September 23, 2025

Redhead Appreciation Day

Today in History:

John Paul Jones victorious (1779)

Neptune is discovered (1846)

Number of the Day: 3604

3604 = 2 x 2 x 17 x 53

3604 and its reversal (4063) are each multiples of 17.

Fun Fact:

The first couple to be shown in bed together on prime time TV were Fred and Wilma Flintstone.

Quote of the Day:

"If a man's wit be wandering, let him study the mathematics."

– Francis Bacon

Today's Weather:

Occasional showers, high 73^{o}

Math 121

Quiz #14

Find $f'(x)$ for

$$f(x) = \frac{1}{x^2} - \sqrt[3]{x^4} + \frac{e^x}{5}$$

$f(x) = x^{-2} - x^{\frac{4}{3}} + \frac{1}{5}e^x$

$f'(x) = -2x^{-3} - \frac{4}{3}x^{\frac{1}{3}} + \frac{1}{5}e^x$

$= \frac{-2}{x^3} - \frac{4\sqrt[3]{x}}{3} + \frac{e^x}{5}$

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mpod #14

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

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

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$r = t - e^t$

$\left.\frac{dR}{dt}\right|_{t=4}$

$\left.\frac{dr}{dt} = 1 - e^t\right|_{t=4} = 1 - e^4$

PRODUCT RULE

$$P(x) = f(x)\,g(x)$$

$$P'(x) = \lim_{h \to 0} \frac{P(x+h) - P(x)}{h}$$

$$= \lim_{h \to 0} \frac{f(x+h)\,g(x+h) - f(x)\,g(x)}{h}$$

$$= \lim_{h \to 0} \frac{f(x+h)\,g(x+h) - f(x+h)\,g(x) + f(x+h)\,g(x) - f(x)\,g(x)}{h}$$

$$= \lim_{h \to 0} \frac{f(x+h)\,g(x+h) - f(x+h)\,g(x)}{h} + \lim_{h \to 0} \frac{f(x+h)\,g(x) - f(x)\,g(x)}{h}$$

$$= \lim_{h \to 0} f(x+h)\left(\frac{g(x+h) - g(x)}{h}\right) + \lim_{h \to 0} g(x)\left(\frac{f(x+h) - f(x)}{h}\right)$$

$$= f(x)\,g'(x) + g(x)\,f'(x)$$

$$P(x) = f(x)\,g(x) \qquad P'(x) = f(x)\,g'(x) + g(x)\,f'(x)$$

EXAMPLE 1

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

$$f'(x) = (2x+4)(6x+1) + (3x^2+x+1)(2)$$

EXAMPLE 2

$x^{\frac{1}{2}} + x^{-\frac{1}{2}}$

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

$$f'(x) = (e^x + x^2)\left(\frac{1}{2}x^{-\frac{1}{2}} - \frac{1}{2}x^{-\frac{3}{2}}\right) + \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)(e^x + 2x)$$

EXAMPLE 3

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

$$f'(x) = e^x \left[(x^2+1)(x^3+1)\right]' + \left[(x^2+1)(x^3+1)\right] e^x$$

$$f'(x) = e^x \left[(x^2+1)(3x^2) + (x^3+1)(2x)\right] + \left[(x^2+1)(x^3+1)\right] e^x$$

$$= e^x (x^2+1)(3x^2) + e^x (x^3+1)(2x) + e^x (x^2+1)(x^3+1)$$

1 2 3′ 1 3 2′ 1′ 2 3

QUOTIENT RULE

$$q(x) = \frac{f(x)}{g(x)} \qquad q'(x) = \frac{g(x)\,f'(x) - f(x)\,g'(x)}{(g(x))^2}$$

$$q(x) = \frac{H1}{H0} \qquad q'(x) = \frac{H0\,dH1 - H1\,dH0}{H0\,H0}$$

EXAMPLE 4

$$f(x) = \frac{x^2+1}{3x+5}$$

$$f'(x) = \frac{(3x+5)(2x) - (x^2+1)(3)}{(3x+5)^2}$$

EXAMPLE 5 $\qquad f(x) = \dfrac{\sqrt{x}}{e^x}$

$$f'(x) = \frac{(e^x)\left(\frac{1}{2}x^{-\frac{1}{2}}\right) - (\sqrt{x})(e^x)}{(e^x)^2}$$

EXAMPLE 6 $\qquad f(x) = \dfrac{x^2 e^x}{(x^2+x+3)}$

$$f'(x) = \frac{(x^2+x+3)\left[x^2 e^x\right]' - (x^2 e^x)(2x+1)}{(x^2+x+3)^2}$$

$$f'(x) = \frac{(x^2+x+3)\left[x^2e^x + 2xe^x\right] - (x^2e^x)(2x+1)}{(x^2+x+3)^2}$$

EXAMPLE 7 $\quad f(x) = \dfrac{1}{x^3+x^2+x+1}$

$$f'(x) = \frac{(x^3+x^2+x+1)(0) - 1(3x^2+2x+1)}{(x^3+x^2+x+1)^2}$$

$$= -\frac{(3x^2+2x+1)}{(x^3+x^2+x+1)^2} \leftarrow$$

RECP. RULE

$$f(x) = \frac{1}{g(x)}$$

$$f'(x) = \frac{(g(x))(0) - 1(g'(x))}{(g(x))^2}$$

$$f(x) = \frac{1}{g(x)} \qquad f'(x) = \frac{-g'(x)}{(g(x))^2}$$

RECAP

$f(x)$	$f'(x)$
C	0
x^N	$N x^{N-1}$
$f(x) \pm g(x)$	$f'(x) \pm g'(x)$
e^x	e^x
$f(x) \cdot g(x)$	$f(x) g'(x) + g'(x) f(x)$
$\frac{f(x)}{g(x)}$	$\frac{g(x) f'(x) - f(x) g'(x)}{(g(x))^2}$