Get your 3.7HW, 3.8HW, and 6 polynomial division problems ready to be checked. Work on your Polynomial Extra WKS from last time, we will go over a couple of questions soon.

Rational Root Theorem:

$$a_n x^n + a_{n-1} x^{n-1} + \cdots + a_0 = 0$$

-Possible rational roots are p/q, where p is an integer factor of the constant term (a_0) and q is an integer factor of the leading coefficient (a_n).

Practice.

State the possible rational zeros for each function. Then find all rational zeros.

$$f(x) = 9x^3 - 6x^2 + 34x - 11$$

$$f(x) = 2x^3 - x^2 - 2x + 1$$

$$f(x) = x^3 - 5x^2 - 15x + 27$$

$$f(x) = 2x^3 - 5x^2 + 4x - 1$$

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Binomial Theorem

According to the theorem, it is possible to expand any power of $x + y$ into a sum of the form

$$(x+y)^n = \binom{n}{0}x^n y^0 + \binom{n}{1}x^{n-1}y^1 + \binom{n}{2}x^{n-2}y^2 + \cdots + \binom{n}{n-1}x^1 y^{n-1} + \binom{n}{n}x^0 y^n,$$

where each $\binom{n}{k}$ is a specific positive integer known as a binomial coefficient.

We determine each binomial coefficient by using Pascal's triangle.

Coefficients

1	n=0
1 1	n=1
1 2 1	n=2
1 3 3 1	n=3
1 4 6 4 1	n=4
1 5 10 10 5 1	n=5
1 6 15 20 15 6 1	n=6
1 7 21 35 35 21 7 1	n=7

1) 3rd term in expansion of $(m-n^2)^4$

$x=m$, $y=-n^2$, $n=4$

$6x^2y^2$

$6(m)^2(-n^2)^2$

$\boxed{6m^2n^4}$

2) 5th term in expansion of $(3+y)^4$

$x=3$, $y=y$, $n=4$

$1x^0y^4$

$1(3)^0(y)^4$

y^4

3) ~~3rd~~ 2nd term in expansion of $(y+4)^4$

$x=y$, $y=4$, $n=4$

$4x^3y^1$

$4(y)^3(4)^1$

$\boxed{16y^3}$

4) 3rd term in expansion of $(2x^2+1)^{\cancel{4}\,5}$

$x=2x^2$, $y=1$, $n=5$

$10x^3y^2$

$10(2x^2)^3(1)^2$

$10\cdot 8x^6\cdot 1$

$\boxed{80x^6}$

$(x+y)^4 = \underline{1}x^4y^0 + \underline{4}x^3y^1 + \underline{6}x^2y^2 + \underline{4}x^1y^3 + \underline{1}x^0y^4$

1 5 10 10 5 1

$(x+y)^5 = 1x^5y^0 + 5x^4y^1 + 10x^3y^2 + 10x^2y^3 + 5x^1y^4 + 1x^0y^5$

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Poly. Extra WKS

17 $x^4 - 3x^3 - x^2 + 3x = 0$

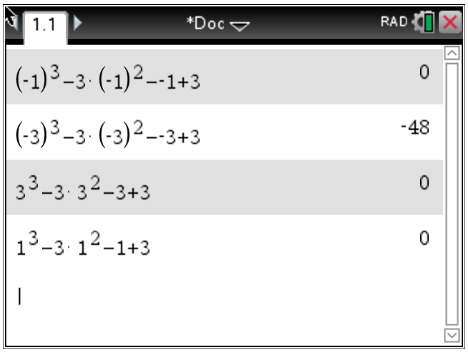
$x(x^3 - 3x^2 - x + 3) = 0$

$x(x+1)(x-1)(x-3)$

p: 3 → 1, 3

q: 1 → 1

$\frac{p}{q} \to \pm\{1, 3\}$



$f(-1) = 0$

$f(-3) = -48$

$f(3) = 0$

$f(1) = 0$

$2\overline{)6}$ 3

$$
\begin{array}{r}
x^2 - 4x + 3 \\
x+1 \overline{)\, x^3 - 3x^2 - x + 3} \\
-(\cancel{x^3} + x^2) \\
\hline
-4x^2 - x \\
-(\cancel{-4x^2} - 4x) \\
\hline
3x + 3 \\
-(\cancel{3x} + 3) \\
\hline
0
\end{array}
$$

$x(x+1)(x^2 - 4x + 3)$

$x(x+1)(x-3)(x-1)$

State the possible rational zeros for each function. Then factor each and find all zeros.

2) $f(x) = 3x^3 + 20x^2 + 44x + 33$

p: 33 → 1, 3, 11, 33
q: 3 → 1, 3

$\frac{p}{q} \to \pm\left\{1, 3, 11, 33, \frac{1}{3}, \cancel{\frac{3}{3}}, \frac{11}{3}, \cancel{\frac{33}{3}}\right\}$

1 11

$\pm\left\{1, 3, 11, 33, \frac{1}{3}, \frac{11}{3}\right\}$

−3

(x+3)

$$\begin{array}{r|l} & 3x^2 + 11x + 11 \\ x+3 & 3x^3 + 20x^2 + 44x + 33 \\ & -(3x^3 + 9x^2) \\ & \quad 11x^2 + 44x \\ & \quad -(11x^2 + 33x) \\ & \qquad 11x + 33 \\ & \qquad -(11x + 33) \\ & \qquad\quad 0 \end{array}$$

$(x+1)(3x^2+11x+11)$

Quad. Form.

a=3
b=11
c=11

$x = \frac{-11 \pm \sqrt{(11)^2 - 4\cdot 3\cdot 11}}{2\cdot 3}$

$= \frac{-11 \pm \sqrt{121 - 132}}{6} = \frac{-11 \pm \sqrt{-11}}{6}$

$= \frac{-11 \pm i\sqrt{11}}{6}$

the $\sqrt{-1}$ is = to i

so, factored down

$(x+1)\left(x + \frac{-11+i\sqrt{11}}{6}\right)\left(x + \frac{-11-i\sqrt{11}}{6}\right)$

and roots are

$x = -1, \frac{-11+i\sqrt{11}}{6}, \frac{-11-i\sqrt{11}}{6}$

Classwork/Homework

Module 3 Study Guide

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