ex. Find the point on the graph of $y = x^2$ at which the slope is 8.

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

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

$$8 = \lim_{h \to 0} \frac{a^2 + 2ah + h^2 - a^2}{h}$$

$$8 = \lim_{h \to 0} \frac{2ah + h^2}{h}$$

$$8 = \lim_{h \to 0} \frac{h(2a+h)}{h}$$

$$8 = 2a + 0$$

$$4 = a$$

$f(x) = x^2$
$f(x+h) = (x+h)^2$
$f(a+h) = (a+h)^2$

$f(x) = x^2$
$f(4) = 4^2$

∴ Point is $(4, 16)$

ex. 2 Find the slopes of the tangent lines to the graph of the function $f(x) = \sqrt{x}$ at the points $(1,1)$, $(4,2)$, and $(9,3)$.

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

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

$$= \lim_{h \to 0} \frac{a+h - a}{h(\sqrt{a+h} + \sqrt{a})}$$

$$= \lim_{h \to 0} \frac{h}{h(\sqrt{a+h} + \sqrt{a})}$$

$$m = \frac{1}{\sqrt{a+0} + \sqrt{a}}$$

$$m = \frac{1}{2\sqrt{a}}$$

Pt $(1,1)$ Pt $(4,2)$ Pt $(9,3)$

$m = \frac{1}{2\sqrt{1}}$ $m = \frac{1}{2\sqrt{4}}$ $m = \frac{1}{2\sqrt{9}}$

$m = \frac{1}{2}$ $m = \frac{1}{4}$ $= \frac{1}{6}$

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5) $m = 12$ $y = 12(x+2)$

7) $m = -\frac{2}{27}$ $y - \frac{1}{9} = -\frac{2}{27}(x-3)$

9) $m = \frac{1}{4}$ $y - 2 = \frac{1}{4}(x-3)$