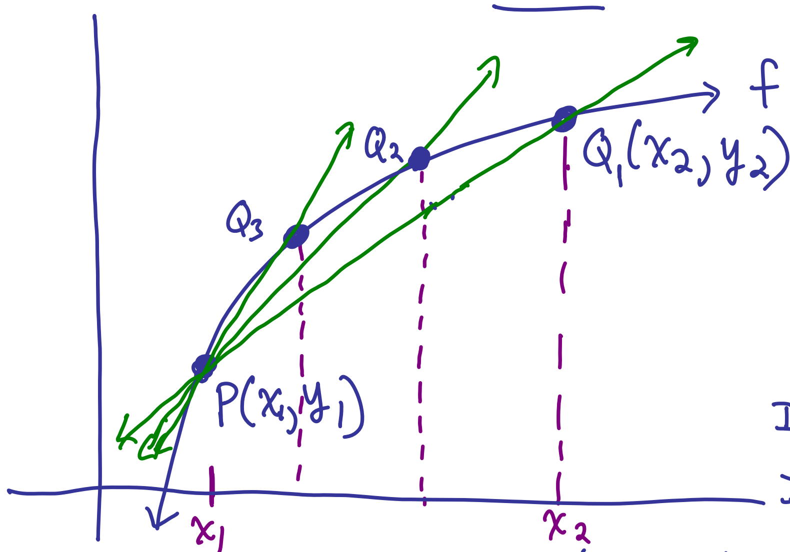
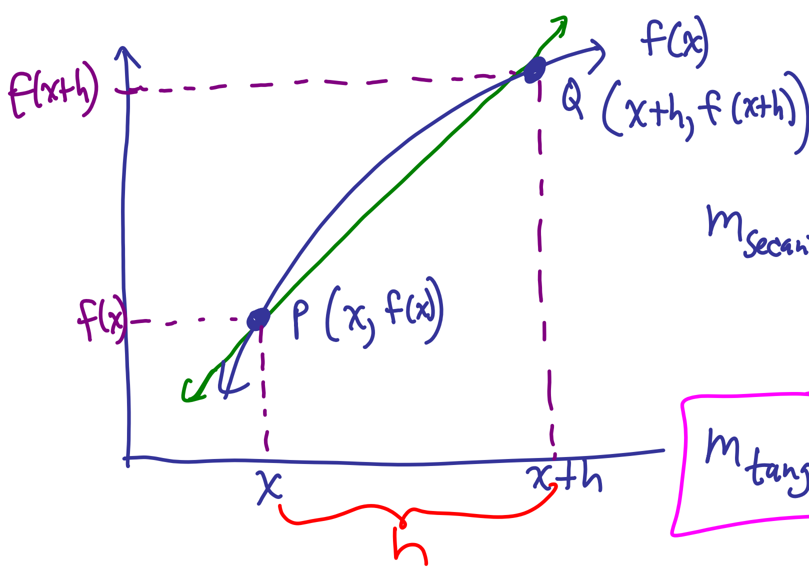
23.2



as x_2 moves closer to x_1, Q will move closer to P.
If Q is not on P then Line is secant
If Q is P then Line is tangent.

secant line crosses the graph at 2 points
tangent line touch the graph at a single point



$$m_{secant} = \frac{f(x+h) - f(x)}{x+h-x}$$

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

$$\boxed{m_{tangent} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}}$$

23.3

The derivative of a function f(x)

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

f(x) needs to be continuous.

p.660

(4) $y = f(x) = 6x + 3$

$f(-1) = 6(-1) + 3 = -3$ $\qquad$ $f(2x) = 6(2x) + 3 = 12x + 3$

$f(x+h) = 6(x+h) + 3 = 6x + 6h + 3$

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

$$= \lim_{h \to 0} \frac{\overbrace{6x + 6h + 3}^{f(x+h)} - (\overbrace{6x + 3}^{f(x)})}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{6x} + 6h + \cancel{3} - \cancel{6x} - \cancel{3}}{h}$$

$$= \lim_{h \to 0} \frac{6\cancel{h}}{\cancel{h}} = \lim_{h \to 0} 6 = 6$$

(8) $y = f(x) = 4 - x^2$

$(x+h)^2 = (x+h)(x+h)$
$= x^2 + 2xh + h^2$

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

$$= \lim_{h \to 0} \frac{\overbrace{[4 - (x+h)^2]}^{f(x+h)} - (4 - x^2)}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{4} - \cancel{x^2} - 2xh - h^2 - \cancel{4} + \cancel{x^2}}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}(-2x - h)}{\cancel{h}} = \lim_{h \to 0} (-2x - h) = -2x$$

$f(x) = 4 - x^2 \qquad f'(x) = -2x$

p. 660-661: 3, 5, 7, 11