Sec 2.7 day 2 page 156 (19-23, 26, 27, 35-38, 42-44)

(19) $f'(x) = \lim_{h \to 0} \frac{\frac{1}{2}(x+h) - \frac{1}{3} - \frac{1}{2}x + \frac{1}{3}}{h} =$

$\lim_{h \to 0} \frac{\frac{1}{2}x + \frac{1}{2}h - \frac{1}{3} - \frac{1}{2}x + \frac{1}{3}}{h} = \lim_{h \to 0} \frac{\frac{1}{2}h}{h} = \frac{1}{2}$

Domain $f(x) = f'(x) \Rightarrow (-\infty, \infty)$

(20) $f'(x) = \lim_{h \to 0} \frac{m(x+h) + b - mx - b}{h} = \frac{mx + mh - mx - b + b}{h}$

$= \lim_{h \to 0} \frac{mh}{h} = m$

Domain $f(x) = f'(x) \Rightarrow (-\infty, \infty)$

(21) $f'(x) = \lim_{h \to 0} \frac{5(t-h) - 9(t-h)^2 - 5t + 9t^2}{h}$

$= \lim_{h \to 0} \frac{5t - 5h - 9t^2 + 18th - 9h^2 - 5t + 9t^2}{h}$

$= \lim_{h \to 0} \frac{-5h + 18th - 9h^2}{h} = 18t - 5$

Domain $f(x) = f'(x) \Rightarrow (-\infty, \infty)$

(22) $f'(x) = \lim_{h \to 0} \frac{1.5(x+h)^2 - (x+h) + 3.7 - 1.5x^2 + x - 3.7}{h}$

$\lim_{h \to 0} \frac{\cancel{1.5x^2} + 3xh + 1.5h^2 - \cancel{x} - h + \cancel{3.7} - \cancel{1.5x^2} + \cancel{x} - \cancel{3.7}}{h}$

$\lim_{h \to 0} \frac{3xh + 1.5h^2 - h}{h} = 3x - 1$ Domain $f(x) =$ Domain $f'(x) = (-\infty, \infty)$

(23) $$f'(x) = \lim_{h\to 0} \frac{(x+h)^2 - 2(x+h)^3 - x^2 + 2x^3}{h}$$

$$= \lim_{h\to 0} \frac{\cancel{x^2} + 2xh + h^2 - 2(x^3 + 3x^2h + 3xh^2 + h^3) - \cancel{x^2} + 2x^3}{h}$$

$$= \lim_{h\to 0} \frac{2xh + h^2 - 2x^3 - 6x^2h - 6xh^2 - 2h^3 + 2x^3}{h}$$

$$= \lim_{h\to 0} \frac{2xh + h^2 - 6x^2h - 6xh^2 - 2h^3}{h} = 2x - 6x^2$$

Domain $f(x)$ = Domain $f'(x) = (-\infty, \infty)$

(26) $$f'(x) = \lim_{h\to 0} \frac{\frac{(x+h)^2 - 1}{2(x+h) - 3} - \frac{x^2 - 1}{2x - 3}}{h} =$$

$$= \lim_{h\to 0} \frac{((x+h)^2 - 1)(2x-3) - (x^2-1)(2x+2h-3)}{h(2x+2h-3)(2x-3)} =$$

$$= \lim_{h\to 0} \frac{(x^2 + 2xh + h^2 - 1)(2x-3) - (2x^3 + 2x^2h - 3x^2 + 2x - 2h + 3)}{h(2x+2h-3)(2x-3)}$$

$$= \lim_{h\to 0} \frac{\cancel{2x^3} + 4x^2h + 2xh^2 - \cancel{2x} - \cancel{3x^2} - 4xh - 3h^2 + \cancel{3} - \cancel{2x^3} - 2x^2h + \cancel{3x^2} - \cancel{2x} + 2h - \cancel{3}}{h(2x+2h-3)(2x-3)}$$

$$= \lim_{h\to 0} \frac{2x^2h + 2xh^2 - 6xh - 3h^2 + 2h}{h(2x+2h-3)(2x-3)} = \frac{2x^2 - 6x + 2}{(2x-3)^2}$$

Domain $f(x)$ = Domain $f'(x) = (-\infty, \frac{3}{2}) \cup (\frac{3}{2}, \infty)$

(27) $G'(t) = \lim_{h \to 0} \dfrac{\frac{4(t+h)}{t+h+1} - \frac{4t}{t+1}}{h} = \lim_{h \to 0} \dfrac{(4t+4h)(t+1) - 4t(t+h+1)}{h(t+h+1)(t+1)}$

$= \lim_{h \to 0} \dfrac{\cancel{4t^2} + \cancel{4th} + \cancel{4t} + 4h - \cancel{4t^2} - \cancel{4th} - \cancel{4t}}{h(t+h+1)(t+1)}$

$= \lim_{h \to 0} \dfrac{4h}{h(t+h+1)(t+1)} = \dfrac{4}{(t+1)^2}$

Domain of $G(t)$ = Domain $G'(t) = (-\infty, -1) \cup (-1, \infty)$

(35) $x = -4$ corner
$x = 0$ discont

(36) $x = 0$ discont
$x = 3$ corner

(37) $x = -1$ vert tan
$x = 4$ corner

(38) $x = -1$ discont
$x = 2$ corner

(42) $f = d$
$f' = c$
$f'' = b$
$f''' = a$

(43) position = c
velocity = b
acceleration = a

(44) position = d
velocity = c
acceleration = b
jerk = a