

3.1 examples

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3.1 examples

Calculus AB, section 3.1

p. 102: 6, 7, 9-13, 15

Example 1 (Finding an Equation of a Tangent Line)



Find an equation of the tangent line to the graph of $f(x) = x^2$ at $x = 5$.

(Use Equation 2.)

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

$$\lim_{h \rightarrow 0} \frac{(5+h)^2 - 5^2}{h} = \frac{25 + 10h + h^2 - 25}{h} \quad a=5$$

$$\frac{10h + h^2}{h} = 10 + h \rightarrow 10 = f'(5)$$

$$y - 25 = 10(x - 5)$$

Example 2

Compute $f'(3)$, where $f(x) = 4x^2 - 7x$. $\lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a} = f'(a)$
(Use Equation 1.)

$$\lim_{x \rightarrow 3} \frac{4x^2 - 7x - (4 \cdot 9 - 7 \cdot 3)}{x - 3} = \frac{4x^2 - 7x - 15}{x - 3} \quad \frac{0}{0}$$

$$\frac{(4x + 5)(x - 3)}{x - 3} \rightarrow 17$$

$$|24: 2, 4$$

Example 3

Sketch the graph of $f(x) = \frac{1}{x}$ and ~~draw~~ ^{find} the tangent line at $x = 2$. $a = 2$

Find $f'(x)$

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

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

$$= \frac{-h}{2(2+h)h} \rightarrow -\frac{1}{4}$$

$$y - \frac{1}{2} = -\frac{1}{4}(x - 2)$$

Example 4

Find the derivative of $f(x) = 9x - 5$ at $x = 2$ and $x = 5$.

Example 5

Estimate the derivative of $f(x) = \sin x$ at $x = \frac{\pi}{6}$.

Example 6 (Determining accuracy graphically)

Let $f(x) = \sin x$. Show that the approximation $f'(\frac{\pi}{6}) \approx 0.8660$ is accurate to 4 decimal places by studying the relationship between the secant and tangent lines.