rm-up

te your answer in Polynomial Form:

$\cdot^3 + 6x + 8)(x + 2)^{-1}$ $= \frac{5x^3+6x+8}{x+2}$

$$\begin{array}{r|rrrr} -2 & 5x^3 & 0 & 6 & 8 \\ & & -10 & 20 & -52 \\ \hline & 5x^2 & -10x & 26 & \boxed{-44\ R} \end{array}$$

$x^3 + 6x + 8 = (x+2)(5x^2 + 10x + 26) + 60$

$\boxed{x^3 + 6x + 8 = (x+2)(5x^2 - 10x + 26) - 44}$

$\frac{x^3+6x+8}{x+2} = 5x^2 + 10x + 26 + \frac{60}{x+2}$

$\frac{x^3+6x+8}{x+2} = 5x^2 - 10x + 26 - \frac{44}{x+2}$

$x + 2 = 0$

$x = -2$

cribe the end behavior using limit notation: $f(x) = 49 - x^3$ $= -x^3 + 49$

3 → odd

neg

$\lim_{x\to\infty} f(x) = \infty$ and $\lim_{x\to-\infty} f(x) = -\infty$

right up left down

C ~~$\lim_{x\to\infty} f(x) = \infty$ and $\lim_{x\to-\infty} f(x) = \infty$~~

$\lim_{x\to\infty} f(x) = -\infty$ and $\lim_{x\to-\infty} f(x) = \infty$

D ~~$\lim_{x\to\infty} f(x) = -\infty$ and $\lim_{x\to-\infty} f(x) = -\infty$~~

e a polynomial function (in factored form) that satisfies given characteristics:

s: $\boxed{x = -1}$ (multiplicity of 2) x = 4 (multiplicity of 2)

even

ee of 4

$\lim_{x\to\infty} f(x) = -\infty$ and $\lim_{x\to-\infty} f(x) = -\infty$

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

$\boxed{f(x) = -a(x+1)^2(x-4)^2}$

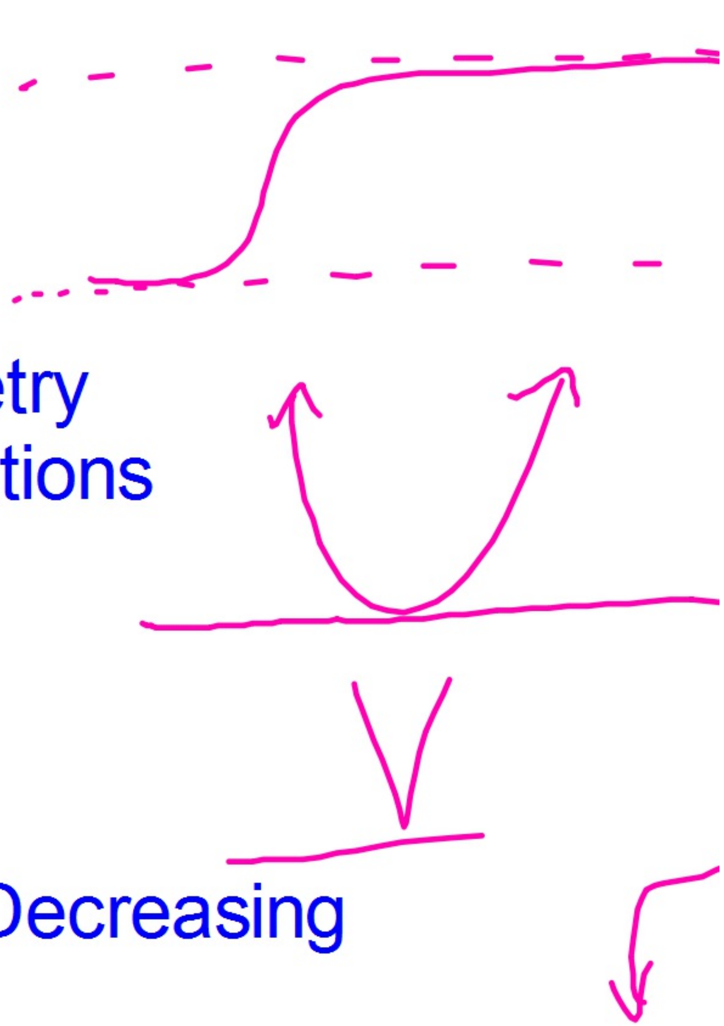
$f(x) = -a(x - 1)^2(x+4)^2$

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

List of Topics on Common Assessment #1

<u>Unit 1</u>

- Range/Domain
- Boundedness
- Transformations
- Piecewise Functions
- Even, odd, neither / Symmetry
- Compositions and Combinations
- VLT, HLT, One to One
- Inverse
- Continuity
- Difference Quotient
- Intervals of Increasing and Decreasing



<u>Unit 2</u>

- End behavior/Limits
- Variation

~~Thursday~~ Friday 2/17/17

2.4 Complex Zeros, Rational Zeros

I can:

1. Find all zeros of a polynomial function, including complex zeros.
2. Write a polynomial function from real zeros with an a-value and from complex zeros.

$$\left(\sqrt{(\text{-shift})}\right)^2$$

Shift just got real

Review of Rational Zeros Theorem

If the polynomial has integer coefficients, then all of the rational roots will be of the form:

$$\boxed{\pm\frac{p}{q} = \frac{\text{factor of constant term}}{\text{factor of leading coefficient}}}$$

This helps us narrow down the infinite number of potential zeros of a polynomial function.

Ex 1: Use the Rational Zeros theorem to write a list of all potential real rational zeros. Then determine which ones, if any, are zeros.

$$f(x) = 3x^3 - 7x^2 + 6x - 14$$

$p = 1, 2, 7\ 14$

$q = 1, 3$

$$\frac{p}{q} = \pm\left\{1, 2, 7, 14, \frac{1}{3}, \frac{2}{3}, \boxed{\frac{7}{3}}, \frac{14}{3}\right\}$$

$$\boxed{\left(\frac{7}{3}, 0\right)}$$

2.

Ex 2: Use the Rational Zeros Theorem and Intermediate Value Theorem to find all real zeros of the polynomial function.

$$f(x) = \boxed{2}x^4 - 7x^3 - 8x^2 + 14x + 8$$

$P = 1, 2, 4, 8$

$Q = 1, 2$

$$\frac{P}{Q} = \pm \left\{ 1, 2, 4, 8, \frac{1}{2}, \cancel{\frac{2}{2}}, \cancel{\frac{4}{2}}, \cancel{\frac{8}{2}} \right\}$$

$\left(-\frac{1}{2}, 0\right)$

$(4, 0)$

$$f(x) = 2\left(x + \frac{1}{2}\right)(x - 4)(x - \sqrt{2})(x + \sqrt{2})$$

$$\begin{array}{r|rrrrr} 4 & 2 & -7 & -8 & 14 & 8 \\ & & 8 & 4 & -16 & -8 \\ \hline & 2 & 1 & -4 & -2 & 0 \end{array}$$

$$\begin{array}{r|rrr} -\frac{1}{2} & 2 & 1 & -4 \\ & & -1 & 0 \\ \hline & 2x^2 & 0 & -4 \end{array}$$

Definition of a Complex Number

If a and b are real numbers, the number $a + bi$ is a **complex number**, and it is said to be written in **standard form.** If $b = 0$, the number $a + bi = a$ is a real number. If $b \neq 0$, the number $a + bi$ is called an **imaginary number.** A number of the form bi, where $b \neq 0$, is called a **pure imaginary number.**

Complex #

imaginary

$a + bi$

$2 + 3i$

$1 - 5i$

real

$a + 0i$

$2, -3, 4$

$b = 0$

pure imaginary

$0 + bi$, $a = 0$

$5i$

$-4i$

Ex 3: Find all zeros of the polynomial and write the function in factored form.

$(-1,0)$

$(2,0)$

$$f(x) = x^4 - x^3 + x^2 - 3x - 6$$

$$\begin{array}{r|rrrrr} -1 & 1 & -1 & 1 & -3 & -6 \\ & & -1 & 2 & -3 & 6 \\ \hline & 1x^3 & -2x^2 & 3x & -6 & 0 \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & -2 & 3 & -6 \\ & & 2 & 0 & 6 \\ \hline & 1x^2 & 0 & +3 & \end{array}$$

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

$$\boxed{y = (x+1)(x-2)(x+i\sqrt{3})(x-i\sqrt{3})}$$

$x^2+3=0$

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

$x = \pm\sqrt{-3}$

$x = \pm i\sqrt{3}$

Ex 4: Find all zeros of the polynomial and write the function in factored form.

$g(x) = (x+2)(x-1)(x-4)(x+i)($

$$g(x) = x^5 - 3x^4 - 5x^3 + 5x^2 - 6x + 8$$

$(-2, 0)$

$(1, 0)$

$(4, 0)$

$$\begin{array}{r|rrrrrr}
-2 & 1x^5 & -3 & -5 & 5 & -6 & 8 \\
 & & -2 & 10 & -10 & 10 & -8 \\
\hline
1 & 1x^4 & -5 & 5 & -5 & 4 & 0 \\
 & & 1 & -4 & 1 & -4 & 0 \\
\hline
4 & 1x^3 & -4 & 1 & -4 & \cancel{0} & \cancel{0} \\
 & & 4 & 0 & 4 & & \\
\hline
 & 1x^2 & 0 & +1 & 0 & &
\end{array}$$

$x^2 + 1 = ($

$\sqrt{x^2} = \sqrt{-}$

$x = \pm\sqrt{}$

$x = \pm i\sqrt{}$

$x = \pm i$

Complex Zeros Occur in Conjugate Pairs

Let $f(x)$ be a polynomial function that has *real coefficients*. If $a + bi$, where $b \neq 0$, is a zero of the function, the conjugate $a - bi$ is also a zero of the function.

Complex Zeros Occur in Conjugate Pairs

Let $f(x)$ be a polynomial function that has *real coefficients*. If $a + bi$, where $b \neq 0$, is a zero of the function, the conjugate $a - bi$ is also a zero of the function.

Given some polynomial function *f(x)*, what possible number(s) of nonreal zeros it can have?

Ex 5: Given the polynomial function, state how many complex zeros and real zeros the function has.

total #

Ex 6: Write a polynomial function with $-3, 4$ and $2-i$ as zeros.

Ex 7: Write a polynomial function with $\underline{2+\sqrt{3}}$ and $\underline{3i}$ as zeros.

Ex 8: Find all zeros of $f\left(x\right)=x^4-3x^3+6x^2+2x-60$ given that $1+3i$ is a zero of *f(x)*