# October 28, 2025

# National Chocolate Day

**Today in History:**

Gateway Arch Completed (1965)

Statue of Liberty dedicated (1886)

**Number of the Day: 744**

**744** = 2 x 2 x 2 x 3 x 31

**744** is the number of perfect squared rectangles of order 14

**Fun Fact:**

It is Texas law that when two train meet at a railroad crossing, each shall come to a full stop, and neither shall proceed until the other has gone.

**Quote of the Day:**

"If I were giving a young man advice as to how he might succeed in life, I would say to him, pick out a good father and mother, and begin life in Ohio."

- Wilbur Wright

**Today's Weather:**

Sunshine. High $58^{o}$

# Math 121 - Quiz #30

Find

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

$$\lim_{x\to 0}\frac{3e^{3x}-3}{2x} = \text{"}\frac{0}{0}\text{"}$$

$$\lim_{x\to 0}\frac{9e^{3x}}{2} = \frac{9}{2}$$

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mpoo 30

#15

$$\lim_{x\to\infty} x\sin\left(\frac{1}{x}\right) = \text{"}\infty\cdot 0\text{"}$$

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

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

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

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

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

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

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

$= \lim_{x\to\infty} \dfrac{\frac{1}{1-\frac{3}{x}}\cdot\left(\frac{3}{x^2}\right)}{\left(\frac{-1}{x^2}\right)} = -3$

$\ln y = -3$

$y = e^{-3}$

# GRAPHING

f
1. Domain
2. Range
3. x-intercepts
4. y-intercepts

f'
5. increasing
6. Deceasing
7. Critical Points

f''
8. Concave up
9. Concave down
10. Inflections Points

EXAMPLE $f(x) = 3x^5 - 5x^3$

(1) DOMAIN ALL $x$

(2) RANGE (SAVE FOR LATER) ALL $y$

→ (3) x-INT $(y = 0)$

$$0 = 3x^5 - 5x^3$$

$$0 = x^3(3x^2 - 5)$$

$x = 0$ $\quad 3x^2 - 5 = 0$

$$x = \pm\sqrt{\frac{5}{3}}$$

(4) y-INT $(x = 0)$

$y = 0$

(5) INC

(6) DEC

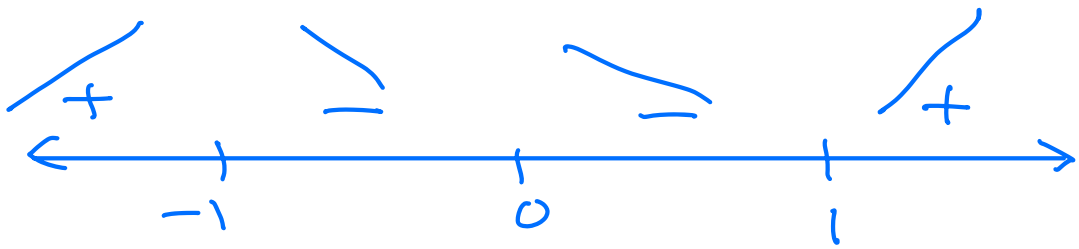
(7) C.P.

$f(x) = 3x^5 - 5x^3$

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

$= 15x^2(x^2 - 1) = 0$

$x = 0, \pm 1$




(5) INC: $(-\infty, -1) \cup (1, \infty)$

(6) DEC: $(-1, 0) \cup (0, 1)$

$x = -1$ MAX

$x = 1$ MIN

$x = 0$ NOTHING.

(8) CON UP

(9) CON DN

(10) I.P

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

$f''(x) = 60x^3 - 30x$

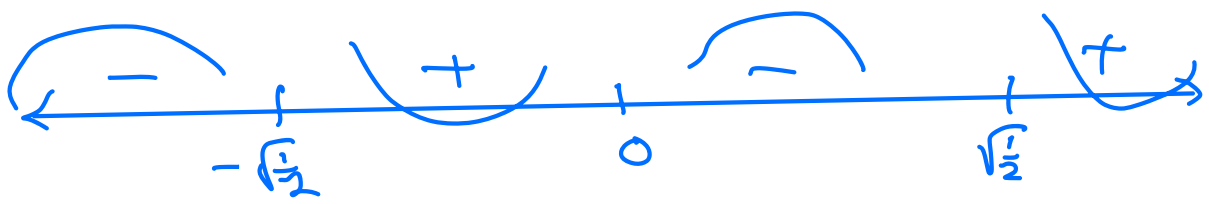
$60x^3 - 30x = 0$

$30x(2x^2 - 1) = 0$

$x = 0$

$2x^2 - 1 = 0$

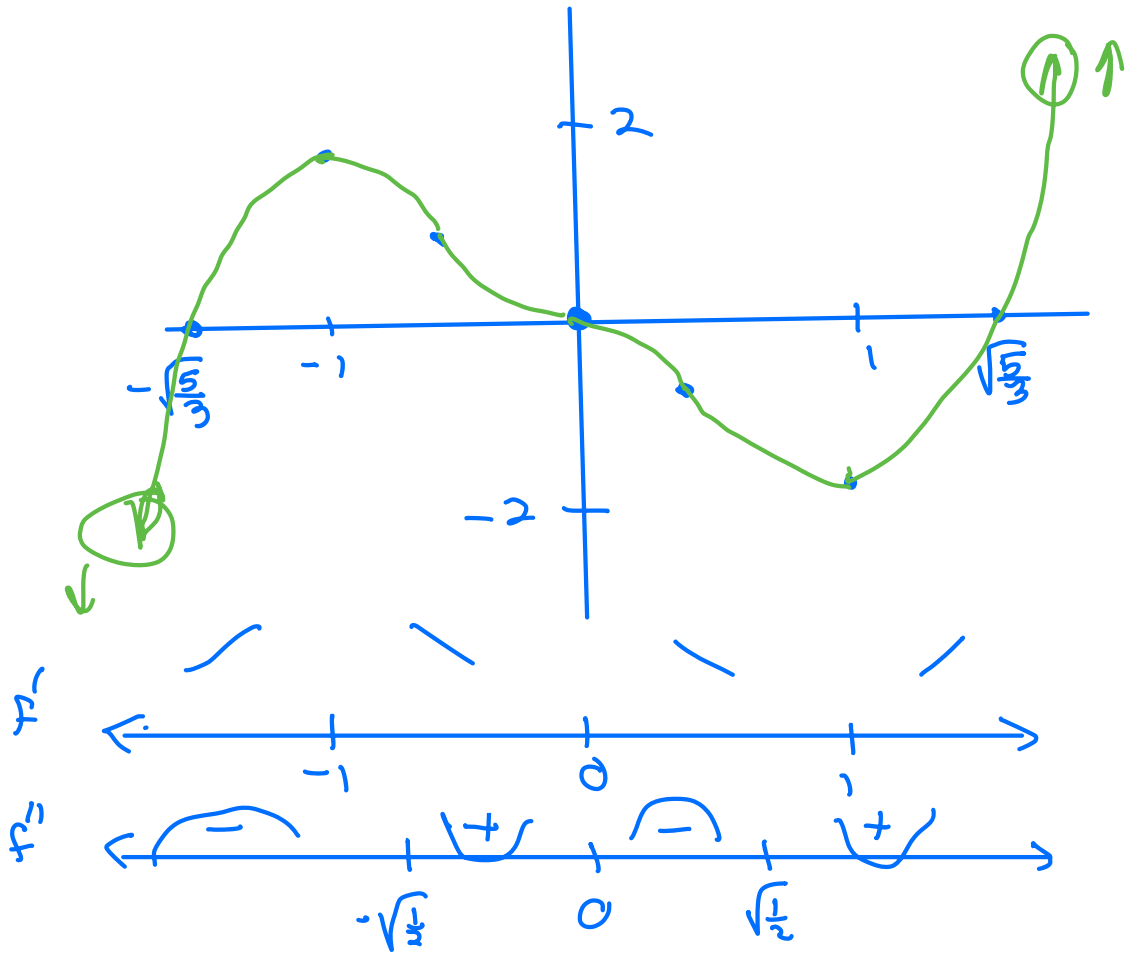
$x = \pm\sqrt{\frac{1}{2}}$



CON UP : $(-\sqrt{\frac{1}{2}}, 0) \cup (\sqrt{\frac{1}{2}}, \infty)$

CON DN $(-\infty, -\sqrt{\frac{1}{2}}) \cup (0, \sqrt{\frac{1}{2}})$

I.P. $\pm\sqrt{\frac{1}{2}}, 0$







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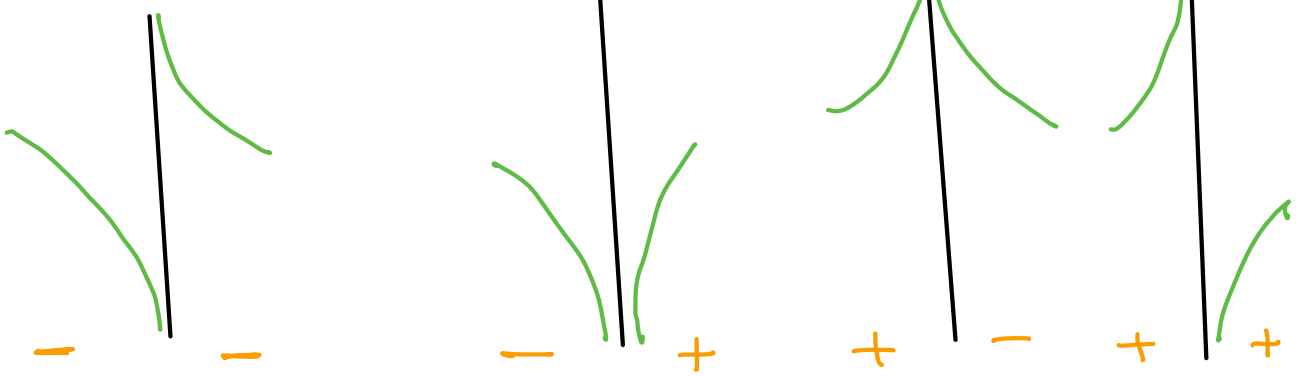
## ASYMPTOTES

HORIZONTAL $\lim_{x \to \pm\infty} f(x) = L$ $\quad Y = L$ H.A.

VERTICAL



FIND V.A. $f(x) = \frac{P(x)}{Q(x)}$

$Q(x) = 0$ AND $P(x) \neq 0$

NEVER CROSS V.A. !!

f
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11. Vertical Asymptotes
12. Horizontal Asymptotes

EXAMPLE $f(x) = \frac{x^2+1}{x^2-4}$

① DOMAIN: $x \neq \pm 2$

② RANGE: LATER $(-\infty, -\frac{1}{4}] \cup (1, \infty)$

③ x-INT: $y = 0$ $0 = \frac{x^2+1}{x^2-4}$

$x^2+1 = 0$ NO!!

④ y-INT $x = 0$ $Y = \frac{1}{-4} = -\frac{1}{4}$

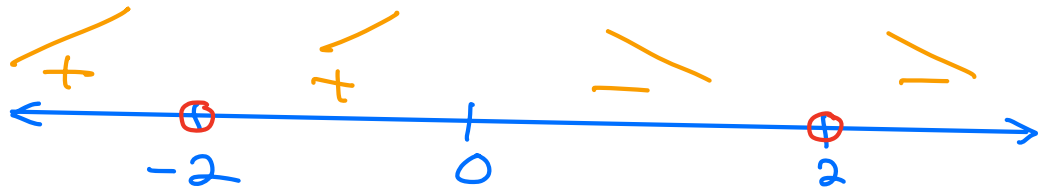
$$f'(x) = \frac{-10x}{(x^2-4)^2}$$

$$\frac{-10x}{(x^2-4)^2} = 0 \qquad -10x = 0$$

$$x = 0$$

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

$$x = \pm 2$$




INC: $(-\infty, -2) \cup (-2, 0)$

DEC: $(0, 2) \cup (2, \infty)$

$x = 0$ MAX

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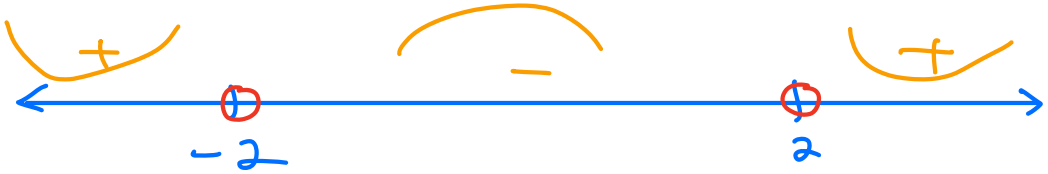
$$f''(x) = \frac{30x^2+40}{(x^2-4)^3}$$

$$\frac{30x^2+40}{(x^2-4)^3} = 0 \qquad 30x^2+40 = 0$$

NO!!

$$(x^2-4)^3 = 0$$

$$x = \pm 2$$



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

CON DN $(-2, 2)$

I.P. NONE

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HOR. A.

$$\lim_{x \to \pm\infty} \frac{x^2+1}{x^2-4} = 1$$

V.A $x^2 - 4 = 0$ $x = \pm 2$