4. $f(x) = \sqrt{30}$ is a constant function, so its derivative is 0, that is, $f'(x) = 0$.

6. $F(x) = \frac{3}{4}x^8 \quad \Rightarrow \quad F'(x) = \frac{3}{4}(8x^7) = 6x^7$

10. $h(x) = (x-2)(2x+3) = 2x^2 - x - 6 \quad \Rightarrow \quad h'(x) = 2(2x) - 1 - 0 = 4x - 1$

12. $B(y) = cy^{-6} \quad \Rightarrow \quad B'(y) = c(-6y^{-7}) = -6cy^{-7}$

14. $h(t) = \sqrt[4]{t} - 4e^t = t^{1/4} - 4e^t \quad \Rightarrow \quad h'(t) = \frac{1}{4}t^{-3/4} - 4(e^t) = \frac{1}{4}t^{-3/4} - 4e^t$

22. $y = ae^v + \frac{b}{v} + \frac{c}{v^2} = ae^v + bv^{-1} + cv^{-2} \quad \Rightarrow \quad y' = ae^v - bv^{-2} - 2cv^{-3} = ae^v - \frac{b}{v^2} - \frac{2c}{v^3}$

28. $y = x^4 + 2x^2 - x \quad \Rightarrow \quad y' = 4x^3 + 4x - 1.$ At $(1, 2)$, $y' = 7$ and an equation of the tangent line is

$y - 2 = 7(x - 1)$ or $y = 7x - 5$.

4. By the Product Rule, $g(x) = \sqrt{x}\, e^x = x^{1/2}e^x \quad \Rightarrow \quad g'(x) = x^{1/2}(e^x) + e^x\left(\frac{1}{2}x^{-1/2}\right) = \frac{1}{2}x^{-1/2}e^x(2x+1)$.

6. By the Quotient Rule, $y = \dfrac{e^x}{1+x} \quad \Rightarrow \quad y' = \dfrac{(1+x)\,e^x - e^x(1)}{(1+x)^2} = \dfrac{e^x + xe^x - e^x}{(x+1)^2} = \dfrac{xe^x}{(x+1)^2}$.

12. $y = \dfrac{x+1}{x^3+x-2} \quad \overset{\text{QR}}{\Rightarrow}$

$$y' = \frac{(x^3+x-2)(1) - (x+1)(3x^2+1)}{(x^3+x-2)^2} = \frac{x^3+x-2-3x^3-3x^2-x-1}{(x^3+x-2)^2} = \frac{-2x^3-3x^2-3}{(x^3+x-2)^2}$$

or $-\dfrac{2x^3+3x^2+3}{(x-1)^2(x^2+x+2)^2}$

18. $z = w^{3/2}(w + ce^w) = w^{5/2} + cw^{3/2}e^w \quad \Rightarrow \quad z' = \frac{5}{2}w^{3/2} + c\left(w^{3/2}\cdot e^w + e^w \cdot \frac{3}{2}w^{1/2}\right) = \frac{5}{2}w^{3/2} + \frac{1}{2}cw^{1/2}e^w(2w+3)$

22. $f(x) = \dfrac{1 - xe^x}{x + e^x} \quad \overset{\text{QR}}{\Rightarrow} \quad f'(x) = \dfrac{(x+e^x)(-xe^x)' - (1-xe^x)(1+e^x)}{(x+e^x)^2}$

$$\overset{\text{PR}}{\Rightarrow} \quad f'(x) = \frac{(x+e^x)[-(xe^x + e^x\cdot 1)] - (1 + e^x - xe^x - xe^{2x})}{(x+e^x)^2}$$

$$= \frac{-x^2e^x - xe^x - xe^{2x} - e^{2x} - 1 - e^x + xe^x + xe^{2x}}{(x+e^x)^2} = \frac{-x^2e^x - e^{2x} - e^x - 1}{(x+e^x)^2}$$

26. $f(x) = x^{5/2}e^x \quad \Rightarrow \quad f'(x) = x^{5/2}e^x + e^x \cdot \frac{5}{2}x^{3/2} = \left(x^{5/2} + \frac{5}{2}x^{3/2}\right)e^x \quad \left[\text{or } \frac{1}{2}x^{3/2}e^x(2x+5)\right] \quad \Rightarrow$

$$f''(x) = \left(x^{5/2} + \tfrac{5}{2}x^{3/2}\right)e^x + e^x\left(\tfrac{5}{2}x^{3/2} + \tfrac{15}{4}x^{1/2}\right) = \left(x^{5/2} + 5x^{3/2} + \tfrac{15}{4}x^{1/2}\right)e^x \quad \left[\text{or } \tfrac{1}{4}x^{1/2}e^x(4x^2 + 20x + 15)\right]$$

42. We are given that $f(2) = -3$, $g(2) = 4$, $f'(2) = -2$, and $g'(2) = 7$.

(a) $h(x) = 5f(x) - 4g(x) \quad \Rightarrow \quad h'(x) = 5f'(x) - 4g'(x)$, so

$h'(2) = 5f'(2) - 4g'(2) = 5(-2) - 4(7) = -10 - 28 = -38$.

(b) $h(x) = f(x)g(x) \quad \Rightarrow \quad h'(x) = f(x)g'(x) + g(x)f'(x)$, so

$h'(2) = f(2)g'(2) + g(2)f'(2) = (-3)(7) + (4)(-2) = -21 - 8 = -29$.

(c) $h(x) = \dfrac{f(x)}{g(x)} \quad \Rightarrow \quad h'(x) = \dfrac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$, so

$$h'(2) = \frac{g(2)f'(2) - f(2)g'(2)}{[g(2)]^2} = \frac{4(-2) - (-3)(7)}{4^2} = \frac{-8 + 21}{16} = \frac{13}{16}.$$

(d) $h(x) = \dfrac{g(x)}{1 + f(x)} \quad \Rightarrow \quad h'(x) = \dfrac{[1 + f(x)]\, g'(x) - g(x) f'(x)}{[1 + f(x)]^2}$, so

$$h'(2) = \frac{[1 + f(2)]\, g'(2) - g(2)\, f'(2)}{[1 + f(x)]^2} = \frac{[1 + (-3)](7) - 4(-2)}{[1 + (-3)]^2} = \frac{-14 + 8}{(-2)^2} = \frac{-6}{4} = -\frac{3}{2}.$$

44. $\dfrac{d}{dx}\left[\dfrac{h(x)}{x}\right] = \dfrac{xh'(x) - h(x) \cdot 1}{x^2} \quad \Rightarrow \quad \dfrac{d}{dx}\left[\dfrac{h(x)}{x}\right]_{x=2} = \dfrac{2h'(2) - h(2)}{2^2} = \dfrac{2(-3) - (4)}{4} = \dfrac{-10}{4} = -2.5$

46. (a) $P(x) = F(x)\, G(x)$, so $P'(2) = F(2)\, G'(2) + G(2)\, F'(2) = 3 \cdot \frac{2}{4} + 2 \cdot 0 = \frac{3}{2}$.

(b) $Q(x) = F(x)/G(x)$, so $Q'(7) = \dfrac{G(7)\, F'(7) - F(7)\, G'(7)}{[G(7)]^2} = \dfrac{1 \cdot \frac{1}{4} - 5 \cdot \left(-\frac{2}{3}\right)}{1^2} = \dfrac{1}{4} + \dfrac{10}{3} = \dfrac{43}{12}$

50. (a) $f(20) = 10{,}000$ means that when the price of the fabric is \$20/yard, 10,000 yards will be sold.

$f'(20) = -350$ means that as the price of the fabric increases past \$20/yard, the amount of fabric which will be sold is decreasing at a rate of 350 yards per (dollar per yard).

(b) $R(p) = pf(p) \quad \Rightarrow \quad R'(p) = pf'(p) + f(p) \cdot 1 \quad \Rightarrow \quad R'(20) = 20f'(20) + f(20) \cdot 1 = 20(-350) + 10{,}000 = 3000$.

This means that as the price of the fabric increases past \$20/yard, the total revenue is increasing at \$3000/(\$/yard). Note that the Product Rule indicates that we will lose \$7000/(\$/yard) due to selling less fabric, but this loss is more than made up for by the additional revenue due to the increase in price.