

September 16, 2026

National Cinnamon Raisin Bread Day

Today in History:

Mayflower departs England (1620)

William Durant creates General Motors (1908)

Number of the Day: 696

$696 = 2 \times 2 \times 2 \times 3 \times 29$

696 is a palindrome n so that $n(n + 8)$ is also palindromic (489984)

Fun Fact:

40% of McDonalds profits come from the sale of Happy Meals.

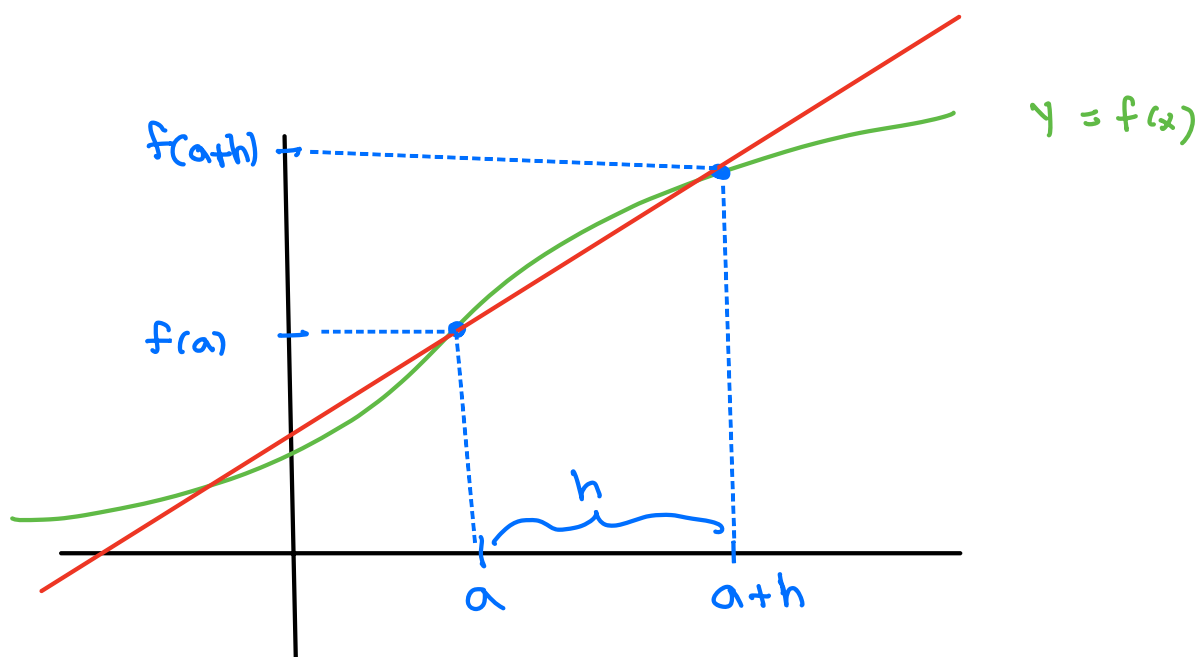
Quote of the Day:

"It is more fun to talk with someone who doesn't use long, difficult words but rather short, easy words like "What about lunch?"

— A.A. Milne

Today's Weather:

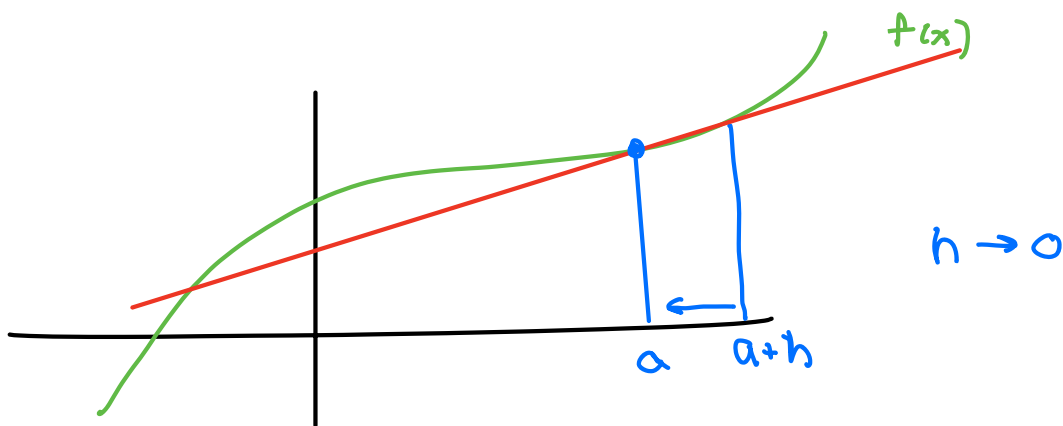
Slight chance of a rain shower, high 76°



$$\text{SLOPE} = \frac{\Delta y}{\Delta x} = \frac{f(a+h) - f(a)}{a+h - a}$$

$$= \frac{f(a+h) - f(a)}{h}$$

SLOPE OF SECANT LINE



TANGENT LINE.

SLOPE OF TANGENT LINE

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$f'(a)$ IS THE SLOPE OF THE
TANGENT

THE DERIVATIVE

EXAMPLE 1

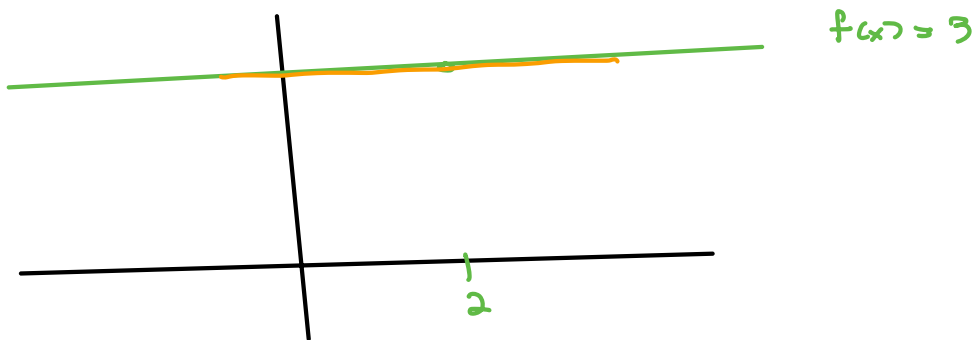
$$f(x) = 3$$

$$a = 2$$

$$f'(2) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{f(2+h) - f(2)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{3 - 3}{h} = 0$$



EXAMPLE 2

$$f(x) = 5$$

$$a = 1$$

$$f'(1) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{f(1+h) - f(1)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{5-5}{h} = 0$$

EXAMPLE 3

$$f(x) = c \quad x = a$$

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{c - c}{h} = 0$$

$$f(x) = c \quad f'(x) = 0$$

EXAMPLE 4 $f(x) = mx + b \quad a = 2$

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{m(2+h) + b - (m \cdot 2 + b)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{2m} + mh + \cancel{b} - \cancel{2m} - \cancel{b}}{h}$$

$$= m$$

EXAMPLE 5 $f(x) = x^2 \quad a = 2$

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{f(2+h) - f(2)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{(2+h)^2 - 4}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{4} + 4\cancel{h} + h^2 - \cancel{4}}{h}$$

$$= \lim_{h \rightarrow 0} 4 + h = 4$$

EXAMPLE 6 $f(x) = x^2$ $x = a$

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{(a+h)^2 - a^2}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{a^2} + 2a\cancel{h} + h^2 - \cancel{a^2}}{h}$$

$$= \lim_{h \rightarrow 0} 2a + h = 2a$$

$$f(x) = x^2$$

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

EXAMPLE 7

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

$$x = a$$

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{(a+h)^3 - a^3}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{a^3} + 3\cancel{a^2}h + 3ah^2 + h^3 - \cancel{a^3}}{\cancel{h}}$$

$$= \lim_{h \rightarrow 0} 3a^2 + 3ah + h^2 = 3a^2$$

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

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

$$f(x) = x^2$$

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

EXAMPLE 8

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

$$x = a$$

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\frac{1}{a+h} - \frac{1}{a}}{h}$$

$$= \lim_{h \rightarrow 0} \frac{a - (a+h)}{(a+h)a} \cdot \frac{1}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{a} - (\cancel{a} + \cancel{h})}{\cancel{h}(a+h)(a)}$$

$$= \lim_{h \rightarrow 0} \frac{-1}{(a+h)(a)} = -\frac{1}{a^2}$$

$$f(x) = \frac{1}{x} \text{ or } x^{-1} \quad f'(x) = -\frac{1}{x^2} \text{ or } -x^{-2}$$

EXAMPLE 9 $f(x) = \sqrt{x}$ $x=a$

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{\sqrt{a+h} - \sqrt{a}}{h} \left(\frac{\sqrt{a+h} + \sqrt{a}}{\sqrt{a+h} + \sqrt{a}} \right)$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{a} + \cancel{h} - \cancel{a}}{\cancel{h}(\sqrt{a+h} + \sqrt{a})} = \frac{1}{2\sqrt{a}}$$

$$f(x) = \sqrt{x} \text{ or } x^{\frac{1}{2}}$$

$$f'(x) = \frac{1}{2\sqrt{x}} \text{ or } \frac{1}{2} x^{-\frac{1}{2}}$$

EXAMPLE 10

$$f(x) = |x|$$

$$a = 0$$

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{|h|}{h} = \text{DNE.}$$

$$\lim_{h \rightarrow 0^-} \frac{|h|}{h} = \lim_{h \rightarrow 0^-} \frac{-h}{h} = -1$$

$$\lim_{h \rightarrow 0^+} \frac{|h|}{h} = \lim_{h \rightarrow 0^+} \frac{h}{h} = 1$$

