

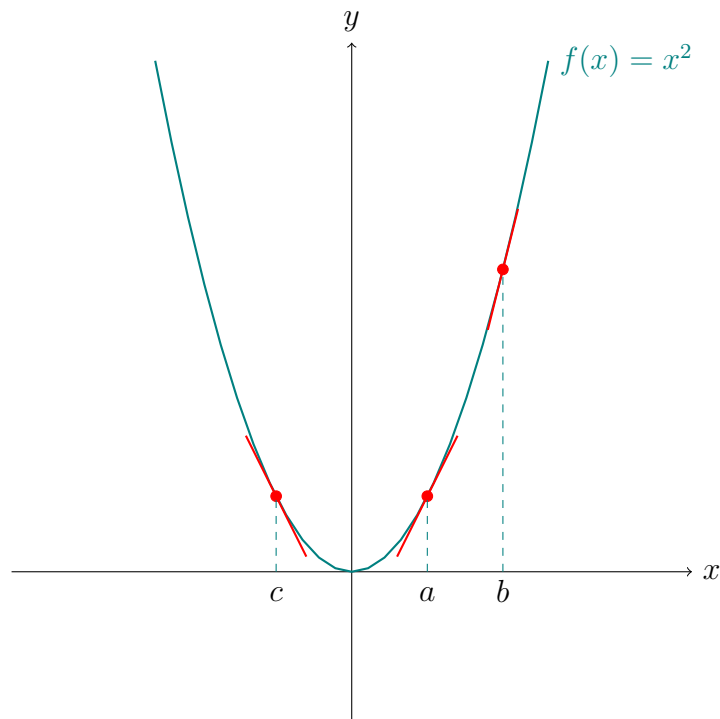
Tangent Lines: The Derivative Function

Video companion

1 Introduction

Derivative formula:

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



- Slope is positive at a : $f'(a) > 0$
- Slope is positive at b and greater than at a : $f'(b) > f'(a)$
- Slope is negative at c : $f'(c) < 0$

2 Calculate derivative

$$\begin{aligned} f'(a) &= \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h} \\ &= \lim_{h \rightarrow 0} \frac{(a+h)^2 - a^2}{h} \\ &= \lim_{h \rightarrow 0} \frac{a^2 + 2ah + h^2 - a^2}{h} \\ &= \lim_{h \rightarrow 0} \frac{h(2a + h)}{h} \\ &= \lim_{h \rightarrow 0} (2a + h) \\ &= 2a \end{aligned}$$

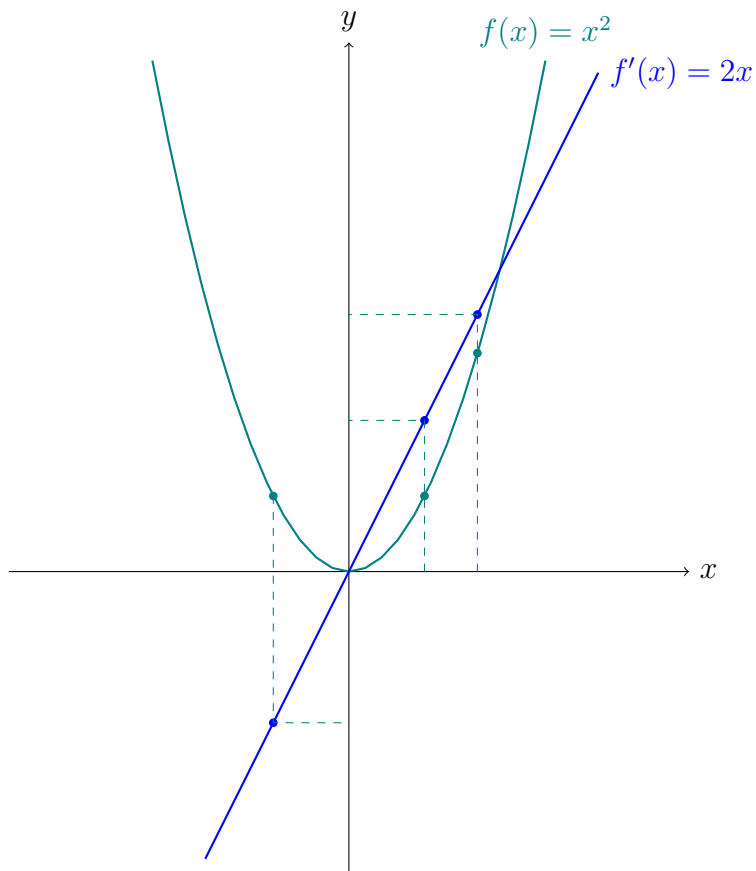
$$f'(a) = 2a$$

$$f'(b) = 2b$$

$$f'(c) = 2c$$

Can verify $2a > 0$, $2b > 2a$, and $2c < 0$

3 Graph of derivative function



Next video: Finding where derivative is zero (where the tangent line to the function is horizontal) is important for optimization problems.