ws – Product, Quotient and Chain Rule Name _____

Find the derivative of each.

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

2. $g(x)=\cos\left(3x^2\right)$

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

4. $f(x)=\sqrt[4]{3x^3-2x+1}$

5. $f(x)=(4x-3)^3(2x+1)^4$

6. $f(x)=\tan^3 2x$

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

8. $g(x)=3x^2\sqrt{4x-1}$

9. $g(x)=\sec 3x$

10. $f(x)=\dfrac{5x-2}{\sqrt{x-1}}$

11. $y=\tan 2x-3\csc x$

Find the equation of the tangent line at the given point.

12. $g(x)=\dfrac{x+1}{2x-3}$, at (2, 1)

13. $h(x)=\dfrac{\sin x}{1-\cos x}$ when x = $\dfrac{\pi}{3}$.

Find the slope of the function at the given value of x.

14. $g(x)=\cos 3x$, x = $\dfrac{\pi}{6}$

15. $f(x)=x\cos x$, x = 0.

Find the value of a and b so that the function is both continuous and differentiable.

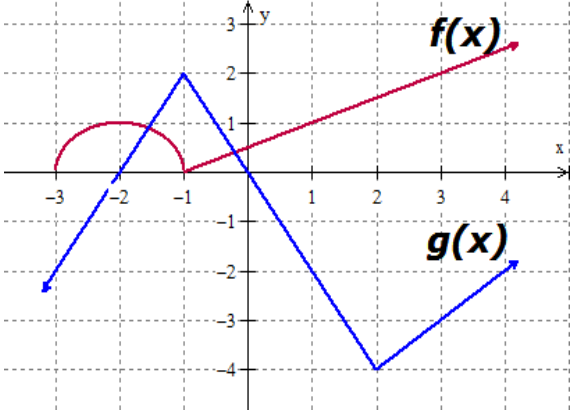
16. $f(x)=\begin{cases}\sin x, & x\le\dfrac{\pi}{2}\\ ax+b, & x>\dfrac{\pi}{2}\end{cases}$

17. $g(x)=\begin{cases}ax^3-bx, & x>1\\ 2x-a, & x\le 1\end{cases}$

18. $f(x)=\begin{cases}ax^2-3x-1, & x>-1\\ ax^3-bx, & x\le -1\end{cases}$

$m(x) = f(x) \cdot g(x)$, $\quad u(x) = 2f(x) - 3g(x)$,

$s(x) = \dfrac{f(x)}{g(x)}$, $\quad t(x) = f(g(x))$



Find each.

19. $t'(0)$
20. $s'(1)$
21. $u'(3)$
22. $m'(-2)$
23. $t'(1)$

Answers – ws Product, Quotient, Chain Rules

1. $-6\cos 3x \cdot \sin 3x$
2. $-6x \cdot \sin\left(3x^2\right)$
3. $\dfrac{5}{(4x-1)^2}$
4. $\dfrac{9x^2-2}{4\left(3x^3-2x+1\right)^{\frac{3}{4}}}$
5. $4(2x+1)^3(4x-3)^2(14x-3)$
6. $6\tan^2(2x) \cdot \sec^2(2x)$
7. $\dfrac{-4(2x-9)(4x-3)^2}{(2x+1)^5}$
8. $\dfrac{6x(5x-1)}{\sqrt{4x-1}}$
9. $3\sec 3x \tan 3x$
10. $\dfrac{5x-8}{2(x-1)^{\frac{3}{2}}}$
11. $2\sec^2 2x + 3\csc x \cot x$
12. $y-1 = -5(x-2)$
13. $y - \sqrt{3} = -2\left(x - \dfrac{\pi}{3}\right)$
14. $g'\left(\dfrac{\pi}{6}\right) = -3$
15. $g'(0) = 1$
16. $a = 0,\ b = 1$
17. $a = 0,\ b = -2$
18. $a = \dfrac{-1}{3},\ b = \dfrac{4}{3}$
19. -1
20. ¼
21. -2
22. 2
23. 0