Section 6.1

1. From the figure, $f(3)=2$. The tangent line passes through $(3,2)$ and $(0,3)$ so it has slope $a=\frac{y_2-y_1}{x_2-x_1}=\frac{3-2}{0-3}=-\frac{1}{3}$. Then $f'(3)=-\frac{1}{3}$

2. $g(5)=1$. Tangent line goes through $(4,0)$ and $(5,1)$ so it has slope $a=\frac{1-0}{5-4}=1$. Then $g'(5)=1$

Section 6.2

1. $f(x)=4x^2$ $\quad \frac{f(5+h)-f(5)}{h}=\frac{4(5+h)^2-4\cdot 5^2}{h}=\frac{4\cdot(25+10h+h^2)-100}{h}=\frac{\cancel{100}+40h+4h^2-\cancel{100}}{h}=$

$=40+4h$ $\quad f'(5)=\lim_{h\to 0}(40+4h)=40.$ We have $f'(x)=8x \Rightarrow f'(5)=8\cdot 5=40.$

4. $C(x)=p+qx^2 \Rightarrow C'(x)=2qx$

5. $f(x)=\frac{1}{x}$ $\quad \frac{f(x+h)-f(x)}{h}=\frac{\frac{1}{x+h}-\frac{1}{x}}{h}=\frac{1}{h}\cdot\frac{\cancel{x}-\cancel{x}-h}{x(x+h)}=-\frac{\cancel{h}}{\cancel{h}x(x+h)}=-\frac{1}{x(x+h)}$

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

Section 6.5

1\. (a) $\lim_{x\to 0}(3+2x^2)=3+2\cdot 0^2=3$ $\quad$ (b) $\lim_{x\to -1}\frac{3+2x}{x-1}=\frac{3+2\cdot(-1)}{-1-1}=\frac{3-2}{-2}=-\frac{1}{2}$

(c) $\lim_{x\to 2}(2x^2+5)^3=(2\cdot 2^2+5)^3=13^3$

4\. (a) $\lim_{x\to 2}(x^2+3x-5)=2^2+3\cdot 2-5=4+6-5=5$ $\quad$ (b) $\lim_{y\to -3}\frac{1}{y+8}=\frac{1}{-3+8}=\frac{1}{5}$

(c) $\lim_{x\to 0}\frac{x^3-2x-1}{x^5-x^2-1}=\frac{-1}{-1}=1$

5\. (a) $\lim_{h\to 2}\frac{\frac{1}{3}-\frac{2}{3h}}{h-2}=\lim_{h\to 2}\frac{\cancel{h-2}}{3h}\cdot\frac{1}{\cancel{h-2}}=\lim_{h\to 2}\frac{1}{3h}=\frac{1}{6}$

(b) $\lim_{x\to 0}\frac{x^2-1}{x^2}=\frac{-1}{0}=-\infty$ $\quad$ (c) $\lim_{t\to 3}\frac{\sqrt[3]{32t-96}}{t^2-2t-3}=\lim_{t\to 3}\frac{\sqrt[3]{32}\cdot\sqrt[3]{t-3}}{(t-3)(t+1)}=\lim_{t\to 3}\frac{\sqrt[3]{32}}{t+1}\cdot\frac{1}{(t-3)^{2/3}}=$

$=\frac{\sqrt[3]{32}}{4}\cdot\frac{1}{0}=+\infty$

6\. $f(x)=x^2+2x$ $\quad$ (a) $\lim_{x\to 1}\frac{f(x)-f(1)}{x-1}=\lim_{x\to 1}\frac{x^2+2x-1-2}{x-1}=\lim_{x\to 1}\frac{x^2+2x-3}{x-1}=\lim_{x\to 1}\frac{\cancel{(x-1)}(x+3)}{\cancel{x-1}}=$

$=1+3=4$ $\quad$ (b) $\lim_{x\to 2}\frac{f(x)-f(1)}{x-1}=\lim_{x\to 2}\frac{x^2+2x-3}{x-1}=\frac{4+4-3}{2-1}=5$

Section 6.6

1\. (a) $y=5\Rightarrow y'=0$ $\quad$ (b) $y=x^4\Rightarrow y'=4x^3$ $\quad$ (c) $y=9x^{10}\Rightarrow y'=9\cdot 10x^9=90x^9$ $\quad$ (d) $y=\pi^7\Rightarrow y'=0$

2\. (a) $D(2g(x)+3)=2g'(x)$ $\quad$ (b) $D\left(-\frac{1}{6}g(x)+8\right)=-\frac{1}{6}g'(x)$ $\quad$ (c) $D\left(\frac{g(x)-5}{3}\right)=\frac{1}{3}g'(x)$

3\. (a) $D(x^6)=6x^5$ $\quad$ (b) $D(3x^{11})=3\cdot 11x^{10}=33x^{10}$ $\quad$ (c) $D(x^{50})=50x^{49}$

(d) $D(-4x^{-7})=-4\cdot(-7)x^{-8}=28x^{-8}$

4\. (a) $\frac{d}{dr}(4\pi r^2)=4\pi\cdot 2r=8\pi r$ $\quad$ (b) $\frac{d}{dy}(Ay^{b+1})=A\cdot b\,y^b$ $\quad$ (c) $\frac{d}{dA}\left(\frac{1}{A^2\sqrt{A}}\right)=$

$=\frac{d}{dA}\left(A^{-2}\cdot A^{-\frac{1}{2}}\right)=\frac{d}{dA}\left(A^{-\frac{5}{2}}\right)=-\frac{5}{2}A^{-\frac{5}{2}-1}=-\frac{5}{2}A^{-7/2}=-\frac{5}{2A^3\sqrt{A}}$