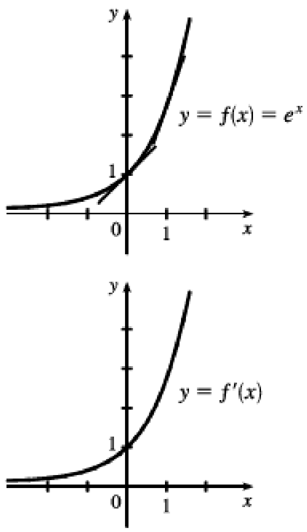
14. See Figure 1 in Section 3.4.

15.



The slope at 0 appears to be 1 and the slope at 1 appears to be 2.7. As x decreases, the slope gets closer to 0. Since the graphs are so similar, we might guess that $f'(x) = e^x$.

23. $$g'(x) = \lim_{h\to 0} \frac{g(x+h)-g(x)}{h} = \lim_{h\to 0} \frac{\sqrt{1+2(x+h)}-\sqrt{1+2x}}{h}\left[\frac{\sqrt{1+2(x+h)}+\sqrt{1+2x}}{\sqrt{1+2(x+h)}+\sqrt{1+2x}}\right]$$
$$= \lim_{h\to 0} \frac{(1+2x+2h)-(1+2x)}{h\left[\sqrt{1+2(x+h)}+\sqrt{1+2x}\right]} = \lim_{h\to 0} \frac{2}{\sqrt{1+2x+2h}+\sqrt{1+2x}} = \frac{2}{2\sqrt{1+2x}} = \frac{1}{\sqrt{1+2x}}$$

Domain of $g = \left[-\frac{1}{2}, \infty\right)$, domain of $g' = \left(-\frac{1}{2}, \infty\right)$.

25. $$G'(t) = \lim_{h\to 0} \frac{G(t+h)-G(t)}{h} = \lim_{h\to 0} \frac{\dfrac{4(t+h)}{(t+h)+1} - \dfrac{4t}{t+1}}{h} = \lim_{h\to 0} \frac{\dfrac{4(t+h)(t+1)-4t(t+h+1)}{(t+h+1)(t+1)}}{h}$$
$$= \lim_{h\to 0} \frac{\left(4t^2+4ht+4t+4h\right)-\left(4t^2+4ht+4t\right)}{h(t+h+1)(t+1)} = \lim_{h\to 0} \frac{4h}{h(t+h+1)(t+1)}$$
$$= \lim_{h\to 0} \frac{4}{(t+h+1)(t+1)} = \frac{4}{(t+1)^2}$$

Domain of G = domain of $G' = (-\infty, -1) \cup (-1, \infty)$.

29. (a) $U'(t)$ is the rate at which the unemployment rate is changing with respect to time. Its units are percent per year.

(b) To find $U'(t)$, we use $\lim\limits_{h\to 0} \dfrac{U(t+h)-U(t)}{h} \approx \dfrac{U(t+h)-U(t)}{h}$ for small values of h.

For 1993: $U'(1993) \approx \dfrac{U(1994)-U(1993)}{1994-1993} = \dfrac{6.1-6.9}{1} = -0.80$

For 1994: We estimate $U'(1994)$ by using $h=-1$ and $h=1$, and then average the two results to obtain a final estimate.

$h=-1 \quad \Rightarrow \quad U'(1994) \approx \dfrac{U(1993)-U(1994)}{1993-1994} = \dfrac{6.9-6.1}{-1} = -0.80;$

$h=1 \quad \Rightarrow \quad U'(1994) \approx \dfrac{U(1995)-U(1994)}{1995-1994} = \dfrac{5.6-6.1}{1} = -0.50.$

So we estimate that $U'(1994) \approx \frac{1}{2}[(-0.80)+(-0.50)] = -0.65$.

t	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
$U'(t)$	-0.80	-0.65	-0.35	-0.35	-0.45	-0.35	-0.25	0.25	0.90	1.10