



- 1) E 2) none
 3) A 4) B, C, D

5) $\{x < -1\}$ $\lim_{x \rightarrow -1} \frac{(x^2 - 3) - (-2)}{x + 1} = \lim_{x \rightarrow -1} \frac{(x-1)(x+1)}{(x+1)} = \lim_{x \rightarrow -1} x - 1 = \boxed{-2}$

$\{x > -1\}$ ~~$\lim_{x \rightarrow -1}$~~ $\lim_{x \rightarrow -1} \frac{(2x) - (-2)}{x + 1} = \lim_{x \rightarrow -1} \frac{2(x+1)}{x+1} = \lim_{x \rightarrow -1} 2 = \boxed{2}$

since $-2 \neq 2$, the derivative does not exist.

6) $\{x \leq 1\}$ $\lim_{x \rightarrow 1} \frac{(5x^2 - 1) - (4)}{x - 1} = \lim_{x \rightarrow 1} \frac{5(x+1)(x-1)}{(x-1)} = \lim_{x \rightarrow 1} 5(x+1) = \boxed{10}$

$\{x > 1\}$ $\lim_{x \rightarrow 1} \frac{(10x - 6) - (4)}{x - 1} = \lim_{x \rightarrow 1} \frac{10(x-1)}{(x-1)} = \lim_{x \rightarrow 1} 10 = \boxed{10}$

$f'(1) = 10$

7) $\lim_{x \rightarrow 5} \frac{(x-5)^{1/3} - (0)}{(x-5)'} = \lim_{x \rightarrow 5} \frac{1}{(x-5)^{2/3}} = \infty$ Vertical tangent line

8) avg velocity: $\frac{y_2 - y_1}{x_2 - x_1}$ or $\frac{h(5) - h(2)}{5 - 2} = \frac{85 - 131}{5 - 2} = \boxed{\frac{-46}{3} \text{ ft/sec}}$ ← don't forget the units!!!

9) estimate $f'(5) = \frac{f(6) - f(4)}{6 - 4} = \frac{-1 - 5}{2} = \frac{-6}{2} = \boxed{-3}$

10) $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$, $x=5$: $\lim_{h \rightarrow 0} \frac{f(5+h) - f(5)}{h} = \lim_{h \rightarrow 0} \frac{-7h^3 + 2h^2 - 8h}{h} = \lim_{h \rightarrow 0} -7h^2 + 2h - 8 = \boxed{-8}$

11) $f(x+y) - f(x) = -2f(y) + 7xy$
 let $y=h$: $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \rightarrow 0} \frac{-2f(h) + 7xh}{h} = -2 \lim_{h \rightarrow 0} \frac{f(h)}{h} + \lim_{h \rightarrow 0} 7x$

$\lim_{h \rightarrow 0} \frac{f(h)}{h} = 3$

$= -2(3) + 7x$ or $f'(x) = 7x - 6$