

Name (print) _____ Discussion hour (T Th ___)

1. (12 pts.) Use algebra to evaluate $f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$, where $f(x) = 3x^2 - 15x$.

Solution:

$$\begin{aligned}
 f'(a) &= \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h} \\
 &= \lim_{h \rightarrow 0} \frac{[3(a+h)^2 - 15(a+h)] - [3a^2 - 15a]}{h} \quad (4 \text{ points}) \\
 &= \lim_{h \rightarrow 0} \frac{[3(a^2 + 2ah + h^2) - 15(a+h)] - [3a^2 - 15a]}{h} \\
 &= \lim_{h \rightarrow 0} \frac{[3(2ah + h^2) - 15h]}{h} \\
 &= \lim_{h \rightarrow 0} \frac{h(6a + 3h - 15)}{h} \\
 &= \lim_{h \rightarrow 0} 6a + 3h - 15 \quad (6 \text{ points for calculations to this point}) \\
 &= 6a - 15. \quad (2 \text{ points}).
 \end{aligned}$$

2. (8 pts.) Estimate $c'(0.2)$, using the table of values
- | | | | | | | |
|--------|---|-----|-----|------|------|------|
| t | 0 | 0.1 | 0.2 | 0.32 | 0.45 | 0.5 |
| $c(t)$ | 2 | 8.1 | 7.5 | 6.7 | 9.3 | 10.2 |
- and $h > 0$.

Solution:

$$\begin{aligned}
 c'(0.2) &\approx \frac{c(0.32) - c(0.2)}{0.32 - .02} \quad (4 \text{ points}) \\
 &= \frac{6.7 - 7.5}{0.32 - .02} \\
 &= \frac{-0.8}{0.12} \approx \boxed{-6.67} \quad (4 \text{ points for calculations})
 \end{aligned}$$

Here $h = 0.12$.

Name (print) _____ Discussion hour (T Th ___)

1. ((12 pts.) Use algebra to evaluate $f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$, where $f(x) = 4x^2 + 21x$.

Solution:

$$\begin{aligned}
 f'(a) &= \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h} \\
 &= \lim_{h \rightarrow 0} \frac{[4(a+h)^2 + 21(a+h)] - [4a^2 + 21a]}{h} \quad \text{(4 points)} \\
 &= \lim_{h \rightarrow 0} \frac{[4(a^2 + 2ah + h^2) + 21(a+h)] - [4a^2 + 21a]}{h} \\
 &= \lim_{h \rightarrow 0} \frac{[4(2ah + h^2) + 21h]}{h} \\
 &= \lim_{h \rightarrow 0} \frac{h(8a + 4h + 21)}{h} \\
 &= \lim_{h \rightarrow 0} 8a + 4h + 21 \quad \text{(6 points for calculations to this point)} \\
 &= 8a + 21. \quad \text{(2 points).}
 \end{aligned}$$

2. (8 pts.) Estimate $c'(0.45)$, using the table of values
- | | | | | | | |
|--------|---|-----|-----|------|------|------|
| t | 0 | 0.1 | 0.2 | 0.32 | 0.45 | 0.5 |
| $c(t)$ | 2 | 8.1 | 7.5 | 6.7 | 9.3 | 10.2 |
- and $h < 0$.

Solution:

$$\begin{aligned}
 c'(0.45) &\approx \frac{c(0.32) - c(0.45)}{0.32 - 0.45} \quad \text{(4 points)} \\
 &= \frac{6.7 - 9.3}{0.32 - 0.45} \\
 &= \frac{-2.6}{-0.13} = \boxed{20} \quad \text{(4 points for calculations)}
 \end{aligned}$$

Here $h = -0.13$.