

Before we begin, are there any questions from last day's work?

Review solutions to 2.1.1-2.1.3.

Today's Learning Goal(s):

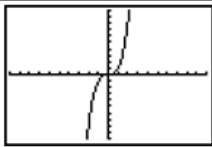
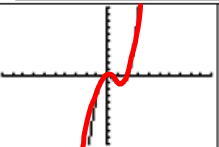
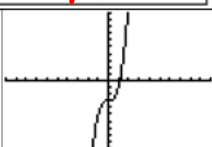
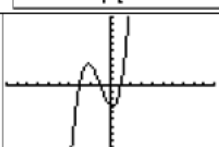
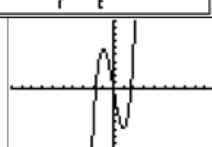

By the end of the class, I will be able to:

- a) describe end behaviours and the impact of the leading coefficient (positive and negative values) for cubic and quartic functions.

2.2.2: Investigation - Cubic and Quartic Functions Part 1

Date: _____

1. Look at each equation and state the value of the leading coefficient. Fill in the information in the column specified below. The first one is done for you.
2. Graph each of the following functions on a graphing calculator and sketch a copy of what you see on the given grids. Use the sketch to fill in the other columns in the table. Again, the first one is done for you.

Equation	Leading coefficient	Graph	Number of x-intercepts	End behaviour
$y = x^3$	1		1	As $x \rightarrow \infty, y \rightarrow \infty$ and as $x \rightarrow -\infty, y \rightarrow -\infty$
$y = x^3 - 2x^2$	+1		2	As $x \rightarrow \infty, y \rightarrow \infty$ As $x \rightarrow -\infty, y \rightarrow -\infty$
$y = 2x^3 - 3$	+2		1	As $x \rightarrow \infty, y \rightarrow \infty$ As $x \rightarrow -\infty, y \rightarrow -\infty$
$y = x^3 + 3x^2 - x - 3$	+1		3	As $x \rightarrow \infty, y \rightarrow \infty$ As $x \rightarrow -\infty, y \rightarrow -\infty$
$y = 3x^3 - 9x$	+3		3	As $x \rightarrow \infty, y \rightarrow \infty$ As $x \rightarrow -\infty, y \rightarrow -\infty$
$y = 3x^3 + x$	+3		1	As $x \rightarrow \infty, y \rightarrow \infty$ As $x \rightarrow -\infty, y \rightarrow -\infty$

As $x \rightarrow \infty, y \rightarrow \infty$

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

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

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

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

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

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

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

2.2.2: Investigation - Cubic and Quartic Functions Part 1 (continued)

Refer to the chart that you just completed on the previous page to answer questions 3–7.

3. What is true about the leading coefficient of all of the polynomials?

It's positive

4. What is true about the degree of all of the polynomials?

all degree 3 (cubic)

5. What is true about the end behaviour of all of the polynomials?

all the same $x \rightarrow \infty, y \rightarrow \infty$
 $x \rightarrow -\infty, y \rightarrow -\infty$

6. What is the maximum number of x -intercepts for all of the polynomials?

3

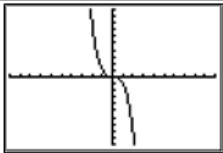
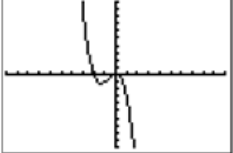
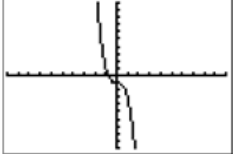
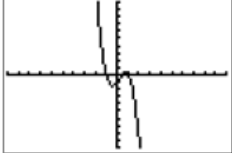
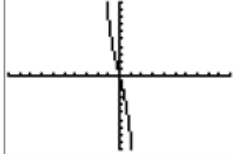
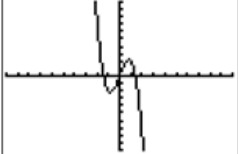
7. Do the graphs of the relations represent functions? Explain.

Yes, all pass VLT (vertical line test)

2.2.2: Investigation - Cubic and Quartic Functions Part 2

Date: _____

- Look at each equation and state the value of the leading coefficient. Fill in the information in the column specified below. The first one is done for you.
- Graph each of the following functions on a graphing calculator and sketch a copy of what you see on the given grids. Use the sketch to fill in the other columns in the table. Again, the first one is done for you.

Equation	Leading coefficient	Graph	Number of x-intercepts	End behaviour
$y = -x^3$	-1		1	As $x \rightarrow \infty$, $y \rightarrow -\infty$ and as $x \rightarrow -\infty$, $y \rightarrow \infty$
$y = -x^3 - 2x^2$	-1		2	As $x \rightarrow \infty$, $y \rightarrow -\infty$ As $x \rightarrow -\infty$, $y \rightarrow \infty$
$y = -2x^3 - 1$	-2		1	As $x \rightarrow \infty$, $y \rightarrow -\infty$ As $x \rightarrow -\infty$, $y \rightarrow \infty$
$y = -2x^3 + x^2 + 2x - 1$	-2		3	As $x \rightarrow \infty$, $y \rightarrow -\infty$ As $x \rightarrow -\infty$, $y \rightarrow \infty$
$y = -2x^3 - 6x$	-2		1	As $x \rightarrow \infty$, $y \rightarrow -\infty$ As $x \rightarrow -\infty$, $y \rightarrow \infty$
$y = -2x^3 + 4x$	-2		3	As $x \rightarrow \infty$, $y \rightarrow -\infty$ As $x \rightarrow -\infty$, $y \rightarrow \infty$

2.2.2: Investigation - Cubic and Quartic Functions Part 2 (continued)

Refer to the chart that you just completed on the previous page to answer questions 3 - 8.

3. What is true about the leading coefficient of all of the polynomials?

all negative

4. What is true about the degree of all of the polynomials?

all cubic

5. What is true about the end behaviour of all of the polynomials?

all the same : $x \rightarrow \infty, y \rightarrow -\infty$
 $x \rightarrow -\infty, y \rightarrow \infty$

6. What is the maximum number of x-intercepts for all of the polynomials?

3

7. Do the graphs of the relations represent functions? Explain.

Yes: pass VLT

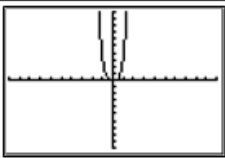
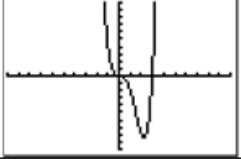
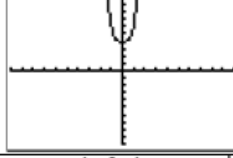
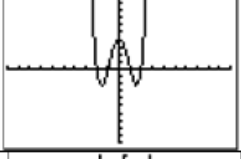
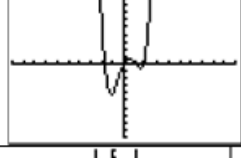
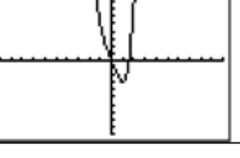
8. What impact do the signs of the leading coefficients seem to have on the graphs from the first chart and the second chart?

by changing the sign of the lead coefficient,
the end behaviours change to the opposite direction.

2.2.2: Investigation - Cubic and Quartic Functions Part 3

Date: _____

1. Look at each equation and state the value of the leading coefficient. Fill in the information in the column specified below. The first one is done for you.
2. Graph each of the following functions on a graphing calculator and sketch a copy of what you see on the given grids. Use the sketch to fill in the other columns in the table. Again, the first one is done for you.

Equation	Leading coefficient	Graph	Number of x-intercepts	End behaviour
$y = 3x^4$	3		1	As $x \rightarrow \infty, y \rightarrow \infty$ and as $x \rightarrow -\infty, y \rightarrow \infty$
$y = x^4 - 3x^3$	+1		2	As $x \rightarrow \infty, y \rightarrow \infty$ As $x \rightarrow -\infty, y \rightarrow \infty$
$y = 2x^4 + 4$	+2		0	As $x \rightarrow \infty, y \rightarrow \infty$ As $x \rightarrow -\infty, y \rightarrow \infty$
$y = x^4 - 5x^2 + 4$	+1		4	As $x \rightarrow \infty, y \rightarrow \infty$ As $x \rightarrow -\infty, y \rightarrow \infty$
$y = x^4 - x^3 - 3x^2 + 3x$	+1		4	As $x \rightarrow \infty, y \rightarrow \infty$ As $x \rightarrow -\infty, y \rightarrow \infty$
$y = x^4 - 4x$	+1		2	As $x \rightarrow \infty, y \rightarrow \infty$ As $x \rightarrow -\infty, y \rightarrow \infty$

2.2.2: Investigation - Cubic and Quartic Functions Part 3 (continued)

Refer to the chart that you just completed on the previous page to answer questions 3 – 7.

3. What is true about the leading coefficient of all of the polynomials?

all positive

4. What is true about the degree of all of the polynomials?

all degree 4 (quartic)

5. What is true about the end behaviour of all of the polynomials?

all the same: $x \rightarrow \infty, y \rightarrow \infty$
 $x \rightarrow -\infty, y \rightarrow \infty$

6. What is the maximum number of x -intercepts for all of the polynomials?

4

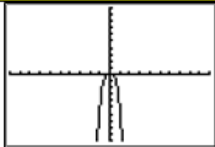

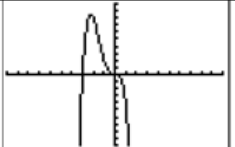


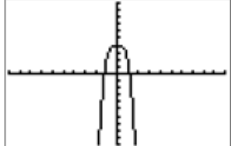


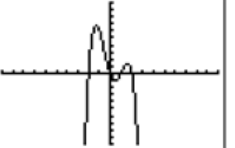


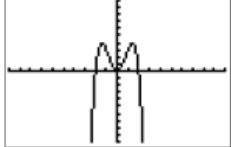


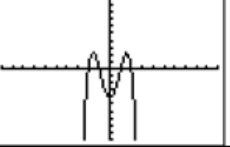

7. Do the graphs of the relations represent functions? Explain.

Yes, pass VLT.

2.2.2: Investigation - Cubic and Quartic Functions Part 4

Date: _____

1. Look at each equation and state the value of the leading coefficient. Fill in the information in the column specified below. The first one is done for you.
2. Graph each of the following functions on a graphing calculator and sketch a copy of what you see on the given grids. Use the sketch to fill in the other columns in the table. Again, the first one is done for you.

Equation	Leading coefficient	Graph	Number of x-intercepts	End behaviour
$y = -5x^4$	-5		1	As $x \rightarrow \infty, y \rightarrow -\infty$ and as $x \rightarrow -\infty, y \rightarrow -\infty$
$y = -x^4 - 3x^3$	 -1		2	As $x \rightarrow \infty, y \rightarrow -\infty$ As $x \rightarrow -\infty, y \rightarrow -\infty$ 
$y = -2x^4 + 4$	 -2		2	As $x \rightarrow \infty, y \rightarrow -\infty$ As $x \rightarrow -\infty, y \rightarrow -\infty$ 
$y = -x^4 + x^3 + 4x^2 - 4x$	 -1		4	As $x \rightarrow \infty, y \rightarrow -\infty$ As $x \rightarrow -\infty, y \rightarrow -\infty$ 
$y = -x^4 + 4x^2$	 -1		3	As $x \rightarrow \infty, y \rightarrow -\infty$ As $x \rightarrow -\infty, y \rightarrow -\infty$ 
$y = -x^4 + 5x^2 - 4$	 -1		4	As $x \rightarrow \infty, y \rightarrow -\infty$ As $x \rightarrow -\infty, y \rightarrow -\infty$ 

2.2.2: Investigation - Cubic and Quartic Functions Part 4 (continued)

Refer to the chart that you just completed on the previous page to answer questions 3 – 9.

3. What is true about the degree of all of the polynomials?

all degree 4

4. What is true about the leading coefficient of all of the polynomials?

all negative

5. What is true about the end behaviour of all of the polynomials?

all same : $x \rightarrow \infty, y \rightarrow -\infty$
 $x \rightarrow -\infty, y \rightarrow -\infty$

6. What is the maximum number of x-intercepts for all of the polynomials?

4

7. Do the graphs of the relations represent functions? Explain.

Yes, Pass VLT.

8. What impact do the signs of the leading coefficients seem to have on the graphs in the third and fourth chart?

by changing the sign of the lead coefficient,
the end behaviours change to the opposite.

9. In general, what is the relationship between the degree of a polynomial and the maximum number of x-intercepts for the polynomial?

the max. number of x-intercepts = degree of the
polynomial
function.