# MATH 149 Homework 9 Solutions



Sec 2.4 #30. $h(t) = \left(\frac{t^2}{t^3+2}\right)^2$

$$h'(t) = 2\left(\frac{t^2}{t^3+2}\right) \cdot \frac{2t\cdot(t^3+2) - t^2\cdot(3t^2)}{(t^3+2)^2} = \frac{2t^2(-t^4+4t)}{(t^3+2)^3} = \boxed{\frac{2t^3(-t^3+4)}{(t^3+2)^3}}$$

#28. $y = \frac{x}{\sqrt{x^4+4}} \Rightarrow y' = \frac{1\cdot\sqrt{x^4+4} - x\cdot\frac{1}{2\sqrt{x^4+4}}\cdot 4x^3}{\left(\sqrt{x^4+1}\right)^2} = \frac{2x^4+8-4x^4}{2\left(\sqrt{x^4+1}\right)^3}$

$$= \frac{8-2x^4}{2\left(\sqrt{x^4+1}\right)^3} = \boxed{\frac{4-x^4}{\left(\sqrt{x^4+1}\right)^3}}$$

#42. $y = \sin \pi x \Rightarrow y' = \cos(\pi x)\cdot\pi = \boxed{\pi\cos(\pi x)}$

#52. $g(t) = 5\cos^2(\pi t) \Rightarrow g'(t) = 10\cos(\pi t)\cdot(-\sin(\pi t))\cdot\pi = \boxed{-10\pi\cos(\pi t)\sin(\pi t)}$

#58. $y = \sin\sqrt[3]{x} + \sqrt[3]{\sin x}$ $\overset{\text{rewrite}}{=} \sin x^{1/3} + (\sin x)^{1/3}$

differentiate $y' = \cos x^{1/3}\cdot\frac{1}{3}x^{-2/3} + \frac{1}{3}(\sin x)^{-2/3}\cdot\cos x = \boxed{\frac{1}{3}\left(\frac{\cos\sqrt[3]{x}}{\sqrt[3]{x^2}} + \frac{\cos x}{\sqrt[3]{\sin^2 x}}\right)}$

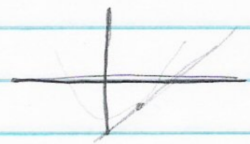
(D) #74. $y = 2\tan^3 x$ @ $\left(\frac{\pi}{4}, 2\right)$

$y' = 6\tan^2 x\cdot\sec^2 x \Rightarrow y'\left(\frac{\pi}{4}\right) = 6\cdot\tan^2\frac{\pi}{4}\cdot\sec^2\frac{\pi}{4} = 6\cdot 1\cdot\left(\frac{2}{\sqrt{2}}\right)^2 = 12$ = slope of the tangent @ $\left(\frac{\pi}{4}, 2\right)$

Tangent line

$$y - 2 = 12\left(x - \frac{\pi}{4}\right)$$

$$\boxed{y = 12x - 3\pi + 2}$$



(D) #78. see DERIVE file $\left(y = \frac{27}{4}t - \frac{47}{2}\right)$

#82. $f(x) = \frac{x}{\sqrt{2x-1}}$

Horizontal tangents when $f'(x) = 0$.

$$f'(x) = \frac{\sqrt{2x-1} - x\cdot\frac{1}{2\sqrt{2x-1}}\cdot 2}{\left(\sqrt{2x-1}\right)^2}$$

So, $f'(x) = \frac{2x-1-x}{2x-1} = \frac{x-1}{2x-1}$ $\searrow$ $f'(x) = 0$ when $x-1=0$, that is $\boxed{x=1}$

#85 $f(x) = \sin x^2$

$f'(x) = \cos x^2 \cdot 2x$

$f''(x) = (-\sin x^2 \cdot 2x)\cdot 2x + \cos x^2 \cdot 2$ (product rule)

$= \boxed{-4x^2\sin x^2 + 2\cos x^2}$