Only the answers to even numbers are given.

1. Chapter Review Chapter 2:
   36)a) IV b) III c) II d) I e) IV f)II

2. Chapter Review Chapter 3:
   22) $\frac{dy}{dx} = 2e^{2x}\sin(3x)(\sin(3x)+\cos(3x))$
   34) $H(t) = \left(-cat^2+2at-bc\right)e^{-ct}$
   60) a) 1 b) 2 c) 3 d) 3 e) $-5/16$ f) 13
   62) a) 20 b) 11/9 c) -4 d)-24 e) $\sin 3 - 8\cos 3$ f) $4\ln 3 - 16/3$
   80) Draw a picture of a right triangle with height 2, other leg x, and hypotenuse s. We then can use the Pythagorean theorem to get $x = \sqrt{s^2-4}$. We find that $\frac{dx}{dt} = \frac{s}{x}\frac{ds}{dt} = 233.2$ mi/hr.
   82) a) We see that $V = \frac{k}{P}$ so volume decreases. b) Since $PV = k$ and $P = 2$ when $V = 10$ we get $k = 20$. Thus using the chain rule we eventually get

$$\frac{dV}{dt} = -\frac{20}{P^2}\frac{dP}{dt}$$

and then we get $\frac{dV}{dt} = -0.25$ cm^3/min.

3. Check your understanding Chapter 2:
   10) False. If f' is positive then f is increasing. f' could be negative and increasing and then f is decreasing.
   12) True. If $f(x) = mx+b$ then $f'(x) = m$, constant.
   22) True. For example, $f(x) = x$ is differentiable at every point and also continuous.

4. Check your understanding Chapter 3:
   2) False. $\frac{d}{dx}\left(\pi/x^2\right) = -2\pi/x^3$
   6) True. The slope is the derivative and the derivative of $f+g$ is $f'+g'$.

5. I leave it to you to plug in the values, but I'll take the derivatives for you:
   a) $3f'(12)$, b) $f'(4)+9g'(4)$, c) $f'(f(4))\cdot f'(4)$, d) $2f(4)f'(4)$, e) $f'(4)g(4)+f(4)g'(4)$, f) $\frac{g(4)f'(4)-f(4)g'(4)}{g(4)^2}$, g) $f'(g(4))g'(4)$, h) $g'(f(4))f'(4)$, i) $g'(f(f(4)))\cdot f'(f(4))\cdot f'(4)$, j) $(\cos g(4))g'(4)$, k) $3f(4)^2 f'(4) - 2(4)f'(16)$, l) $3f'(12)\sqrt{4} + f(12)\frac{1}{2\sqrt{4}}$

6.a) 1st derivative $= 2x\sin x + x^2\cos x$, 2nd derivative $= 2\sin x + 2x\cos x + 2x\cos x - x^2\sin x = 2\sin x + 4x\cos x - x^2\sin x$
   b) 1st derivative$= 4(x+1)^3\sqrt{x} + \frac{1}{2}(x+1)^4 x^{-1/2}$, 2nd derivative $= 12(x+1)^2\sqrt{x} + 2(x+1)^3 x^{-1/2} + 2(x+1)^3 x^{-1/2} - \frac{1}{4}(x+1)^4 x^{-3/2} = 12(x+1)^2\sqrt{x} + 4(x+1)^3 x^{-1/2} - \frac{1}{4}(x+1)^4 x^{-3/2}$

7. State the definitions of derivative of f at 4 and of the statement "f is continuous at 4."

$$f'(4) = \lim_{h \to 0} \frac{f(4+h) - f(4)}{h}.$$

f is continuous at 4 if

$$\lim_{x \to 4} f(x) = f(4).$$

8.

a) $3x^{300}+300(3x+2)x^{299} = 903x^{300}+600x^{299}$, b) $\frac{6x^2+2x^3-1}{(x+2)^2}$ c) $\frac{1}{3}(2x+2)\left(x^2-2x\right)^{-2/3}$,d) $\frac{\left(2x^2-1\right)e^x-2xe^x}{2x^2-1}$,e $\sin(-x)$,f) $3999(2x+3)^{1998}$,g) $\frac{99}{100}\left(x+3x^3\right)^{98}\left(1+9x^2\right)$,h) $5e^{5x+1}$,i) $2\sin x\cos x$,j) $2x(\ln 2)\,2^{x^2+1}$,k) $2xe^x\sin x+x^2e^x\sin x+x^2e^x\cos x$, l) $-\frac{1}{2\sqrt{x}}\sin\sqrt{x}$, m) $\frac{\sin x-x\cos x}{\sin^2 x}$, n) 0, o) $-\frac{e^{x^2}-2x^2e^{x^2}}{e^{2x^2}}$, o) ex^{e-1}, p) $(\ln 10)\,10^{\sin\left(x^3+2\right)}\cos\left(x^3+2\right)3x^2$

9. a) $p(x) = \frac{7}{2}x^2+3x+2$. b) $E(x) = 2(4^x)$Give an exponential function $E(x)$ which satisfies $E(0) = 2$, $E'(0) = 2\ln 4$.

10. Give the equation of a tangent line to the following curves at $x = 1$.
a) $y = 8x-4$ b) $y = \frac{1}{\cos^2 1}x-\frac{1}{\cos^2 1}+\tan 1$ c) $y = -\frac{3}{8}(\ln 2)\,x+\frac{3}{8}\ln 2+1/8$.

11. List two ways a function can be continuous but not differentiable at the same point.

The function could have a corner or a vertical tangent.