180 $\boxed{\text{SECTION 3.1}}$

(7) $K(z) = \dfrac{1-z}{2z}$

$$K'(z) = \lim_{h\to 0} \frac{K(z+h)-K(z)}{h}$$

$$= \lim_{h\to 0} \frac{\dfrac{1-(z+h)}{2(z+h)} - \dfrac{1-z}{2z}}{h}$$

$$= \lim_{h\to 0} \frac{\overset{z}{\dfrac{1-z-h}{2(z+h)}} - \overset{z+h}{\dfrac{1-z}{2z}}}{h}$$

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

$$= \lim_{h\to 0} \frac{z-z^2-zh-(z+h-z^2-zh)}{2hz(z+h)}$$

$$= \lim_{h\to 0} \frac{\cancel{z}-\cancel{z^2}-\cancel{zh}-\cancel{z}-h+\cancel{z^2}+\cancel{zh}}{2hz(z+h)}$$

$$= \lim_{h\to 0} \frac{-\cancel{h}}{2\cancel{h}z(z+h)}$$

$$= \lim_{h\to 0} \frac{-1}{2z(z+h)} = \frac{-1}{2z\cdot z}$$

$$\boxed{K'(z) = \frac{-1}{2z^2}}$$

$$K'(-1) = \frac{-1}{2(-1)^2} = \frac{-1}{2}$$

$$K'(1) = \frac{-1}{2(1)^2} = \frac{-1}{2}$$

$$K'(\sqrt{2}) = \frac{-1}{2(\sqrt{2})^2} = \frac{-1}{4}$$

(10) $v = t - \dfrac{1}{t}$

$$\frac{dv}{dt} = \lim_{h\to 0} \frac{v(t+h)-v(t)}{h}$$

$$= \lim_{h\to 0} \frac{t+h-\frac{1}{t+h} - \left(t-\frac{1}{t}\right)}{h}$$

$$= \lim_{h\to 0} \frac{\cancel{t}+h-\frac{1}{t+h}-\cancel{t}+\frac{1}{t}}{h}$$

$$= \lim_{h\to 0} \left(\frac{h}{h} + \frac{\frac{1}{t}-\frac{1}{t+h}}{h}\right)$$

$$= 1 + \lim_{h\to 0} \frac{t+h-t}{ht(t+h)}$$

$$= 1 + \lim_{h\to 0} \frac{\cancel{h}}{\cancel{h}t(t+h)}$$

$$= 1 + \lim_{h\to 0} \frac{1}{t(t+h)}$$

$$= 1 + \frac{1}{t^2}$$

$$\boxed{\frac{dv}{dt} = 1 + \frac{1}{t^2}}$$

(16) $y=(x+1)^3, \quad x=-2$

$$\frac{dy}{dx}=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

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

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

(Note: $(a+b)^3=a^3+3a^2b+3ab^2+b^3$)

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

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

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

$$=3(x+1)^2$$

So $\boxed{y'=\frac{dy}{dx}=3(x+1)^2}$

$$m=\left.\frac{dy}{dx}\right|_{x=-2}=3(-2+1)^2=\boxed{3}$$

(22) $w=z+\sqrt{z}$

$f(z)=w=z+\sqrt{z}$

$$w'=\frac{dw}{dz}=\lim_{h\to 0}\frac{f(z+h)-f(z)}{h}$$

$$=\lim_{h\to 0}\frac{z+h+\sqrt{z+h}-(z+\sqrt{z})}{h}$$

$$=\lim_{h\to 0}\frac{h+\sqrt{z+h}-\sqrt{z}}{h}$$

$$=\lim_{h\to 0}\left(\frac{h}{h}+\frac{\sqrt{z+h}-\sqrt{z}}{h}\right)$$

$$=1+\lim_{h\to 0}\frac{\sqrt{z+h}-\sqrt{z}}{h}\cdot\frac{\sqrt{z+h}+\sqrt{z}}{\sqrt{z+h}+\sqrt{z}}$$

$$=1+\lim_{h\to 0}\frac{\cancel{z}+h-\cancel{z}}{h(\sqrt{z+h}+\sqrt{z})}$$

$$=1+\lim_{h\to 0}\frac{\cancel{h}}{\cancel{h}(\sqrt{z+h}+\sqrt{z})}$$

$$=1+\lim_{h\to 0}\frac{1}{\sqrt{z+h}+\sqrt{z}}=1+\frac{1}{2\sqrt{z}}$$

$$\boxed{w'=\frac{dw}{dz}=1+\frac{1}{2\sqrt{z}}}$$

$$\left.\frac{dw}{dz}\right|_{z=4}=1+\frac{1}{2\sqrt{4}}=1+\frac{1}{4}=\boxed{\frac{5}{4}}$$