1. Equations of Tangent & Secant Lines

1.1 Essential Questions

Essential Questions 1.1

1. How do we find the equation of the tangent line of a given function at the point $P(a, b)$?
2. How do we find the equation of the tangent line of a given function at $x = a$?

1.2 Finding the Equation of the Tangent Line

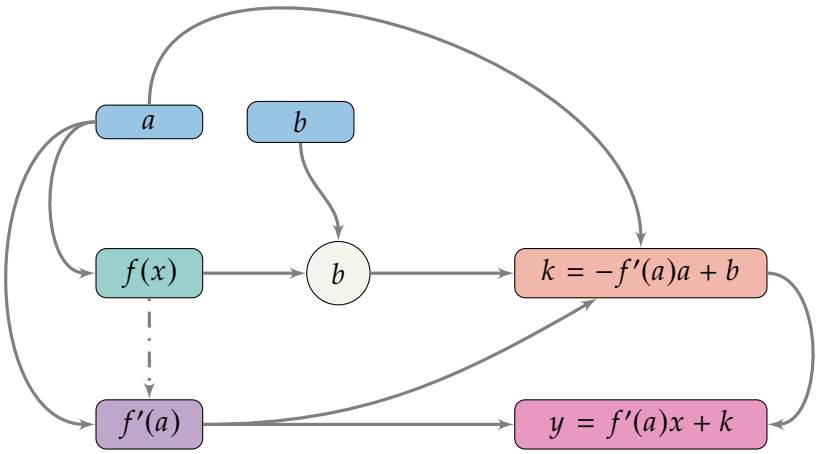

Figure 1.1: Finding the Equation of a Tangent Line Workflow

For a given function, $f(x)$, our goal is to find the equation of the tangent line at the point $P(a, b)$, which can be expressed in slope-intercept form as:

$$y = f'(a)x + k$$

Where $f'(a)$ is the value of the derivative, slope, at $x = a$ and k is the y-intercept. We therefore need to:

1. Find the derivative of the function $f(x)$: $f'(x)$
2. Find the value of the derivative at $x = a$: $f'(a)$
3. Find the value of the y-intercept: $k = -f'(a) + b$:
4. If the ordinate b is not explicitly given, then find $f(a) = b$

Example 1.1 – id:20151011-154209.
Find the equation of the line tangent to the curve of the function $f(x) = 2x^2 + 3x + 7$ at the point $P(2, 21)$.

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Solution:
Find the derivative of $f(x)$

$$f'(x) = 4x + 3 \text{ goto } \textbf{??}$$

Evaluate the derivative at $x = 2$

$f'(2) = 4[2] + 3$	SPE(**??**)
$f'(2) = 8 + 3$	OOM(**??**)
$f'(2) = 11$	OOA(**??**)

Find the y-intercept, k, of the equation of the tangent line.

$y = f'(x)x + k$	
$[21] = [11][2] + k$	SPE(**??**)
$21 = 22 + k$	OOM(**??**)
$\neg 22 + [21] = \neg 22 + [22 + k]$	SPE+AI
$\neg 22 + 21 = (\neg 22 + 22) + k$	APA(**??**)
$\neg 1 = 0 + k$	OOA(**??**)
$\neg 1 = k$	AId(**??**)
$-1 = k$	ONeg(**??**)
$k = -1$	SyPE(**??**)

The equation of the tangent line is

$y = f'(2)x + k$	
$y = 11x - 1$	SPE(**??**)

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