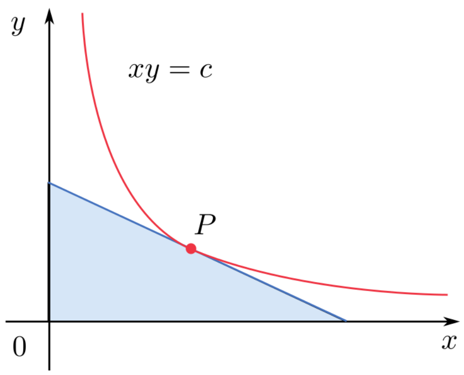
3.1.86 Find numbers a and b such that the given function g is differentiable at 1.

$$g(x) = \begin{cases} ax^3 - 3x & \text{if } x \le 1 \\ bx^2 + 2 & \text{if } x > 1 \end{cases}$$

3.1.88 A tangent line is drawn to the hyperbola $xy = c$ at a point P as shown in the figure.

(a) Show that the midpoint of the line segment cut from this tangent line by the coordinate axes is P.

(b) Show that the triangle formed by the tangent line and the coordinate axes always has the same area, no matter where P is located on the hyperbola.



3.1.90 Sketch the parabolas $y = x^2$ and $y = x^2 - 2x + 2$. Do you think there is a line that is tangent to both curves? If so, find its equation. If not, why not?

3.2.44 If $g(x) = \dfrac{x}{e^x}$, find $g^{(n)}(x)$

3.2.50 If $f(2) = 10$ and $f'(x) = x^2 f(x)$ for all x, find $f''(2)$.

3.2.58 Compute $Q'(0)$, where $Q(x) = \dfrac{1 + x + x^2 + xe^x}{1 - x + x^2 - xe^x}$

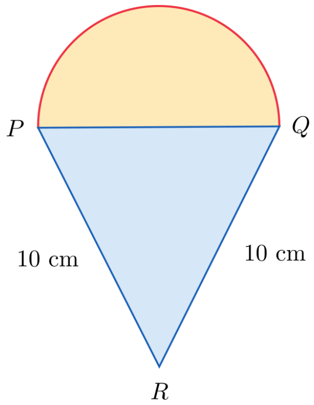
Hint: Instead of finding $Q'(x)$ first, let $f(x)$ be the numerator and $g(x)$ be the denominator of $Q(x)$, and compute $Q'(0)$ from $f(0)$, $f'(0)$, $g(0)$ and $g'(0)$.

3.3.46 Find the limit $\lim\limits_{x \to 0} \dfrac{\sin(x)}{\sin(\pi x)}$.

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

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

3.3.66 A semicircle with diameter PQ sits on an isosceles triangle PQR to form a region shaped like a two-dimensional icecream cone, as shown in the figure. If $A(\theta)$ is the area of the semicircle and $B(\theta)$ is the area of the triangle, find $\lim_{\theta \to 0^+} \dfrac{A(\theta)}{B(\theta)}$.



3.4.46 Find the derivative of the function $y = \sqrt{x + \sqrt{x + \sqrt{x}}}$.

3.4.48 Find the derivative of the function $y = 2^{3^{4^x}}$.

3.4.62 The curve $y = \dfrac{|x|}{\sqrt{2-x^2}}$ is called a *bullet-nose curve*. Find an equation of the tangent line to this curve at the point $(1, 1)$.

3.4.69 A table of values for f, g, f' and g' is given.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
1	3	2	4	6
2	1	8	5	7
3	7	2	7	9

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

(b) If $H(x) = g(f(x))$, find $H'(1)$.

3.4.99 Let c be the x-intercept of the tangent line to the curve $y = b^x$ $(b > 0, b \neq 1)$ at the point (a, b^a). Show that the distance between the points $(a, 0)$ and $(c, 0)$ is the same for all values of a.