Read Section 3.2. Work the embedded problems.

1. Definition of the Derivative Function

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

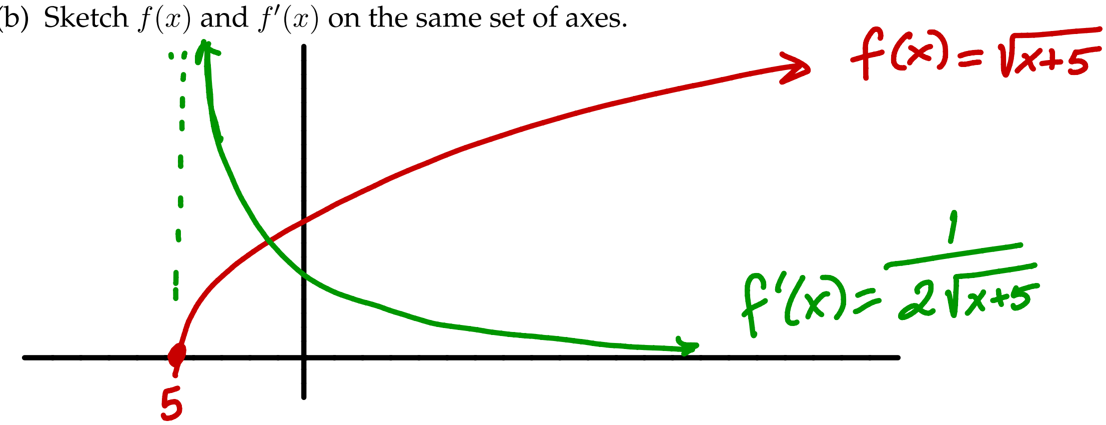
2. Let $f(x) = \sqrt{x+5}$.

   (a) Use the definition of the derivative to find $f'(x)$.

$$f'(x) = \lim_{h \to 0} \frac{\sqrt{x+h+5} - \sqrt{x+5}}{h} \cdot \frac{\left(\sqrt{x+h+5} + \sqrt{x+5}\right)}{\left(\sqrt{x+h+5} + \sqrt{x+5}\right)} = \lim_{h \to 0} \frac{x+h+5-(x+5)}{h\left(\sqrt{x+h+5} + \sqrt{x+5}\right)}$$

$$= \lim_{h \to 0} \frac{h}{h\left(\sqrt{x+h+5} + \sqrt{x+5}\right)} = \lim_{h \to 0} \frac{1}{\sqrt{x+h+5} + \sqrt{x+5}} = \frac{1}{\sqrt{x+0+5} + \sqrt{x+5}} = \frac{1}{2\sqrt{x+5}}$$

   (b) Sketch $f(x)$ and $f'(x)$ on the same set of axes.



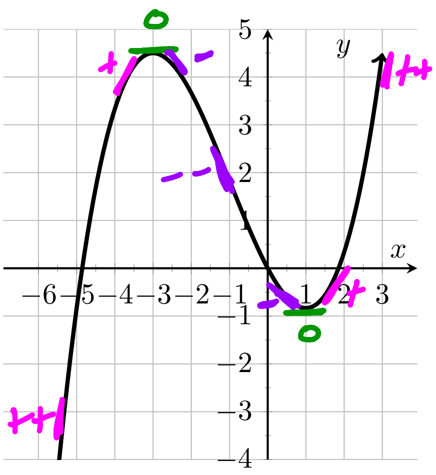
   (c) Write the equation of the line tangent to $f(x)$ at $x = 0$.

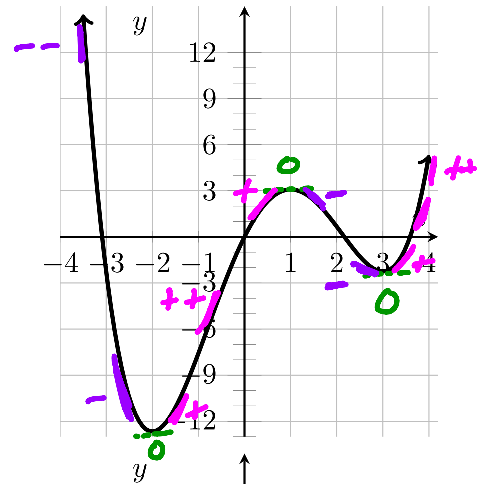
need point $P(0, f(0)) = (0, \sqrt{5})$ and slope $m = f'(0) = \frac{1}{2\sqrt{5}}$

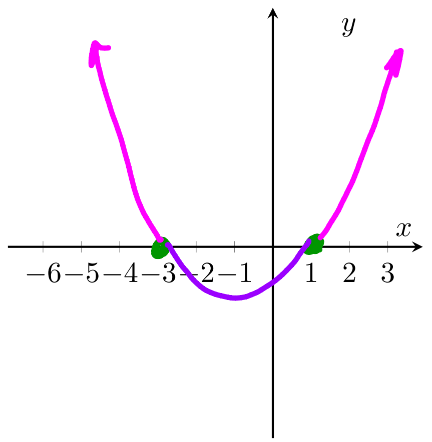
line: $y - \sqrt{5} = \frac{1}{2\sqrt{5}}(x - 0)$ or

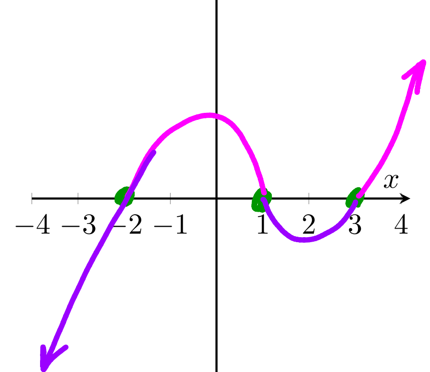
$$y = \frac{x}{2\sqrt{5}} + \sqrt{5}$$

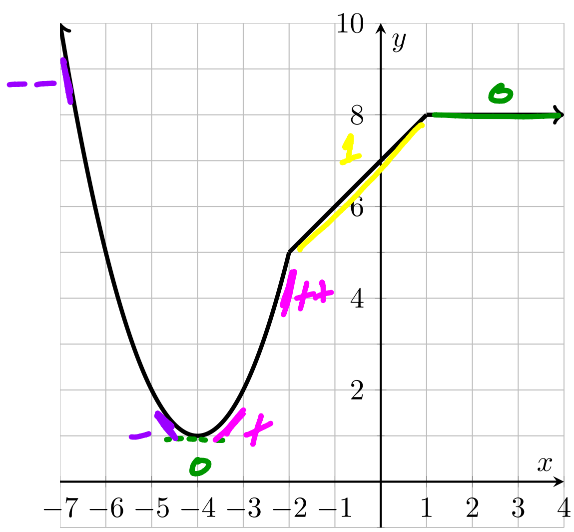
3. For each graph below, sketch the graph of $f'(x)$ on the axes below.



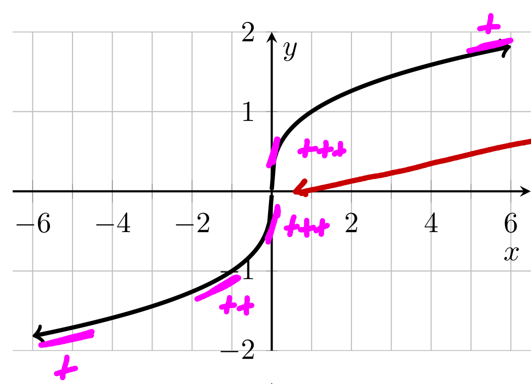








← Where does this function fail to be differentiable? x=-2, x=1.



right at x=0, the tangent is vertical!