1) $g(x) = -5$

$$g'(x) = \lim_{h\to 0} \frac{-5+5}{h}$$
$$= \lim_{h\to 0} \frac{0}{h} = 0$$

$g'(x) = 0$

2) $h(x) = \frac{3}{2}x + 3$

$$h'(x) = \lim_{h\to 0} \frac{\frac{3}{2}(x+h)+3-\left(\frac{3}{2}x+3\right)}{h}$$
$$= \lim_{h\to 0} \frac{\frac{3}{2}x+\frac{3}{2}h+3-\frac{3}{2}x-3}{h}$$
$$= \lim_{h\to 0} \frac{\frac{3}{2}h}{h} = \frac{3}{2}$$

$h'(x) = \frac{3}{2}$

3) $f(t) = 5t - t^2$; $(1,2)$

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

$\underline{f'(1) = 3}$

4) $f(x) = 7-9x^2$; $(1,-2)$

$$f'(x) = \lim_{h\to 0} \frac{7-9(x+h)^2-(7-9x^2)}{h}$$
$$= \lim_{h\to 0} \frac{7-9(x^2+2xh+h^2)-7+9x^2}{h}$$
$$= \lim_{h\to 0} \frac{7-9x^2-18xh-9h^2-7+9x^2}{h}$$
$$= \lim_{h\to 0} \frac{-18xh-9h^2}{h}$$
$$= \lim_{h\to 0} (-18x-9h) = -18x$$

$f'(x) = -18x$

$\underline{f'(1) = -18}$

5) $f(x) = x^2+2x+1$; $x=-4$

$\underline{\text{point}}$

$(-4,9)$

$\underline{\text{slope}}$

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

$f'(-4) = -6$

$\underline{\text{Tangent: } y-9 = -6(x+4)}$

6)

$$f(x) = \begin{cases} 2kx^2 - x, & x < 3 \\ x^3 + x, & x \geq 3 \end{cases}$$

$$\lim_{x \to 3^-} (2kx^2 - x) = \lim_{x \to 3^+} (x^3 + x)$$

$$18k - 3 = 30$$

$$18k = 33$$

$$k = \frac{33}{18}$$

7) $ROC = \dfrac{f(2) - f(1)}{2 - 1}$

$= 24 - 18$

$= \underline{6}$

8) $ROC = \dfrac{f(9) - f(5)}{9 - 5}$

$= \dfrac{44 - 32}{4}$

$= \underline{3}$

9) $f'(3) \approx \dfrac{f(5) - f(2)}{5 - 2}$

$= \dfrac{32 - 24}{3}$

$= \dfrac{8}{3}$

$\underline{f'(3) \approx \dfrac{8}{3}}$