2/16/2021

Lesson 4.1/4.8

Graphing Polynomial Functions and End Behavior

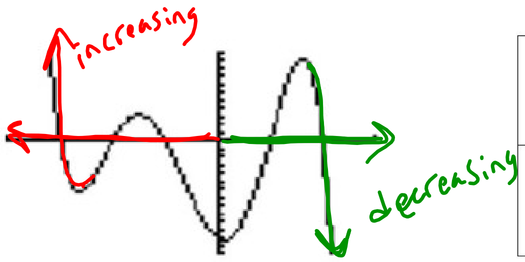
snowman homework

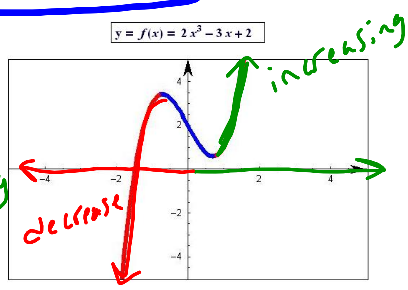
Make table and graph

End behavior | What happens towards the ends of the function

As x approaches ∞, where are the y values headed?

$$\boxed{\begin{array}{l} \text{As } x \to \infty \quad y \to \ ? \\ \text{As } x \to -\infty \quad y \to \ ? \end{array}}$$





As $x \to \infty$, $y \to -\infty$
As $x \to -\infty$, $y \to \infty$

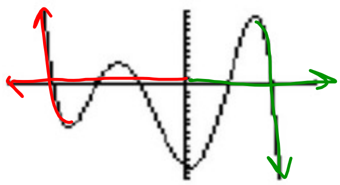
As $x \to +\infty$, $y \to \infty$
As $x \to -\infty$, $y \to -\infty$

Another way to write it...

The y values are going where, as x approaches ∞?

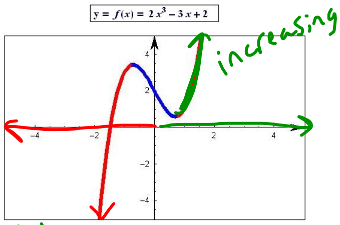
$f(x) \longrightarrow ?$ As $x \longrightarrow \infty$

$f(x) \longrightarrow ?$ As $x \longrightarrow -\infty$



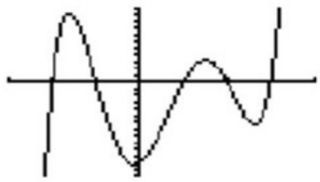
$f(x) \to -\infty$ As $x \to \infty$

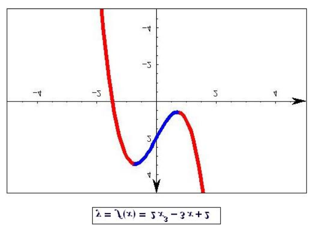
$f(x) \to \infty$ As $x \to -\infty$



$f(x) \to \infty$ As $x \to \infty$

$f(x) \to -\infty$ As $x \to -\infty$





Degree of a function: determines solutions and end behavior

End behavior

x^2 x^4 x^6 Even degree both ends are the same

x^1 x^3 x^5 Odd Degree opposite

Lead Coefficient of a function: determines right side of end behavior

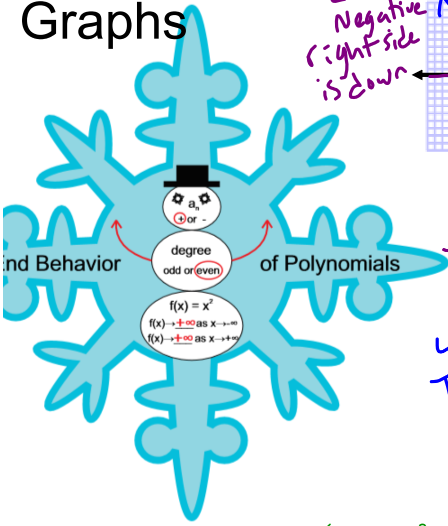
Positive - right side up $3x^2$ $3x^3$

Negative - right side down $-3x^2$ $-3x^3$

$y = 3x^2$

$a = 3$

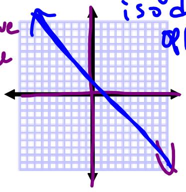
Sketching Graphs



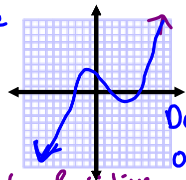
$-40x^1 + 2$

L.C. Negative right side is down

Degree is odd: opposite



$0.3x^3 - 2$



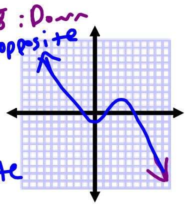
L.C. Positive right side is up

Degree 3 odd: opposite

$-8x^3 + 7x^2 + 3x + 7$

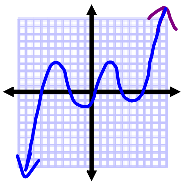
L.C -8 : Down

D: 3: opposite



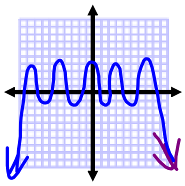
$3x^5 - 2x^2 + 40x^4 - x + 100$

4 Turns



$-4x^{10} + x + 2$

9 Turns

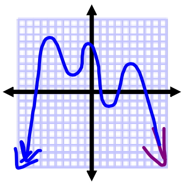


$3x - 2x^6 + 40x^3 - 1 + 100x$

Put in Standard Form

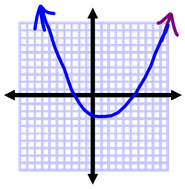
$-2x^6 + 40x^3 + 103x - 1$

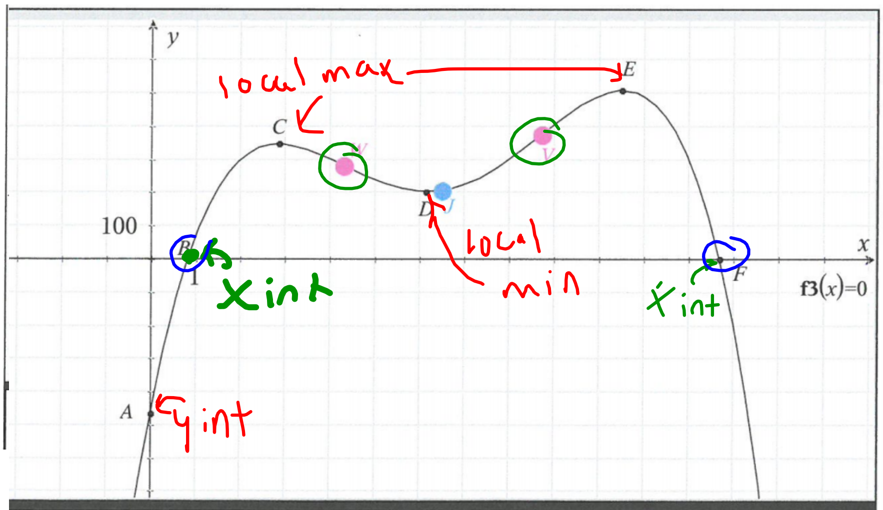
turns is one less than the degree



$4x^2 - 3x^t$

1 Turn

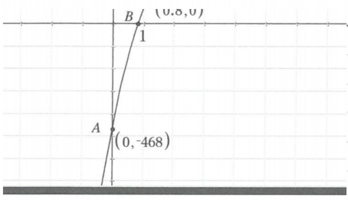




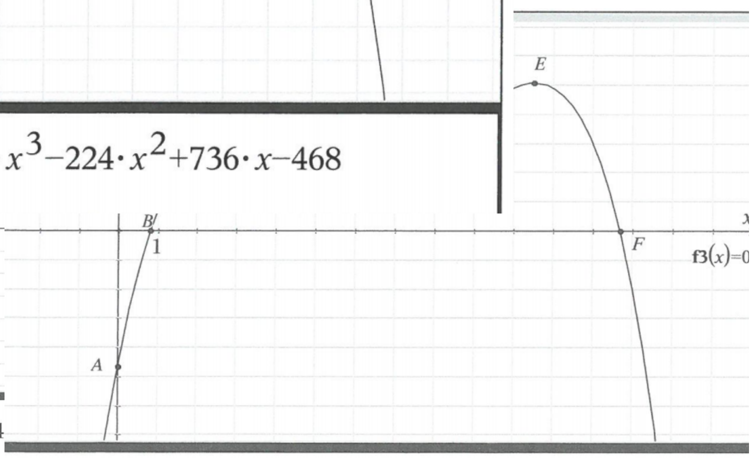
2 Real

2 Imag

Graph 4 $f(x) = -x^4 + 26 \cdot x^3 - 224 \cdot x^2 + 736 \cdot x - 468$



Graph 7 $f(x) = -x^4 + 26 \cdot x^3 - 224$



Graph 8 $f(x) = -x^4 + 26 \cdot x^3 - 224 \cdot x^2 + 736 \cdot x - 468$

Interval Notation

( ) for when the boundaries are NOT included $<$

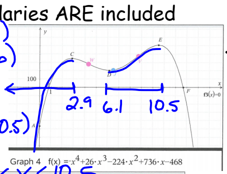
[ ] for when the boundaries ARE included $\leq$

$\cup$ OR (Both)

$\cap$ And (only overlap)

Increasing

From left to right, y values increase

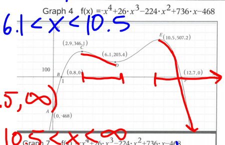


Set: $x \in (-\infty, 2.9) \cup (6.1, 10.5)$ element

Inequality: $-\infty < x < 2.9 \cup 6.1 < x < 10.5$

Decreasing

From left to right, y values decrease



$x \in (2.9, 6.1) \cup (10.5, \infty)$

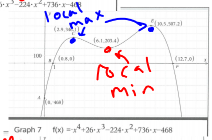
$2.9 < x < 6.1$ OR $10.5 < x < \infty$

Local Extreme

High points - local Maximums

Low points - local Minimums

where direction changes happen



Absolute Extreme

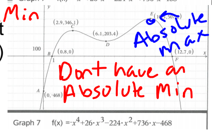
Absolute max Absolute Min

The highest or lowest point (most extreme max or min)

it is possible to have only one

to have none

to have both by limiting the interval



Max # of Direction changes

The amount is one less than the degree

Concavity

Interval: (W, V)

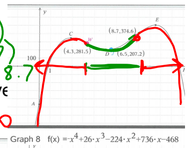
Concave Up: cave is up $(4.3, 8.7)$

$4.3 < x < 8.7$

Concave down: cave is flipped over

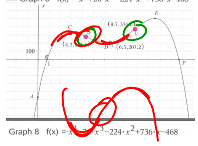
$(-\infty, W) \cup (V, \infty)$

$-\infty < x < 4.3$ or $8.7 < x < \infty$

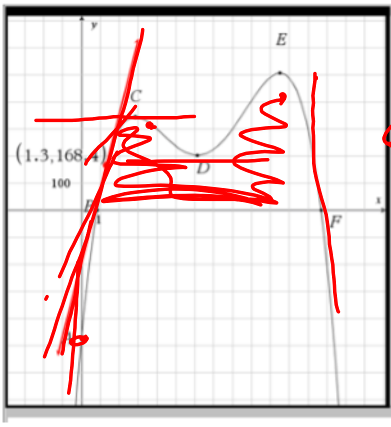


Points of Inflection

Causes Concavity to Switch



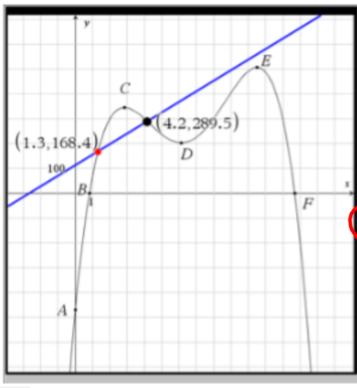
$\cup$ OR $\cap$ AND



What type of line is present?

tangent line

secant line



What type of line is present?

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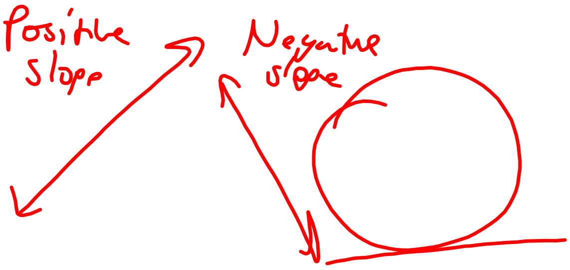
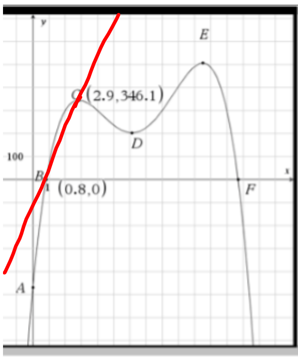


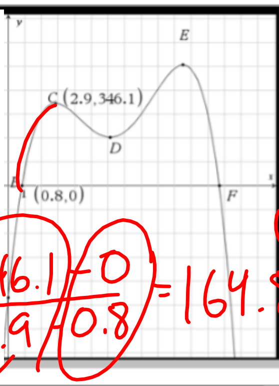
$$m = \frac{rise}{run} = \frac{Y_1 - Y_2}{X_1 - X_2}$$



Determine the slope between Point B and Point C

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{346.1 - 0}{2.9 - 0.8} = 164.8$$

$$\frac{y_1 - y_2}{x_1 - x_2}$$

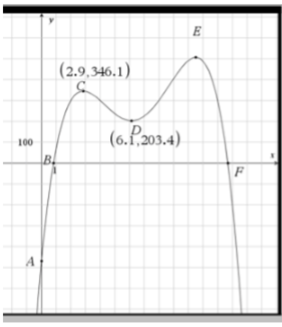


What best describes the behavior of y from Point B and Point C?

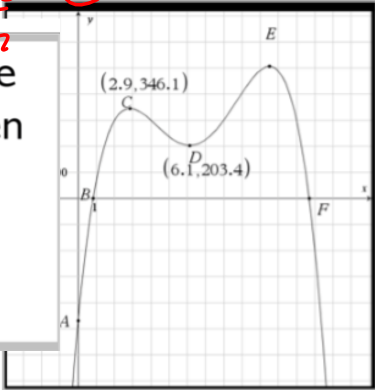
y is increasing as x increases

y is decreasing as x increases

y stays the same as x increases



Determine the slope between Point C and Point D



What best describes the behavior of y from Point C and Point D?

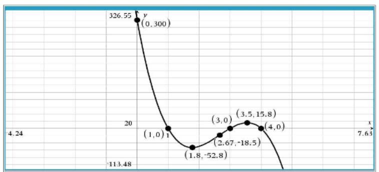
y is increasing as x increases

y is decreasing as x increases

y stays the same as x increases

)

Name____KEY____Polynomials and their graphs basics 1 2-23-24



$f(x) = -25 \cdot x^3 + 200 \cdot x^2 - 475 \cdot x + 300$

1. State the intercepts of this cubic function
   x int: (1,0) , (3,0) , (4,0)
   y int: (0, 300)
2. State the point of inflection of this cubic function
   (2.67, -18.5)
3. State the local extremes
   Local Max: (3.5, 15.8)
   Local Min: (1.8, -52.8)
4. Use intervals of x to describe when this cubic function's y coordinates are INCREASING

Use inequalities	Use bracket notation
1.8 < x < 3.5	x E (1.8, 3.5)

5. Use intervals of x to describe when this cubic function's y coordinates are DECREASING

Use inequalities	Use bracket notation
- inf < x < 1.8 OR 3.5 < x < inf	x E (-inf, 1.8) U (3.5, inf)

6. Use intervals of x to describe when this cubic function's is concave UP

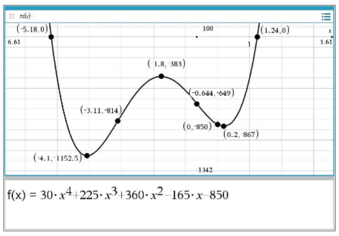
Use inequalities	Use bracket notation
-inf < x < 2.67	x E (- inf, 2.67)

7. Use intervals of x to describe when this cubic function's is concave DOWN

Use inequalities	Use bracket notation
2.67 < x < inf	x E (2.67, inf)

8. Use intervals of x to describe when this cubic function's y coordinates are positive

Use inequalities	Use bracket notation
-inf < x < 1 OR 3 < x < 4	x E (-inf, 1) U (3,4)



9. State the intercepts of this quartic function

x int: (-5.18, 0) , (1.24, 0)

y int: (0, -850)

10. State the points of inflection of this quartic function

(-3.11, -814) , (-0.644, -649)

11. State the local extremes points

Local Max: (-1.8, -383)

Local Min: (-4.1, -1152.5) , (0.2, -867)

12. State the absolute extreme point

Absolute Min: (-4.1, -1152.5)

13. Use intervals of x to describe when this quartic function's y coordinates are INCREASING

Use inequalities	Use bracket notation
-4.1< x < -1.8 OR 0.2 < x < inf	x E (-4.1, -1.8) U (0.2, inf)

14. Use intervals of x to describe when this quartic function's y coordinates are DECREASING

Use inequalities	Use bracket notation
-inf < x < -4.1 OR -1.8 < x < 0.2	x E (-inf, -4.1) U (-1.8, 0.2)

15. Use intervals of x to describe when this quartic function's is concave UP

Use inequalities	Use bracket notation
-inf < x < -3.11 OR -0.644 < x < inf	x E (-inf, -3.11) U (-0.644, inf)

16. Use intervals of x to describe when this quartic function's is concave DOWN

Use inequalities	Use bracket notation
-3.11 < x < -0.644	x E (- 3.11, -0.644)

17. Use intervals of x to describe when this quartic function's y coordinates are positive

Use inequalities	Use bracket notation
-inf < x < -5.18 OR 1.24 < x < inf	x E (-inf, -5.18) , (1.24, inf)