MATH 112 SOLUTIONS FOR 4.1, P. 316

2. (b) $\frac{3}{2}x^2 + C$ (d) $6x^{1/2} + C$ (f) $x^4 + \frac{5}{3}x^3 - \frac{7}{2}x^2 - 2x + C$
3. (a) $\dfrac{2^x}{\ln 2} + C$. (f) $\dfrac{x^{\pi+1}}{\pi+1} + \dfrac{\pi^x}{\ln \pi} - \dfrac{\pi^{-x}}{\ln \pi} + C$. (g) $-\cos x + \frac{3}{2}x^2 - \sec x + C$.
   (h) $3\sin x + 4\sinh x + C$.
4. (b) $D_x(\frac{1}{a}\sin ax) = \frac{1}{a}\cos ax \cdot a = \cos ax$.
   (d) $D_x\left[\dfrac{1}{a}\tan^{-1}\dfrac{x}{a}\right] = \dfrac{1}{a}\cdot\dfrac{1/a}{1+(x/a)^2} = \dfrac{1}{a^2+x^2}$
   (e) $D_x(\sin^{-1}\frac{x}{a}) = \dfrac{1}{\sqrt{1-(x/a)^2}}\cdot\dfrac{1}{a} = \dfrac{1}{\sqrt{a^2-x^2}}$.
   (g) $D_x(\frac{1}{a}e^{ax}) = \frac{1}{a}\cdot ae^{ax} = e^{ax}$.
   (h) $D_x[\frac{1}{2}x\sqrt{a^2-x^2} + \frac{1}{2}a^2\sin^{-1}\frac{x}{a}] = \frac{1}{2}\sqrt{a^2-x^2} + \frac{1}{2}x\cdot\dfrac{-x}{\sqrt{a^2-x^2}} +$
   $\frac{1}{2}a^2\dfrac{1/a}{\sqrt{1-(x/a)^2}} = \frac{1}{2}\sqrt{a^2-x^2} + \dfrac{a^2-x^2}{2\sqrt{a^2-x^2}} = \sqrt{a^2-x^2}$
5. (b) $\frac{1}{a}\cosh ax$. (c) $\frac{1}{a}\tan ax$. (g) $\dfrac{a^{bx}}{b\ln a}$. (h) $\frac{1}{a}\ln|ax+b|$.
6. f: ii f': i F: iii ϕ: iv
8. (b) $s = t^2$ (d) $s = \frac{3}{\pi}\sin \pi t + 4$
9. (b) $v = t - \frac{1}{2}t^2 - 24, s = \frac{1}{2}t^2 - \frac{1}{6}t^3 - 24t + 55$
   (d) $v = \frac{5}{2}\cos 2t, s = \frac{5}{4}\sin 2t$
12. 24,806.25 feet. Seems too high, so air resistance is probably substantial.
15. 400 ft/sec.
16. $\sqrt{2gh}$.
18. 240 ft.
20. $\dfrac{d^2s}{dt^2} = \dfrac{d}{dt}[\dfrac{d}{dt}(C\cos\omega t + D\sin\omega t)] = \dfrac{d}{dt}(-C\omega\sin\omega t + D\omega\cos\omega t) = -C\omega^2\cos\omega t -$
    $D\omega^2\sin\omega t = -\omega^2(C\cos\omega t + D\sin\omega t) = -\omega^2 s$.
23. $s = \dfrac{pv_0}{2\pi}\sin\left(\dfrac{2\pi t}{p}\right)$.
26. (a) $g(0) = g(0+0) = g(0) + g(0) - 3\cdot 0\cdot 0 = g(0) + g(0) \Rightarrow 0 = g(0)$.
    (b) $g'(x) = \lim_{h\to 0}\dfrac{g(x+h)-g(x)}{h} = \lim_{h\to 0}\dfrac{g(x)+g(h)-3xh-g(x)}{h} = \lim_{h\to 0}\left(3x + \dfrac{g(h)}{h}\right) =$
    $3x + 5$.
    (c) $g(x) = \frac{3}{2}x^2 + 5x + C, g(0) = C = 0 \Rightarrow g(x) = \frac{3}{2}x^2 + 5x$.