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3.1 Graphing Polynomial Functions

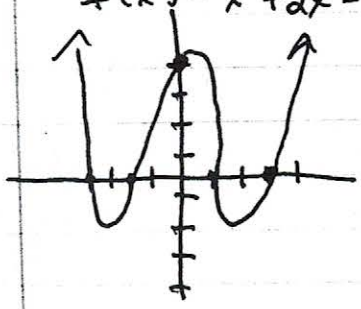
degree - highest exponent
Standard form - highest degree to lowest degree
Leading coefficent - number in front of highest degree
Turning points - Points where the function change from increasing to decreasing
minimum - lowest point(s)
maximum - highest point (s)

Label Polynomials

number of terms	Name
1	monomial
2	binomial
3	trinomial
4+	Polynomial

ex) Find degree, Leading coefficent, turning points, min, max, y-intercept, x-intercept

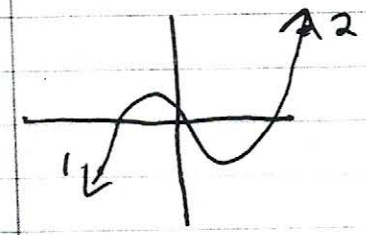
$f(x) = x^4 + 2x^3 - 13x^2 - 4x + 4$



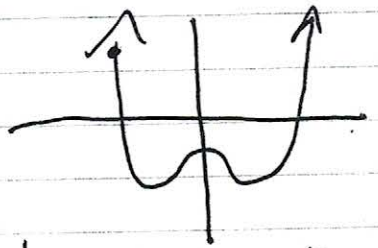
degree = 4
L.C. = 1
T.P. = 3
min (-3,-2) (2,2)
max (0,4)

y int (0,4)
x int (-4,0) (-2,0) (1,0) (3,0)

End behavior pg 132



1. as $x \to -\infty$ $y \to -\infty$
2. as $x \to \infty$ $y \to \infty$



1. as $x \to -\infty$ $y \to \infty$
2. as $x \to \infty$ $y \to \infty$

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3.2 Adding, Subtracting, Multiplying Polynomials

ex) $(4a^4-6a^3-3a^2+a+1)+(5a^3+7a^2+2a-2)$

* combine like terms, same exponent *

$4a^4-1a^3+4a^2+3a-1$

b) $(2x^2y^2+3xy^2-5x^2y)-(3x^2y^2-9x^2y+7xy^2)$

$-1x^2y^2-4xy^2+4x^2y$

multiply

ex) $3x(2x^3+4x-2)$ *add exponents*

$6x^4+12x^2-6x$

b) $(6x^2-7)(x^2+x+3)$

$6x^4+6x^3+18x^2-7x^2-7x-21$ * combine *

$6x^4+6x^3+11x^2-7x-21$

c) $\boxed{(x-5)(x+7)}(2x+3)$

FOIL

$(x-5)(x+7)$

$x^2+7x-5x-35$

$(x^2+2x-35)(2x+3)$

$2x^3+4x^2-70x+3x^2+6x-105$ * combine *

$2x^3+7x^2-64x-105$

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maybe odds?

3.3 Polynomial Identities

Difference of Squares

$a^2 - b^2 = (a-b)(a+b)$

ex) $x^2 - 9 = ($

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

Square of a Sum

$(a+b)^2 = (a+b)(a+b)$ then FOIL

Difference of Cubes

$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

* Talk about cubes of numbers *

ex) $x^3 - 27$

$x^3 - 3^3$

$a = x$

$b = 3$

$(x-3)(x^2 + 3x + 9)$

Sum of Cubes

$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

ex) $8x^9 + 64y^3$

$(2)^3(x^3)^3 + (4)^3 y^3$

$a = 2x^3$

$b = 4y$

$(2x^3 + 4y)((2x^3)^2 - (2x^3)(4y) + (4y)^2)$

$(2x^3 + 4y)(4x^6 - 8x^3y + 16y^2)$

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3.4 Dividing Polynomials

ex)

$$\begin{array}{r} x^2+2x \\ x+3\,\overline{)\,x^3+5x^2+6x+9} \\ -(x^3+3x^2) \\ \hline 2x^2+6x \\ -(2x^2+6x) \\ \hline 0+9 \end{array}$$

$x \cdot \underline{x^2} = x^3$

$x \cdot \underline{2x} = 2x^2$

$0+9$ = remainder

$$x^2+2x+\frac{9}{x+3}$$

Synthetic Division

ex) $(2x^3-7x-4) \div (x-3)$

3	2	0	-7	-4
	↓	6	18	33
	2	6	11	29
	x^2	x	c	r

* must have place holder *

$$2x^2+6x+11+{}^{29}/_{x-3}$$

b) $(3x^3-5x+10) \div (x-1)$

1	3	0	-5	+10
	↓	3	3	-2
	3	3	-2	8
	x^2	x	c	r

$$3x^2+3x-2+\frac{8}{x-1}$$

Need a worksheet from last year

3.5 Zeros of Polynomial Functions

ex) Find the zeros

$F(x) = x(x-4)(x+3)$

$x=0$ $\quad$ $x-4=0$ $\quad$ $x+3=0$

$\quad\quad\quad +4\ +4$ $\quad$ $-3\ -3$

$\quad\quad\quad x=4$ $\quad$ $x=-3$

b) $F(x) = 4x^3 + 4x^2 - 24x$

☆ Have to factor ☆

GCF

$4x(x^2 + x - 6)$ Chart

x^2	-6	$+x$
x	$+3$	$3x$
x	-2	$-2x$

$4x(x+3)(x-2)$

$\frac{4x}{4} = \frac{0}{4}$ $\quad$ $x+3=0$ $\quad$ $x-2=0$

$\quad\quad\quad -3\ -3$ $\quad$ $+2\ +2$

$x=0$ $\quad$ $x=-3$ $\quad$ $x=2$

c) $g(x) = x^4 - 81$ (difference of 2 squares)

$(x^2-9)(x^2+9)$ (difference of 2 squares)

$(x-3)(x+3)(x^2+9)$

$x-3=0$ $\quad$ $x+3=0$ $\quad$ $x^2+9=0$

$\quad +3\ +3$ $\quad$ $-3\ -3$ $\quad$ $-9\ -9$

$x=3$ $\quad$ $x=-3$ $\quad$ $\sqrt{x^2} = \sqrt{-9}$

$x = \pm\sqrt{-9}$

$\sqrt{-1}\ \sqrt{9}$

$\pm i3 = \pm 3i$

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3.6 Roots of Polynomial Equations

Factors of Constant
Factors of leading Coefficient

ex] Find all the Possible Rational Solutions
$F(x) = 8x^5 - 32x^4 + x^2 - 4$

Constant $= \pm 1, \pm 2, \pm 4$
L.C. $= \pm 1, \pm 8, \pm 2, \pm 4$

$\pm \frac{1}{1}, \pm \frac{1}{8}, \pm \frac{1}{2}, \pm \frac{1}{4}, \pm \frac{2}{1}, \pm \frac{2}{8}, \pm \frac{2}{2}, \pm \frac{2}{4},$
$\pm \frac{4}{1}, \pm 4/8, \pm 4/2, \pm 4/4$

ex] What are real and complex roots?
$F(x) = x^3 - 2x^2 + 5x - 10$
$C = \pm 1, \pm 10, \pm 2, \pm 5$
L.C. $= \pm 1$

Try this first

2	1	-2	5	-10
	↓	2	0	10
	1	0	5	0
	x^2	x	c	

- has to be 0

-2	1	-2	5	-10
	↓	-2	8	-26
	1	-4	13	-36

$x^2 - 2x + 5$
won't Factor use Quadrate Formula
$a = 1 \quad b = -2 \quad c = 5$

$$\frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(5)}}{2(1)}$$

$$\frac{2 \pm \sqrt{4-20}}{2} = \frac{2 \pm \sqrt{-16}}{2} = \frac{2 \pm 4i}{2} = 1 \pm 2i$$

and
$(x = 2)$

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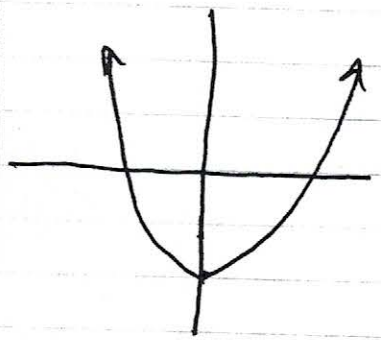
3.7 Transformations of Polynomial Functions

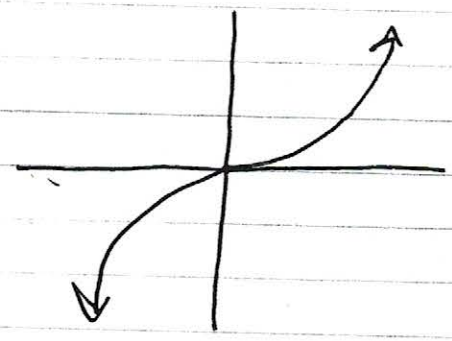
<u>even function</u> - symmetric about the y-axis

<u>odd function</u> - symmetric about the origin

Even Function



odd function



Go over example 1 pg 180

ex) Is the function odd, even or neither?

a) $f(x) = 4x^4 + 5$ plug in $-x$

$f(-x) = 4(-x)^4 + 5$

$f(-x) = 4x^4 + 5$

since $f(x) = f(-x)$ then even

b) $g(x) = 2x^3 + 3x$ plug in $-x$

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

$g(-x) = -2x^3 - 3x$

since opposite then odd

ex) Describe transformation

a) $g(x) = 3x^4 - 18$

stretch 3, down 18

b) $5(x-2)^3 + 4$

stretch 5, right 2
up 4