1. Definition of derivative: $f'(a)=\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$

$$f'(1)=\lim_{h\to 0}\frac{f(1+h)-f(1)}{h}=\lim_{h\to 0}\frac{\frac{1}{3(1+h)+2}-\frac{1}{5}}{h}=\lim_{h\to 0}\frac{\frac{1}{3h+5}-\frac{1}{5}}{h}=\lim_{h\to 0}\frac{\frac{5-3h-5}{5(3h+5)}}{h}=\lim_{h\to 0}\frac{-3h}{5(3h+5)(h)},$$

which is just $\lim_{h\to 0}\frac{-3}{5(3h+5)}=-\frac{3}{25}$.

You can always check this by doing a regular derivative and plugging in 1.

2. $y=\cos^{-1}x \Rightarrow \frac{dy}{dx}=\frac{-1}{\sqrt{1-x^2}}$. *Know your derivatives!*

3. $h(x)=e^{2x^3} \Rightarrow h'(x)=\left(e^{2x^3}\right)\left(6x^2\right)=6x^2e^{2x^3}$. *Know the chain rule!*

4. $G(x)=\int_{-2}^{x}\frac{t}{\sqrt[3]{6+t^4}}\,dt \Rightarrow G'(x)=\frac{x}{\sqrt{6+x^4}}$. *We applied the Fundamental Theorem (part 1).*

5. $z=\tan^2\theta \Rightarrow \frac{dz}{dt}=2(\tan\theta)^1(\sec^2\theta)=2\tan\theta\sec^2\theta$. *Chain rule, again.*

6. $f(t)=\csc t \Rightarrow f'(t)=-\csc t\cot t$.

7. $f(t)=t^2\ln(t) \Rightarrow f'(t)=t^2\left(\frac{1}{t}\right)+(2t)(\ln t)=t+2t\ln t$. *We used the product rule.*

8. $y=\frac{x^2-5}{x^2+4} \Rightarrow \frac{dy}{dx}=\frac{\left(x^2+4\right)(2x)-\left(x^2-5\right)(2x)}{\left(x^2+4\right)^2}=\frac{2x^3+8x-2x^3+10x}{\left(x^2+4\right)^2}=\frac{18x}{\left(x^2+4\right)^2}$. *We used the quotient rule.*

9. $g(\theta)=\cos^4\left(e^\theta\right)=\left(\cos\left(e^\theta\right)\right)^4 \Rightarrow 4\left(\cos\left(e^\theta\right)\right)^3\left(-\sin\left(e^\theta\right)\right)\left(e^\theta\right)=-4e^\theta\sin\left(e^\theta\right)\cos^3\left(e^\theta\right)$. *This problem required two applications of the Chain Rule.*

10. $y=(t+2)^{\ln(t+2)} \Rightarrow \ln y=\ln\left((t+2)^{\ln(t+2)}\right) \Rightarrow \ln y=\ln(t+2)\left(\ln(t+2)\right) \Rightarrow \ln y=\left(\ln(t+2)\right)^2$. Now we can take the derivative implicitly: $\frac{1}{y}\frac{dy}{dt}=2\left(\ln(t+2)\right)^1\left(\frac{1}{t+2}\right) \Rightarrow \frac{dy}{dt}=\frac{2y\ln(t+2)}{t+2}$. But, this contains a *y*, so we substitute back: $\frac{dy}{dt}=\frac{2(t+2)^{\ln(t+2)}\ln(t+2)}{t+2}$. *We could have some alternative forms for this, but that is really not necessary.*

Check back for more solutions soon!