<table>
<thead>
<tr>
<th>Term of Highest Degree</th>
<th>Function</th>
<th>Graph of f(x)</th>
<th>Roots, Multiplicity and Type of Behavior</th>
<th>End Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ax^n$</td>
<td></td>
<td></td>
<td></td>
<td>$x \to -\infty$ Up</td>
</tr>
<tr>
<td>$x^3$</td>
<td>$f(x) = (x+2)^3(x-1)^3$</td>
<td><img src="image" alt="Graph of f(x) 1" /></td>
<td>x = -2 Bounce</td>
<td>Up</td>
</tr>
<tr>
<td>$x^3$</td>
<td>$f(x) = (x+2)^3(x-1)^3$</td>
<td><img src="image" alt="Graph of f(x) 2" /></td>
<td>x = 2 Bounce</td>
<td>Up</td>
</tr>
<tr>
<td>$x^3$</td>
<td>$f(x) = (x+2)^3(x-1)^3$</td>
<td><img src="image" alt="Graph of f(x) 3" /></td>
<td>$x \to -\infty$ Up</td>
<td></td>
</tr>
<tr>
<td>$x^3$</td>
<td>$f(x) = -2(x-1)^3$</td>
<td><img src="image" alt="Graph of f(x) 4" /></td>
<td>$x \to -\infty$ Up</td>
<td></td>
</tr>
<tr>
<td>$x^3$</td>
<td>$f(x) = 2(x+2)^3(x-1)^3$</td>
<td><img src="image" alt="Graph of f(x) 5" /></td>
<td>$x \to -\infty$ Up</td>
<td></td>
</tr>
</tbody>
</table>

**Polynot Algebra WS**

PAP Algebra 2

Sketch the graph on the chart. (Do not worry about scale.) Fill in the remaining columns of the chart based on your graph.
PAP Algebra 2 Ch. 4 Review

1. Complete the charts below.

### Quadratics

<table>
<thead>
<tr>
<th>Odd or Even Symmetry</th>
<th>EVEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>End behaviors</td>
<td>↑↑ or ↓↓</td>
</tr>
<tr>
<td># of roots</td>
<td>0, 1, 2</td>
</tr>
<tr>
<td>Possible # of extrema</td>
<td>1</td>
</tr>
<tr>
<td>Absolute maximum or minimum</td>
<td>Possible</td>
</tr>
<tr>
<td>domain</td>
<td>IR</td>
</tr>
<tr>
<td>range</td>
<td>depends on max or min</td>
</tr>
</tbody>
</table>

### Cubics

<table>
<thead>
<tr>
<th>Odd or Even Symmetry</th>
<th>odd</th>
</tr>
</thead>
<tbody>
<tr>
<td>End behaviors</td>
<td>↓↑ or ↑↓</td>
</tr>
<tr>
<td># of roots</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Possible # of extrema</td>
<td>2, 0</td>
</tr>
<tr>
<td>Absolute maximum or minimum</td>
<td>NO</td>
</tr>
<tr>
<td>domain</td>
<td>IR</td>
</tr>
<tr>
<td>range</td>
<td>TR</td>
</tr>
</tbody>
</table>

### Quartics

<table>
<thead>
<tr>
<th>Odd or Even Symmetry</th>
<th>even</th>
</tr>
</thead>
<tbody>
<tr>
<td>End behaviors</td>
<td>↑↑ or ↓↓</td>
</tr>
<tr>
<td># of roots</td>
<td>0, 1, 2, 3, 4</td>
</tr>
<tr>
<td>Possible # of extrema</td>
<td>3, 1</td>
</tr>
<tr>
<td>Absolute maximum or minimum</td>
<td>Possible</td>
</tr>
<tr>
<td>domain</td>
<td>IR</td>
</tr>
<tr>
<td>range</td>
<td></td>
</tr>
</tbody>
</table>

### Quintics

<table>
<thead>
<tr>
<th>Odd or Even Symmetry</th>
<th>odd</th>
</tr>
</thead>
<tbody>
<tr>
<td>End behaviors</td>
<td>↓↑ or ↑↓</td>
</tr>
<tr>
<td># of roots</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>Possible # of extrema</td>
<td>4, 2, 0</td>
</tr>
<tr>
<td>Absolute maximum or minimum</td>
<td>NO</td>
</tr>
<tr>
<td>domain</td>
<td>IR</td>
</tr>
</tbody>
</table>

Sketch a Quadratic with zero roots.

Sketch a Cubic with two roots.

Sketch a Quartic with exactly 2 roots.

Sketch a Quintic with 3 roots.
Given the equation in factored form, answer the questions.

2. \( y = 3x(x + 3)(x - 2) \)

Roots: \( x = 0, -3, 2 \)

Write the multiplicity under each root.

End behavior \( \downarrow \uparrow \)
Sketch the graph.

3. \( y = (1 - 2x)(2x + 1)(x + 4) \)

Roots: \( x = \frac{1}{2}, -\frac{1}{2}, -4 \)

Write the multiplicity under each root.

End behavior \( \uparrow \downarrow \)
Sketch the graph.

Standard form: (Show Work!)

\[
\begin{array}{|c|c|}
\hline
x & 3x^3 + 9x^2 - 18x \\
\hline
-2 & -2x \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|}
\hline
x & 4x^3 - 16x^2 + x + 4 \\
\hline
1 & 2x \\
\hline
\end{array}
\]
4. \[ y = (2x + 1)(4x^2 + 4x + 1) \]

\[
\frac{2x + 1}{2x^4 + 4x^2 + 1}
\]

\[
+ \frac{12x}{4x^2 + 4x} + 1
\]

\[
\frac{4}{4}
\]

Roots:

\[
x = -\frac{1}{2},
\]

\[
m = 3
\]

Write the multiplicity under each root.

End behavior \[ \downarrow \uparrow \]

Sketch the graph.

---

5. \[ y = -7x(x + 5)^2 \]

Roots:

\[
x = 0, x = -5
\]

Write the multiplicity under each root.

End behavior \[ \uparrow \downarrow \]

Sketch the graph.

---

Standard form: \( y = 8x^3 + 12x^2 + 40x + 1 \)

Standard form: \( y = -7x^3 - 70x^2 - 115x \)
Sketch the graph of \( f(x) \) and describe the end behavior of each graph.

6. \( x^4 \)

7. \(-x^5\)

8. \( x^3 \)

9. \(-x^2\)

10. Describe transformations happening from \( f(x) \). Write a cubic function to represent each and complete a table to 3 points on the graph.

a. \( g(x) = -2f(x) - 3 \)
   - V. Stretch
   - V. Reflection
   - Down 3
   - \( y = -2(x)^3 - 3 \)

b. \( g(x) = f(-2x) + 3 \)
   - H. Reflection
   - H. Comp
   - Up 3
   - \( y = (-2x)^3 + 3 \)

c. \( g(x) = \frac{1}{2}f(x - 5) - 2 \)
   - V. comp
   - Right 5
   - Down 2
   - \( y = \frac{1}{2}(x-5)^3 - 2 \)

11. Describe the transformations from \( p(x) \) to \( m(x) \).

d. \( p(x) = x^3; \ m(x) = 0.5p(-x) + 4 \)
   - V. Comp
   - H. Reflection
   - Up 4

e. \( p(x) = x^4; \ m(x) = -p(0.5x) + 2 \)
   - V. Reflection
   - H. Stretch
   - Up 2
12. List the number of possible extrema for each polynomial.

a. 3\textsuperscript{rd} degree polynomial \(2, 0\)

b. 4\textsuperscript{th} degree polynomial \(3, 1\)

c. 8\textsuperscript{th} degree polynomial \(7, 5, 3, 1\)

d. 15\textsuperscript{th} degree polynomial \(14, 12, 10, 8, 6, 4, 2, 0\)

Circle the function(s) that could model each graph. Describe your reasoning for either eliminating or choosing each function.

13. \(f(x) = x^4 - 2x^3 - 3x^2\)

\(f(x) = -2x^4 - 3x^2 - x\) opens up

\(f(x) = 2(x - 2)(x + 3)(x + 1)\) cross all roots

14. \(f(x) = 4x^6 + 2x^3 - 1\) odd degree

\(f(x) = (x + 2)(x - 5)(x + 3) + 2\)

\(f(x) = -0.25(x + 2)(x - 5)(x + 3) + 2\) ends going \(\downarrow\)
15. 
\[ f(x) = -2x^6 - 13x^5 + 20x \]
\[ f(x) = 2x^6 - 13x^5 + 26x^4 - 7x^3 - 28x^2 + 20x \]
\[ f(x) = 2(x+7)(x-4)(x+3)(x-2) - 3 = \text{degree 5} \]

16. 
\[ f(x) = 3x^5 + 20x^4 - 10x^3 - 240x^2 - 250x + 200 \]
\[ f(x) = (2x-3)(x+4)(x-10)(x+14) + 20 = \text{degree 4} \]
\[ f(x) = -3x^7 + 15x^6 - 20x^5 + 125x - 150 \]

17. 
\[ f(x) = -x^3 + 2x^2 - x + 3 \]
\[ f(x) = \frac{1}{2}x(x+3)^3 \]
\[ f(x) = (x+3)^3 = \text{degree 4} \]

18. 
\[ f(x) = x^4 - 4x^3 - 2x^2 + 12x - 3 \]
\[ f(x) = 2(x+3)(x+4) = \text{degree 2} \]
\[ f(x) = -2x^2 + x^4 - 3x^3 + 12 \]

Neg degrees