

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) $\frac{dy}{dx} = -\frac{1}{7} \cosh x + 8 \operatorname{sech}^2 x - 6 \operatorname{sech} x \tanh x$
- j) $f'(x) = \sinh x - \frac{3}{5} \operatorname{csch} x \coth x + \operatorname{csch}^2 x$
- k) $\frac{dy}{dx} = 0$

2.

- a) $f'(x) = -2x^4 \sin x + 8x^3 \cos x$
- b) $\frac{dy}{dx} = -3x^3 e^x - 9x^2 e^x + x e^x + e^x + 18x^2 - 2$
- 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 $\frac{1}{1 - \sinh x}$)
- 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) $f'(x) = \frac{-x^2 - 2x - 2}{x^3 e^x}$
- 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) $\frac{dy}{dx} = \frac{\csc x \operatorname{sech} x \left(x \cdot \frac{1}{x} + 1 \cdot \ln x\right) - x \ln x (\csc x (-\operatorname{sech} x \tanh x) + (-\csc x \cot x) \operatorname{sech} x)}{(\csc x \operatorname{sech} x)^2}$
- n) $\frac{dy}{dx} = -\csc^2 x - \csc x \cot x$

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

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

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

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

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

$$8. y + 2 = -2x \quad (\text{or } y = -2x - 2)$$

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

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

11.

a. ∞

b. $-\infty$

c. ∞

d. ∞

e. 1

f. $f'(0) = 0$

Review

12.

a) $-\infty$

b) ∞

c) $-\infty$

13. See solutions.

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