Problem 1. Section 3.6 #218

We know from memorized trig derivatives that $\frac{\mathrm{dy}}{\mathrm{du}} = \sec^2(u)$, and compute $\frac{\mathrm{du}}{\mathrm{dx}} = 9$. Thus $\frac{\mathrm{dy}}{\mathrm{dx}} = \frac{\mathrm{dy}}{\mathrm{du}}\frac{\mathrm{du}}{\mathrm{dx}} = \sec^2(u) \cdot 9$, but we can substitute in $u = 9x + 2$ to get $\boxed{\frac{\mathrm{dy}}{\mathrm{dx}} = 9\sec^2(9x+2)}$.

Problem 2. Section 3.6 #224

We can decompose this as $y = \tan(u)$ and $u = \sec(x)$. Then $\frac{\mathrm{dy}}{\mathrm{dx}} = \frac{\mathrm{dy}}{\mathrm{du}}\frac{\mathrm{du}}{\mathrm{dx}} = \sec^2(u)\sec(x)\tan(x)$, which substituting in for u gives $\boxed{\sec^2(\sec(x))\sec(x)\tan(x)}$.

Problem 3. Section 3.6 #232

We see $y = \frac{1}{u}$ and $u = \sin^2(x)$. We can find $\frac{\mathrm{dy}}{\mathrm{du}}$ using the power rule, and $\frac{\mathrm{du}}{\mathrm{dx}}$ using the chain rule, to get that $\frac{\mathrm{dy}}{\mathrm{dx}} = \frac{\mathrm{dy}}{\mathrm{du}}\frac{\mathrm{du}}{\mathrm{dx}} = -\frac{1}{u^2}(2\sin(x))\cos(x)$, which substituting for u yields $\boxed{\frac{\mathrm{dy}}{\mathrm{dx}} = -\frac{2\cos(x)}{\sin^3(x)}}$.

Problem 4. Section 3.6 #236

Let $y = \sqrt{(u)}$ and $u = 6 + \sec(\pi x^2)$. We find $\frac{\mathrm{dy}}{\mathrm{du}}$ with the power rule, and $\frac{\mathrm{du}}{\mathrm{dx}}$ with the sum rule and chain rule, to get that $\frac{\mathrm{dy}}{\mathrm{dx}} = \frac{\mathrm{dy}}{\mathrm{du}}\frac{\mathrm{du}}{\mathrm{dx}} = \frac{1}{2\sqrt{u}}\sec(\pi x^2)\tan(\pi x^2)2\pi x$, which substituting for u yields $\boxed{\frac{\mathrm{dy}}{\mathrm{dx}} = \frac{\pi x\sec(\pi x^2)\tan(\pi x^2)}{\sqrt{6+\sec(\pi x^2)}}}$.

Problem 5. Section 3.6 #240

First let's compute $\frac{\mathrm{dy}}{\mathrm{dx}}$. We can compute the chain rule to see that $\frac{\mathrm{dy}}{\mathrm{dx}} = 2(f(u)+3x)(f'(u)u'+3)$. Evaluating this at $x = 2$, we get $18 = 2(f(4)+6)(f'(4)\cdot 10+3) = (2)(12)(10f'(4)+6)$, so $f'(4) = \boxed{-\frac{9}{40}}$.

Problem 6. Section 3.6 #250

First compute $h'(x) = 3(1+g(x))^2(g'(x))$, and then plug in $a = 2$ to get $h'(2) = 3(1+g(2))^2(g'(2))$, which from the chart shows $h'(2) = 3(1+1)^2(-1) = \boxed{-12}$.

Problem 7. Section 3.6 #256

(a) We see $\frac{dA}{dr} = 2\pi r$. Similarly, $\frac{dr}{dt} = \frac{200}{(t+7)^3}$. Thus $\frac{dA}{dt} = 2\pi r\frac{200}{(t+7)^3} = \boxed{2\pi(2-\frac{100}{(t+7)^2})\frac{200}{(t+7)^3}}$.