Calculus Review WS – Unit 3

Find the derivative of each function below:

1. $y = \sin^{-1}\sqrt{2x}$
2. $y = log_7(x^2 + 6)$
3. $y = sin^2(3x)$
4. $y = e^{\tan x}$
5. $y = cot^{-1}(x^3)$
6. $y = \ln(e^{4x-7})$
7. $y = 4^{\sqrt{x}}$
8. $y = (3x^4 - 7)^3$

9. If $q(x) = g(r(x))$, $g(x) = \frac{3}{x^4}$, and $r(x) = \cos x$, use the chain rule to find $q'(x)$.

10. Find $\frac{dy}{dx}$ for $x^3y - xy^3 + 3y = 4$.

11. Find $\frac{d^2y}{dx^2}$ for $x^3 + y^3 = 9$.

12. Write the equation of the line normal to $y^2 + x = 4$ at $(-5,3)$.

13. Using implicit differentiation, find the derivative of the inverse of $xy = \sin\left(x^2\right) + x$.

14. Using the inverse derivative rule, find the derivative of the inverse of $f(x) = \frac{x+1}{2x-3}$ at $x = -2$.

15. If $h(x) = g^{-1}(x)$, find $h'(2)$ given $h(2) = 6, g(2) = 4, g'(2) = -3, g'(6) = -5$

16. For each pair of functions, state which one grows faster, and show or explain why.

a. $y = log_3 x$ or $y = \ln x$
b. $y = x^{10}$ or $y = 100x^{10}$
c. $y = x^{10}$ or $y = 10^x$
d. $y = e^x$ or $y = e^{x+3}$
e. $y = e^x$ or $y = e^{3x}$

17. Use the table below to find each derivative in parts a-e:

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
-2	-4	3	-1	-3
3	1	2	5	7

a. $f-g$ at $x=-2$ b. fg at $x=-2$ c. $\frac{f}{g}$ at $x=3$

d. $f\left(g(x)\right)$ at $x=-2$ e. f^{-1} at $x=1$

Answers:

1. $y'=\frac{1}{\sqrt{2x}\sqrt{1-2x}}$ 2. $y'=\frac{2x}{(ln7)(x^2+6)}$ 3. $y'=6\sin(3x)\cos(3x)$

4. $y'=e^{\tan x}(sec^2x)$ 5. $y'=\frac{-3x^2}{1+x^6}$ 6. $y'=4$

7. $y'=\frac{4^{\sqrt{x}}(ln4)}{2\sqrt{x}}$ 8. $y'=36x^3\,(3x^4-7)^2$ 9. $q'(x)=\frac{12\sin x}{cos^5x}$

10. $\frac{dy}{dx}=\frac{y^3-3x^2y}{x^3-3xy^2+3}$ 11. $\frac{dy}{dx}=\frac{-x^2}{y^2}$, $\frac{d^2y}{dx^2}=\frac{-2xy^3-2x^4}{y^5}$ 12. $y-3=6(x+5)$

13. $\frac{dy}{dx}=\frac{-y}{x-2y\cos(y^2)-1}$ 14. $\frac{-1}{5}$ 15. $\frac{-1}{5}$

16. a. same rate b. same rate c. $y=10^x$ d. same rate e. $y=e^{3x}$

17. a. 2 b. 9 c. $\frac{3}{4}$ d. -15 e. $\frac{1}{5}$