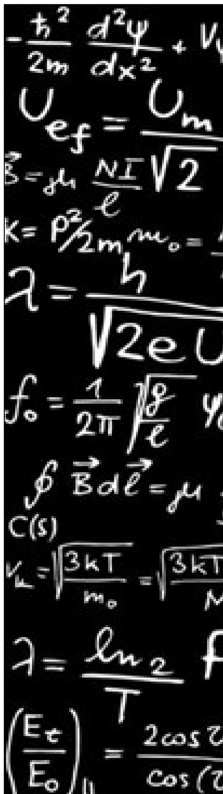


Unit 4 / Day 5

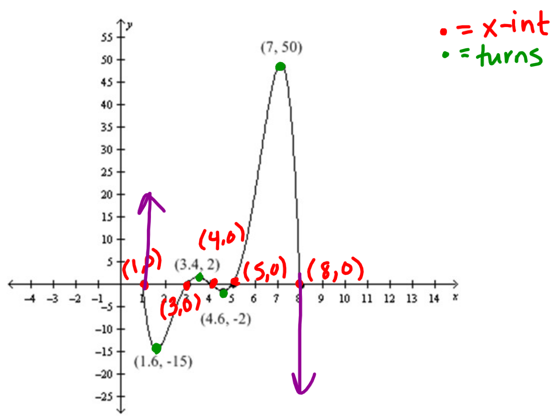
Graphs of Polynomial Functions

Objective:

Students will describe key characteristics of polynomial functions including maximum and minimum values, intervals and end behavior.

Unit 4 / Day 5

Maple Point is designing a new roller coaster that will be partially above ground and partially underground. The following is a graph of the proposed design.



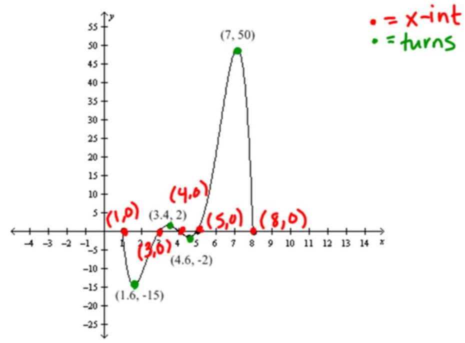
a. What is the domain of this graph? 1 ← 8 →

$\{x = \mathbb{R},\ 1 \le x \le 8\}$

-15 ↓ 50 ↑

b. What is the range of this graph?

$\{y = \mathbb{R},\ -15 \le y \le 50\}$



x's **c.** When is the roller coaster above ground?
$3<x<4$ $5<x<8$

x's **d.** When is the roller coaster underground?
$1<x<3$ $4<x<5$

x's **e.** When is the roller coaster going uphill?
$1.6<x<3.4$ $4.6<x<7$

x's **f.** When is the roller coaster going downhill?
$1<x<1.6$ $3.4<x<4.6$ $7<x<8$

g. How high does the roller coaster go? (y)
50 ft

h. How low does the roller coaster go? (y)
-15 ft

VOCABULARY:

Real Roots / Zeros / Real Solutions

x-intercepts (if x is a real number) $(x=\#)$
the value of x when $y = 0$
where the polynomial graph crosses the x-axis

Extreme Maximum / Minimum Values

also called "extrema"; the overall largest or smallest y-value on a polynomial graph

y-values $(y=\#)$

Relative Maximum / Minimum Values

the largest or smallest y-value on a polynomial graph within an interval; it's where the graph turns

uphill downhill
Increasing / Decreasing Intervals

as the x-values increase...
an interval is increasing if the y-values are also increasing;
an interval is decreasing if the y-values are decreasing

above ground below ground
Positive / Negative Intervals

an interval is positive if the y-values are positive
(the graph is above the x-axis)

an interval is negative if the y-values are negative
(the graph is below the x-axis)

End Behavior

describes the far right (and far left) ends of the graph

RA: ↑ or ↓
LA: ↑ or ↓

$\uparrow = +\infty$
$\downarrow = -\infty$

$\underbrace{\text{As } x \to \infty, y \to}_{\text{right arm}}$ ___

$\uparrow = +\infty$
$\downarrow = -\infty$

$\underbrace{\text{As } x \to -\infty, y \to}_{\text{left}}$ ___

Vocabulary

Identify the following information for the polynomial:

$$y = \frac{1}{2}x^4 - 2x^3 + 6x - 4$$

Real Roots:
$x = -1.71$ $x = 2$
$x = .81$ $x = 2.9$

End Behavior:
As $x \to \infty, y \to +\infty$
As $x \to -\infty, y \to +\infty$

Extreme Maximum: y=
none

Extreme Minimum:
$y = -7.62$

Relative Maximum: y=
$y = .84$

Relative Minimum:
$y = -7.62$
$y = -.72$

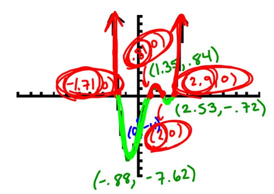
uphill
Increasing Intervals: x's
$-.88 < x < 1.35$
$x > 2.53$

downhill
Decreasing Intervals: <=left
$x < -.88$
$1.35 < x < 2.53$

above ground
Positive Intervals: x's
$x < -1.71$
$.81 < x < 2$
$x > 2.9$

below ground
Negative Intervals:
$-1.71 < x < .81$
$2 < x < 2.9$

Sketch:



y-intercept:
$(0, -4)$
2^{nd}, calc, value, x = 0

Identify the following information for the polynomial:

$$y = x^5 + 6x^4 - 6x^3 - 36x^2 + 5x + 30$$

Real Roots:
$x = -6$ $x = -1$ $x = 2.24$
$x = -2.24$ $x = 1$

End Behavior:
As $x \to \infty, y \to \infty$
As $x \to -\infty, y \to -\infty$

Extreme Maximum:
none

Extreme Minimum:
none

Relative Maximum:
$y = 481.39$
$y = 30.17$

Relative Minimum:
$y = -17.15$
$y = -30.97$

Increasing Intervals:
$x < -4.93$
$-1.69 < x < .07$
$x > 1.75$

Decreasing Intervals:
$-4.93 < x < -1.69$
$.07 < x < 1.75$

Positive Intervals:
$-6 < x < -2.24$
$-1 < x < 1$
$x > 2.24$

Negative Intervals:
$x < -6$
$-2.24 < x < -1$
$1 < x < 2.24$

Sketch: