(4) $y = \tan(2x - x^3)$ $\quad u = 2x - x^3$

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

(6) $y = 5\cot\left(\frac{2}{x}\right)$ $\quad u = \frac{2}{x} = 2x^{-1}$

$$\frac{dy}{dx} = -5\csc^2\left(\frac{2}{x}\right)\cdot\left(-2x^{-2}\right)$$
$$= \boxed{\frac{10\csc^2\left(\frac{2}{x}\right)}{x^2}}$$

(7) $y = \cos(\sin x)$ $\quad u = \sin x$

$$\frac{dy}{dx} = -\sin(\sin x)\cdot\cos x$$
$$= \boxed{-\cos x \sin(\sin x)}$$

(12) $s = \sin\left(\frac{3\pi}{2}t\right) + \cos\left(\frac{7\pi}{4}t\right)$

$$v(t) = s'(t) = \cos\left(\frac{3\pi}{2}t\right)\cdot\frac{3\pi}{2} - \sin\left(\frac{7\pi}{4}t\right)\cdot\frac{7\pi}{4}$$
$$= \boxed{\frac{3\pi}{2}\cos\left(\frac{3\pi}{2}t\right) - \frac{7\pi}{4}\sin\left(\frac{7\pi}{4}t\right)}$$

(16) $y = \overset{u}{x^3}(2\overset{v}{x} - 5)^4$

① Product Rule
② Chain Rule for v' only

$$\frac{dy}{dx} = \overset{u'}{3x^2}\overset{v}{(2x-5)^4} + \overset{u}{x^3}\cdot\overset{v'}{4(2x-5)^3\cdot 2}$$
$$= \boxed{3x^2(2x-5)^4 + 8x^3(2x-5)^3}$$

(20) $y = \dfrac{x}{\sqrt{1+x^2}}$

① Quotient Rule
② Chain rule for v' only

$$\frac{dy}{dx} = \frac{\sqrt{1+x^2}\cdot 1 - x\cdot\frac{1}{2}(1+x^2)^{-\frac{1}{2}}\cdot 2x}{\left(\sqrt{1+x^2}\right)^2}$$
$$= \frac{\sqrt{1+x^2} - x^2(1+x^2)^{-\frac{1}{2}}}{1+x^2}$$

Lots of simplifying!

$$\frac{\sqrt{1+x^2}}{\sqrt{1+x^2}} \cdot = \frac{\sqrt{1+x^2} - \frac{x^2}{\sqrt{1+x^2}}}{1+x^2}$$
$$= \frac{1 + \cancel{x^2} - \cancel{x^2}}{\sqrt{1+x^2}}\cdot\frac{1}{1+x^2}$$
$$= \boxed{\frac{1}{(1+x^2)\sqrt{1+x^2}}} = \boxed{\frac{1}{(1+x^2)^{3/2}}}$$

(24) $y = \sqrt{\tan 5x} = (\tan 5x)^{\frac{1}{2}}$

outermost function $(\ )^{\frac{1}{2}}$
middle function $\tan(\ )$
innermost function $5x$

$$\frac{dy}{dx} = \frac{1}{2}(\tan 5x)^{-\frac{1}{2}}\cdot\sec^2 5x\cdot 5$$
$$= \boxed{\frac{5}{2}(\tan 5x)^{-\frac{1}{2}}\cdot\sec^2(5x)}$$

(28) $r = 2\overset{u}{\theta}\overset{v}{\sqrt{\sec\theta}}$

① Product Rule
② Chain Rule only for v'

$$\frac{dr}{d\theta} = \overset{u'}{2}\overset{v}{\sqrt{\sec\theta}} + \overset{u}{2\theta}\cdot\overset{v'}{\frac{1}{2}(\sec\theta)^{-\frac{1}{2}}\cdot\sec\theta'\tan\theta}$$

multiply (add exponents)

$$= 2\sqrt{\sec\theta} + \theta(\sec\theta)^{\frac{1}{2}}\tan\theta$$
$$= \boxed{\sqrt{\sec\theta}\,(2 + \theta\tan\theta)}$$

(32) $y = 9\tan\left(\frac{x}{3}\right)$

$$y' = 9\sec^2\left(\frac{x}{3}\right)\cdot\left(\frac{1}{3}\right)$$
$$y' = 3\sec^2\left(\frac{x}{3}\right)$$

outermost $(\ )^2$
middle $\sec(\ )$
Innermost $\frac{x}{3}$

$$y'' = 3\cdot 2\sec\left(\frac{x}{3}\right)\cdot\sec\left(\frac{x}{3}\right)\tan\left(\frac{x}{3}\right)\cdot\frac{1}{3}$$
$$= \boxed{2\sec^2\left(\frac{x}{3}\right)\tan\left(\frac{x}{3}\right)}$$

$= \boxed{\sqrt{\sec\theta}\,(2+\theta\tan\theta)}$

GCF

$y' = 3\cdot 2\sec\left(\frac{x}{3}\right)\cdot\sec\left(\frac{x}{3}\right)\tan\left(\frac{x}{3}\right)\cdot\frac{1}{3}$

sec( )

Innermost

$\frac{x}{3}$

$= \boxed{2\sec^2\left(\frac{x}{3}\right)\tan\left(\frac{x}{3}\right)}$