

1. Consider $f(x) = x(x + 3)(x - 2)$ $[-6, 6, 1]$ by $[-10, 10, 1]$ which can also be written as $f(x) = x^3 + x^2 - 6x$.

Find the x-intercepts: $0 = x(x + 3)(x - 2)$

$$x = 0, x + 3 = 0, x - 2 = 0$$

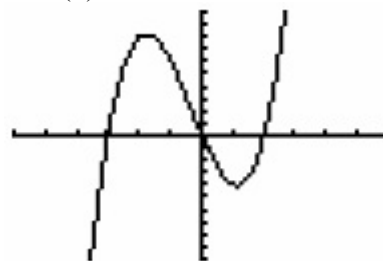
$$x = 0, x = -3, x = 2$$

Notice each of these x-intercepts occurs once. Consider the graph; it crosses the x-axis at each x-intercept.

Degree is _____ which is **ODD** **EVEN**

Leading coefficient is _____ **POSITIVE** **NEGATIVE**

End behavior: _____ on the left and _____ on the right.
up / down up / down



2. Consider $f(x) = -x(x + 3)(x - 2)$ $[-6, 6, 1]$ by $[-10, 10, 1]$ which can also be written as $f(x) = -x^3 - x^2 + 6x$.

Find the x-intercepts: $0 = -x(x + 3)(x - 2)$

$$-x = 0, x + 3 = 0, x - 2 = 0$$

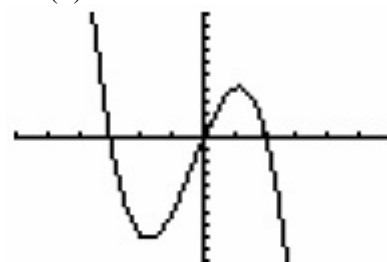
$$x = 0, x = -3, x = 2$$

Notice each of these x-intercepts occurs once. Consider the graph; it crosses the x-axis at each x-intercept.

Degree is _____ which is **ODD** **EVEN**

Leading coefficient is _____ **POSITIVE** **NEGATIVE**

End behavior: _____ on the left and _____ on the right.
up / down up / down



3. Consider $f(x) = x(x + 3)^2(x - 2)$ $[-6, 6, 1]$ by $[-20, 20, 2]$ which can also be written as $f(x) = x^4 + 4x^3 - 3x^2 - 18x$.

Find the x-intercepts: $0 = x(x + 3)^2(x - 2)$

$$x = 0, x + 3 = 0, x + 3 = 0, x - 2 = 0$$

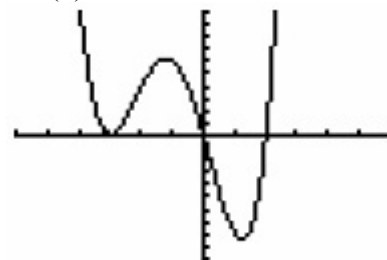
$$x = 0, x = -3, x = -3, x = 2$$

Notice the x-intercepts of 0 and 2 each occur once. Consider the graph; it crosses the x-axis at 0 and at 2. The x-intercept of -3 occurs twice. The graph of f touches the x-axis at this x-intercept.

Degree is _____ which is **ODD** **EVEN**

Leading coefficient is _____ which is **POSITIVE** **NEGATIVE**

End behavior: _____ on the left and _____ on the right.
up / down up / down



4. Consider $f(x) = -x(x + 3)^2(x - 2)$ $[-6, 6, 1]$ by $[-20, 20, 2]$ which can also be written as $f(x) = -x^4 - 4x^3 + 3x^2 + 18x$.

Find the x-intercepts: $0 = -x(x + 3)^2(x - 2)$

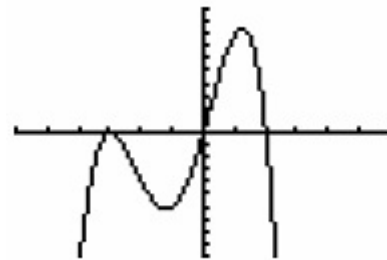
$$-x = 0, x + 3 = 0, x + 3 = 0, x - 2 = 0$$

$$x = 0, x = -3, x = -3, x = 2$$

Notice the x-intercepts of 0 and 2 each occur once. Consider the graph; it crosses the x-axis at 0 and at 2. The x-intercept of -3 occurs twice. The graph of f touches the x-axis at this x-intercept.

Degree is _____ which is **ODD** **EVEN**

Leading coefficient is _____ which is **POSITIVE** **NEGATIVE**



9. Consider the function $f(x) = -4x^7 + 3x^6 + x^5 - 2x^3 + 9x^2 - 11$ to answer the following:

Degree: _____ Even or Odd? _____ Leading Coefficient: _____
 End Behavior: Left _____ Right _____ Number of zeros of the function: _____
 Maximum # of x-intercepts expected: _____ Minimum # of x-intercepts: _____
 Maximum # of turning points (extrema) expected: _____ y-intercept: _____

10. Consider the function $f(x) = 9x^6 + x^5 - 2x^4 + 4x^3 - 13x^2 + x + 2$ to answer the following:

Degree: _____ Even or Odd? _____ Leading Coefficient: _____
 End Behavior: Left _____ Right _____ Number of zeros of the function: _____
 Maximum # of x-intercepts expected: _____ Minimum # of x-intercepts: _____
 Maximum # of turning points (extrema) expected: _____ y-intercept: _____

11. Consider the function $f(x) = x(x - 7)^4(x + 3)(x + 12)^2(x - 2)^5$ to answer the following:

Degree: _____ Even or Odd? _____ Leading Coefficient: _____
 End Behavior: Left _____ Right _____ Number of zeros of the function: _____

of x-intercepts: _____ Maximum # of turning points (extrema) expected: _____

Name the x-intercepts of this function and answer the questions about them:

- 1) x-int. _____ Multiplicity _____ Does the graph touch or cross the x-axis at this x-intercept: _____
- 2) x-int. _____ Multiplicity _____ Does the graph touch or cross the x-axis at this x-intercept: _____
- 3) x-int. _____ Multiplicity _____ Does the graph touch or cross the x-axis at this x-intercept: _____
- 4) x-int. _____ Multiplicity _____ Does the graph touch or cross the x-axis at this x-intercept: _____
- 5) x-int. _____ Multiplicity _____ Does the graph touch or cross the x-axis at this x-intercept: _____

12. Consider a function whose only zeros are 3, -5, and 1. Suppose this function is of degree 5, crosses the x-axis only at 1 and has a negative y-intercept. Sketch a possible graph for this function.

Since this function is of degree 5, we know that the end behavior will be (the same or opposite)_____.

The graph crosses the x-axis only at $x = 1$, at $x = 3$ and $x = 5$ the graph _____ the x-axis so the zeros

3 and -5 must be of (even / odd) _____ multiplicity. The y-intercept is negative, so the graph crosses the y-axis at some negative value (or below the x-axis).

The fully factored form for this function is _____.

13. Write the fully factored form of $f(x) = x^4 + 8x^3 + 15x^2 - 4x - 20$

14. Sketch a possible graph for a function of degree 3 whose turning points are $(-3, -1)$ and $(3, 5)$.

15. Sketch a possible graph for a function whose leading coefficient is negative and whose only zeros are -5 with multiplicity 3, -1 with multiplicity 2 and 3 with multiplicity 4.