

20.  $f'(x) = 2x - 3/x^4 = 2x - 3x^{-4} \Rightarrow f(x) = x^2 + x^{-3} + C$  because we're given that  $x > 0$ .  
 $f(1) = 2 + C$  and  $f(1) = 3 \Rightarrow C = 1$ , so  $f(x) = x^2 + 1/x^3 + 1$ .
22.  $f'(x) = 4/\sqrt{1-x^2} \Rightarrow f(x) = 4 \sin^{-1} x + C$ .  $f(\frac{1}{2}) = 4 \sin^{-1}(\frac{1}{2}) + C = 4 \cdot \frac{\pi}{6} + C$  and  $f(\frac{1}{2}) = 1 \Rightarrow \frac{2\pi}{3} + C = 1 \Rightarrow C = 1 - \frac{2\pi}{3}$ , so  $f(x) = 4 \sin^{-1} x + 1 - \frac{2\pi}{3}$ .
49. (a) First note that  $90 \text{ mi/h} = 90 \times \frac{5280}{3600} \text{ ft/s} = 132 \text{ ft/s}$ . Then  $a(t) = 4 \text{ ft/s}^2 \Rightarrow v(t) = 4t + C$ , but  $v(0) = 0 \Rightarrow C = 0$ . Now  $4t = 132$  when  $t = \frac{132}{4} = 33 \text{ s}$ , so it takes 33 s to reach 132 ft/s. Therefore, taking  $s(0) = 0$ , we have  $s(t) = 2t^2$ ,  $0 \leq t \leq 33$ . So  $s(33) = 2178 \text{ ft}$ . 15 minutes =  $15(60) = 900 \text{ s}$ , so for  $33 < t \leq 933$  we have  $v(t) = 132 \text{ ft/s} \Rightarrow s(933) = 132(900) + 2178 = 120,978 \text{ ft} = 22.9125 \text{ mi}$ .
- (b) As in part (a), the train accelerates for 33 s and travels 2178 ft while doing so. Similarly, it decelerates for 33 s and travels 2178 ft at the end of its trip. During the remaining  $900 - 66 = 834 \text{ s}$  it travels at 132 ft/s, so the distance traveled is  $132 \cdot 834 = 110,088 \text{ ft}$ . Thus, the total distance is  $2178 + 110,088 + 2178 = 114,444 \text{ ft} = 21.675 \text{ mi}$ .
- (c)  $45 \text{ mi} = 45(5280) = 237,600 \text{ ft}$ . Subtract  $2(2178)$  to take care of the speeding up and slowing down, and we have  $233,244 \text{ ft}$  at 132 ft/s for a trip of  $233,244/132 = 1767 \text{ s}$  at 90 mi/h. The total time is  $1767 + 2(33) = 1833 \text{ s} = 30 \text{ min } 33 \text{ s} = 30.55 \text{ min}$ .
- (d)  $37.5(60) = 2250 \text{ s}$ .  $2250 - 2(33) = 2184 \text{ s}$  at maximum speed.  $2184(132) + 2(2178) = 292,644 \text{ total feet}$  or  $292,644/5280 = 55.425 \text{ mi}$ .