The Chain Rule: If $h(x) = f\big(g(x)\big) then\ h'(x) = f'(g(x)) \cdot g'(x)$

Find the derivative:

1. $y = \frac{1}{4\sin(2x-3)}$
2. $f(\theta) = \theta + 2\tan\sqrt[3]{\theta}$
3. $g(z) = \sqrt[3]{2z-1}$
4. $h(\alpha) = (4\alpha\cos\alpha)^3$
5. $f(x) = (4x+1)^2(x-7)^3$
6. $g(x) = \frac{(x-3)^2}{\sqrt{x+1}}$
7. $f(x) = \left(\frac{2x-5}{3-x}\right)^3$
8. $f(x) = \sin(2x+4)^3$
9. $f(x) = x^5(\sec x^2)^2$
10. $f(x) = (\tan x)^3 + \tan x^2$
11. $f(x) = \sqrt[3]{\sin x + \cos x}$
12. $f(x) = \left(\frac{1}{x+\pi}\right)^2$
13. $f(x) = \left(\csc\left(\frac{x}{5}\right)\right)^3$
14. $f(x) = \pi^2(\sec(\pi x - 1))^2$
15. $y = x^2\cot\frac{1}{x}$
16. $f(x) = \csc(2x)\cot(2x)$

Find $f''(x)$ for # 17 - 21

17. $f(x) = 2(x^2-1)^3$
18. $f(x) = \sin(x^2)$
19. $f(x) = \tan(2x)$ at $\left(\frac{\pi}{6}, \sqrt{3}\right)$
20. $f(x) = (\sin x)^2$
21. $h(x) = f\big(g(x)\big)$

22. Find the equation of the tangent line to the curve at the indicated point.

a) $s(t) = \sqrt{t^2 + 2t + 8}$ at x=2

b) $f(t) = \frac{3t+2}{t-1}$ at $(0, -2)$

23. Determine the points in $(0,2\pi)$ at which the graph of $f(x) = 2\cos x + \sin(2x)$ has a horizontal tangent line.

24. Find the equation of the normal line to the curve $y = 2\tan\left(\frac{\pi x}{4}\right)$ at $x = 1$.

25. If $g(5) = -3\,, g'(5) = 6,\ h(5) = 3, and h'(5) = -2\ find\ f'(5)$ if possible. If not tell what the missing information is.

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

b) $f(x) = g(h(x))$

c) $f(x) = g(x)h(x)$

d) $f(x) = (g(x))^3$

e) $f(x) = g(x + h(x))$

f) $f(x) = (g(x) + h(x))^{-2}$