September 26, 2025

National Pancake Day

Today in History:

First Kennedy – Nixon debate (1960)

The Brady Bunch premieres (1969)

Number of the Day: 5873

5873 = 7 x 839

5873 divides $1^1 + 2^2 + 3^3 + \ldots + 5873^{5873}$

Fun Fact:

Only 4 words in the English language end in “dous”

Horrendous, tremendous, hazardous and stupendous

Quote of the Day:

"The most rewarding things you do in life are often the ones that look like they cannot be done."

– Arnold Palmer

Today’s Weather:

Partly cloudy skies, high 71^o

Math 121

Quiz #16

The position of a particle is $s(t) = 2t^2 - t + 5$ for $0 \leq t \leq 5$. Find the value of t where the average velocity over the entire time is equal to the instantaneous velocity.

$$V_{AVE} = \frac{\Delta s}{\Delta t} = \frac{s(5) - s(0)}{5 - 0} = \frac{50 - 5}{5} = \frac{45}{5} = 9$$

$s(5) = 2(25) - 5 + 5 = 50$

$s(0) = 5$

$v(t) = 4t - 1$ $\quad 4t - 1 = 9$

$4t = 10$

$t = \frac{10}{4} = \frac{5}{2} = 2.5$

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mpoo #15

(5) $B(p) = \frac{900}{p}$

(a) $B(40) = \frac{900}{40} = 22.50$

(b) $B'(p) = -\frac{900}{p^2}\Big|_{p=40} = -0.5625$

(c) $B'(P) = -\frac{900}{P^2}\Big|_{P=40} = 0.5625$

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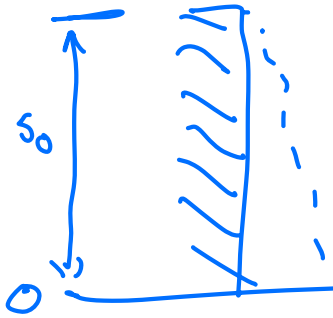
(4) 3 SEC.



$$S(t) = S_0 + V_0 t - \frac{1}{2} g t^2$$

$$S(t) = S_0 + V_0 t - \frac{1}{2}(9.8) t^2$$

$V_0 = 0$

$$S(t) = S_0 - \frac{1}{2}(9.8) t^2$$

$t = 3 \quad S = 0 \qquad 0 = S_0 - \frac{1}{2}(9.8)(3)^2$

$$S_0 = 44.1$$

$$S(t) = 44.1 - \frac{1}{2}(9.8) t^2$$

$$V(t) = -\frac{1}{2}(9.8)(2t)\Big|_{t=3} = -29.4 \text{ m/s}$$

HIGHER DERIVATIVES

NOTATION	$f'(x)$	y'	$\frac{dy}{dx}$	$\frac{df}{dx}$	FIRST DERIVATIVE

SECOND DERIVATIVE

$f''(x)$ $\quad y''$ $\quad \frac{d^2y}{dx^2}$ $\quad \frac{d^2f}{dx^2}$

$$\frac{d}{dx}\left(\frac{dy}{dx}\right) = \frac{d^2y}{dx^2}$$

$f(x) = x^2 + 3x + 5$

$f'(x) = 2x + 3$

$f''(x) = 2$

THIRD

$f'''(x)$ $\quad y'''$ $\quad \frac{d^3y}{dx^3}$ $\quad \frac{d^3f}{dx^3}$

FOURTH

$f''''(x)$ $\quad y''''$ $\quad \frac{d^4y}{dx^4}$ $\quad \frac{d^4f}{dx^4}$

FIFTH

$f^{\text{fifth}}(x)$ $\quad f^5(x)$ $\quad f^{V}(x)$

EXAMPLE

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

$f'(x) = 3e^x + 5x^4 + 4x^3 + 3x^2 + 2x + 1$

$f''(x) = 3e^x + 20x^3 + 12x^2 + 6x + 2$

$$f'''(x) = 3e^x + 60x^2 + 24x + 6$$

$$f^{(4)}(x) = 3e^x + 120x + 24$$

$$f^{5}(x) = 3e^x + 120$$

$$f^{6}(x) = 3e^x$$

$$\vdots$$

$$f(x) = \frac{e^x + x}{x^2 + 5}$$

$$f'(x) = \frac{(x^2+5)(e^x+1) - (e^x+x)(2x)}{(x^2+5)^2}$$

$$= \frac{x^2e^x + 5e^x + x^2 + 5 - 2xe^x - 2x^2}{(x^2+5)(x^2+5)}$$

$$f''(x) = \frac{\left[(x^2+5)(x^2+5)\right]\left[x^2e^x + 2xe^x + 5e^x + 2x - 2xe^x - 2e^x - 4x\right] - \left(x^2e^x + 5e^x + x^2 + 5 - 2xe^x - 2x^2\right)\left[(x^2+5)(2x) + (x^2+5)(2x)\right]}{\left((x^2+5)(x^2+5)\right)^2}$$