Algebra 2 5.3

- Evaluate polynomial functions
- Identify general shapes of polynomial function graphs

polynomial number, variable, products

function terms + or -

Quiz 5.1-5.2 Wed.

* parent graph

degree $f(x) = 1x^2 + \underline{6}x - 3$

coefficient $y =$

leading coefficient

function notation

end behavior

even function

odd function

activity: Kroon says

$$
\begin{array}{r}
2x^2+3x+1 \\
x-4 \\
\hline
-8x^2-12x-4 \\
2x^3+3x^2+x \\
\hline
2x^3-5x^2-11x-4
\end{array}
$$

Polynomial	Expression	Degree	Leading Coefficient	
Constant	$12 \cdot x^0 = 12 \cdot 1 = 12$	0	12	*technically
Linear	$4x^1 - 9$	1	4	
Quadratic	$5x^2 - 6x - 9$ $\quad -6x - 9 + 5x^2$	2	5	
Cubic	$8x^3 + 12x^2 - 3x + 1$	3	8	
General	$a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$	n	a_n	

Example 1 Degrees and Leading Coefficients

State the degree and leading coefficient of each polynomial in one variable. If it is not a polynomial in one variable, explain why.

a. $8x^5 - 4x^3 + 2x^2 - x - 3$

b. $\cancel{12x^2 - 3xy + 8x}$

c. $3x^4 + 6x^3 - 4x^8 + 2x$

Guided Practice

1A. $\cancel{5x^3 - 4x^2 - 8x + \frac{4}{x}}$ **1B.** $5x^6 - 3x^4 + 12x^3 - 14$ **1C.** $8x^4 - 2x^3 - x^6 + 3$

G e m A

$\boxed{f(x) = 3x + 5}$

$f(2) = 3 \cdot 2 + 5 = 11$

$f(-5) = 3 \cdot -5 + 5 = -10$

$\boxed{f(x) = 3x^2 - 5}$

$f(4) = 3 \cdot 4^2 - 5 = 43$

$f(-3)$

$= 3 \cdot x \cdot x - 5$

$= 3 \cdot -3 \cdot -3 - 5$

$= 27 - 5 = 22$

-3^2

$-1 \cdot 3^2$

$(-3)^2$

$f(x) = x^2+2x - 3$

1. f(2a) - f(a)
2. f(3c) - 4f(c)

What is the function?
Have a plan... order of ops.

$= 3a^2+2a$

$f(2a) - f(a)$

$x \cdot x + 2x - 3$

$2a \cdot 2a + 2 \cdot 2a$

$(4a^2+4a-3) - (a \cdot a + 2 \cdot a - 3)$

$+ \; -(a^2+2a-3)$

$-a^2-2a+3$

Example 3 Function Values of Variables

3. Find $f(3c - 4) - 5f(c)$ if $\boxed{f(x) = x^2 + 2x - 3.}$

$3c-4$

$3c-4$

$-12c+16$

$9c^2-12c$

$9c^2-24c+16$

$f(3c-4) - 5f(c)$

$x \cdot x + 2x - 3$

$((3c-4)(3c-4)+2(3c-4)-3) + -1(5 \cdot (c^2+2c-3))$

$9c^2-24c+16+6c-8-3$

$5c^2+10c-15$

$(9c^2-18c+5) + (-5c^2-10c+15)$

$4c^2-28c+20$

GuidedPractice

3A. Find $g(5a-2)+3g(2a)$ if $g(x)=x^2-5x+8$.

x^2

$(5a-2)(5a-2)-5(5a-2)+8+\left(3\left(2a\cdot 2a-5\cdot 2a+8\right)\right)$

$4a^2-10a+8$

$25a^2-20a+4-25a+10+8$

[redacted]

$25a^2-45a+22 \quad + \quad 12a^2-30a+24$

order of operations...

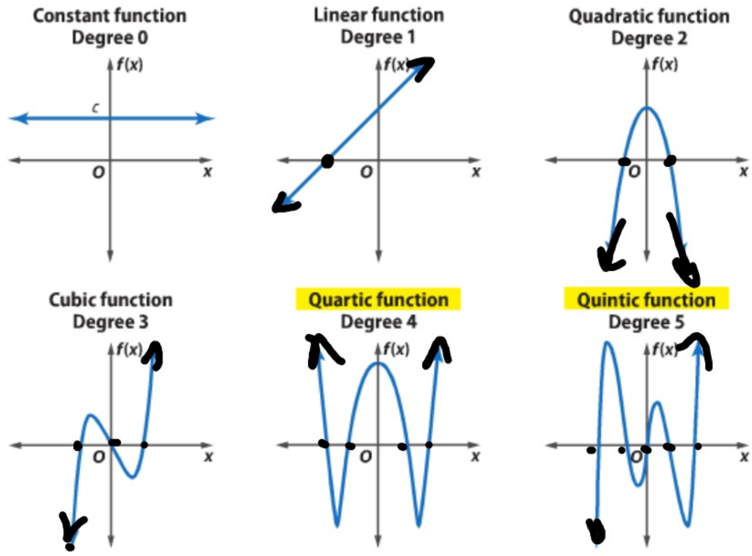
$37a^2-75a+46$

3B. Find $h(-4d + 3) - 0.5h(d)$ if $h(x) = 2x^2 + 5x + 3$.

h(-4d+3)
h(d)
order of operations

2 Graphs of Polynomial Functions The general shapes of the graphs of several polynomial functions show the *maximum* number of times the graph of each function may intersect the x-axis. This is the same number as the degree of the polynomial.

p 324



degree =
degree -1 =

d - 1 = t.p. (at most)

d = x-int (at most)

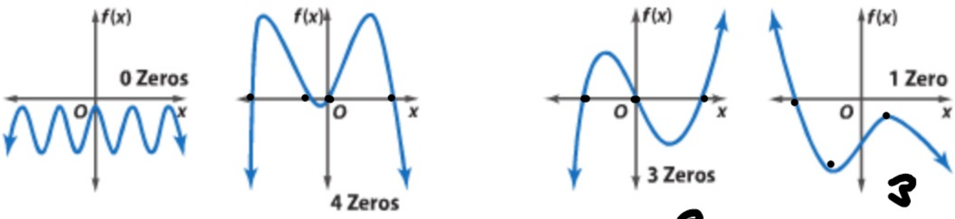
Kroon says...

KeyConcept **Zeros of Even- and Odd-Degree Functions**

Odd-degree functions will always have an odd number of real zeros. Even-degree functions will always have an even number of real zeros or no real zeros* at all.

*zero is an even number

Even-Degree Polynomials **Odd-Degree Polynomials**



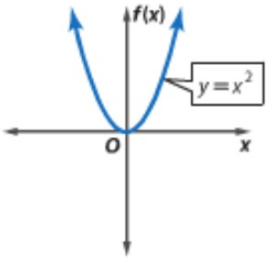
x^4 x^3 x^3

KeyConcept End Behavior of a Polynomial Function

Degree: even
Leading Coefficient: positive
End Behavior:

$f(x) \to +\infty$ as $x \to -\infty$

$f(x) \to +\infty$ as $x \to +\infty$

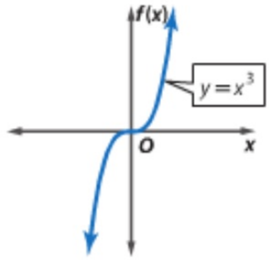


Domain: all real numbers
Range: all real numbers $\geq$ minimum

Degree: odd
Leading Coefficient: positive
End Behavior:

$f(x) \to -\infty$ as $x \to -\infty$

$f(x) \to +\infty$ as $x \to +\infty$

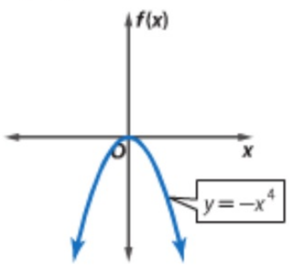


Domain: all real numbers
Range: all real numbers

Degree: even
Leading Coefficient: negative
End Behavior:

$f(x) \to -\infty$ as $x \to -\infty$

$f(x) \to -\infty$ as $x \to +\infty$

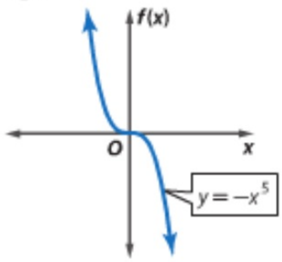


Domain: all real numbers
Range: all real numbers $\leq$ maximum

Degree: odd
Leading Coefficient: negative
End Behavior:

$f(x) \to +\infty$ as $x \to -\infty$

$f(x) \to -\infty$ as $x \to +\infty$



Domain: all real numbers
Range: all real numbers

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Looks pretty intimidating:
You just have to know the cod

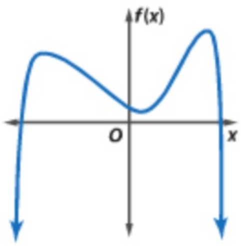
end behavior: words, code

Example 4 Graphs of Polynomial Functions

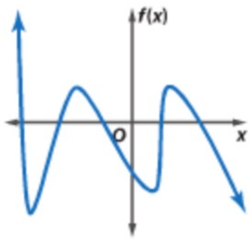
For each graph,

- describe the end behavior,
- determine whether it represents an odd-degree or an even-degree polynomial function, and
- state the number of real zeros.

a.

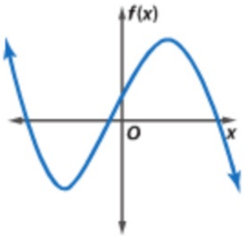


b.



GuidedPractice

4A.



4B.