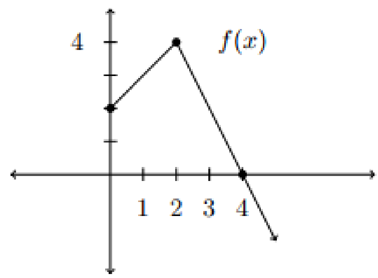
1. A graph of the piecewise linear function $f(x)$ and table of the functions $g(x)$ and $g'(x)$ are shown below.



x	0	1	2	3	4
$g(x)$	2	5	9	11	8
$g'(x)$	3	4	2	-3	-4

   (a) Given $h(x) = f(x)g(x)$, find $h'(1)$.

   (b) Given $k(x) = \dfrac{f(x)}{g(x)}$, find $k'(3)$.

   (c) $l(x) = \dfrac{g(x)}{\sqrt{x}}$, find $l'(4)$.

2. If f is a differentiable function, find an expression for the derivative fo the following function:

$$y = \frac{1 + xf(x)}{\sqrt{x}}$$

3. A manufacturer produces bolts of a fabric with a fixed width. The quantity q of this fabric (measured in yards) that is sold is a function of the selling price p (in dollars per yard), so we can write $q = f(p)$. Then the total revenue earned with selling price p is $R(p) = pf(p)$.

   (a) What does it mean to say that $f(20) = 10,000$ and $f'(20) = -350$?

   (b) Assuming the values in part (a), find $R'(20)$ and interpret your answer.

4. On what interval is the function $f(x) = x^3 e^x$ increasing?

5. On what interval is the function $f(x) = x^2 e^x$ concave downward?

6. (a) If $F(x) = f(x)g(x)$, where f and g have derivatives of all orders, show that $F'' = f''g + 2f'g' + fg''$.

   (b) Find similar formulas for F''' and $F^{(4)}$.

   (c) Guess a formula for $F^{(n)}$.

7. Prove that $\frac{d}{dx}(\sec(x)) = \sec(x)\tan(x)$.

8. A ladder 10 ft long rests against a vertical wall. Let θ be the angle between the top of the ladder and the wall and let x be the distance from the bottom of the ladder to the wall. If the bottom of the ladder slides away from the wall, how fast does x change with respect to θ when $\theta = \frac{\pi}{3}$?

9. Find the given derivative by finding the first few derivatives and observing the pattern that occurs.

   (a) $\frac{d^{99}}{dx^{99}}(\sin(x))$

   (b) $\frac{d^{35}}{dx^{35}}(x\sin(x))$

Optional Challenge Problems

How many tangent lines to the curve $y = x/(x+1)$ pass through the point $(1,2)$? At which points do these tangent lines touch the curve?