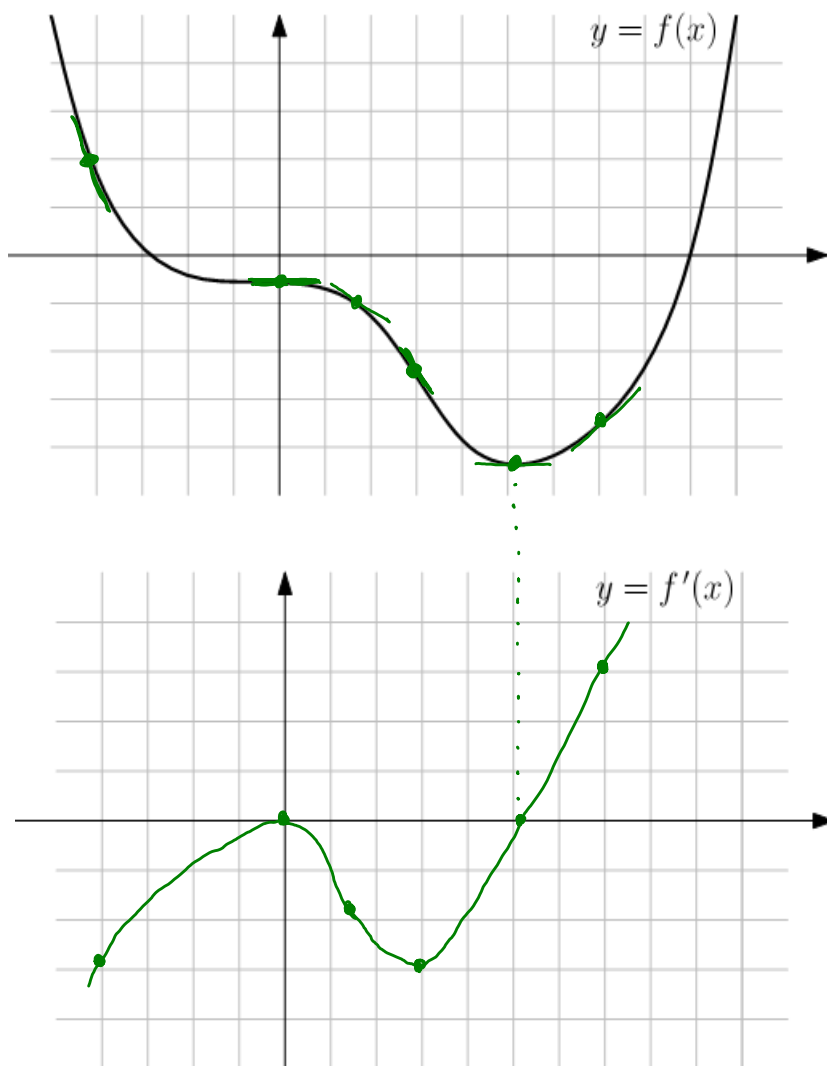


Show your work in all problems.

1. Sketch the derivative of  $y = f(x)$  on the axes below.



2. The amount of water in a water tower is given by  $V = f(t)$  gallons where  $t$  is hours since noon. Interpret the following in terms of the problem.

(a)  $f(5) = 2500$

At 5pm there was 2500 gallons of water in the tower.

(b)  $f'(5) = -20$

Around 5pm, the water in the tower decreases by about 20 gallons each hour.

3. Find the derivative of  $f(x) = 3x + x^2$  algebraically. (no other method will receive points)

$$\begin{aligned}
 f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \rightarrow 0} \frac{3(x+h) + (x+h)^2 - (3x + x^2)}{h} \\
 &= \lim_{h \rightarrow 0} \frac{\cancel{3x} + 3h + \cancel{x^2} + 2xh + h^2 - \cancel{3x} - \cancel{x^2}}{h} \\
 &= \lim_{h \rightarrow 0} \frac{\cancel{h}(3 + 2x + h)}{\cancel{h}} \\
 &= \lim_{h \rightarrow 0} 3 + 2x + \underbrace{h}_{\text{approaches zero}} = \boxed{3 + 2x = f'(x)}
 \end{aligned}$$