5. Let $u = g(x) = \sqrt{x}$ and $y = f(u) = e^u$. Then $\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx} = (e^u)\left(\frac{1}{2}x^{-1/2}\right) = e^{\sqrt{x}} \cdot \frac{1}{2\sqrt{x}} = \frac{e^{\sqrt{x}}}{2\sqrt{x}}$.

9. $g(t) = \frac{1}{(t^4+1)^3} = (t^4+1)^{-3} \quad \Rightarrow \quad g'(t) = -3(t^4+1)^{-4}(4t^3) = -12t^3(t^4+1)^{-4} = \frac{-12t^3}{(t^4+1)^4}$

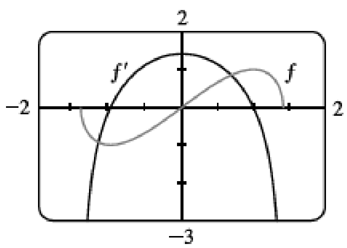
11. $y = \cos(a^3 + x^3) \quad \Rightarrow \quad y' = -\sin(a^3+x^3)\cdot 3x^2 \quad [a^3 \text{ is just a constant}] \quad = -3x^2\sin(a^3+x^3)$

12. $y = a^3 + \cos^3 x \quad \Rightarrow \quad y' = 3(\cos x)^2(-\sin x) \quad [a^3 \text{ is just a constant}] \quad = -3\sin x\cos^2 x$

39. (a) $f(x) = x\sqrt{2-x^2} = x(2-x^2)^{1/2} \quad \Rightarrow$

$$f'(x) = x\cdot\tfrac{1}{2}(2-x^2)^{-1/2}(-2x) + (2-x^2)^{1/2}\cdot 1 = (2-x^2)^{-1/2}[-x^2+(2-x^2)] = \frac{2-2x^2}{\sqrt{2-x^2}}$$

(b)



$f' = 0$ when f has a horizontal tangent line, f' is negative when f is decreasing, and f' is positive when f is increasing.

43. (a) $h(x) = f(g(x)) \quad \Rightarrow \quad h'(x) = f'(g(x))\cdot g'(x)$, so $h'(1) = f'(g(1))\cdot g'(1) = f'(2)\cdot 6 = 5\cdot 6 = 30$.

(b) $H(x) = g(f(x)) \quad \Rightarrow \quad H'(x) = g'(f(x))\cdot f'(x)$, so $H'(1) = g'(f(1))\cdot f'(1) = g'(3)\cdot 4 = 9\cdot 4 = 36$.