

1. Find a formula for each derivative:

(a) $U(x) = \ln(x + \sqrt{x^2 - 1})$

(b) $N(x) = \exp(-x) \cos(5\pi x)$

(c) $K(x) = \sec^{-1}(1/x)$

(d) $U(x) = (\tan^{-1}(x))^2$

(e) $N(x) = (\tan^{-1}(x))^{-1}$

(f) $K(x) = (\cos^{-1}(x))^{-1}$

(g) $U(x) = (\cot^{-1}(1/x))^2$

(h) $N(x) = (\cot^{-1}(1/x))^{-1}$

(i) $K(x) = (\sec^{-1}(1/x))^{-1}$

(j) $U(x) = \cos(x) \sin(x)$

(k) $N(x) = \tan(x) \cot(x)$

(l) $K(x) = \tan^{-1}(x) \tan(x)$

(m) $U(x) = 2 \cos(x) \sin(x) - \sin(2x)$

(n) $N(x) = \cos(|x^2 - 1|)^2 + \sin(|x^2 - 1|)^2$

(o) $K(x) = \tan^{-1}(x) \tan(x)$

2. Find all *horizontal tangents* to the Devil's curve $y^4 - x^4 + 8x^2 - 4y^2 = 0$.

3. Find a formula for $\frac{dy}{dx}$ given that $y^4 - x^4 + 8x^2 - 4y^2 = 0$.

4. Define a function $Q(x) = (2x - 1)\lfloor x \rfloor - \lfloor x \rfloor^2$. It's a fun fact to know and to tell that Q is differentiable everywhere and that $Q'(x) = 2\lfloor x \rfloor$. Find a formula for the derivative of

$$W(x) = (2x^2 - 1)\lfloor x^2 \rfloor - \lfloor x^2 \rfloor^2.$$