

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

$$16. y = \sqrt{x}(x - 1) = x^{3/2} - x^{1/2} \Rightarrow y' = \frac{3}{2}x^{1/2} - \frac{1}{2}x^{-1/2} = \frac{1}{2}x^{-1/2}(3x - 1) \quad [\text{factor out } \frac{1}{2}x^{-1/2}]$$

or  $y' = \frac{3x - 1}{2\sqrt{x}}.$

$$22. y = \frac{\sin \theta}{2} + \frac{c}{\theta} = \frac{1}{2} \sin \theta + c\theta^{-1} \Rightarrow y' = \frac{1}{2} \cos \theta + c(-1)\theta^{-2} = \frac{\cos \theta}{2} - \frac{c}{\theta^2}$$

$$24. u = \sqrt[3]{t^2} + 2\sqrt{t^3} = t^{2/3} + 2t^{3/2} \Rightarrow u' = \frac{2}{3}t^{-1/3} + 2\left(\frac{3}{2}\right)t^{1/2} = \frac{2}{3\sqrt[3]{t}} + 3\sqrt{t}$$

$$32. h(t) = \sqrt{t} + 5 \sin t \Rightarrow h'(t) = \frac{1}{2}t^{-1/2} + 5 \cos t \Rightarrow h''(t) = -\frac{1}{4}t^{-3/2} - 5 \sin t$$

$$65. \text{Solution 1: Let } f(x) = x^{1000}. \text{ Then, by the definition of a derivative, } f'(1) = \lim_{x \rightarrow 1} \frac{f(x) - f(1)}{x - 1} = \lim_{x \rightarrow 1} \frac{x^{1000} - 1}{x - 1}.$$

But this is just the limit we want to find, and we know (from the Power Rule) that  $f'(x) = 1000x^{999}$ , so

$$f'(1) = 1000(1)^{999} = 1000. \text{ So } \lim_{x \rightarrow 1} \frac{x^{1000} - 1}{x - 1} = 1000.$$

*Solution 2:* Note that  $(x^{1000} - 1) = (x - 1)(x^{999} + x^{998} + x^{997} + \cdots + x^2 + x + 1)$ . So

$$\begin{aligned} \lim_{x \rightarrow 1} \frac{x^{1000} - 1}{x - 1} &= \lim_{x \rightarrow 1} \frac{(x - 1)(x^{999} + x^{998} + x^{997} + \cdots + x^2 + x + 1)}{x - 1} = \lim_{x \rightarrow 1} (x^{999} + x^{998} + x^{997} + \cdots + x^2 + x + 1) \\ &= \underbrace{1 + 1 + 1 + \cdots + 1 + 1 + 1}_{1000 \text{ ones}} = 1000, \text{ as above.} \end{aligned}$$