1. In this problem $y = x^3 + \dfrac{1}{x}.$ $= x^3 + x^{-1}$

    (a) $\dfrac{dy}{dx} = 3x^2 - x^{-2} \;=\; \boxed{3x^2 - \dfrac{1}{x^2}}$

    (b) $\dfrac{d^2y}{dx^2} = 6x + 2x^{-3} \;=\; \boxed{6x + \dfrac{2}{x^3}}$

    (c) $\dfrac{d^3y}{dx^3} = 6 - 6x^{-4} \;=\; \boxed{6 - \dfrac{6}{x^4}}$

2. $D_x\Big[\cos(e^x)\Big] = \boxed{-\sin(e^x)\,e^x}$

3. $D_x\left[\tan\left(\dfrac{x^5+1}{5x}\right)\right] = \sec^2\left(\dfrac{x^5+1}{5x}\right)\dfrac{(5x^4+0)5x - (x^5+1)\cdot 5}{(5x)^2}$

$= \sec^2\left(\dfrac{x^5+1}{5x}\right)\dfrac{25x^5 - 5x^5 - 5}{25x^2} = \boxed{\sec^2\left(\dfrac{x^5+1}{5x}\right)\dfrac{4x^5-1}{5x^2}}$

4. $D_x\Big[\sec(x^5+x)\Big] = \boxed{\sec(x^5+x)\tan(x^5+x)\left(5x^4+1\right)}$

1. In this problem $y = x^2 + \frac{1}{x^2}$. $= x^2 + x^{-2}$

   (a) $\frac{dy}{dx} = 2x - 2x^{-3} = \boxed{2x - \dfrac{2}{x^3}}$

   (b) $\frac{d^2y}{dx^2} = 2 + 6x^{-4} = \boxed{2 + \dfrac{6}{x^4}}$

   (c) $\frac{d^3y}{dx^3} = -24x^{-5} = \boxed{\dfrac{-24}{x^5}}$

2. $D_x\left[\csc(e^x)\right] = \boxed{-\csc(e^x)\cot(e^x)e^x}$

3. $D_x\left[\cot(x^5 + x)\right] = \boxed{-\csc^2(x^5+x)(5x^4+1)}$

4. $D_x\left[\sin\left(\frac{x^5+1}{5x}\right)\right] = \cos\left(\frac{x^5+1}{5x}\right)\dfrac{(5x^4+0)5x - (x^5+1)5}{(5x)^2}$

   $= \cos\left(\frac{x^5+1}{5x}\right)\dfrac{25x^5 - 5x^5 - 5}{25x^2} = \boxed{\cos\left(\frac{x^5+1}{5x}\right)\dfrac{4x^5 - 1}{5x^2}}$