October 26, 2026

National Pumpkin Day

Today in History:

Shoot out at the OK Corral (1881)

Erie Canal Opens (1825)

Number of the Day: 434

434 = 2 x 7 x 31

434 is 2002 in base 6**.**

Fun Fact:

The United Kingdom eats more cans of baked beans than the rest of the world combined.

Quote of the Day:

"Education is the ability to listen to almost anything without losing your temper."

- Robert Frost

Today's Weather:

Sunny to partly cloudy, high near 66^{o}.

Math 121 - Quiz #29

For

$$f(x) = 3x^5 - 40x^3 + 7x + 5$$

Find where f is concave up, concave down and any inflection points.

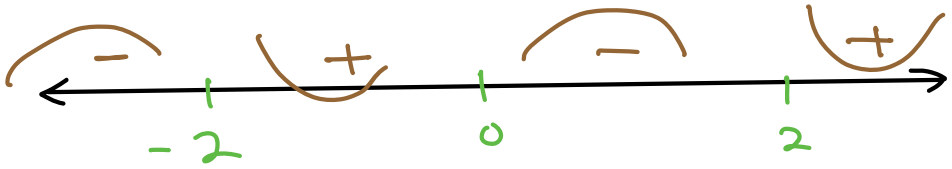
$f'(x) = 15x^4 - 120x^2 + 7$

$f''(x) = 60x^3 - 240x$

$60x^3 - 240x = 0$

$60x(x^2 - 4) = 0$

$x = 0, -2, 2$



CON UP $(-2, 0) \cup (2, \infty)$

CON DN $(-\infty, -2) \cup (0, 2)$

I.P: $x = -2, 0, 2$

L'HOSPITAL'S RULE

① $\lim_{x \to 2} \frac{x^2 - 4}{x - 2} = \lim_{x \to 2} \frac{(x-2)(x+2)}{(x-2)} = 4$

② $\lim_{x \to 0} \frac{e^{2x} - 1}{x}$

$$\lim_{x \to a} \frac{f(x)}{g(x)} = \text{"}\frac{0}{0}\text{"}$$

LOOK AT $\lim_{x \to a} \frac{f'(x)}{g'(x)} = L$

$$\Rightarrow \lim_{x \to a} \frac{f(x)}{g(x)} = L$$

L'HOSPITAL'S RULE

$$\lim_{x \to 0} \frac{e^{2x} - 1}{x} = \text{"}\frac{0}{0}\text{"}$$

$$\lim_{x \to 0} \frac{2e^{2x}}{1} = 2$$

$$\Rightarrow \lim_{x \to 0} \frac{e^{2x} - 1}{x} = 2$$

(3) $\lim_{x \to 0} \frac{e^x - 1}{\sin(2x)} = \frac{"0"}{0} = \frac{1}{2}$

$\lim_{x \to 0} \frac{e^x}{2\cos(2x)} = \frac{1}{2}$

(4) $\lim_{x \to 1} \frac{1 - x + \ln x}{1 + \cos(\pi x)} = \frac{"0"}{0}$ $-\frac{1}{\pi^2}$

$\lim_{x \to 1} \frac{-1 + \frac{1}{x}}{-\pi \sin(\pi x)} = \frac{"0"}{0}$

$\lim_{x \to 1} \frac{-\frac{1}{x^2}}{-\pi^2 \cos(\pi x)} = \frac{-1}{\pi^2} = -\frac{1}{\pi^2}$

$\lim_{x \to a} \frac{f(x)}{g(x)} = \frac{"\infty"}{\infty} = L$

$\lim_{x \to a} \frac{f'(x)}{g'(x)} = L$

$\lim_{x \to \infty} \frac{x^2 + 5x + 2}{3x^2 + 2x + 7} = \frac{"\infty"}{\infty}$ $\frac{1}{3}$

$\lim_{x \to \infty} \frac{2x + 5}{6x + 2} = \frac{"\infty"}{\infty}$ $\lim_{x \to \infty} \frac{2}{6} = \frac{1}{3}$

$$= "0 \cdot \infty"$$

$$\lim_{x \to 0^+} x^2 \ln x = "0 \cdot \infty" = 0$$

$$= \lim_{x \to 0^+} \frac{\ln x}{\frac{1}{x^2}} = \frac{"\infty"}{\infty}$$

$$\lim_{x \to 0^+} \frac{\frac{1}{x}}{-\frac{2}{x^3}} = \lim_{x \to 0^+} \frac{x^2}{-2x} =$$

$$\lim_{x \to 0^+} \frac{x^2}{-2} = 0$$

$$= "\infty - \infty"$$

$$\lim_{x \to 0^+} \left(\frac{1}{x} - \frac{1}{\sin x} \right) = "\infty - \infty" = 0$$

$$= \lim_{x \to 0^+} \left(\frac{\sin x - x}{x \sin x} \right) = \frac{"0"}{0}$$

$$\lim_{x \to 0^+} \frac{\cos x - 1}{x \cos x + \sin x} = \frac{"0"}{0}$$

$$\lim_{x \to 0^+} \frac{-\sin x}{-x\sin x + \cos x + \cos x} = \frac{0}{2} = 0$$

$$= 0^0 =$$

$$\lim_{x \to 0^+} x^x = "0^0"$$

$$y = \lim_{x \to 0^+} x^x = 1$$

$$\ln y = \ln \lim_{x \to 0^+} x^x$$

$$= \lim_{x \to 0^+} \ln x^x$$

$$= \lim_{x \to 0^+} x \ln x = "0 \cdot \infty"$$

$$= \lim_{x \to 0^+} \frac{\ln x}{\frac{1}{x}} \overset{\text{LHR}}{=} \frac{"\infty"}{\infty}$$

FINALLY L'HOSPITAL.

$$= \lim_{x \to 0^+} \frac{\frac{1}{x}}{-\frac{1}{x^2}} = \lim_{x \to 0^+} -\frac{x^2}{x} = 0$$

$$e^{\ln y} = e^{0}$$

$$y = e^0 = 1$$

$$= "1^{\infty}"$$

$$\lim_{x\to\infty} \left(1+\frac{2}{x}\right)^{3x} = "1^{\infty}"$$

$$y = \lim_{x\to\infty} \left(1+\frac{2}{x}\right)^{3x}$$

$$\ln y = \ln \lim_{x\to\infty} \left(1+\frac{2}{x}\right)^{3x}$$

$$= \lim_{x\to\infty} \ln\left(1+\frac{2}{x}\right)^{3x}$$

$$= \lim_{x\to\infty} 3x \ln\left(1+\frac{2}{x}\right) = "\infty \cdot 0"$$

$$= \lim_{x\to\infty} \frac{\ln\left(1+\frac{2}{x}\right)}{\frac{1}{3x}} = "\frac{0}{0}"$$

$$\lim_{x\to\infty} \frac{\frac{1}{1+\frac{2}{x}} \cdot \frac{+2}{x^2}}{\frac{-1}{3x^2}} = 6$$

$$\ln y = 6$$

$$y = e^6$$

L'HOSPITAL'S RULE

