1.

a) $\frac{dy}{dx} = -\frac{3}{4}x^2 - \frac{1}{4\sqrt{x}} + 7 + \frac{3}{2}\sqrt{x}$

b) $f'(x) = -\frac{2}{x^2} + \frac{1}{3x^{2/3}} + \frac{6}{x^3} - \frac{4}{5}x^3 - \frac{2}{3x^{4/3}}$

c) $\frac{dy}{dx} = -2\csc x \cot x - 3\cos x + \frac{1}{2}\sec^2 x$

d) $f'(x) = -\csc^2 x - \sec x \tan x - \frac{2}{3}\sin x$

e) $\frac{dy}{dx} = -\frac{3}{\sqrt{1-x^2}} - \frac{2}{1+x^2} - \frac{1}{|x|\sqrt{x^2-1}}$

f) $f'(x) = \frac{2}{5(1+x^2)} + 11 - 1.1x^{0.1} + \frac{1}{\sqrt{1-x^2}}$

g) $\frac{dy}{dx} = -\frac{1}{2}e^x + \frac{3}{x\ln 2} + 2 \cdot 5^x \ln 5$

h) $f'(x) = 4 \cdot 3^x \ln 3 - \frac{2}{3x} - 5e^x$

i) $\frac{dy}{dx} = -\frac{1}{7}\cosh x + 8\,\mathrm{sech}^2 x - 6\,\mathrm{sech}\, x \tanh x$

j) $f'(x) = \sinh x - \frac{3}{5}\mathrm{csch}\, x \coth x + \mathrm{csch}^2 x$

k) $\frac{dy}{dx} = 0$

2.

a) $f'(x) = -2x^4 \sin x + 8x^3 \cos x$

b) $\frac{dy}{dx} = -3x^3e^x - 9x^2e^x + xe^x + e^x + 18x^2 - 2$

c) $f'(x) = \ln x \cos x + \frac{\sin x}{x}$

d) $f'(x) = \frac{2^x}{\sqrt{1-x^2}} + 2^x \sin^{-1} x \ln 2$

e) $f'(x) = \frac{x^2-10x+3}{(x^2-3)^2}$

f) $\frac{dy}{dx} = \frac{2(2x+3)(x-2)}{(4x-1)^2}$

g) $\frac{dy}{dx} = \frac{\cos x + x\sin x}{\cos^2 x}$

h) $f'(x) = \frac{\sinh x - \sinh^2 x + \cosh^2 x}{(1-\sinh x)^2}$ (Note: You'll learn later in the homework packet that $\cosh^2 x - \sinh^2 x = 1$, so $f'(x)$ can simplify down to $\frac{\sinh x + 1}{(1-\sinh x)^2}$)

i) $\frac{dy}{dx} = \frac{x\sec^2 x + \csc x \sec^2 x - \tan x + \tan x \csc x \cot x}{(x+\csc x)^2}$

j) $f'(x) = \frac{-x^2-2x-2}{x^3e^x}$

k) $\frac{dy}{dx} = \frac{e^x(x\cos x + x\sin x - 3\sin x)}{x^4}$

l) $\frac{dy}{dx} = \frac{2x^2 \sinh x(-3^x \sin x + 3^x \cos x \ln 3) - 3^x \cos x(2x^2 \cosh x + 4x \sinh x)}{(2x^2 \sinh x)^2}$

m) $\frac{dy}{dx} = \frac{\csc x\,\mathrm{sech}\, x\left(x\cdot\frac{1}{x} + 1\cdot\ln x\right) - x\ln x(\csc x(-\mathrm{sech}\, x \tanh x) + (-\csc x \cot x)\,\mathrm{sech}\, x)}{(\csc x\,\mathrm{sech}\, x)^2}$

n) $\frac{dy}{dx} = -\csc^2 x - \csc x \cot x$

o) $\frac{dy}{dx} = x\ln x \sec^2 x + \tan x + \ln x \tan x$

p) $\frac{dy}{dx} = e^x \cos^2 x - e^x \sin^2 x + e^x \sin x \cos x$ (or $e^x(\cos^2 x - \sin^2 x + \sin x \cos x)$)

3. $y'' = -\frac{1}{2x^{3/2}} - \frac{12}{x^5}$

4. $\frac{d^2y}{dx^2} = \frac{9}{4\sqrt{x}} + 2e^x - 4 \cdot 2^x (\ln 2)^2$

5. $f''(x) = \sec^3 x + \sec x \tan^2 x$

6. $y'' = \frac{9}{4\sqrt{x}} - \frac{1}{2x^{3/2}}$

7. $f^{(5)}(x) = -\frac{240}{x^6}$

8. $y + 2 = -2x$ (or $y = -2x - 2$)

9. $y - \frac{\pi}{2} = 1\left(x - \frac{\pi}{2}\right)$ (or $y = x$)

10. $y - 2 = 2\left(x - \frac{\pi}{4}\right)$ (or $y = 2x - \frac{\pi}{2} + 2$)

11.
   a. ∞
   b. $-\infty$
   c. ∞
   d. ∞
   e. 1
   f. $f'(0) = 0$

Review

12.
   a) $-\infty$
   b) ∞
   c) $-\infty$

13. See solutions.

Challenge Problem: $\frac{d^{875}}{dx^{875}}(\sin x) = -\cos x$