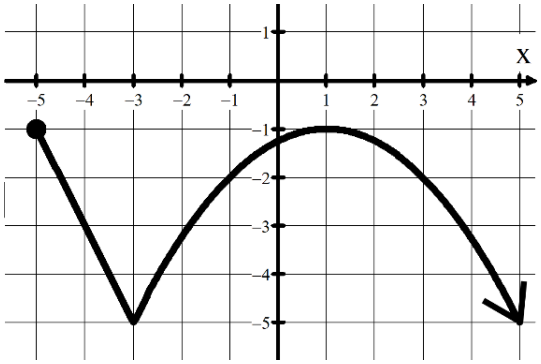


14. Absolute **min** of _____ when $x =$

15. Absolute **max** of _____ when $x =$

16. Relative **min**(s) at $x =$

17. Relative **max**(es) at $x =$

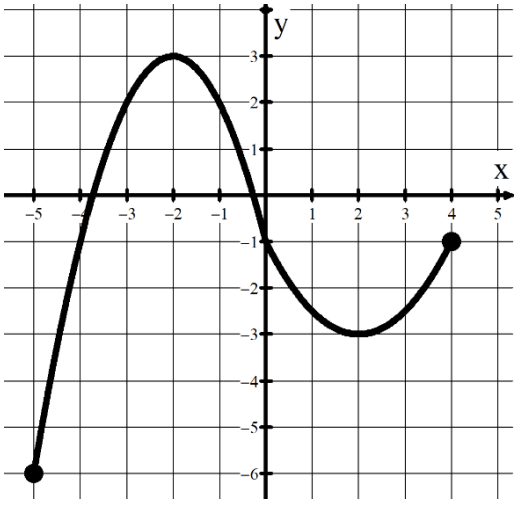


18. Absolute **min** of _____ when $x =$

19. Absolute **max** of _____ when $x =$

20. Relative **min**(s) at $x =$

21. Relative **max**(es) at $x =$



22. Absolute **min** of _____ when $x =$

23. Absolute **max** of _____ when $x =$

24. Relative **min**(s) at $x =$

25. Relative **max**(es) at $x =$

1.4 Test Prep

26. For each of the following polynomials, determine if there is an absolute minimum, absolute maximum, or neither.

a. $f(x) = 3x(x-5)(x+2)^2$

b. $g(x) = -4(x^3+1)(x-3)^2$

c. $h(x) = (x^2-6x+3)(2-x^4)$

27. **Calculator active.** For $1 \leq t \leq 4$, the number of people waiting in line to ride a new rollercoaster at time t hours can be modeled by the function $L(t) = -0.56t^5 + 2.31t^4 - 0.264t^3 + 1$. Based on this model, at what time t does the number of people waiting in line change from increasing to decreasing?