Sec 1.1 Difference Quotient pg 84 #79-85 odd

#79) $f(x)=2x$, $\dfrac{f(x+c)-f(x)}{c}$, $c\neq 0$

$$=\frac{[2(x+c)]-[2x]}{c}$$

$$=\frac{\cancel{2x}+2c-\cancel{2x}}{c}$$

$$=\frac{2c}{c}=\boxed{2,\ c\neq 0}$$

#81) $f(x)=x^2-x+1$, $\dfrac{f(2+h)-f(2)}{h}$, $h\neq 0$

$$=\frac{[(2+h)^2-(2+h)+1]-[2^2-2+1]}{h}$$

$$=\frac{[4+4h+h^2-2-h+1]-[4-2+1]}{h}$$

$$=\frac{h^2+3h+\cancel{3}+\cancel{3}}{h}=\frac{h^2+3h+6}{h}$$

$$=\frac{h^2+3h}{h}=\boxed{h+3,\ h\neq 0}$$

#83) $f(x)=x^3$, $\dfrac{f(x+c)-f(x)}{c}$, $c\neq 0$

$$=\frac{[(x+c)^3]-[x^3]}{c}$$

$(x^2+2cx+c^2)(x+c)$

$=x^3+\underline{x^2c+2x^2c}+\underline{2xc^2+xc^2}+c^3$

$$=\frac{[(x^2+2cx+c^2)(x+c)]-[x^3]}{c}$$

$$=\frac{[x^3+3x^2c+3xc^2+c^3]-[x^3]}{c}$$

$$=\frac{\cancel{x^3}+3x^2c+3xc^2+c^3-\cancel{x^3}}{c}$$

$$=\frac{\cancel{c}(3x^2+3xc+c^2)}{\cancel{c}}$$

$$=\boxed{3x^2+3xc+c^2,\ c\neq 0}$$

#85) $f(t) = \frac{1}{t}$, $\quad \frac{f(t) - f(1)}{t-1}, \ t \neq 1$

$$= \frac{\frac{1}{t} - \frac{1}{1}}{t-1}$$

$$= \frac{\frac{1}{t} - 1 \cdot \frac{t}{t}}{t-1} \Rightarrow \frac{\frac{1-t}{t}}{t-1} = \frac{1-t}{t} \cdot \frac{1}{t-1}$$

$$= \frac{1-t}{t(t-1)} = \cancel{\frac{1-t}{t^2-t}}$$

$$= \frac{-1\cancel{(-1+t)}}{t\cancel{(t-1)}} = \boxed{-\frac{1}{t},\ t \neq 1}$$