

Math 1121 HW #3

Section 3.3

10/14 $s(t) = t^2 + 5t + 2$

$$\begin{aligned}
 s'(1) &= \lim_{h \rightarrow 0} \frac{s(1+h) - s(1)}{h} = \lim_{h \rightarrow 0} \frac{(1+h)^2 + 5(1+h) + 2 - (1^2 + 5 \cdot 1 + 2)}{h} \\
 &= \lim_{h \rightarrow 0} \frac{\cancel{1} + 2h + h^2 + \cancel{5} + 5h + \cancel{2} - \cancel{1} - \cancel{5} - \cancel{2}}{h} \\
 &= \lim_{h \rightarrow 0} \frac{7h + h^2}{h^2} = \lim_{h \rightarrow 0} \frac{\cancel{h}(7+h)}{\cancel{h}} = \lim_{h \rightarrow 0} 7+h = 7+0 = 7
 \end{aligned}$$

12/16 $s(t) = 5t^2 - 2t - 7$

$$\begin{aligned}
 s'(3) &= \lim_{h \rightarrow 0} \frac{s(3+h) - s(3)}{h} = \lim_{h \rightarrow 0} \frac{5(3+h)^2 - 2(3+h) - 7 - (5 \cdot 3^2 - 2 \cdot 3 - 7)}{h} \\
 &= \lim_{h \rightarrow 0} \frac{5(9+6h+h^2) - 6 - 2h - 7 - (45 - 6 - 7)}{h} \\
 &= \lim_{h \rightarrow 0} \frac{\cancel{45} + 30h + 5h^2 - \cancel{6} - 2h - \cancel{7} - \cancel{45} + \cancel{6} + \cancel{7}}{h} \\
 &= \lim_{h \rightarrow 0} \frac{28h + 5h^2}{h} = \lim_{h \rightarrow 0} \frac{\cancel{h}(28+5h)}{\cancel{h}} = \lim_{h \rightarrow 0} 28+5h \\
 &= 28 + 5 \cdot 0 = 28
 \end{aligned}$$

#15/19 $f(x) = x^2 + 2x$ at $x=0$

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

#17/21 $g(t) = 1-t^2$ at $t=-1$

$$\begin{aligned} g'(-1) &= \lim_{h \rightarrow 0} \frac{g(-1+h) - g(-1)}{h} = \lim_{h \rightarrow 0} \frac{1 - (-1+h)^2 - (1 - (-1)^2)}{h} \\ &= \lim_{h \rightarrow 0} \frac{1 - (-1+h)(-1+h) - (1-1)}{h} = \lim_{h \rightarrow 0} \frac{1 - (1-2h+h^2) - 0}{h} \\ &= \lim_{h \rightarrow 0} \frac{\cancel{1} - 1 + 2h - h^2}{h} = \lim_{h \rightarrow 0} \frac{\cancel{h}(2-h)}{\cancel{h}} = \lim_{h \rightarrow 0} 2-h = 2-0 = 2 \end{aligned}$$

#27c/31c $N(p) = 80 - 5p^2$

$$\begin{aligned} N'(3) &= \lim_{h \rightarrow 0} \frac{N(3+h) - N(3)}{h} = \lim_{h \rightarrow 0} \frac{80 - 5(3+h)^2 - (80 - 5 \cdot 3^2)}{h} \\ &= \lim_{h \rightarrow 0} \frac{80 - 5(9 + 6h + h^2) - (80 - 5 \cdot 9)}{h} \\ &= \lim_{h \rightarrow 0} \frac{\cancel{80} - \cancel{45} - 30h - 5h^2 - \cancel{80} + \cancel{45}}{h} = \lim_{h \rightarrow 0} \frac{-30h - 5h^2}{h} \\ &= \lim_{h \rightarrow 0} \frac{\cancel{h}(-30-5h)}{\cancel{h}} = \lim_{h \rightarrow 0} -30-5h = -30-5 \cdot 0 = -30 \end{aligned}$$