The following activity will help you to learn how to sketch the graph of a polynomial function.

1. Write each function in factored form:
	1. $f\left(x\right)=x^{3}-4x^{2}-3x+18$ c. $g\left(x\right)=-x^{4}+13x^{2}-36$
	2. $h\left(x\right)=4x^{4}-2x^{3}-16x^{2}+8x$ d. $p\left(x\right)=x^{4}+x^{3}-3x^{2}-5x-2$
2. Complete the chart to show the *x*-intercept(s), *y*-intercept, and end behavior of each of the functions above. Leave the column called ***Order*** blank for now.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Function*** | ***x-intercepts*** | ***order*** | ***y-intercept*** | ***End behavior***  |
| $f\left(x\right)=x^{3}-4x^{2}-3x+18$  |  |  |  |  |
| $h\left(x\right)=4x^{4}-2x^{3}-16x^{2}+8x$  |  |  |  |  |
| $g\left(x\right)=-x^{4}+13x^{2}-36$  |  |  |  |  |
| $p\left(x\right)=x^{4}+x^{3}-3x^{2}-5x-2$  |  |  |  |  |

1. If you noticed, some of the functions we are examining have the same factor multiple times (for example, *f*(*x*) has the factor (*x* – 3) two times).

In this situation, we would say that the polynomial *f* has a zero/root/*x*-intercept at *x* = 3 of ***order 2***.

The order of the zero/root/*x*-intercept determines the shape of the graph as it crosses the *x*-axis at this point. The most common orders we will experience are:

Order 1 Order 2, 4, 6, 8, … Order 3, 5, 7, 9, …



For each function in the table in Q2, determine the order of each *x*-intercept.

1. Now that we have collected information about our functions, let’s use this information to sketch the graph of each function. You can ignore max/min values. Check your solution for each function using your GDC or graphing software (like Desmos)

 

 

1. Sometimes, we need to draw a graph without being given the equation. In the following examples, use the information given to sketch a possible graph for the function.
	1. Sketch a function that extends from quadrant 2 to quadrant 1, has *x*-intercepts of -2 and 1, and a degree of 4.
	2. Sketch a polynomial function that has roots of -1, 0, and 2, two of which have an order of 2. The *y*-intercept of this function is 0.

 