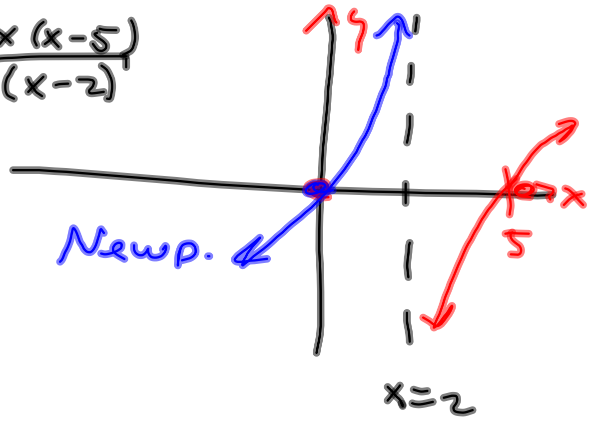
Test 2 Tuesday over C3

§3.8 #13 See Excel spreadsheet, dated 10/16 (yesterday). That's where we did it.

$$\lim_{x\to 2} \frac{x^2-5x}{x-2} \ \nexists \qquad \frac{x(x-5)}{(x-2)}$$



$$\lim_{x\to 2^-} \frac{x^2-5x}{x-2} = +\infty$$

$$\lim_{x\to 2^+} \frac{x^2-5x}{x-2} = -\infty$$

$$\lim_{x\to \pm\infty} f(x) = ?$$

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

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

O.A.

$$\begin{array}{r l}
 & x-3 \quad r-6 \\
x-2 \,\big) & x^2-5x+0 \\
 & -(x^2-2x) \\
 & \quad -3x+0 \\
 & \quad -(-3x+6)
\end{array}$$

$y = x-3$ is oblique asymptote. We get these whenever top degree $>$ bottom degree.

This work says:

$$\frac{x^2-5x}{x-2} = x-3-\frac{6}{x-2}$$

-6

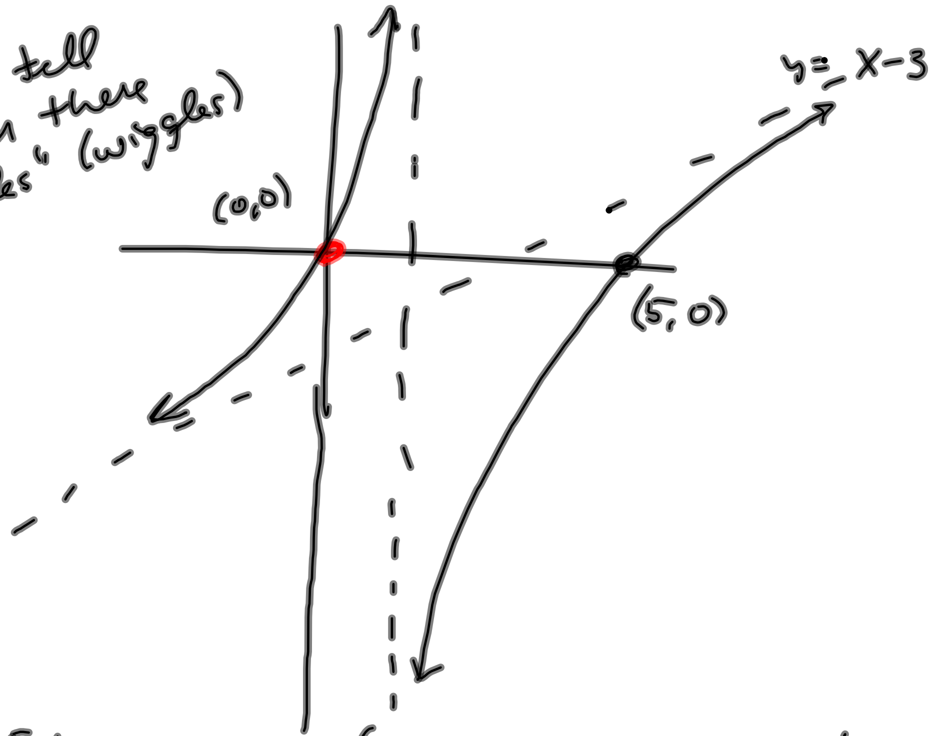
$\frac{-6}{x-2}$ runs the show close to $x=2$

$x-3$ calls the shots AWAY from $x=2$

$$3\overline{)29}^{\,9\,r\,2}$$
$$\frac{-27}{2}$$

$$\frac{29}{3} = 9+\frac{2}{3}$$

About all calculus can tell us is whether there are "wrinkles" (wiggles)



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

shows an advantage to dividing out.

$$y' = -6(-1)(x-2)^{-2} = \frac{6}{(x-2)^2} = 6(x-2)^{-2}$$

Always positive

$$y'' = -12(x-2)^{-3}$$

No cv's.

$x=2 \notin \mathcal{D}(y)$

$+ \quad | \quad - \quad y''$

2

Oct 17-1:01 PM

Evil Twin.

$$\lim_{x \to \infty}\left(\sqrt{x^2-9x+2} - x\right) \qquad \lim_{x \to -\infty}\Big(\underbrace{\sqrt{x^2-9x+2}}_{\infty} \underbrace{- x}_{-(-\infty)}\Big) = 2\infty = \infty$$

$$\left(\sqrt{x^2-9x+2} - x\right)\left(\frac{\sqrt{x^2-9x+2}+x}{\sqrt{x^2-9x+2}+x}\right)$$

$$= \frac{x^2-9x+2-x^2}{\sqrt{x^2-9x+2}+x} = \frac{-9x+2}{|x|\sqrt{1-\frac{9}{x}+\frac{2}{x^2}}+x}$$

$$= \frac{x\left(-9+\frac{2}{x}\right)}{x\left(\sqrt{1-\frac{9}{x}+\frac{2}{x^2}}+1\right)} = \frac{-9+\frac{2}{x}}{\sqrt{1-\frac{9}{x}+\frac{2}{x^2}}+1} \xrightarrow{x \to \infty} -\frac{9}{2}$$

$$\sqrt{x^2\left(1-\frac{9}{x}+\frac{2}{x^2}\right)} = \sqrt{x^2}\sqrt{1-\frac{9}{x}+\frac{2}{x^2}}$$

Now, $|x| = x$ when $x > 0$.

Evil Twin.

$$\lim_{x\to-\infty}\left(\sqrt{x^2-9x+2}-x\right)=2\infty=\infty$$
$$\infty-(-\infty)$$

Evil triplets

$$\lim_{x\to-\infty}\left(\sqrt{x^2-9x+2}+x\right)$$
$$\infty+-\infty$$
$$\infty-\infty=?$$

$$\left(\sqrt{x^2-9x+2}+x\right)\left(\frac{\sqrt{x^2-9x+2}-x}{\sqrt{x^2-9x+2}-x}\right)$$

$$=\frac{x^2-9x+2-x^2}{\sqrt{x^2-9x+2}-x}=\frac{-9x+2}{-x\sqrt{1-\frac{9}{x}+\frac{2}{x^2}}-x}$$

$$=\frac{\left(-9+\frac{2}{x}\right)x}{-x\left(\sqrt{1-\frac{9}{x}+\frac{2}{x^2}}+1\right)}=\frac{-9+\frac{2}{x}}{-\left(\sqrt{1-\frac{9}{x}+\frac{2}{x^2}}+1\right)}\xrightarrow{x\to-\infty}\frac{9}{2}$$

$$\sqrt{x^2-9x+2}=\sqrt{x^2\left(1-\frac{9}{x}+\frac{2}{x^2}\right)}=\sqrt{x^2}\sqrt{1-\frac{9}{x}+\frac{2}{x^2}}$$

$$=|x|\sqrt{1-\frac{9}{x}+\frac{2}{x^2}}=-x\sqrt{1-\frac{9}{x}+\frac{2}{x^2}}$$

$\lim_{x\to-\infty}$ * says $x<0$

& $x<0 \Rightarrow |x|=-x$.