Trig Function Derivative Solutions

1. $y = \sin(x)$

   $y' = \cos(x)$

2. $s(t) = \cos(t)$

   $s'(t) = -\sin(t)$

3. $f(x) = \sec(x)$

   $f'(x) = \sec(x)\tan(x)$

4. $y = \tan(x)$

   $y' = \sec^2(x)$

5. $f(x) = \csc(x)$

   $f'(x) = -\csc(x)\cot(x)$

6. $v(t) = \cot(t)$

   $v'(t) = -\csc^2(t)$

7. $y = x^2 \sin(x)$

   $u = x^2 \qquad v = \sin(x)$

   $u' = 2x \qquad v' = \cos(x)$

   $y' = 2x\sin(x) + x^2\cos(x)$

8. $y = \dfrac{\sin(x)}{\cos(x)}$

$u = \sin(x)$ $\quad v = \cos(x)$

$u' = \cos(x)$ $\quad v' = -\sin(x)$

$$y' = \frac{\cos(x)(\cos(x)) - \sin(x)(-\sin x)}{\cos^2(x)}$$

$$y' = \frac{\cos^2(x) + \sin^2(x)}{\cos^2(x)}$$ $\leftarrow$ Note $\underline{\sin^2 x + \cos^2 x = 1}$

note: $\dfrac{\sin(x)}{\cos(x)} = \tan(x)$

$$y' = \frac{1}{\cos^2(x)} = \sec^2 x$$

9. $y = \dfrac{x}{\cos(x)}$

$u = x$ $\quad v = \cos(x)$

$u' = 1$ $\quad v' = -\sin(x)$

$$y' = \frac{\cos(x) - x(-\sin(x))}{\cos^2(x)}$$

$$y' = \frac{\cos(x) + x\sin(x)}{\cos^2(x)}$$

$$y' = \sec(x) + x\tan(x)\sec(x)$$

10. $y = \dfrac{\sin(x)}{2x+3}$

$u = \sin(x)$ $\quad v = 2x+3$

$u' = \cos(x)$ $\quad v' = 2$

$$y' = \frac{(2x+3)(\cos(x)) - 2\sin(x)}{(2x+3)^2}$$

11. $y = \sin(x) + \cos(x)$

$y' = \cos(x) - \sin(x)$

12. $y = x^2 + 2\tan x$

$y' = 2x + 2\sec^2 x$

13. $y = \cos(x)\sin(x)$

$u = \cos(x)$ $v = \sin(x)$

$u' = -\sin(x)$ $v' = \cos(x)$

$y' = -\sin^2(x) + \cos^2(x)$

$y' = \cos^2(x) - \sin^2(x)$ ← Not 1

14. $y = \cos(x) \cdot \cos(x)$ ← remember this problem when we do chain rule

$u = \cos(x)$ $V = \cos(x)$

$u' = -\sin(x)$ $v' = -\sin(x)$

$y' = \cos(x)(-\sin(x)) + \cos(x)(-\sin(x))$

$y' = -2\cos(x)\sin(x)$

15. $y = \dfrac{4x^3}{\cos(x) + \sin(x)}$

$u = 4x^3 \qquad v = \cos(x) + \sin(x)$

$u' = 12x^2 \qquad v' = -\sin(x) + \cos(x)$

$$y' = \frac{12x^2(\cos(x) + \sin(x)) - 4x^3(\cos(x) - \sin(x))}{(\cos(x) + \sin(x))^2}$$

16. $s(t) = \dfrac{e^t \cos t}{1 + t^2}$

$u = e^t \cos t \qquad v = 1 + t^2$

$a = e^t \quad b = \cos t \qquad v' = 2t$

$a' = e^t \quad b' = -\sin t$

$u' = e^t \cos t - e^t \sin t$

$$s'(t) = \frac{e^t(1 + t^2)(\cos t - \sin t) - e^t\, 2t \cos t}{(1 + t^2)^2}$$