Provide a clear and organized presentation. Give exact values only and completely simplify all answers.

1. (10 pts) Determine $f'(x)$ if $f(x)=\dfrac{2x}{3-x^2}$ using our definition of the derivative function (i.e., the limit of a difference quotient).

2. (15 pts) Determine the equation of the tangent line that passes through the point $(-6,3)$ if the line is tangent to the graph of $y = f(x)$ where $f(x) = \sqrt{2-x}$

3. (15 pts) Determine $\frac{dy}{dx}$ if $\sqrt{xy} - x^2 = y^3 + \ln\left(xy\right)$

4. (10 pts) Find all values of x for which the tangent line to the graph of $y = f(x)$ is horizontal if $f(x) = x + 3\sin x$

5. (21 pts) Find y':

i) $y = \tan^{-1}\dfrac{1}{x\sqrt{x}}$

ii) $y = x^2 e^{x^3}$

iii) $y = \pi^x + x^\pi - e^\pi$

6. (15 pts) Find y' if $y = \ln^3 \dfrac{e^x + e^{-x}}{e^x - e^{-x}}$

7. (7 pts) If $y = \ln x^{\pi}$, determine $y^{(n)}$

8. (7 pts) Evaluate $\lim_{x \to 0} \frac{\tan^2 5x}{\sin^2 3x}$