17. $y = \dfrac{r^2}{1+\sqrt{r}} \quad \Rightarrow$

$$y' = \frac{(1+\sqrt{r}\,)(2r) - r^2\left(\frac{1}{2}r^{-1/2}\right)}{(1+\sqrt{r}\,)^2} = \frac{2r + 2r^{3/2} - \frac{1}{2}r^{3/2}}{(1+\sqrt{r}\,)^2} = \frac{2r + \frac{3}{2}r^{3/2}}{(1+\sqrt{r}\,)^2} = \frac{\frac{1}{2}r(4+3r^{1/2})}{(1+\sqrt{r}\,)^2} = \frac{r(4+3\sqrt{r}\,)}{2(1+\sqrt{r}\,)^2}$$

25. $f(x) = \dfrac{x}{x+c/x} \quad \Rightarrow \quad f'(x) = \dfrac{(x+c/x)(1) - x(1-c/x^2)}{\left(x+\frac{c}{x}\right)^2} = \dfrac{x + c/x - x + c/x}{\left(\dfrac{x^2+c}{x}\right)^2} = \dfrac{2c/x}{\dfrac{(x^2+c)^2}{x^2}} \cdot \dfrac{x^2}{x^2} = \dfrac{2cx}{(x^2+c)^2}$

27. $y = \dfrac{2x}{x+1} \quad \Rightarrow \quad y' = \dfrac{(x+1)(2)-(2x)(1)}{(x+1)^2} = \dfrac{2}{(x+1)^2}$. At $(1,1)$, $y' = \frac{1}{2}$, and an equation of the tangent line is $y - 1 = \frac{1}{2}(x-1)$, or $y = \frac{1}{2}x + \frac{1}{2}$.

29. $y = \tan x \quad \Rightarrow \quad y' = \sec^2 x \quad \Rightarrow$ the slope of the tangent line at $\left(\frac{\pi}{4}, 1\right)$ is $\sec^2\frac{\pi}{4} = \left(\sqrt{2}\right)^2 = 2$ and an equation of the tangent line is $y - 1 = 2\left(x - \frac{\pi}{4}\right)$ or $y = 2x + 1 - \frac{\pi}{2}$.

42. We are given that $f(3) = 4$, $g(3) = 2$, $f'(3) = -6$, and $g'(3) = 5$.

(a) $(f+g)'(3) = f'(3) + g'(3) = -6 + 5 = -1$

(b) $(fg)'(3) = f(3)g'(3) + g(3)f'(3) = (4)(5) + (2)(-6) = 20 - 12 = 8$

(c) $\left(\dfrac{f}{g}\right)'(3) = \dfrac{g(3)f'(3) - f(3)g'(3)}{[g(3)]^2} = \dfrac{(2)(-6)-(4)(5)}{(2)^2} = \dfrac{-32}{4} = -8$

46. (a) $y = x^2 f(x) \quad \Rightarrow \quad y' = x^2 f'(x) + f(x)(2x)$

(b) $y = \dfrac{f(x)}{x^2} \quad \Rightarrow \quad y' = \dfrac{x^2 f'(x) - f(x)(2x)}{(x^2)^2} = \dfrac{xf'(x) - 2f(x)}{x^3}$

(c) $y = \dfrac{x^2}{f(x)} \quad \Rightarrow \quad y' = \dfrac{f(x)(2x) - x^2 f'(x)}{[f(x)]^2}$

(d) $y = \dfrac{1 + xf(x)}{\sqrt{x}} \quad \Rightarrow$

$$y' = \frac{\sqrt{x}\,[xf'(x) + f(x)] - [1 + xf(x)]\,\dfrac{1}{2\sqrt{x}}}{(\sqrt{x}\,)^2}$$

$$= \frac{x^{3/2}f'(x) + x^{1/2}f(x) - \frac{1}{2}x^{-1/2} - \frac{1}{2}x^{1/2}f(x)}{x} \cdot \frac{2x^{1/2}}{2x^{1/2}} = \frac{xf(x) + 2x^2 f'(x) - 1}{2x^{3/2}}$$

52. $y = \dfrac{\cos x}{2 + \sin x} \quad \Rightarrow \quad y' = \dfrac{(2 + \sin x)(-\sin x) - \cos x \, \cos x}{(2 + \sin x)^2} = \dfrac{-2 \sin x - \sin^2 x - \cos^2 x}{(2 + \sin x)^2} = \dfrac{-2 \sin x - 1}{(2 + \sin x)^2} = 0$ when $-2 \sin x - 1 = 0 \quad \Leftrightarrow \quad \sin x = -\frac{1}{2} \quad \Leftrightarrow \quad x = \frac{11\pi}{6} + 2\pi n$ or $x = \frac{7\pi}{6} + 2\pi n$, n an integer. So $y = \frac{1}{\sqrt{3}}$ or $y = -\frac{1}{\sqrt{3}}$ and the points on the curve with horizontal tangents are: $\left(\frac{11\pi}{6} + 2\pi n, \frac{1}{\sqrt{3}}\right)$, $\left(\frac{7\pi}{6} + 2\pi n, -\frac{1}{\sqrt{3}}\right)$, n an integer.