Find the derivative of each function.

1a) $h(x) = (2x^2 + 1)(3x^3 - 4x + 10)$

1b) $f(x) = x^3 \cos x$

$h(x) = f(x) \bullet g(x)$

So....let $f(x) = (2x^2 + 1)$ and $g(x) = (3x^3 - 4x + 10)$

Since $h'(x) = f(x) \bullet g'(x) + g(x) \bullet f'(x)$

$h'(x) = (2x^2 + 1)(9x^2 - 4) + (3x^3 - 4x + 10)(4x)$

1c) $h(t) = \sqrt{t}(1 - t^2)$

1d) $y = 2x \sin x + x^2 \cos x$

2a) $h(x) = \dfrac{3x}{2x^2 - x + 1}$

2b) $f(x) = \dfrac{3x - 1}{\sqrt{x}}$

$$h(x) = \frac{f(x)}{g(x)}$$

So....let $f(x) = 3x$ and $g(x) = (2x^2 - x + 1)$

Since $h'(x) = \dfrac{g(x) \bullet f'(x) - f(x) \bullet g'(x)}{(g(x))^2}$

$$h'(x) = \frac{(2x^2 - x + 1) \bullet 3 - 3x \bullet (4x - 1)}{(2x^2 - x + 1)^2}$$

$$h'(x) = \frac{(6x^2 - 3x + 3) - (12x^2 - 3x)}{(2x^2 - x + 1)^2}$$

$$h'(x) = \frac{-6x^2 + 3}{(2x^2 - x + 1)^2}$$

$$h'(x) = \frac{-3(2x^2 - 1)}{(2x^2 - x + 1)^2}$$

2c) $f(x) = \dfrac{4 - 3x - x^2}{x^2 - 1}$

2d) $f(t) = \dfrac{\cos t}{t}$

2e) $h(x) = \dfrac{1 + \csc x}{1 - \csc x}$

Evaluate the derivative of the function at the given point.

3a) $f(x) = (x^3 + 4x)(3x^2 + 2x - 5)$ at (0, 0)

$$f'(x) = (x^3 + 4x)(6x + 2) + (3x^2 + 2x - 5)(3x^2 + 4)$$
$$= 6x^4 + 24x^2 + 2x^3 + 8x + 9x^4 + 6x^3 - 15x^2 + 12x^2 + 8x - 20$$
$$= 15x^4 + 8x^3 + 21x^2 + 16x - 20$$
$$f'(0) = -20$$

3b) $f(x) = \dfrac{x^2 - 4}{x - 3}$ at (1, 3/2)

3c) $f(x) = x \cos x$ at $\left(\dfrac{\pi}{4}, \dfrac{\pi\sqrt{2}}{8}\right)$

Find an equation of the tangent line to the graph of at the given point and use the *derivative* feature of a graphing utility to confirm your results.

4a) $f(x) = \dfrac{x}{x+4}, \quad (-5, 5)$

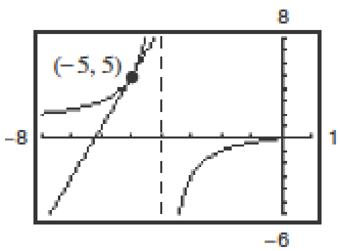
4b) $f(x) = \tan x, \quad \left(\dfrac{\pi}{4}, 1\right)$

$$f(x) = \frac{x}{x+4}, \quad (-5, 5)$$

$$f'(x) = \frac{(x+4)(1) - x(1)}{(x+4)^2} = \frac{4}{(x+4)^2}$$

$$f'(-5) = \frac{4}{(-5+4)^2} = 4; \quad \text{Slope at } (-5, 5)$$

Tangent line: $y - 5 = 4(x + 5) \Rightarrow y = 4x + 25$



Graphing utility confirms $\dfrac{dy}{dx} = 4$ at $(-5, 5)$.

4c) $f(x) = (x^3 + 4x - 1)(x - 2), \quad (1, -4)$

Find the derivative of each function.

5a) $f(x)=\csc x(\tan x-\cos x)$

5b) $f(x)=\cot x(\tan x+\sec x)$

$f(x)=\csc x \bullet \tan x-\csc x\cos x$

$f(x)=\dfrac{1}{\sin x}\bullet\dfrac{\sin x}{\cos x}-\dfrac{1}{\sin x}\bullet\cos x$

$f(x)=\dfrac{1}{\cos x}-\cot x$

$f(x)=\sec x-\cot x$

$f'(x)=\sec x\tan x-(-\csc^2 x)$

$f'(x)=\sec x\tan x+\csc^2 x$

6a) The following table lists the values of functions f and g, and of their derivatives, f' and g', for $x=-1$.

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

Evaluate $\dfrac{d}{dx}\left[\dfrac{f(x)}{g(x)}\right]$ at $x=-1$.

$$\frac{f'(-1)g(-1)-f(-1)g'(-1)}{[g(-1)]^2}$$

$$=\frac{(4)(1)-(3)(-2)}{(1)^2}$$

$$=\frac{10}{1}$$

$$=10$$

6b) Use the table above to evaluate the following:

1) $\dfrac{dy}{dx}[f(x)\bullet g(x)]$ at x = -1

2) $P'(-1)$ if $P(x)=\dfrac{f(x)\bullet g(x)}{f(x)+g(x)}$

7) AP MULTIPLE CHOICE EXAMPLES

1) An equation of the line tangent to the graph of $y = \dfrac{2x+3}{3x-2}$ at the point $(1,5)$ is

(A) $13x - y = 8$ (B) $13x + y = 18$ (C) $x - 13y = 64$

(D) $x + 13y = 66$ (E) $-2x + 3y = 13$

2) If $y = \tan x - \cot x$, then $\dfrac{dy}{dx} =$

(A) $\sec x \csc x$ (B) $\sec x - \csc x$ (C) $\sec x + \csc x$ (D) $\sec^2 x - \csc^2 x$ (E) $\sec^2 x + \csc^2 x$

3) If $f(x) = \dfrac{x-1}{x+1}$ for all $x \neq -1$, then $f'(1) =$

(A) -1 (B) $-\dfrac{1}{2}$ (C) 0 (D) $\dfrac{1}{2}$ (E) 1

4) If $y = \dfrac{3}{4+x^2}$, then $\dfrac{dy}{dx} =$

(A) $\dfrac{-6x}{\left(4+x^2\right)^2}$ (B) $\dfrac{3x}{\left(4+x^2\right)^2}$ (C) $\dfrac{6x}{\left(4+x^2\right)^2}$ (D) $\dfrac{-3}{\left(4+x^2\right)^2}$ (E) $\dfrac{3}{2x}$