1. Find the limit.

   (a) $\lim_{t\to 0} \dfrac{\sin^2 3t}{t^2}$

   (b) $\lim_{x\to 0} \dfrac{\sin 3x}{\sin 5x}$

   (c) $\lim_{x\to 0} \dfrac{(\cos x - 1)\sin 3x}{x^2}$

   (d) $\lim_{x\to -2} \dfrac{\tan \pi x}{x+2}$

2. Differentiate the function.

   (a) $f(x) = \tan x + x \sec x$

   (b) $f(x) = (3x^3 - 2x^2 + 1)^6$

   (c) $f(x) = (1 + \cos^2 x)^3$

(d) $f(x) = \cos\sqrt{x}$

(e) $f(x) = \left(\dfrac{x^4 - 1}{x^4 + 1}\right)^3$

(f) $f(x) = \dfrac{2x + 1}{\sqrt{x^2 + 3}}$

(g) $f(x) = (x^6 + 4x^5 - 11)^5(2 + x^8)^7$

3. Functions f and g satisfy the properties as shown in the table. Find the indicated quantity.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	-3	3	1	1
2	0	3	-5	10
3	2	5	0	4

(a) $h'(1)$, if $h(x) = f(g(x))$

(b) $z'(2)$, if $z(x) = [f(2x-1)]^4$

(c) $G'(1)$, if $G(x) = \left[x^2 - g(2x)\right]^3$

4. Find the equation of the tangent line to the curve $y = x\sqrt{1+x^2}$ at the point where $x = 1$.

5. Find $\dfrac{dy}{dx}$ for the equation $\cos(x-y) = y\sin x$.

6. Find $\dfrac{dx}{dy}$ for the equation $y^4 + x^2y^2 + yx^4 = y + 1$.

7. Find the slope of the tangent line to the curve $2(x^2 + y^2)^2 = 25(x^2 - y^2)$ at the point (3,1).

8. Find a tangent vector of unit length to the curve $\mathbf{r}(t) =< t\cos t, t\sin t >$ at the point where $t = \dfrac{\pi}{4}$.

9. Find the vector and parametric equations for the line tangent to the curve $\vec{r}(t) =< 1 - 4t, 2t - 3t^2 >$ at the point $P(-11, -21)$.

10. The ball is tossed into the air. Its position at time t is given by $\mathbf{r}(t) =< 5t, 100t - 16t^2 >$.

(a) Find the velocity and the speed of the ball when $t = 2$.

(b) How high does the ball go?

(c) With what speed does the ball hit the ground?

11. Find the angle of intersection of the curves traced by $\mathbf{r}_1(t) =< 1 - t, 3 + t^2 >$ and $\mathbf{r}_2(s) =< s - 2, s^2 >$.