Heinl 2015

Math 4 Honors Unit 3 Test Review

Station #1: SAT Subject Test Math Questions

1. The function h is defined by $h(x)=\frac{x^2+16}{x^2-9}$. Which of the following values is NOT included in the domain of h?

$$=\frac{x^2+16}{(x+3)(x-3)}$$

$x \neq -3 \quad x \neq 3$

- a. −4
- b. −3
- c. 0
- d. 4
- e. 9

2. Which of the following expressions is equivalent to $\frac{2y^5+6y^3}{y^4+3y^2}$?

$$=\frac{2y^3\cancel{(y^2+3)}}{y^2\cancel{(y^2+3)}}$$

$$=\frac{2y^{\cancel{3}}}{\cancel{y^2}}=2y$$

- a. $\frac{y}{3}$
- b. $\frac{y+3}{2}$
- c. $2y$
- d. $2y+3$
- e. $\frac{2y^2}{y+3}$

3. If $(x-1)\left(\frac{x^2-4x+3}{x-1}\right)=5(x-1)$, then $x=$

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

$x^2-4x+3=5x-5$
$\quad -5x+5 \quad -5x+5$

$x^2-9x+8=0$

$(x-8)(x-1)=0$

$x=8 \quad \cancel{x=1}$ Extr.

- a. 8
- b. 6
- c. 5
- d. 4
- e. 2

4. What is $\lim\limits_{x\to -4}\frac{5x^2+22x+8}{x^2+5x+4}$?

$$\frac{(5x+2)\cancel{(x+4)}}{(x+1)\cancel{(x+4)}}$$

$$\frac{5(-4)+2}{-4+1}=\frac{-18}{-3}=6$$

- a. −3
- b. 0
- c. 3
- d. 6
- e. The limit does not exist.

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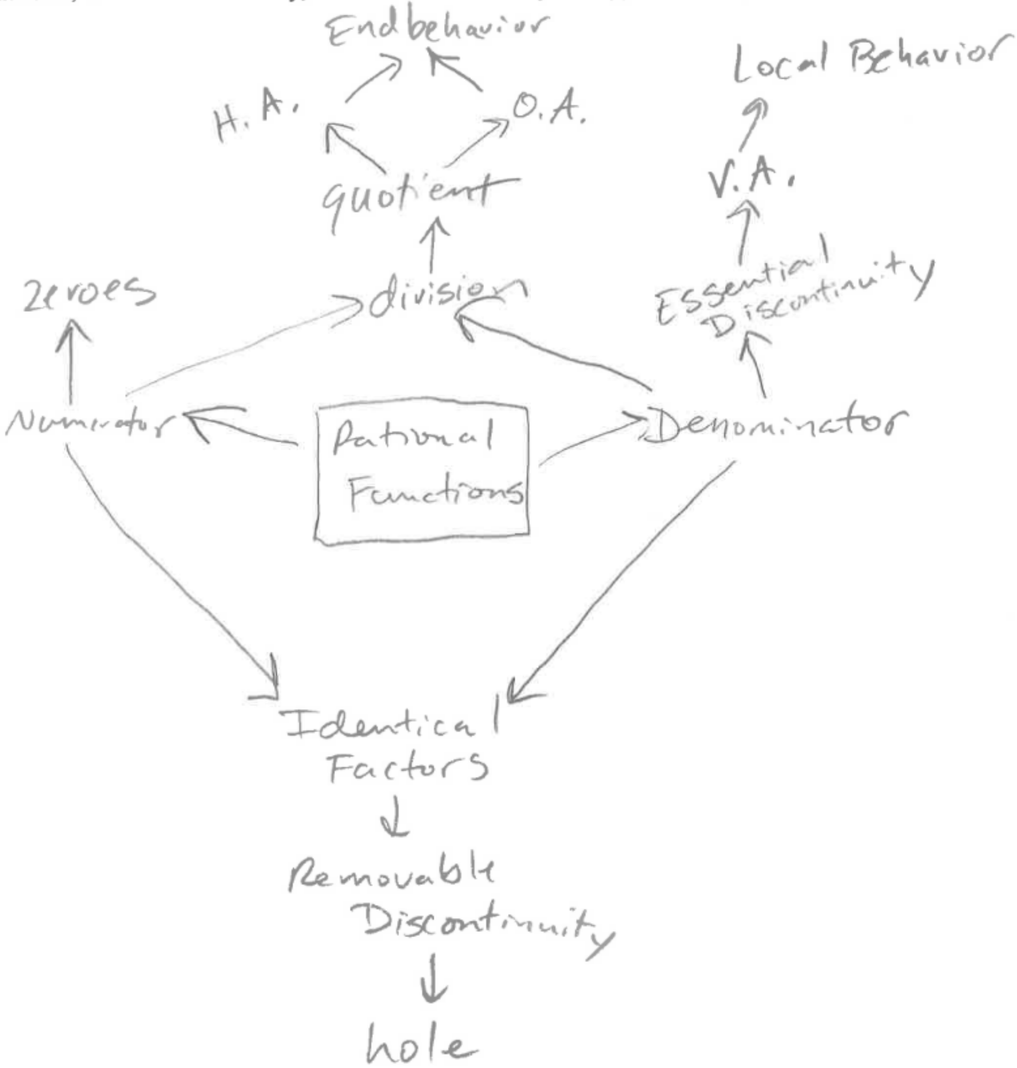
Station #2: Rational Function Concept Map (or some other graphic organizer)

Make a concept map (or some other graphic organizer) for *rational functions* and the vocabulary associated with them.

Vertical asymptote, horizontal asymptote, oblique asymptote, local behavior, end behavior, hole, numerator, denominator, essential discontinuity, removable discontinuity, zero(s), division, quotient, identical factors



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Station #3: Partial Fraction Decomposition

1. Draw lines to match the rational expression with the form of its decomposition.

$\dfrac{x+21}{x(x^2-64)}$ $x(x+8)(x-8)$	$\dfrac{A}{x}+\dfrac{Bx+C}{x^2+64}$
$\dfrac{x+21}{x^2(x-64)}$	$\dfrac{A}{x}+\dfrac{B}{x^2}+\dfrac{C}{x-64}$
$\dfrac{x+21}{x(x^2+64)}$	$\dfrac{A}{x}+\dfrac{B}{x+8}+\dfrac{C}{x-8}$
$\dfrac{x+21}{x(x-64)^2}$	$\dfrac{A}{x}+\dfrac{B}{x-64}+\dfrac{C}{(x-64)^2}$

2. Find the partial fraction decompostion of $\dfrac{x+21}{x(x^2+64)}$.

$$\cancel{x(x^2+64)}\left(\frac{x+21}{\cancel{x(x^2+64)}}\right)=\left(\frac{A}{x}+\frac{Bx+C}{x^2+64}\right)x(x^2+64)$$

$$x+21=A(x^2+64)+(Bx+C)x$$

$$x+21=Ax^2+64A+Bx^2+Cx$$

$$x+21=Ax^2+Bx^2+Cx+64A$$

$$x+21=(A+B)x^2+Cx+64A$$

$A+B=0 \rightarrow B=-A$

$C=1$ $\quad B=\dfrac{-21}{64}$

$64A=21$

$A=\dfrac{21}{64}$

$$\frac{x+21}{x(x^2+64)}=\frac{21}{64x}+\frac{\frac{-21}{64}x+1}{x^2+64}$$

$$\boxed{=\frac{21}{64x}+\frac{-21x+64}{64(x^2+64)}}$$

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Station #4: Solving Inequalities Using NLA

Solve the following inequalities. Write your answers in interval notation.

1. $\frac{x^2-25}{x+5} \le 0$

$$\frac{\cancel{(x+5)}(x-5)}{\cancel{x+5}} \le 0$$

$$x-5 \le 0$$

$x-5$	$-$		$+$
	$-$	5	$+$

$(-\infty, 5]$

2. $\frac{x^2+1}{x^2+x-6} \ge 0$

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

x^2+1	$+$		$+$		$+$
$x+3$	$-$		$+$		$+$
$x-2$	$-$		$-$		$+$
	$+$	-3	$-$	2	$+$

$(-\infty, -3) \cup (2, \infty)$

3. $\frac{x-2}{x-3} \le \frac{1}{x+3}$

$$\frac{x-2}{x-3} - \frac{1}{x+3} \le 0$$

$$\frac{(x-2)(x+3)}{(x-3)(x+3)} - \frac{x-3}{(x-3)(x+3)} \le 0$$

$$\frac{x^2+x-6-x+3}{(x-3)(x+3)} \le 0$$

$$\frac{x^2-3}{(x-3)(x+3)} \le 0 \quad x^2=3 \quad x=\pm\sqrt{3}$$

$x \ne 3$ $x \ne -3$

$x+\sqrt{3}$	$-$		$-$		$+$		$+$		$+$
$x-\sqrt{3}$	$-$		$-$		$-$		$+$		$+$
$x+3$	$-$		$+$		$+$		$+$		$+$
$x-3$	$-$		$-$		$-$		$-$		$+$
	$+$	-3	$-$	$-\sqrt{3}$	$+$	$\sqrt{3}$	$-$	3	$+$

$(-3, -\sqrt{3}] \cup [\sqrt{3}, 3)$

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Station #5: Analyzing Functions *without* a Graphing Calculator

Match each function rule with ALL properties that apply to that function.
Some may be used more than once.

Functions

$x^2+16=0$
$\sqrt{x^2}=\sqrt{-16}$
$x=\pm 4i$

1. C, G, K $f(x)=\dfrac{-2(x^2+16)}{x}$

O.A.
$m=-2$
so $-\infty \uparrow$, $\infty \downarrow$

$\to 2x=0$
$x=0$

2. B, E, F $f(x)=\dfrac{2x}{x^2-9}$ $(x+3)(x-3)$

H.A.
$y=0$

hole when $x=8$

3. A, J $f(x)=\dfrac{(x+4)\cancel{(x-8)}}{(2x+7)\cancel{(x-8)}} = \dfrac{x+4}{2x+7}$ $\to 2x+7=0$
$2x=-7$

H.A.
$y=\frac{1}{2}$ V.A. $x=-3.5$

4. I, N, C $f(x)=3+\dfrac{1}{x^2}$ V.A.: $x=0$
Local behavior

H.A.: $y=3$

$\dfrac{3x^2+1}{x^2}$

Properties

A. Has a hole when $x = 8$.
B. $x = 0$ is a zero.
C. Has exactly two imaginary zeros.
D. Has a vertical asymptote at $x = 8$
E. Has a vertical asymptote at $x = -3$
F. Has the x-axis as its horizontal asymptote
G. Has an oblique asymptote
H. Has 3 different real zeros
I. As $x \to -\infty$, $f(x) \to 3$.
J. As $x \to \infty$, $f(x) \to 1/2$.
K. As $x \to -\infty$, $f(x) \to \infty$.
L. Has an even multiplicity of 2.
M. As $x \to -3.5^-$, $f(x) \to \infty$
N. As $x \to 0^+$, $f(x) \to \infty$